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FINAL REPORT OF THE SECRETARIAT U.S. WORKING GROUP ON GLOBAL ENERGY EFFICIENCY INTIATIVE: Year 1

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Final Report of the Secretariat
U.S. Working Group on
Global Energy Efficiency Initiative: Year 1
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Final Report: U.S. Working Group on Global Energy Efficiency

Prepared by: Deirdre Lord
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Project Objectives:

In response to a Congressional directive in the Foreign Operations, Export Financing, and Related Appropriations Acts of 1990 and 1991, and in an effort to provide solutions for the energy, economy, and environment bind facing developing countries, the AID Office of Energy established GEEI to focus on the implementation of energy efficiency activities on a massive scale worldwide. Energy efficiency measures average approximately half the cost per kilowatt of capacity expansion through traditional power plant construction, decreases energy-related environmental pollution, and reduces the need for energy sector investment capital.

In 1991, a Working Group comprised of U.S. government officials, university professors, national laboratory representatives, officials from industry, environmental group delegates, and other non-governmental group representatives was formed to assist in the development and implementation of GEEI. The Working Group agreed on a plan of action that will be the focus of GEEI, and implemented an organizational structure that includes the appointment of IIEC as the Executive Director and Secretariat of the Working Group.

The plan of action included various activities that were designed to increase the awareness of energy efficiency as an option in energy sector development, develop a strategy for donor coordination, and facilitate the implementation of energy efficiency projects. The final report follows the outline of the annual work plan, and then describes the accomplishments of the project upon the completion of this cooperative agreement.

Approach, Activities and Deliverables:

Ongoing Activities: In order to fulfill the appointed duties of the Secretariat, IIEC prepared for and conducted bimonthly meetings of the full U.S. Working Group, presented any relevant materials to the Working Group, and wrote and distributed minutes for the meetings. General communication and information requests about the U.S. Working Group were coordinated by the Secretariat.

Output: Meeting minutes are attached in Appendix A.

Long Term Activities:

As the Secretariat, IIEC performed the following activities:

1. As directed in the annual workplan, IIEC worked with the Executive Committee and Working Group in various activities.

   a) IIEC fostered the development of more than twenty (20) proposals that address information exchange, training, model project demonstrations, financing, technology export, and joint technology research and development. This effort far exceeds the level of proposal development directed by the annual work plan, which was set at five (5). The Secretariat coordinated project proposal review, and the presentation of the proposals to potential donors

Output: The Working Group set criteria for proposal submission and review. The Secretariat coordinated the development and technical review of project proposals. The Secretariat developed the proposals into a marketable format and has coordinated the ongoing presentation of the proposal portfolio. Presentations took place from the Spring of 1992 and are still continuing. Potential funders that have seen the proposals include: the Global Environmental Facility at the World Bank, the Energy Sector Management Assistant Program (ESMAP) at the World Bank, the U.S. Asian Environmental Partnership and the World Environment Center. The portfolio of over 20 project proposals that were submitted, reviewed and marketed to potential funders as of December 1992 is attached in Appendix B. In addition, see Working Group minutes of March, May, July, and October 1992 for reports on proposal presentations to potential funders.

   b) Expanded participation in the Working Group.

Output: The U.S. Working Group membership has grown significantly over the last year and a half. Membership grew from roughly a dozen members representing a dozen organizations in environmental groups, non-governmental organizations (NGOs), U.S. government agencies, academic institutions, and national laboratories. As the directory of Working Group members attached in Appendix C shows clearly, the membership has grown to nearly fifty individuals from close to forty organizations that include the private sector, private voluntary organizations, national laboratories, NGOs, environmental groups, U.S. government agencies and research institutions. In addition, see Appendix B, the project portfolio for a list of collaborating members who have teamed with Working Group members to submit proposals from developing countries.

   c) Tracked the implementation of the proposals mentioned above and drafted a report on examples of energy efficiency projects that will be used for training.

Output: The Secretariat tracked proposals by constantly coordinating with individuals who submitted proposals both in the U.S. and in developing countries. This tracking activity was an important result of the proposal presentations to potential funders undertaken by the Secretariat. Although no official report was filed to be sued for training, an important activity related to project development and training was undertaken by four U.S. Working Group members. See the training manual from the non-governmental organization training

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held in Berkeley, California from November 16-20, 1992. The manual is attached in Appendix D. Training was managed by IIEC with collaboration from Working Group members: the Natural Resources Defense Council, University of Maryland's Center for Global Change, Oak Ridge National Laboratory, and Lawrence Berkeley Laboratory. Although the November training activity was not funded by AID, the project will result in the development of energy efficiency projects in participant countries. Depending on the project quality, the U.S. Working Group will coordinate with proposal submitters to develop the proposals and market them to potential funders.

d) Assisted in the formation of an international steering committee on energy efficiency that included participants from donor organizations and developing and Eastern European countries.

Output: The activity was undertaken by the Office of Energy as the Stockholm Initiative on Energy, Environment, and Sustainable Development (SEED) conference in November of 1991. The conference, co-sponsored by the British Overseas Development Administration, German Bundesminiterium für Wirtschaftliche Zusammenarbeit, Netherlands Ministry of Foreign Affairs, Swedish Agency for International Technical and Economic Cooperation, United Nations Development Program, and the United States Agency for International Development. The consultative meeting included 21 developing country key decision makers in government and industry and heads of major utilities, and 24 senior officials from bilateral and multilateral organizations. The meeting was designed to build on a number of programs to promote efficiency as the centerpiece of a strategy for meeting rising power demand. The meeting recommended joint North-South initiatives that focus on reducing energy-related environmental degradation, mobilizing capital, and improving power sector performance. Conference recommendations and proceedings were published in Report on the Stockholm Initiative on Energy, Environment, and Sustainable Development: Strategies for Implementing Power Sector Efficiency.

e) Increased the awareness of GEEI among other relevant organizations, including U.S. foundations.

Output: The Secretariat traveled to the Ivory Coast and Botswana to discuss GEEI activities at the African Development Bank and at a network of African non-governmental organizations that works on energy efficiency policy and technology transfer. The Secretariat, on the recommendation of the U.S. Working Group and with the approval of the Office of Energy at AID, developed an initial exhibit on energy efficiency policies and technologies for presentation at the UN Conference on Environment and Development in Rio de Janeiro, Brazil. In addition, the Secretariat developed a slide show through which the Global Energy Efficiency Initiative can be marketed, both to potential proposal funders, and to potential participants. Attached in Appendix E you will find the trip reports from GEEI travel to the Ivory Coast and Botswana in the Spring of 1992, and to the UN Conference on Environment and Development in June of 1992.

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2. As directed in the annual workplan, IIEC worked with the Working Group to develop and implement a strategy for collaboration with bilateral and multilateral assistance agencies. The GEEI Government Subcommittee, of which A.I.D. is Chair, coordinated the implementation of the strategy.

   a) Coordinated the financing of a country-specific project between bilateral and multilateral assistance agencies;

Output: In the Fall of 1992, IIEC, in collaboration with Working Group member Lawrence Berkeley Laboratory (LBL), complete a feasibility study for the World Bank on the feasibility of implementing 1.5 million compact fluorescent lamps (CFL) in two cities in Mexico, Guadalajara and Monterrey. Appendix F, the report from the project entitled Feasibility Study Ilumex: Proyecto de Uso Racional de Iluminación en Mexico, describes the proposed project. This activity is ongoing. In coordination with the Office of Energy and other AID contractors, the Secretariat is identifying continued collaboration in Mexico to be coordinated between bilateral and multilateral assistance agencies. A potential opportunity for consideration is the development of a Mexico energy efficiency collaborative through which major Mexican institutions will identify mutually beneficial energy efficiency activities and projects.

3. As directed by the annual work plan, IIEC worked with the Executive Committee and Working Group to undertake an aggressive program to develop and fortify links with developing and Eastern European governments and individuals. This activity was a complementary component of donor coordination activity, specifically as a compliment to the SEED meeting, and should strengthen the ability of non-governmental institutions to facilitate the implementation of energy efficiency within their country or region. This activity has been broadened to include other interested parties from developing and Eastern European countries, including governments, businesses, academic institutions, and other non-governmental organizations. The Secretariat coordinated this activity with U.S. Working Group Subcommittee members Oak Ridge National Laboratory (ORNL), Natural Resources Defense Council (NRDC), and Lawrence Berkeley Laboratory (LBL) as well as with relevant developing countries institutions.

Output: The Secretariat has recently taken on the task of coordinating the development of a GEEI training activity. The activity is meant to be led by the countries in which training programs are to take place. The Working Group identified Indonesia and Mexico as two likely countries for GEEI training initiatives. A meeting in Mexico to identify future energy efficiency activities in Mexico, and to determine training needs, is planned for the Spring of 1993. The U.S. Working Group Training Subcommittee will proceed with initial training activities which include 1) development of an energy efficiency training initiative in Mexico; 2) design of an international workshop on energy efficiency training program agendas, priorities, and mechanisms; 3) support for the organization of a workshop on energy efficiency training for nongovernmental organizations; 4) coordination of the evolving GEEI

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training program with South-based institutions; 5) program oversight and information dissemination.

The Secretariat also coordinates responses to inquiries from dozens of international organizations each month. Inquiries came from the director of the committee on energy in developing countries of the World Energy Council, for example. In addition, the Working Group is coordinating the export to Brazil, Mexico, and Chile of the very successful U.S. Environmental Protection Agency program known as Green Lights. The export of this U.S. federal government program to be managed out of non-governmental organizations in the above-mentioned countries and endorsed by governments in these same countries represents an important link between U.S. and developing country governments, non-governmental organizations and the U.S. Working Group. A project manager for the Luz Verde project in Brazil has been designated. Appendix G includes letters of inquiry on EPA's Green Lights program from developing country counterparts in Brazil and Chile.

4. As directed in the annual work plan, IIEC continued to coordinate the dissemination of the background report, released in June of 1991, entitled Energy Efficiency, Developing Nations and Eastern Europe. The background report elucidates the need to incorporate energy efficiency into development strategies of developing countries and Eastern Europe.

Output: The Secretariat coordinated two briefings with the lead authors on Capitol Hill and with the international press. The report generated extensive interest among the international press and on Capitol Hill. Over 5,000 reports were distributed internationally. Appendix H contains the report and an example of the press release that helped to draw interest to the report.

Minutes for the Meeting of
the U.S. Working Group on
Global Energy Efficiency
September 5, 1991

The meeting opened with the distribution of additional copies of the newly released report to the U.S. Working Group, Energy Efficiency, Developing Nations and Eastern Europe, and the GEEI brochure, both of which all Working Group members should have received in the mail some time ago.

I. Release of the Report, and discussion of the press and congressional briefings and Report distribution.

A discussion of the imminent release of the report to the U.S. Working Group began the meeting. Mark Levine described the format and the intended outcome of the press and Congressional briefings occurring that afternoon. Mark, Tom Wilbanks and Jack Stafurik represented the authors of the report at the press briefing, while Debbie and Michael Totten represented the Secretariat. Mark planned to speak for 35 to 40 minutes about report findings. The press would then have the opportunity to direct questions to any of the five Working Group representatives. The Congressional briefing, following the luncheon press briefing, consisted of a small number of top-level senior staff, and aimed to inform the Congressional staffers of foreign assistance needs.

Report distribution is in the initial stages due to the slow submission of Working Group Member mailing lists to IIEC. There was a final sign-up sheet circulated at the meeting so that Working Group members previously unable to submit a mailing list to IIEC for cross referencing could now do so. As agreed, IIEC will distribute Reports and return cross-referenced mailing lists to the respective Working Group members so that they may mail the Reports with a personal cover letter. International NGOs have had a particularly poor representation on mailing lists already received by IIEC; more NGO representation was requested.

II. Release of the GEEI brochure, and discussion of distribution.

The procedure for distribution of the GEEI brochure, as a mechanism for gaining recognition for the Working Group, followed the discussion of the report's distribution. Alberto Sabadell reported that he took a number of brochures down to a private power sector conference in Columbia where they generated a great deal of interest.

Suggested distribution points for the brochure included: the Nairobi climate change negotiations, UNCED conference preparatory meetings, upcoming climate and energy briefings at EESI, University mailings, technology cooperation meetings in London and

Japan, and the technology cooperation meeting of the OECD. Working Group members were asked to contact IIEC if they needed more brochures. It was suggested that at some future time, an insert be added to the existing brochure to provide information on and solicit project proposals for GEEI.

III. Report on progress of Projects book.

The discussion turned to that of the projects book and an update on its progress. It was announced that IIEC has received AID funding, and can therefore now commit significant staff time to the development and completion of the projects book. Progress to date was therefore reviewed. The Working Group had earlier assembled a Technical Review Subcommittee, which had expressed concern that the projects were not of uniform quality. It had directed IIEC to make the initial improvements in the proposals, after which the Review Subcommittee will conduct its review.

The projects received thus far have two major deficiencies; first, many of the projects lack a local LDC counterpart in the country in which they will be implemented; and, second, some of the proposals lack a clear definition of what the project is, and what it seeks to accomplish. Michael Totten announced a goal of having at least two dozen projects completed by the end of September for review by the Technical Review Committee. Revisions to clarify previously submitted proposals were welcomed and should be sent directly to IIEC. Mock-ups of the desk top publishing format being used for the projects were distributed at the meeting. The projects fit into seven subheadings in the book: buildings, industry, lighting, training, transport, utilities, and "other".

Additional projects were welcomed, particularly in areas where we are now weak: projects from major greenhouse gas producers (little from Mexico, one from China, a few from Indonesia, weak on Brazil, strong on Thailand and India); and comprehensive transport project proposals (Ken Newcombe of GEF is interested in a transport flagship project, but most of what has already been received involves just non-motorized transport projects). Mike Adler suggested approaching TERI's new Washington office for project ideas. In addition, David Jhirad and Padmanabhan will shortly be traveling to India and offered to distribute information about GEEI and the projects. Padu then went on to describe a GEEI proposal he submitted known as DEEPAK to take place in Karnataka State, India, which would compare a conventional electricity supply expansion approach with a least cost program put forth by Amulya Reddy that takes into consideration demand-side management options.

The discussion then turned to the recent events in the Soviet Union, and what these events might mean to GEEI in the future. Jacob Scherr raised the question of whether GEEI is now willing to involve the former Soviet Union in the project portfolio. He suggested perhaps it is time to go ahead with projects in this region. A discussion on present multilateral and U.S. agency policies toward Soviet aid followed, although it was recognized that these policies are evolving. During the week prior to the GEEI meeting, it was noted,

the World Bank and IMF passed through a $50 million technical assistance grant to the Soviet Union. In addition, EPA is trying to establish an energy efficiency center in Moscow.

Jacob also asked for clarification about the Rockefeller Foundation's proposed $25 million fund for energy efficiency demonstrations. According to Debbie's understanding of the fund, it will support the demonstration of energy efficiency projects (in a pre-widespread implementation phase) that many donor agencies are hesitant to move into, filling an interim gap in Rockefeller's view. Although there was confusion as to whether these funds were a part of the Global Energy Efficiency Mechanism (GEM), the $25 million Rockefeller investment portfolio is distinct from GEM and, unlike GEM, is accessible.

Finally, the status of the potential American contribution to GEF was discussed. There is a proposal for the U.S. to contribute $150 million over three years. However, ambiguous language in Congressional bills perpetuates uncertainty in defining whether the funds will be a direct contribution or will be provided in parallel financing. Moreover, there is uncertainty as to whether the funds will be taken out of the existing AID budget or additional funds will be provided specifically for GEF.

IV. Reports by members of Executive Committee on their efforts to broaden their constituencies.

The discussion continued on to updates from each member of the Executive Committee on efforts to expand the visibility of GEEI. Tom Wilbanks discussed progress on reaching the university and research communities. The approach in this area will be two-fold: first, simply disseminating information on GEEI; and second, seeking to actively involve the university and research community in training programs and workshops. To this end, Tom has developed a list of 50 or 60 contact people. He will also be visiting 5 or 6 universities where he will discuss the GEEI. Other suggestions for the work of the university and research community included: interacting with the State Energy Offices at their October meeting in New Orleans; tying into the technical community through the Association of DSM Professionals; linking in with a meeting of the State R & D offices in Berkeley and a conference on expanding the environmental curriculum at the university level which will be attended by international university presidents at Tufts University, and establishing curriculum materials for use in university classes.

An update from the Industry Subcommittee from Henri-Claude Bailly described a re-working of the structure of the Subcommittee. The previous structure of working with industry associations had not been particularly effective due to their predominantly domestic policy focus. The new approach involves two strategies: 1) targeting 50 to 100 companies with a broad mailing of the GEEI report accompanied by an appeal to have them become involved in GEEI by contributing to a publication fund for GEEI; and 2) identifying a subset of this group that will be interested in providing much higher levels of financial support to prepare a traveling exhibit on American energy efficiency technologies. Towards these ends, Henri-Claude Bailly mentioned there is an upcoming meeting on Business

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Concepts for Sustainable Development in Switzerland during which four or five dozen companies could be apprised of GEEI. He added that GEEI was also mentioned in the forthcoming USEA report on energy efficiency. And Tom Wilbanks, suggested GEEI involvement at the Atlantic Council Working Group meeting which will look at trade and financing barriers to technology transfer between developed and less developed countries.

V. Report on November Donors' Meeting.

David Jhirad then summarized progress to date on the Donor's Meeting. The meeting will take place from November 13-15 in Stockholm and will be hosted by the government of Sweden, and the U.N. Department of Technical Cooperation for Development. It will involve about 25 representatives of donor agencies (including multilateral development banks) and 25 energy efficiency experts and decisionmakers from developing countries, who will discuss how efforts to implement energy efficiency in the developing world can be expedited. Meeting objectives include: A) establishing an institutional network to facilitate continued collaboration and coordination beyond the meeting; B) producing a statement on energy efficiency to be presented at the UNCED conference; and C) identifying bankable energy efficiency projects on which donors can collaborate

VI. Report on Energy Conservation Projects Database.

Jeff Erickson then offered an update on Hagler Bailly's Energy Conservation Projects Database. Based upon Working Group discussions, the Office of Energy at AID commissioned Hagler Bailly to create a database on energy conservation projects in developing countries. The software has been designed and was demonstrated. Among the information input's on each project are: a project description, the status of project, the anticipated outcome if the project is complete, the sector in which the project is being implemented, the results of completed projects, the funding levels, the contact person(s), and the country where it is being implemented. Print-out samples of the database were distributed at the meeting and will be sent to absentee Working Group Members. Working Group members were asked to participate in the database development and to fill out their database entries. One suggested first use for the database was the November Donors' meeting.

VII. Notes

The next meeting was tentatively set for the first week in November, members will be apprised of the actual date shortly. (The meeting has subsequently been set for November 7 at RCG\Hagler Bailly's Conference Room, 370 L'Enfant Promenade, SW, Suite 700 near the L'Enfant Promenade Metro stop (202) 488-1500 from 9 to 11 a.m.). That being the final order of business, the meeting was adjourned at 11:30 a.m.

Minutes for the Meeting of
the U.S. Working Group on
Global Energy Efficiency
November 7, 1991

The meeting opened with a change to the agenda. David Jhirad was unable to speak because he was in Europe preparing for the Stockholm meeting. T.J. Glauthier reported on the conference on technology transfer to advanced developing countries which took place in Bellagio from October 28 to November 1, 1991.

I. Summary of press and congressional briefings on the GEEI Report held September 5, 1991.

Mark Levine reported that he was pleased with both briefings held on the report, Energy Efficiency, Developing Nations, and Eastern Europe. The press briefing was well attended, with representatives from Indian, German, Venezuelan, Japanese and French publications as well as from the wire services. Mark, Tom Wilbanks and Jack Stafurik represented the authors at the press briefing. Mark was impressed by the quality of questions fielded from the press. The Congressional briefing drew a small but influential group including Ann James from Rep. John Porter's Office, Anne Georges from Rep. David Obey's Office, Herb Spira of the House Banking Committee, Fred Sissine from CRS and others.

II. Update on distribution of GEEI brochure and report.

In previous Working Group meetings, members were asked to submit extensive mailing lists to IIEC to avoid duplicate mailings, and then to mail out the brochures and/or reports. IIEC has now returned both the mailing lists and the requisite number of reports to submitters, who will send them out with a cover letter of introduction. Because of the extensive circulation of the Report during the month of October, IIEC has put out a bid for a second printing of 2000 copies of the report. Any requests for additional reports or brochures should be directed to IIEC.

III. Progress on GEEI Project Proposals Book and additional proposals for the Book.

A core group of around thirty project proposals has now been edited and sent to the Technical Review Committee. The Committee includes: John Shonder, ORNL; Henry Norman, VITA; Rick Sellers, SEIA; Mark Levine, LBL; Glenn Prickett, NRDC; John Armstrong, RCG/Hagler, Bailly; [confirmed since the November 7th meeting] and, Jeanne Solé, CLF. The other proposals have been returned to the submitters with suggestions for improvements.

In general those that were returned had one of two weaknesses: (1) the lack of local developing country counterparts for completing the proposed work; and (2) the lack of technical details for the proposed project.

The proposals submitted to the Technical Review Committee are on a fast track, with a goal of having the first presentations on the proposals take place early in 1992. AID and GEF are initial targets. Nevertheless, the Working Group stressed the need to continue to solicit new proposals. Suggested outreach opportunities to develop future proposals were: FINESSE participants, World Energy Council, PVOs, Geneva climate change negotiations, and DOE offices overseas.

In recognition of the problems suffered so far by many of the proposals, Debbie discussed a recommendation to target five or fewer countries for intensive future efforts. IIEC simply does not have the staff resources to dispatch individuals to all the countries for which proposals have been received in order to flesh them out in more detail. Concentration on five or fewer nations enables IIEC to live within such limitations. Debbie mentioned she has had preliminary discussions with AID on this subject. Suggestions for initial candidate countries were Mexico, Brazil, Central America/Jamaica, India and Indonesia. Working Group members expressed initial concerns that neither an African nor an Eastern European country was mentioned. The proposal to target five or fewer countries will be addressed in more detail at the next Working Group meeting as part of the 1992 agenda discussions. It was emphasized, however, that even if the five-country approach is adopted, proposals from around the world will still be solicited vigorously; IIEC will simply not have the resources to travel to the relevant country to flesh out individual proposals.

The discussion then turned to meetings in Europe which took place in the weeks prior to the GEEI meeting. The Italian government invited representatives from both industrialized countries and the developing world to a conference on environment and technology transfer. Debbie noted that LDC representation was high, especially from Africa, and that these individuals could prove to be good contacts for the Working Group. This conference was followed by the World Wildlife Fund's Bellagio Conference on advanced developing countries as a focal point for technological cooperation related to global climate change (the final GEEI agenda item).

Other reports from Europe included an update on the newly incorporated GEM. Amulya Reddy has been named CEO for GEM which has been renamed the International Energy Initiative (IEI). The Rockefeller Foundation is acting as the temporary Secretariat for IEI which has an operating budget of US$ 1 million. It is uncertain where IEI will be based. Reddy has asked to address GEEI's next meeting. On the subject of European activities, Debbie announced that IIEC will open a European office to be located in Brussels within the next 12 months. One of the potential activities of IIEC's Europe office will be to facilitate the establishment of a European equivalent of the U.S. Working Group.

IV. Reports by Academic and Industrial Committees on efforts to broaden their constituencies (Tom Wilbanks, Scott Sklar).

Tom Wilbanks began the Academic Committee briefing with a discussion of recent efforts to reach the research and academic communities. Tom Wilbanks sent a mailing list of research and academic institutions to receive GEEI materials to Alan Miller at the Center for Global Change so they could be certain they are reaching all relevant researchers and academics. The Committee will also contact national research institutions in order to further extend the GEEI network; suggestions included Earth Sciences and Social Sciences Committees of the National Academy of Sciences and the Transportation Research Board.

Tom then distributed a draft proposal for a training program initiative that was developed after consulting with Peter Miller (NRDC) and Mark Levine (LBL), individuals in developing countries, among others. The draft includes major objectives of a training initiative as well as three potential training activities. The objectives were: to build capability in developing countries by fostering the establishment of South-based institutions which will provide quality, self-sustaining energy efficiency training for the long term, and to facilitate training assistance for energy efficiency improvement on a project level. The training activities were broken into three time periods: suggested endeavors for the next three to four months to be supported by funds previously allotted; activities to take place over the next fiscal year covered by U.S. AID funding; and projects for the next three to five years, which will be coordinated with potentially fundable training projects from recently submitted training project proposals. Tom is currently in the process of developing a work plan to meet the goals set by the training initiative.

Scott Sklar went on to discuss the Industry Committee's recent activities. Sklar also reported that he informed the energy committee of the Council on Environmental Quality (CEQ) about GEEI activities. The meeting was attended by CEOs of PG&E and Honeywell, among others. Corporate attendees provided their perspective on the concept of potential industry involvement in the U.S. Working Group. They were intrigued by GEEI and anticipated some degree of interest on the part of industry. Due to difficult economic times that have diverted attention away from developing new export markets the Committee has undertaken a modest first step of sending a letter for wide industry distribution. There will be an attempt to get some of these letters signed by industry leaders asking for donations towards supporting the Working Group's publications. At the same time, there will be a more targeted effort to raise corporate funds (in larger amounts) for a traveling energy efficiency technologies exhibit that will travel to international conferences.

Alain Streicher then went on to update the Working Group on RCG/ Hagler/Bailly's work for the Industry Committee, since Henri-Claude Bailly was out of the country at the time of the meeting. Henri-Claude sent 100 letters about GEEI to participants in USEA. Alain discussed GEEI at the International Power Forum, where he found participants were

hesitant to think about developing export markets due to the poor state of the national economy and to uncertainty about developing country markets.

In David Jhirad's absence, Nathaniel Brackett presented a brief update prior to the SEED (Stockholm Initiative on Energy, Environment and Development), which would take place from November 13-15 in Stockholm. The meeting, hosted by the Swedish government and the U.N. Department of Technical Cooperation for Development, brought together LDC representatives and lending agencies. The purpose was to create a network between developing country institutions and lending institutions.

V. Report on the Bellagio Conference "Relatively Advanced Developing Country Focus for Technology Cooperation Related to Global Climate Change" (T.J. Glauthier).

This conference, held from October 28th to November 1st, 1991, was funded by the Rockefeller Foundation and attended by 19 people from 9 countries including: China, Japan, the U.S., Brazil, India, Switzerland, Kenya, Turkey, and Indonesia. T.J. Glauthier distributed a draft conference statement prepared by the World Wildlife Fund. Conference participants agreed that an appropriate objective to guide action related to developing countries on the issue of global climate change is to reduce the rate of growth of manmade greenhouse gas emissions while promoting sustainable development. To this end, the Conference decided that the effective development, transfer, and dissemination of appropriate technologies is essential.

Two major recommendations were made. First, conference attendees suggested establishing national and regional centers (or expanding existing centers) to focus on technology development, acquisition, transfer, and local adaptation so as to enhance widespread diffusion and use of sustainable technologies. Second, the conference recommended the creation of a matching fund for technology transfer to provide "seed" money for the promotion of effective incentives to governments and private sector. Glauthier commented that both recommendations are closely tied to the goals of GEEI; once the process of better defining these recommendations is underway, GEEI could play a significant role.

The meeting concluded with Mark Levine's announcement that DOE has contracted to do a similar Report as the GEEI Report. The paper's section on electricity end-use efficiency will be authored by Mark. He encouraged colleagues from the U.S. Working Group to contribute their expertise to portions of the paper. For further information, contact Mark.

VI. Notes

Dr. Amulya Reddy will address the next GEEI meeting which will take place on January 30th, 1991 from 9:00 to 11:00 am. Please save this date and time. An agenda and address for the meeting will follow shortly.

Minutes for the Meeting
of the U.S. Working Group
on Global Energy Efficiency
January 30, 1992

The meeting opened with three changes to the agenda. Due to his travel schedule, Amulya Reddy's discussion of the International Energy Initiative (IEI) was postponed to the second to last item on the agenda. David Jhirad's discussion of the November SEED meeting was moved to the third item on the agenda. Joy Dunkerley concluded the meeting with a brief description of a forthcoming AFREPREN meeting.

I. Discussion of 1992 proposed agenda for the Working Group.

Michael Totten opened the meeting with a summary of IIEC's proposed 1992 tasks for the U.S. Working Group. First, in order to address some shortcomings in the U.S. Working Group project proposals, IIEC suggested targeting 5 or fewer countries on which to focus intensive future efforts. This recommendation developed out of a meeting with AID in which it was agreed that no proposals will be precluded from consideration, but that focussing on 5 or fewer countries would permit IIEC staff to enhance existing proposals by working with local counterparts in the targeted countries.

Second, Tom Wilbanks summarized proposed 1992 training activities for the Working Group, which were developed after consulting the Training Subcommittee consisting of Peter Miller (NRDC), Debbie Bleviss (IIEC) and Mark Levine (LBL). One proposed training initiative for 1992 will focus activities in two key countries, Mexico and Indonesia, with a principle emphasis on the electric utility sector and a secondary emphasis on transportation. Activities will include the development of model training courses and materials in collaboration with institutions in the targeted countries. Other proposed training activities include an international workshop on agendas and structures for energy efficiency training in collaboration with South-based institutions, and an NGO training program.

Third, to increase the visibility of the Working Group within the private sector a trade show exhibit on energy efficiency was proposed which will travel to 5 or 6 conferences internationally. In addition to displaying energy efficient technologies, the Working Group agreed the exhibit should incorporate overviews of policy options which expand markets for these technologies. Also, in recognition of the fact that many energy-related exhibits already exist, the development of the exhibit will be informed by an assessment of work done by other organizations including DOE, the Energy Efficiency Committee of IEA, and others. A subcommittee was formed to develop the exhibit and includes Tom Wilbanks, Christopher Flavin, Michael Totten, Bill Nitze, Alain Streicher, and Jack Young.

Fourth, follow up was proposed to the Stockholm Initiative on Energy, Environment, and Sustainable Development (SEED), held in November 1991. Finally, it was proposed that

cooperation with other like-minded organizations be increased, such as with the IEI discussed by Dr. Amulya Reddy later in the meeting. Included in this effort may be the establishment of a European Working Group on Global Energy Efficiency--essentially a parallel of the U.S. Working Group-- through IIEC's new European Office, and the organization of a fall meeting of developing country energy efficiency activists and experts to take place in Washington. The Working Group accepted the proposed tasks for 1992.

II. Presentation on proposed Working Group Projects which have received partial funding.

The Working Group was updated on four proposed Working Group projects which have already received partial funding. Ruth Cherenson with IIEC discussed the status of a non-governmental organization (NGO) training workshop proposed by IIEC, NRDC, the Center for Global Change, and Lawrence Berkeley Laboratory. The project will bring together representatives from developing country NGOs and counterparts in their governments involved in the energy planning process. The objective of the workshop is to provide developing country NGOs with the technical expertise to initiate, carry out and provide input on energy efficiency projects, in conjunction with energy decision makers in these countries. Initial 5-day training will take place in Berkeley in the Fall of 1992, with a follow-up meeting in Washington, DC to discuss proposed projects and funding from donor organizations. The project has received $60,000, approximately half the necessary funds, from the Moriah Fund and a proposal is pending for the remaining funds. [Since the meeting, the proposal for the remainder has been approved by the C.S. Mott Foundation].

Joe Sedlak of VITA provided an overview of Volunteers in Technical Assistance's (VITA) ongoing work in Djibouti. VITA has worked in Djibouti since 1982. The work began with a national energy assessment. VITA went on to establish a national energy strategy and helped the country to install a 10 Megawatt geothermal plant with World Bank funding. VITA is installing a geographic information service (GIS) to assess energy and natural resources for sustainable energy development, and it is training energy planners to use this system. VITA has also assisted Djibouti in launching a low earth orbiting satellite which is used for renewable energy projects.

Jeanne Solé of the Conservation Law Foundation (CLF) briefed the Working Group on an ongoing demand side management (DSM) program in Jamaica. Based on their experience with DSM in New England, CLF is working with Jamaica Public Service to identify the potential to reduce future power demand growth through improvements in electrical energy efficiency. An initial energy efficiency potential study has been completed, and has identified the capability to reduce power demand by what is deemed to be a conservative 20%. A 40% demand reduction is considered feasible in CLF's estimation. Energy audits are currently underway. Work on capability-building is an ongoing and intricate part of every phase of the process. The Board of the Jamaica Public Service has recently approved the creation of a subsidiary to administer energy efficiency projects. A pilot program has been designed and partially funded; a request has been submitted to have GEF make up the difference. CLF and JPS expect to implement comprehensive energy efficiency programs in over 20 selected Jamaican buildings. Monitoring and evaluation of the projects' success will be an intricate part of the project.

Finally, Alain Streicher summarized RCG/Hagler, Bailly's work in Costa Rica. A power sector efficiency assessment of energy saving potential in the industrial, commercial and residential sectors has been proposed for Costa Rica based upon a study that was completed in June of 1991. A workshop bringing together all the relevant players in the process recently took place in Costa Rica.

III. Strategies for presentation of Project Proposals Book.

A quick review of the status of Working Group proposals was then provided. The Working Group's Technical Review Committee has now reviewed selected project proposals, following IIEC's work in editing and improving the proposals. The Committee returned those proposals to the Secretariat with suggested revisions for the project proposals which were recorded on specific proposals. Responses to the suggested corrections or improvements were requested by February 15th in order to ensure proposals are included in the first set of planned donor presentations.

The Working Group discussed a short, medium and long term proposal presentation strategy during which proposals will be presented to multilateral and bilateral funding agencies. As has been discussed at previous Working Group meetings, initial presentations, in the next 6 to 9 months, will focus on AID and the World Bank's Global Environment Facility (GEF). Ken Newcombe, Global Environment Facility Coordinator, and his staff have expressed interest in a presentation of the portfolio. The GEF has a three year life as a pilot facility and has $770 million in core funds, not including parallel American or Japanese co-financing. Approximately 40-50% of the funds are designated for reducing greenhouse gases. The US AID Office of Energy Director Jim Sullivan has agreed to coordinate meetings with relevant AID bureaus. Meetings will be arranged as soon as the final changes to proposals are complete.

Intermediate presentations, in the next year to year and a half, were proposed to focus on agencies housed in North America. At U.S. EPA three offices have expressed interest in such presentations: the Office of Air and Radiation, the Office of Policy, Planning and Evaluation, and the Office of Research and Development. At U.S. DOE, presentations are planned for five offices in Conservation and Renewable Energy and the International Office. Other intermediate targets include: the U.S. Overseas Private Investment Corporation (OPIC), as well as OPIC's recently established Environmental Fund, various World Bank divisions, the InterAmerican Development Bank and the International Finance Corporation.

For the long term, presentations were proposed for agencies located outside North America. Included in these organizations are: African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, European Commission, International Energy Agency, OECD Agencies, and potentially bilateral agencies and AID missions. Activities and meetings for the long term will largely depend on interest, country focus, and coordination with ongoing project work. While IIEC will facilitate the presentation of the portfolio, the intention is that for each presentation, the Working Group will be represented by individuals who have had prior collaboration with

the relevant agency. The U.S. Working Group accepted the proposed presentation strategy.

IIIa. Follow-up on the Stockholm Initiative on Energy, Environment, and Sustainable Development (SEED).

David Jhirad summarized the recommendations which resulted from the November 13-15 SEED meeting. The meeting was attended by 20 developing country representatives and 10 representatives of multilateral and bilateral funding agencies. Participants agreed on three basic recommendations: one, that both developing and industrialized country governments should develop and implement programs to improve the efficiency of both energy supply and demand; two, that multilateral and bilateral lending agencies in cooperation with developing countries, do long term power sector and environmental appraisals in order to identify policy options and investment priorities for governments and the private sector; and three, that existing multilateral and bilateral networks expand to link with developing country energy and environment networks. SEED is now investigating a follow-up meeting in Rio for the UNCED conference.

IV. Briefing on the International Energy Initiative (IEI).

Dr. Amulya Reddy gave a three part briefing on the newly formed International Energy Initiative (IEI). Dr. Reddy discussed the design and status of IEI, the principles behind IEI's operation and interaction with other organizations, and, finally, he explored the opportunities for working with GEEI.

IEI is a Southern-led institution, which seeks to foster North-South partnerships by strengthening existing networks which focus on energy, environment and development. IEI will conduct information, training, advocacy and analysis activities. The organization will identify crucial energy-related issues and will do policy papers on these issues. Initially, its analysis and advocacy work is focussing on the debt/ energy axis in India and Brazil, two net energy-importing countries, and in Mexico and Nigeria, two net energy exporters. The Board of Directors of IEI includes Jose Goldemberg, Chairman, Alvaro Umaña, Thomas Johansen, and Dr. Reddy. The organization is in the process of hiring personnel, and expects to hire initially one individual from each region of the developing world, one Latin American, one Asian, and one African. IEI expects to allocate 25% of its budget to general support and 75% to analysis and advocacy. The goal for the core budget is $ 7 million (US), which Dr. Reddy expects to increase to $12.6 million after conducting a "Stakeholders" Conference. The institute's location is uncertain, although Singapore or Kuala Lumpur have been discussed. LaRocco Associates, located at 1133 Avenue of the Americas, Suite 1125, New York, NY 10036 ph: (212) 921-7670 fax: (212) 921-7731, currently functions as the Secretariat for IEI.

Among Dr. Reddy's list of principles for IEI are: keep development as the Institute's goal and make energy an instrument to meet development needs; strengthen and reorganize existing networks; initiate and catalyze activities; get needed technologies into LDC economies; build indigenous capability; develop complete implementation strategies for

hardware and software; don't consult; keep overhead down; funnel money directly to LDCs for in-country use; use and strengthen existing training centers; don't get directly involved in training; and collaborate on projects, don't directly implement projects. Dr. Reddy and the U.S. Working Group agreed that there are numerous opportunities for collaboration between GEEI and IEI. Once IEI gets underway, specific circumstances for joint participation will be discussed further. Initial areas which were cited for possible future collaboration include: training workshops and seminars, joint analyses of critical energy related issues, and advocacy on the international, regional, national and micro levels.

V. AFREPREN Energy Efficiency Conference.

Joy Dunkerley recently attended an AFREPREN (African Energy Policy Research Network) meeting during which a spring seminar on energy efficiency was discussed. AFREPREN members include researchers and policy makers performing research on development-related energy issues for sub-Saharan Africa. Currently, there are 6 ongoing research projects conducted by the network. Due to the levels of sophistication and commitment evidenced at the January AFREPREN meeting, Joy suggested that it would be worthwhile for U.S. Working Group members to attend the April Conference on Energy Efficiency sponsored by AFREPREN. Materials on the April meeting are enclosed.

Note:

Material disseminated at the Working Group meeting, including the GEEI report, brochure, and copies of the Project Proposals of the U.S. Working Group are available upon request from Deirdre Lord at IIEC.

The next U.S. Working Group meeting will take place on Thursday, March 26th, 1992 from 9 to 11am in the Thomas Alva Edison Room B of the Edison Electric Institute at 701 Pennsylvania Avenue, NW 4th Floor (near National Archives Metro on the Green or Yellow Line). An agenda will follow shortly.

Minutes for the Meeting of the U.S. Working Group on Global Energy Efficiency March 26, 1992

The meeting opened with introductions from all Working Group members present. Then, the Working Group set the next meeting for the last week in May.

I. Briefing on the Moscow Center for Energy Efficiency.

Dr. Igor Bashmakov, of the newly-established Moscow Center for Energy Efficiency (CENEf), gave a three-part presentation on the energy intensity and economic situation in the former Soviet Union, energy conservation potential in the former Soviet Union, goals of CENEf, and possibilities for collaboration with the U.S. Working Group. The Confederation of Independent States (CIS) faces a difficult economic situation, with demand for energy and social needs far outstripping existing supply and infrastructure capabilities. The minimum cost of a balanced diet in Russia as of January 1992 grew by more than two orders of magnitude since the first quarter of 1991.

Investments in the energy sector in the former USSR accounted for 14% of total capital expenditures in 1988. Energy investments commanded forty-two percent of total capital investments in the industrial sector in 1988. Industry accounts for 46% of total electricity consumption in the former USSR. In a comparison of the energy intensity of national material production (national income excluding services) in the former USSR, the USA, and Western Europe, the total energy intensity of the former USSR is double that of Western Europe, and about one quarter greater than the USA. Dr. Bashmakov attributes the disparity in industrial energy efficiency between the former USSR and the USA to higher material intensity, less efficient technological structure of the industry (eg. wet process cement manufacturing accounts for 80% of cement manufacturing capability as opposed to more efficient dry process employed in U.S. accounting for 60-70% of cement production), and lower technical efficiency due to low quality maintenance and management. These levels of inefficiency combined with projected high demand for increased energy services is expected to contribute to increasing levels of greenhouse gas emissions, which have been implicated in global climate change. The Ukrainian and Russian republics combined account for 80% of CO_2 emissions in the former Soviet Union. As Dr. Bashmakov's data show, the CIS must confront formidable economic, energy and environmental challenges in the future (see enclosed copy of presentation).

In an attempt to address these economic and environmental issues confronting the Russian republic and the former Soviet Union as a whole, CENEf was officially registered in January of 1992. The strategic goal of this independent, non-profit organization is to help Russia achieve economic development and environmental protection by promoting energy

efficiency. The principles of operation of CENEf are: 1) to strengthen relationships with governments, NGOs, industries, and the scientific community in Russia; 2) to stress policy development and recommend effective implementation mechanisms; 3) to develop project proposals and project implementation strategies; 4) to avoid direct involvement in large-scale projects except through joint venture sponsorship; and 5) to channel information and coordinate transfer of experience between industrialized countries and the Russian republic.

Opportunities for collaboration between CENEf and U.S. groups including the U.S. Working Group that were identified by Bashmakov include: information exchange on energy efficient technologies and policies and on appropriate energy experts and producers of energy efficient equipment; joint project preparation; training of CENEf staff at like-minded U.S. organizations, and U.S. staff training in Moscow; joint organization of conferences and workshops; and mutual support of programs coordinating government, industries, scientific communities, and the mass media worldwide. Dr. Bashmakov will be in Washington until the end of May. Anyone interested in contacting Dr. Bashmakov can reach him at Battelle Pacific Northwest Laboratory, 901 D. St, SW, Suite 900, Washington, DC 20024-2115 Tel: (202) 646-5207 or Fax: (202) 646-5233.

II. Report on presentation of project proposals to the Global Environment Facility.

Michael Totten gave an overview of the first in a series of presentations of the GEEI project proposals to potential funders. Ken Newcombe of the Global Environment Facility (GEF) met for an hour and a half with representatives of the Executive Committee of the U.S. Working Group on March 23, 1992. Michael Totten briefly described the goals of the U.S. Working Group to Mr. Newcombe and the rationale behind the development of a project proposal portfolio. Then, Glenn Prickett (NRDC), Steve Hirsch (VITA), Marc Ledbetter (ACEEE), Scott Sklar (U.S. ECRE), Deirdre Lord (IIEC) and Michael Totten gave brief overviews of eight different project proposals.

Glenn Prickett and Marc Ledbetter subsequently briefed the Working Group on the presentation's outcome. The Executive Committee met with Ken Newcombe first because of his level of expertise and knowledge of these issues. He was a sympathetic, knowledgeable audience who could give excellent direction for future presentations. Based on the goal of soliciting advice from the GEF coordinator, the meeting was a success. Newcombe gave excellent recommendations, both general and concrete, for future presentations of the project proposals, and he took interest in one proposal (on developing a CFC-free, energy efficient refrigerator for India) as a potential project for GEF funding. Newcombe suggested that the project proposals seemed small for World Bank interest. This concern could be addressed by presenting related project proposals (related both geographically and topically) as a "bundle." Finally, Newcombe suggested specific individuals to approach for specific proposals and advised that the Working Group present proposals to the Operations Sectoral Board, which cross-cuts policy and operations divisions in the Bank.

III. Discussion of format for future project proposal presentations.

The various levels of knowledge and interest represented by Newcombe's recommendations for future presentations raised two important issues about future project proposal presentations. First, as the Working Group approaches individuals who are not sympathetic and/ or knowledgeable about energy efficiency, the Working Group agreed that presentations should be more focussed, formal, and direct. The Working Group concluded that an appropriate format for future proposal presentations may well be a slide show which makes the case for improving energy efficiency with specific examples taken from Working Group proposals, and developing country proposal submitters. IIEC will solicit photographs, slides and graphics from Working Group members, duplicate them, and include them in the slide presentation.

The second issue which pertains to proposal presentations is how the Working Group chooses the target audience for future presentations, and how to act on suggestions from initial meetings like the one at the GEF. Glenn Prickett suggested that the proposal presentations be a two-tiered process. The initial presentations will consist of a slick, "high-tech" marketing slide show which makes the case for energy efficiency in developing countries, with maximum input from visiting developing country and Eastern European energy experts, when possible. The Working Group decided that initial efforts will be coordinated by IIEC and will involve representatives from the Executive Committee. The second-tier of meetings will take place with individuals who have expressed interest based on the initial slide presentations. These meetings will focus on specific proposals in specific countries and will involve the relevant proposed project implementers whenever possible.

On the subject of marketing the proposals, Jim Sullivan suggested that the Working Group do careful market research on which funders have money available, particularly at AID, and target these audiences for presentations. At AID, he recommended that the Executive Committee target Henrietta H. Fore's U.S.-Asia Environmental Partnership for a future presentation, as well as the Small Business Department, and the Office of Forestry, Environment and Natural Resources for future presentations at AID. The Working Group agreed that presentations to departments at AID should progress concurrently with follow-up meetings at the World Bank. Anyone who has photographs, graphics, or slides appropriate to include in the slide presentation should contact Deirdre Lord at IIEC.

IV. Preparation for Traveling Exhibit to UNCED and beyond.

Michael Totten reviewed the present status of a 1992 U.S. Working Group activity which was approved at the January meeting, the creation of a traveling exhibit on energy efficiency technologies. An initial exhibit, to be introduced at the UNCED conference in Rio, is planned to have graphics, text and a video on energy efficient technologies and policies. After Michael Totten's trip to the Lawrence Berkeley Lab to investigate the

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feasibility of incorporating interactive multimedia (IM) into the traveling exhibit, it was determined that the technology is not currently compact enough to travel to UNCED. Instead, LBL, in conjunction with other U.S. Working Group members, will create a video on IM, energy efficient technologies, transportation and land-use planning issues, and innovative energy policies which open markets for these efficient technologies for use in that exhibit. IIEC is working with an AID consultant, Alan Poole, to handle the logistics of transporting the exhibit down to Rio, as well as to coordinate a GEEI media strategy for the conference. In addition, IIEC is coordinating with both U.S. ECRE and ACEEE in their planned exhibits at UNCED. Graphics acquired for use in the U.S. Working Group proposal presentations (see above) could be incorporated into the traveling exhibit.

Alain Streicher discussed the U.S. Working Group with Al Thumann of the Association of Energy Engineers, who, due to the rapid timeline, indicated a strong interest in getting involved after the exhibit is introduced at UNCED.

V. U.S. Working Group Training Initiative.

Tom Wilbanks updated the Working Group on the status of the Training Initiative. In January, the Training Subcommittee, which is comprised of Peter Miller at NRDC, Mark Levine at LBL, Debbie Bleviss at IIEC, and Tom Wilbanks at ORNL, proposed three potential training activities to the U.S. Working Group. The Working Group approved the proposed training initiatives for 1992. Two of the activities have been proposed to AID's Office of Energy and Infrastructure to start in the next four months. Included in the proposal pending at AID is an energy efficiency training initiative for Mexico to be coordinated with Mexican counterparts through ongoing activities by a number of U.S. Working Group members and support for the NGO training workshop which will be organized by the Center for Global Change, LBL, NRDC and IIEC in the fall of 1992.

Two additional training activities proposed for the U.S. Working Group in 1992 are an international workshop on agendas and structures for energy efficiency training in collaboration with South-based institutions (such as Amulya Reddy's International Energy Initiative [IEI see January minutes 1992]) and the development of standard energy efficiency training materials and courses with international energy organizations such as IEI, Tata Energy Research Institute (TERI), AFREPREN, and OLADE. With regard to IEI, in particular, Debbie Bleviss also noted that Amulya Reddy had agreed to cosponsor with the Working Group the workshop of developing country energy efficiency experts (to be held in the fall) which the Working Group endorsed at its last meeting.

VI. Newly formed Brazilian Foundation.

Bill Nitze briefed the Working Group on a meeting he had recently with the newly-formed Brazilian Foundation for Sustainable Development which is comprised of large Brazilian corporations. The Foundation is interested in funding energy and environmental projects.

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Bill Nitze suggested that the Working Group contact them in order to establish a relationship with the foundation and with the corporations involved.

Notes:

U.S. Working Group members will be apprised as soon as possible as to the date of the next meeting, tentatively set for the last week in May. Also, in recognition of the value of recent presentations to the U.S. Working Group by individuals doing work in developing countries and Eastern Europe, Working Group members are encouraged to invite scientists and experts visiting from developing countries, Eastern and Central Europe to discuss their work and possible collaboration with GEEI at future meetings. Anyone interested in receiving a full copy of the March 1992 U.S. Working Group project proposals should contact Deirdre Lord at IIEC.

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Minutes for the Meeting of
the U.S. Working Group on
Global Energy Efficiency
May 26, 1992

The meeting opened with introductions from all Working Group members present. Also, the briefing on follow-up to the Stockholm Initiative on Energy, Environment and Sustainable Development (SEED) had to be postponed until the next meeting due to a scheduling conflict. The next meeting was set for Thursday, July 23rd, at IIEC's new office.

I. Discussion of World Bank Policy Papers on Energy Efficiency and the U.S. Working Group's Response.

Various Working Group members have been involved in the review of the World Bank's recently-released energy efficiency policy papers. The World Bank formed a Task Force on Energy Efficiency and Conservation in the Fall of 1991 which generated the two papers framing the World Bank's policy toward energy efficiency in developing countries. The papers, entitled Energy Efficiency and Conservation in the Developing World: The World Bank's Role and The Bank's Role in the Electric Power Sector: Policies for Effective Institutional, Regulatory and Financial Reform, fail, in the estimation of the Working Group members, to adequately define the potential for energy efficiency in developing countries. Although the power sector paper discusses end-use energy efficiency, the document makes no strong recommendations. In fact, the paper recommends that developing countries not do end-use efficiency through utilities.

The energy efficiency paper has two principal shortcomings. First, the paper constantly stresses that end-use energy efficiency cannot be accomplished in less developed countries, but the paper does not define the obstacles confronting energy efficiency policy implementation in these regions. Second, the paper suggests no alternatives to conventional energy supply expansion and neglects to delineate an active leadership role for the World Bank. The paper disregards integrated resource planning (IRP) and demand-side management (DSM) as viable alternatives to conventional energy supply expansion options.

The Working Group suggested two possible actions to respond to the inadequacies of the World Bank papers. First, representatives from various NGOs are collecting comments from energy experts in industrialized and developing countries to send to the Bank. Comments are encouraged and will be accepted through July with the aim of affecting revisions in the papers internally. Second, due to the topical nature of environmental, energy and development issues in the media during United Nations Conference on Environment and Development (UNCED), Working Group members proposed launching a direct media campaign. Working Group members attending UNCED agreed to hold a press conference in Rio in which the U.S. Working Group would discuss the disparity between recommendations in the World Bank papers in comparison to findings of the U.S.

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Working Group report released in June of 1991. The Working Group agreed to circulate a press release on which members of the Working Group are listed with affiliations for identification purposes only.

II. Briefing on the AFREPREN Energy Efficiency Workshop, Gabarone, Botswana.

Michael Totten represented GEEI at the African Energy Policy Research Network (AFREPREN) conference in Gabarone, Botswana during the first week in April. AFREPREN was begun in 1989 and is solely funded by the Swedish Agency for Research Cooperation with Developing Countries (SAREC). The network aims to promote research relating to the formulation and implementation of appropriate energy policies in 16 sub-Saharan countries in Africa. Twenty-five energy professionals representing AFREPREN from government ministries, Universities and NGOs also strive to strengthen the region's research capability. The first volume of work produced by the network focussed on supply side energy issues. Energy efficiency as a strategy for improving and increasing energy services at a fraction of the cost of new energy production provides the policy framework for Volume 2, Energy Management in Africa. Authors developed case studies and formulated policy recommendations to improve the use of energy in the transportation and industrial sectors, as well as in the generation of electric power.

At the conference in April, Michael Totten presented an overview of the status of DSM in the U.S. He also discussed the Golden Carrot Incentive as a model program for leapfrogging technical innovations. As a result of his visit, AFREPREN members are coordinating with Michael to submit project proposals to GEEI based on their long range plan. Members of AFREPREN currently have an active exchange between the U.S. and the network. Ogunlade Davidson, who is an AFREPREN member, is a visiting scholar at Lawrence Berkeley Laboratory (LBL). Chris Neme, formerly of the Center for Clean Air Policy, is currently in Botswana to assess energy conservation opportunities in Botswana. Any further questions can be directed to Michael Totten at IIEC, or Ogunlade Davidson at LBL (510/ 486-5965).

III. Discussion of U.S. Working Group Activities at UNCED.

Mia Birk, who will officially represent the U.S. Working Group at the UNCED conference, briefed Working Group members on GEEI activities that are taking place in Rio. The initial GEEI traveling exhibit, an approved U.S. Working Group activity for 1992, was created and will be launched at UNCED. Seven posters were designed for display at the Global Forum in Flamengo Park. The posters review policy and technology options which promote energy efficiency as a least cost development strategy for developing countries. A display of state-of-the-art lighting and window technologies will also be exhibited at the GEEI booth.

The U.S. Working Group will sponsor a symposium on June 8th at FURNAS auditorium. The symposium, entitled Global Energy Efficiency Initiative, U.S. Working Group: A Call

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to Action, will be hosted by the newly-formed Brazilian NGO called the National Institute for Energy Efficiency (INEE). Two panels will discuss opportunities and barriers to implementing energy efficiency in developing countries. Panel one will focus on innovative energy efficiency policies and technologies for developing countries. Panel two will discuss institutional mechanisms for overcoming barriers and realizing opportunities for energy efficiency in developing countries. The symposium will be followed by a press luncheon hosted by the Honorable Jayme Lerner, Mayor of Curitiba, Brazil. Brazilian Senator Teotonio Vilela Filho will provide a keynote speech. The symposium will open with a slide show, highlighting the mission and activities of the U.S. Working Group. The slide presentation also introduces various energy efficiency-related issues and the innovative policies and technologies that exist to confront these issues. The slide show will yield the Working Group multiple benefits. The Working Group decided that a slide presentation would be a practical marketing tool for use during initial project proposal presentations to potential funders. If any Working Group members have photos or slides that they would like to submit to the slide presentation, contact Deirdre Lord at IIEC.

IV. UNCED and Beyond: The Energy Perspective.

Steven Klein of US UNCED, Todd Goldman of EDF, and T.J. Glauthier of WWF provided their perspectives on energy efficiency as it relates to UNCED. Stephen Klein began with an overview of US UNCED's approach to the Earth Summit as it relates to energy efficiency and developing countries. According to Klein, the energy chapter in the climate convention emphasizes energy efficiency, intellectual property rights with a technology cooperation focus, information and capacity building and public/ private partnerships. Innovative policies are perceived as a central building block to implementing energy efficiency through technology transfer, however specific reference to which policies are replicable was not discussed.

The Conference's preparatory papers do not spur specific actions or provide a model for action. Rather, the agreements leave responsibility for action and implementation to multilateral and bilateral lending institutions, NGOs, the United Nations organization, the private sector and less developed countries. The Global Environment Facility (GEF) has been discussed during preparation for UNCED as a major mechanism for implementing energy efficiency.

The strength of the climate convention is its stated objective, which is to stabilize the existence of greenhouse gases in the atmosphere. The convention's objective suggests that the existence, not simply emissions, of greenhouse gases must be stabilized. According to U.S. NGOs who have been working on preparation for the Conference, however, the convention's weakness is a lack of commitment and timetables to achieve this stated goal. Any activity to reduce CO_2 emissions is voluntary. The European Community, in particular, has expressed such disappointment with this lack of resolve to abate CO_2 emissions that these countries may formulate a separate declaration at the Conference. Although the U.S. government, according to Klein, has not dedicated finances to UNCED

follow-up, TJ Glauthier reiterated the need for firm commitments to CO_2 emissions stabilization outside the U.N. process. A commitment has been made to supply GEF with "new and additional funds" to meet the agreed full costs of greenhouse mitigation projects. AID will apparently be involved in deciding the methodology for what "agreed full costs" entails. Again, both Glauthier and Klein emphasized a major role for the NGO community in the follow-up to UNCED. The Climate Action Network and Earth Summit News will continue after the completion of the UNCED conference.

The U.S. Working Group then proposed developing a second report, using the June 1991 report to the U.S. Working Group as a benchmark from which to survey energy efficiency programs and projects which are currently taking place. The second component of a proposed report could define what the U.S. Working Group believes is needed to meet objectives described in the climate convention, what this means for this country in relation to international positions. Finally, the paper would outline what the U.S. government might do to respond to this need.

5. Funding Diversification for GEEI.

The Working Group proposed setting up a Sub-Working Group on Funding Diversification which would develop a strategy for diversifying GEEI's funding. The two funding issues facing GEEI are: securing funding for project proposals, which is an ongoing activity providing the opportunity to secure funds from diverse sources as projects are rather diverse; and, diversified support for the Secretariat, which allows for more limited options and is currently funded solely by AID's Office of Energy. An as yet untapped resource for the U.S. Working Group is the private sector. Inviting private sector participation in GEEI would serve to broaden the scope of GEEI. Potential private sector contacts suggested by the Working Group were: foundations, large corporations, particularly energy efficiency related corporations, the USEA, and the Atlantic Council, which is working on technology transfer and trade issues.

6. Update on project proposal presentations.

The slide show that was created for UNCED will serve as a marketing tool for potential funders of the GEEI project proposals. Jim Sullivan is setting up meetings at different divisions of AID. The Working Group agreed to distribute the project proposals to IIEC's three regional offices so that they can present the proposals to funders while traveling in their respective regions. IIEC's new European Office will provide the Working Group with access to the European Bank for Reconstruction and Development (EBRD).

Note:

The next U.S.Working Group meeting will be on July 23rd, 1992 at the new IIEC office at 750 1st Street, NE Suite 940 (Phone: 202/ 842-3388) at Union Station on the red line.

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Minutes for the Meeting of
the U.S. Working Group on
Global Energy Efficiency
July 23, 1992

The meeting opened with introductions from all Working Group members in attendance. There were two changes to the agenda. Four of the five organizations which are sponsoring the NGO Training Project in November gave an overview of the project's status. Also, Working Group members were updated on the July meeting of the Executive Directors of the World Bank and their response to comments provided by Working Group members on energy policy papers compiled by the Bank.

I. Briefing on the Export of Green Lights to Brazil.

Howard Geller and Bill Nitze gave an update on the status of exporting Green Lights to Brazil. The project concept originated last spring when Bill Nitze met with the Brazilian Foundation for Sustainable Development. The Foundation expressed an interest in funding energy and environmental projects, and suggested Bill Nitze return to them with a proposed project. Working Group members decided to propose a Green Lights project for Brazil. After meeting with appropriate individuals at EPA, Bill Nitze (the Alliance to Save Energy), Howard Geller (American Council for an Energy-Efficient Economy, ACEEE), Alan Poole (National Institute for Energy Efficiency, INEE, Brazil), and John Lebens (International Institute for Energy Conservation, IIEC) gave a Green Lights slide presentation to members of the Brazilian Foundation during the UNCED conference. Although the Foundation was interested in the project, it is not likely it will take an active role in initiating it.

However, Brazil's National Institute for Energy Efficiency (INEE), a newly formed NGO, is strongly interested in acting as EPA's Brazilian counterpart in the management of the project. INEE will coordinate the efforts of all the Brazilian organizations involved, including PROCEL/Eletrobras, and the Brazilian Business Council. INEE will also conduct audits and provide the technical expertise with training and assistance from EPA. Howard Geller will act as the U.S. manager for the project. Although EPA and two U.S. foundations have expressed an interest in supporting the project, they prefer some start-up funding to come from Brazil. Currently, funding from the Brazilian government for most projects is paralyzed because Brazil's government is enduring a scandal similar to Watergate. In the absence of national government funds, it is expected that Brazilian state governments will fund a portion of the project. A proposal from the Brazilian project coordinators is expected in September. The total expected budget for the project is US $300,000 to 400,000 over two years, with $50,000 for seed funding.

International efforts to promote Green Lights may also be supported through the National Energy Strategy, which is currently in the Congress. In June, the House and Senate Subcommittee Chairs for HUD and Independent Agencies were sent letters by

Congressmen and Senators on the Subcommittee requesting an additional $ 1 million to expand the EPA Green Lights program internationally. In an effort to keep Working Group members informed of the process of exporting Green Lights, initially to Brazil, Bill Nitze proposed chairing a U.S. Advisory Group which will coordinate U.S. efforts to export Green Lights.

II. Discussion of GEEI member activities at UNCED.

From June 1 to 14, Mia Birk and John Lebens, representing IIEC as the Secretariat of the U.S. Working Group of the Global Energy Efficiency Initiative, organized and participated in various events at the Global Forum, in Brazil. On Monday, June 8, the GEEI sponsored the conference "A Call to Action" hosted by the newly-formed Brazilian National Institute for Energy Efficiency (INEE). The conference was well attended by over 40 people from around the world. A number of attendees were Brazilian, from INEE, FURNAS, and PROCEL, which is the Brazilian national electricity conservation program. The english presentations, questions, and answers were simultaneously translated into portuguese, while the portuguese language participants were translated into english.

The conference opened with introductory remarks from INEE's Marcos Jose Marques, who facilitated the first panel. The first presentation was a slide show delivered by Mia Birk from IIEC. The slides described GEEI, its purpose and activities, and technology and policy options to improve the efficiency of energy use worldwide. Ms. Birk's presentation was followed by a panel of experts discussing energy-efficiency opportunities and barriers. The panel included Scott Sklar, US ECRE; David Jhirad, AID; and John Lebens, Director of IIEC's Latin America office in Santiago, Chile. Among the topics presented were energy demand growth for energy in developing countries, utility incentives to invest in energy efficiency, components necessary for a quality demand-side management effort, and how to design projects that successful combine renewable energy sources and energy efficiency technologies. This panel was followed by an audience discussion session.

The second panel was chaired by INEE's Jayme Buarque de Hollanda. Two subject matters were discussed on this panel. The first was the role of the World Bank in the energy lending picture, opened by Howard Geller ACEEE, and followed by Ian Johnson, Administrator of the Global Environmental Facility (GEF). The second panel topic focused on Brazilian activities in energy conservation, with short talks by Leoncio Cardoso Neto from Abilux, a Brazilian lighting trade alliance, and Mario Santos from PROCEL, the Brazilian National Electricity Conservation Program. The presentation of these topics was followed by another audience discussion session, which focused attention on the GEF program and its possible future directions. The participation and sponsorship of INEE, PROCEL, and Abilux set the stage for the following day's activity, a one-day workshop, "Implementing Energy Efficiency," sponsored by INEE. John Lebens attended this workshop.

The GEEI exhibit was located in Flamengo Park, the site of the Global Forum. The exhibit included 7 laminated GEEI posters displaying: 1) the GEEI logo and list of members, 2) the projected capital savings from an energy efficiency investment scenario versus a reference scenario (assuming some energy efficiency improvements), 3) the projected CO_2 emissions reductions from an energy efficiency scenario, 4) the potential energy savings from building design and technology improvements, 5) the potential energy savings from mitigating the urban heat island effect, 6) the potential savings in the transportation sector from mass transit and land-use planning improvements, and 7) the potential energy savings from industrial efficiency improvements such as high-efficiency motors. The exhibit displayed examples of energy-efficient lighting and window technologies. Unfortunately, at the end of the first week, the GEEI exhibit suffered the theft of the 7 posters. Subsequently, the GEEI exhibit was combined with the ACEEE/LBL booth. The flow of inquiries from Global Forum attendees was unabated throughout the conference.

Literature from GEEI, including brochures, the GEEI report, and GEEI project portfolios, was distributed to interested parties and the general public. We also distributed literature from other GEEI members, including ACEEE, LBL, IIEC, the U.S. Office of Technology Assessment, the U.S. Export Council for Renewable Energy, the Stockholm Initiative on Energy, the Environment, and Sustainable Development (sponsored by U.S. AID, et. al.), the Institute for Transportation and Development Policy, the Alliance to Save Energy, and Biomass Users' Network.

There were a number of other activities conducted by GEEI members during the UNCED conference. Aside from the meeting to discuss exporting Green Lights to Brazil (see above), John Lebens and Mia Birk both attended seminars sponsored by such GEEI members as the U.S. ECRE/Solar Energy Industries Association, Tata Energy Research Institute/Stockholm Environment Institute, Conservation International, INEE and the Danish Organization for Renewable Energy, At the Danish meeting, an international network of NGOs working in energy efficiency and renewable energy (International Network for Sustainable Energy - ENFORSE) was organized. Howard Geller and Alden Meyer are the U.S. contacts.

Also, during the last GEEI meeting, it was decided that significant attention should be paid to publicizing the World Bank's recent draft energy policy papers, which, among other shortcomings, down played the importance of IRP. Howard Geller and John Lebens arranged a press conference to bring attention to the World Bank's papers at the International Press Center of the Global Forum. Two reporters, one Brazilian and one North American, spent more than an hour in the interview.

III. Overview of the briefing by Dr. Pramod Deo.

On July 1st, Dr. Pramod Deo of the Energy Management Centre of India briefed the U.S. Working Group on the energy situation in India. The Energy Management Centre

was established in recognition of the high projected demand for energy and electricity in India and the constraints in confronting this high demand. The Centre coordinates with various energy and industry ministries and departments of the Indian government to assess energy use patterns and to initiate rational use of energy. The Centre conducts various activities including: training and information exchange, energy audits, target setting for industries, publications and publicity, policy studies, establishment of energy training institutes, and coordination with energy advisory cells. Under the eighth five year plan, the Centre will focus its efforts on meeting energy targets for various Indian sectors. For industry, the goal is for reductions in energy consumption of 10 percent. The consumption growth rate of diesel and petrol in the transport sector are proposed to be held to 7 percent per year. Lighting loads are also targeted for reductions in the residential sector. Currently, agricultural electricity tariffs are heavily subsidized. The Centre intends to bring about the revision of the agricultural tariff structure.

Dr. Deo outlined the various constraints the Energy Management Centre faces, including absence of a perceived need for energy efficiency; the limited possible impact of a small program; an inadequate database of information, technologies and policies; and limited advisory services available to the Centre. These constraints highlighted opportunities for further collaboration with the Working Group, particularly through continued information exchange.

The success of the presentations to the Working Group from energy efficiency experts from developing countries and Eastern and Central Europe, which have occurred regularly over the past 6 months, prompted a suggestion to institute a more formal process of setting up regular Working Group presentations. These briefings may occur between bimonthly meetings of the U.S. Working Group. Suggestions for future presentations include: coordinating with foreign nationals attending the ACEEE conference in Asilomar, CA; coordinating with individuals passing through Washington before or after the World Energy Council in Madrid; and scheduling a briefing around the IMF/ World Bank meeting. Any Working Group member who knows that an energy expert will be in Washington should inform Deirdre Lord at IIEC in advance so that a briefing can be arranged.

IV. Briefing on the proposal presentation to the U.S. Asia Environmental Partnership.

Representatives from the Executive Committee presented an overview on GEEI and the project proposal portfolio to Lewis Reade, Director-General of the U.S.-Asia Environmental Partnership (US AEP) and Owen Cylke, Acting Managing Director for Program Development. US AEP aims to assist U.S. energy and environmental companies seeking opportunities in Asia. The organization seeks to be a clearinghouse for U.S. businesses. US AEP will receive no new authorization, but rather it represents the synergism of existing Federal programs and projects, U.S. businesses, and community groups with similar goals.

There are four major components to the program, three of which are directly linked to GEEI. First, a fellowship program coordinated by the World Environment Center will fund exchanges between professionals in Asia and the U.S. Second, an environment and energy infrastructure fund will expedite the review of projects for U.S. government agencies involved in the U.S. AEP. Under this program, Lew Reade and Owen Cylke expressed an interest in policies and programs (DSM, for example) which provide institutional development mechanisms for technology transfer. The technology transfer programs seek to expand the utilization of U.S. technologies in both the public and private sectors. The establishment of U.S. environmental business centers is an initial goal of this program. The final program supported by US AEP is a biodiversity project which is applicable to the GEEI projects in that energy efficiency reduces demand on natural resources for supplying energy services.

The Working Group discussed the format of project proposal presentations and the members involved in the process. Some Executive Committee members believe that the current practice of involving the Executive Committee is a significant burden on member's time. The advantage to the current structure, however, is that the potential funders are able to see the diversity of the GEEI constituency, and the individuals involved are able to bring their diverse backgrounds to the discussion. The Working Group decided that the Executive Committee should be informed of the timing of the meetings so they can decide whether they should attend.

V. Briefing on the NGO Training Project.

The NGO Training project, one of the GEEI projects, which will bring seven individuals from NGOs paired with a utility or government counterpart to Northern California, will take place from November 9 to 13th. The pairs have been chosen based on their level of expertise on integrated resource planning (IRP) and demand side management (DSM). Pairs will attend from Poland, Sri Lanka, Mexico, India, Chile, Botswana and Russia. The project is cosponsored by the International Institute for Energy Conservation (IIEC), the Center for Global Change (CGC), the Natural Resources Defense Council (NRDC), and Oak Ridge National Laboratory (ORNL). The first week of training will take place at LBL because of its proximity to a range of relevant organizations including: the Electric Power Research Institute (EPRI), Pacific Gas & Electric (PG&E), Sacramento Municipal Utility District (SMUD), and others. A needs assessment and questionnaire was sent to all potential participants in an effort to ensure consistent levels of knowledge on IRP and DSM.

VI. GEEI Training Update.

AID has agreed to launch a GEEI training initiative which will focus on training for an AID priority country in power sector resource capability development. The initial country focus will be on Mexico. In coordination with the ongoing high efficiency residential lighting project for Mexico, the initial training effort will identify the needs and

capabilities of a range of Mexican players including: utilities, building and plant managers, and others. The initial effort will identify technical resource capabilities by assessing who needs to be trained, who in Mexico can train, and how trainers develop the expertise to continue the process. The initiative is meant to be a collaborative process and will develop an ongoing working relationship with colleagues in Mexico.

V. Subcommittee on Funding Diversification.

The Subcommittee on Funding Diversification has identified possible alternatives for future funding in various U.S. government agencies. One possible future source of funding may be a $1/2 million energy efficiency counterpart or subcommittee of the Committee on Renewable Energy Commerce Trade (CORECT). Also, EPA has expressed an interest in possibly providing seed funds for a more significant energy efficiency exhibit. The recent proposal presentations also have begun a dialogue with organizations which have not been approached by GEEI before.

VI. Summary of World Bank Executive Director Meetings.

The meeting of the World Bank Board of Executive Directors took place on July 21st. After rigorous discussion and numerous letters from around the world, the Board agreed to send the two papers framing the World Bank's policy in developing countries with regard to energy efficiency and the power sector back to World Bank management for further policy development. The papers, entitled Energy Efficiency and Conservation in the Developing World: The World Bank's Role and The Bank's Role in the Electric Power Sector: Policies for Effective Institutional, Regulatory and Financial Reform had been faulted for, among other issues, down playing the value of integrated resource planning (IRP). Working Group members who have been involved in this process developed an action plan for how to proceed. Groups involved, including NRDC, IIEC, ACEEE and TERI, propose that the Bank's Power Sector paper establish a policy that all loans in the electric power sector be based on, or support development of, integrated resource plans. Other recommendations from Working Group members include committing the Bank to hiring new staff with professional training and experience in implementing end-use efficiency programs; and proposing the creation of an external Energy Efficiency Advisory Board to serve as a resource for the Bank staff on technology and policy issues. The comments from less developed countries on the policy papers were extremely influential in impressing upon the Executive Directors the need for an action plan and a new assessment of the comprehensiveness of the policy papers.

The meeting concluded with a brief discussion of efforts to create Working Groups outside the U.S. Although there have been discussions about beginning Working Groups in Europe, Japan, Latin America and Southeast Asia, funding and action is absent and proposals are welcome. One development from the UNCED conference was the establishment of an international network of NGOs working in energy efficiency and renewable energy (International Network for Sustainable Energy - ENFORSE). NGOs

may also use the existing Climate Action Network regional networks established prior to UNCED to move more significantly into energy efficiency. Howard Geller, Alden Meyer, Carol Werner and Michael Totten will develop a concerted strategy on coordinating with regional Climate Action Networks. Also, Howard Geller announced that efforts are under way to create a European Council for an Energy-Efficient Economy (ECE3). The group would be modelled on ACE3 to some degree. Key individuals involved in the process will meet in Asilomar during the summer study.

Notes: The date for the next meeting has yet to be set. An announcement will follow shortly with the date for the meeting and dates for upcoming briefings.

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Minutes for the Meeting of
the U.S. Working Group on
Global Energy Efficiency
October 15, 1992

The meeting opened with introductions from all Working Group members in attendance. There was one change to the agenda. An overview of the new World Energy Council for Energy Efficiency was added to the end of the agenda.

I. Proposed Action Items for the U.S. Working Group over the next year.
Debbie Bleviss provided an overview of the proposed action items for the U.S. Working Group over the coming year.

- The Working Group has discussed in prior meetings the possibility of hosting a workshop of international energy efficiency experts in coordination with energy efficiency networks in developing countries, including the International Energy Initiative (IEI). The objective of the proposed workshop would be to bring together a small group of the top energy efficiency experts in developing countries, and Eastern and Central Europe to network and coordinate their ongoing activities. The meeting could also facilitate the development of a matrix of needs identified by attendees, and to determine how these needs can be met through GEEI or IEI.
- Based on interest and direction from initial presentations to potential funders which took place during the first six months of 1992, the U.S. Working Group proposes targeting AID, the InterAmerican Development Bank (IDB), various departments in the World Bank, and the Asian Development Bank (ADB) for follow-up proposal presentations.

- The success of the U.S. Environmental Protection Agency's (EPA) Green Lights program has generated extensive international interest, starting in the countries where GEEI representatives have presented the concept. GEEI representatives at UNCED were successful in stimulating interest in the concept among top-level Brazilian corporate executives. And IIEC's Latin America office has encountered similar interest by the Chilean government. A proposed action item for the coming year is to coordinate the international export of EPA's Green Lights program to countries such as Brazil and Chile. Congress recently appropriated funds for EPA's export of the Green Lights program. It is proposed that the Working Group organize an advisory committee to coordinate the export of such a program, the initial focus of which is likely to be in Brazil and Chile.

- The NGO Training Project on integrated resource planning and demand-side management is a GEEI project cosponsored by five Working Group member organizations: including the Center for Global Change at the University of Maryland, the Natural Resources Defense Council (NRDC), Oak Ridge National Laboratory (ORNL), Lawrence Berkeley Laboratory (LBL), and the International Institute for Energy Conservation (IIEC). Seven countries will be represented by an attendee from an NGO

who will be paired with a government or utility counterpart. The workshop's objective is to develop fundable; bankable IRP and DSM project proposals in the seven countries. It was proposed that the Working Group, in coordination with the cosponsors of the workshop, identify the top two or three proposals developed by a team, and coordinate ongoing project development.

- Of the three focus countries (Mexico, Indonesia, and Brazil) identified by the U.S. Working Group at the start of 1992, Mexico has been the most active recently on energy efficiency. It was proposed that efforts be directed in Mexico to spur additional activities in this country. Potential future activities in Mexico could include: the development of a Mexican utility DSM/IRP collaborative; development of an energy efficiency product guide for application in Mexico; and training and curriculum development for energy efficiency.

- It was proposed that GEEI training efforts be coordinated with ongoing activities in Mexico. An initial exercise could be assessing training needs and expertise in the country; another effort could be the development and implementation of energy efficiency standards for energy consuming technologies. On a more global scale, another potential GEEI training activity could be follow up to the planned NGO training endeavor on a regional level.

The Working Group accepted the proposed action items for the coming year with some suggestions. Also, ad hoc subcommittees formed that will provide input and guidance on the planned U.S. Working Group activities for the coming year. The subcommittee on the proposed meeting of international energy experts includes John Armstrong, RCG/Hagler, Bailly; Todd Goldman, Environmental Defense Fund; Murray McCombs, BNF Technologies; Scott Sklar, U.S. Export Council for Renewable Energy (US-ECRE); Carol Werner, Energy and Environmental Study Institute (EESI); Tom Wilbanks, Oak Ridge National Laboratory (ORNL). The subcommittee on donor agency presentations includes S. Padmanabhan, EPIC Program, US AID; Steve Wiel, Lawrence Berkeley Laboratory (LBL). The subcommittee for the proposed coordination of the export of Green Lights Programs, initially in Brazil and Chile includes Howard Geller, American Council for an Energy-Efficient Economy (ACEEE); Bill Nitze, The Alliance to Save Energy; Michael Totten, International Institute for Energy Conservation (IIEC). The NGO Training Project as a potential mechanism for identifying fundable GEEI projects will have a subcommittee comprised of Todd Goldman, (EDF); Rick Sellers, US-ECRE; Steve Wiel, LBL. The subcommittee for the proposed energy efficiency activities in a key country will involve John Armstrong, RCG/Hagler, Bailly; Glenn Prickett, Natural Resources Defense Council (NRDC), Steve Wiel, LBL. Finally, GEEI members forming a subcommittee on GEEI training include Ahmad Ghamarian, Institute of International Education (IEI); Todd Goldman, EDF; Harvey Sachs/Alan Miller, Center for Global Change; Peter Miller/ Glenn Prickett, NRDC; Rick Sellers/Scott Sklar, US-ECRE; Steve Wiel, LBL; Tom Wilbanks, ORNL; Steve Witkowski, US AID.

On the subject of GEEI Training, Scott Sklar suggested that there are a number of other activities that should be coordinated with the GEEI Training Program. For example, a new U.S. Technology Center has been established at Savannah State College which will train developing country people on water related technologies for numerous applications. Also, U.S. ECRE recently signed a lease on a building on Massachusetts Ave. the purpose of which will be to provide training and technology demonstration center to familiarize and educate people on policy issues related to energy efficiency and renewable energy. These two new developments underscored the Working Group commitment to coordinate the GEEI training program with the ongoing efforts of counterpart organizations in the U.S. and abroad.

The discussion of activities in Mexico prompted U.S. Working Group members to report on their ongoing activities in the country. RCG/ Hagler, Bailly, is completing a national DSM assessment. Currently, Hagler Bailly is assessing DSM potential in the industrial sector. IIEC and LBL are evaluating the feasibility of a large-scale residential lighting program for the Mexican cities of Monterrey and Guadalajara. U.S. ECRE is organizing a trade show and conference for Latin America in Mexico, which will take place in the Fall of 1993, and will be funded by the Committee for Renewable Energy Commerce and Trade (CORECT). As part of the GEEI Training program, Tom Wilbanks will organize a session in Mexico with key Mexican decision makers who are involved in the Mexico lighting project to identify training needs and capabilities in Mexico.

II. Briefing on the Program for the Acceleration of Commercial Energy Research (PACER) and the Energy Management Consultation and Training (EMCAT).

Dr. David Jhirad and S. Padmanabhan provided background and overviews of the Program for the Acceleration of Commercial Energy Research (PACER) and the Energy Management Consultation and Training Program (EMCAT), two U.S. Agency for International Development (U.S. AID) energy programs for India. The PACER program was developed in response to some barriers in India that influenced the development and commercialization of advanced energy technologies in the country. While the country has a large, highly skilled scientific establishment market forces have not effectively reached Indian energy research and development leading to a disassociation between science and industry. The PACER program was capitalized in 1987 with US $20 million and is operated by the Industrial Credit and Investment Corporation (ICICI), an Indian financial institution. The Program provides grants and low-interest loans to consortia of manufacturers and research and development organizations for the commercialization of energy-efficient technologies. The Program encourages technology transfer as well, and provides hard currency for the purpose. To date, PACER has supported sixteen projects, three of which have advanced to the commercialization phase of project development.

The Energy Management Consultation and Training (EMCAT) program was designed in 1991. The program has US $20 million in funds. The program evolved as a result of a sector assessment. EMCAT promotes the deployment of supply and end-use technologies that promote energy efficiency. The current focus of the EMCAT program is to leverage existing World Bank

activities to promote the development of three particular categories of energy efficient products and services in the Indian market: energy service companies (ESCOs); cogeneration technologies and advanced energy audits. The EMCAT program, unlike PACER, works with existing technologies to adopt partnerships for training and aims to better integrate supply and demand systems. The evaluation component of the EMCAT program is not yet in place.

III. NGO Training Program.

The Non-Governmental (NGO) Training Program on integrated resource planning (IRP) and demand-side management (DSM) is a GEEI project that will bring together seven teams of participants from seven countries around the world. Participants will come from Poland, Russia, Sri Lanka, India, Mexico, Chile, and Africa (Botswana and Kenya). Each team will be comprised of a representative from a non-governmental organization (NGO) and a utility or government counterpart. The training will take place from November 16 to 20th at Lawrence Berkeley Laboratory (LBL). The week's agenda will open with presentations from each team on each country's electricity situation, regulatory oversight, utility decision making process, market conditions, government policies, and access to information. The objective of the initial workshop in Berkeley is to develop the tools to begin the process of designing IRP and DSM projects in the respective countries represented there. Each cosponsor-organization will have the added responsibility of teaming up with a pair to develop projects that will be presented to funders initially at a workshop six months after the Berkeley workshop to be held in Washington, DC.

IV. Dates for Meetings on Proposal Presentations/ Briefings.

Michael Philips and Deirdre Lord have screened the existing GEEI project proposals. The proposals have been divided into two categories: those projects that are suitable for investment financing, and those that provide technical assistance. Those projects identified as investment oriented are now being strengthened with more background material to ensure the project officers at the banks will consider the projects as important and carefully conceived. Projects that are more closely focused on technical assistance will be presented to the Energy Sector Management Assistance Program (ESMAP). The training proposals will be presented to the Economic Development Institute at the World Bank at the end of November. As was discussed at previous meetings, members of the Executive Committee will be apprised of the dates for the meetings at ESMAP and at the Economic Development Institute so that they can choose whether or not they want to attend.

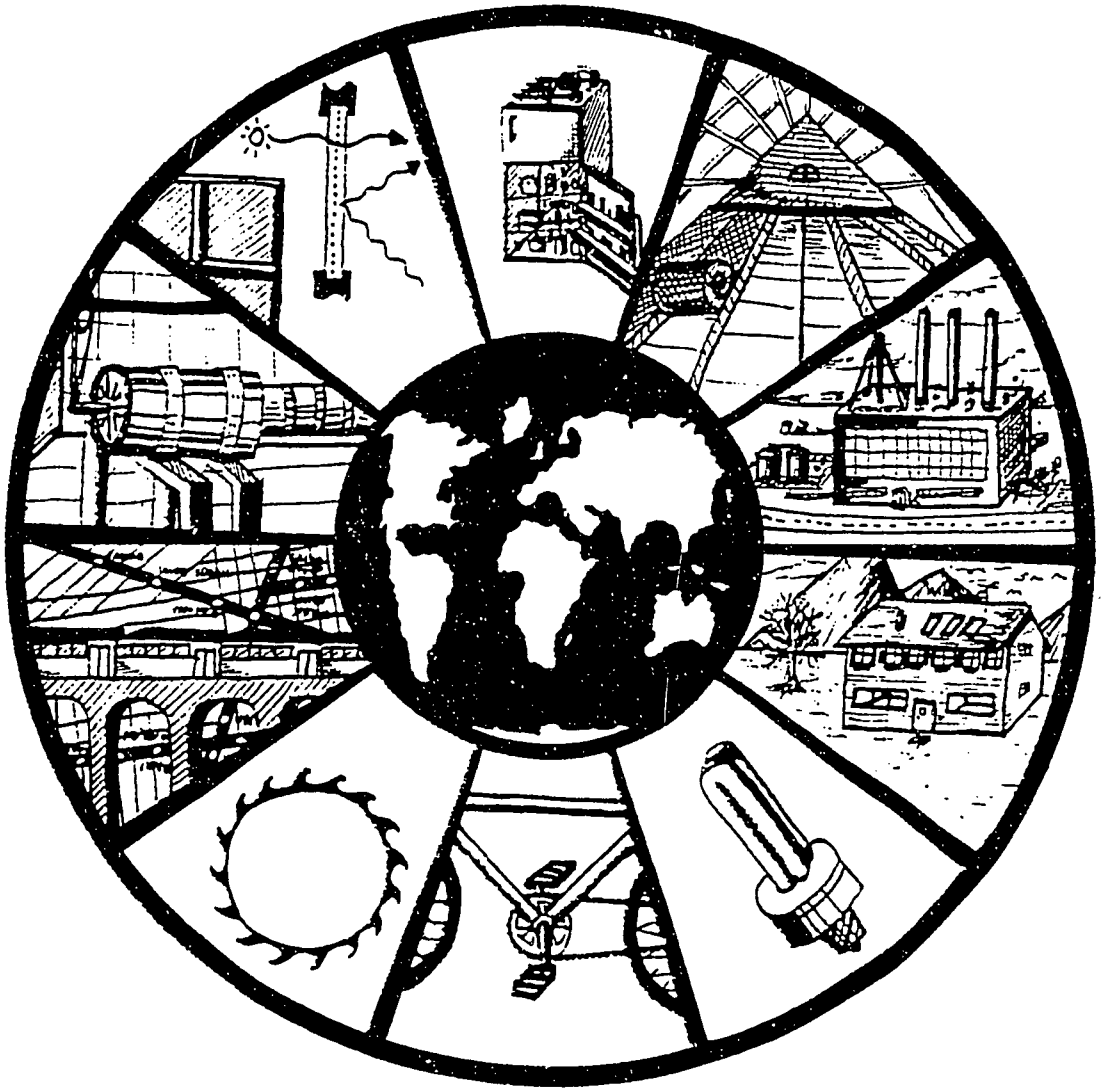
V. Discussion of the World Energy Council for Energy Efficiency to be Established by the Atlantic Council.

John Armstrong of RCG/Hagler, Bailly provided a brief overview of the newly formed World Council for Energy Efficiency. The U.S. Energy Agency and the Atlantic Council plan to create the World Energy Council for Energy Efficiency to address the issue of information transfer break down between countries with information on energy efficiency and those requiring

such information. The Center will be supported by the private sector and aims to coordinate with energy efficiency centers in developed and developing countries.

Note: The next meeting U.S. Working Group meeting will take place on Thursday, January 14th, 1992 from 9:00 to 11:00 am at the IIEC offices.

The Global Energy Efficiency Initiative



Project Proposals of the U.S. Working Group

Training

Project Name: GEEI Training Program.

Countries Where It Will Be Implemented: Mexico and Indonesia.

Project Objectives: (1) To support the emergence of South-based institutions that will provide high-quality self-sustaining energy efficiency training for the long term; and (2) to promote attention to human resource development as an integral part of major energy efficiency projects in order to help assure a demand for the training services, to anchor training for well-defined needs, and to increase the likelihood that the project's momentum will be maintained after funding ends.

Project Description: Training will be a central element of the U.S. contribution to the developing country part of GEEI, both because improvements in individual and organizational skills are the foundation for progress with efficiency improvement; and because developing countries generally welcome collaboration and partnership related to human resource development, even while other agendas remain under discussion.

To move toward these objectives, this activity will first strengthen the framework for training program development by involving developing country colleagues actively in program planning, surveying the experience with human resource development as a part of major energy projects, reviewing available training materials to identify gaps, and supporting efforts to increase awareness among key decisionmakers in developing countries of energy efficiency improvement potentials.

The project will conduct an international workshop, tentatively set for fall of 1992, on energy efficiency training programs and South-based institution-building. Ongoing work with Mexican and Indonesian counterparts to develop and implement a model set of training courses and materials in a selected country, develop generic training materials to fill current gaps, and assist in assuring effective mechanisms to meet human resource development needs in connection with several large efficiency improvement projects. Initial training will focus primarily on electric utilities, with a secondary emphasis on transportation.

Over a three to five year period, the project will develop South-based energy efficiency training capability in Mexico and Indonesia, assist in filling further generic gaps in energy efficiency training program curricula and materials, and assist MDBs in developing a consistent approach to supporting training as part of major energy efficiency related projects.

Project's Duration: Five years.

Project Status at Present: Pump-priming support in fiscal year 1991 from AID Office of Energy to ORNL. Specific activities and direction subject to guidance from the U.S. Working Group and other interested parties.

Implementing Institutions: Oak Ridge National Laboratory in close and direct collaboration with LBL, IIEC, Princeton and other leading universities, interested U.S. electric utilities (including EPRI), and other centers of expertise. A steering group will be established to provide guidance and oversight for the project.

Training...

Other Institutions Involved: Interested individuals in NGO's, Energy Foundation (Hal Harvey), IIE.

Ability to Meet USWG Criteria

1) Ripeness: Aside from the fact that many developing countries welcome training assistance more than most other kinds of collaboration, the main issue is whether training programs can be connected at an early stage to concrete country-specific projects, such as the proposed project for "Building Energy Efficiency Improvement in Czechoslovakia". If training programs can be given direction by focusing them on such targets of opportunity, they can be "ripe" indeed. The GEEI training initiative intends to coordinate with Working Projects.

2) Realizable Energy Savings Potential: Clearly, training programs represent a kind of cross-cutting contribution that is only converted into energy savings when it is connected with other policy reforms and technology transfer activities. In this sense, they are not comparable to many other kinds of projects that, in fact, depend heavily on human resources for their success.

3) Capability & Institution Building: This, of course, is the explicit purpose of training programs. The central issue is whether, from the start, they can be developed with a focus on specific institutional requirements in specific countries.

4) Fundability: A good prospect for diverse sources of support, including taking advantage of funding for energy efficiency improvement related training in the U.S. (for example, the new Energy Foundation).

Projected Cost:
$5 million over five years.

5) Facilitation of Innovation & Models: A training program that emphasizes electric utility roles in efficiency improvement in developing countries will, almost by definition, serve as a change agent in many countries where such roles are only beginning to emerge.

6) Emphasis on Concrete & Specific Models: Depends on how the program is implemented. This proposal would develop general materials and perspectives from experience in meeting specific needs, such as training activities in support of the proposed Czechoslovakia project, rather than starting first with general activities and moving later to specific applications.

7) Non-Energy Benefits: Any effective training program is rich in benefits not only of energy savings but also of life changes, job opportunities, and individual fulfillment. In addition, skills developed due to the program often spill over into other sectors of the economy as participants in the programs move onward in their careers.

8) Cooperation Potential: An enormous potential to develop effective collaboration among universities, electric utilities, national laboratories, and private-sector institutions involved in offering training courses and developing training materials. Also special potentials for U.S.-developing country cooperation because of the relatively benign nature of training as a GEEI activity.

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Training

Project Name: International Cooperative Programs in Energy Efficiency Analysis, Policy and Advocacy.

Countries Where It Will Be Implemented: Thailand and Indonesia, India, newly industrializing countries, Central America, China, and Brazil.

Project Objectives: International exchange, workshops and training programs to promote analysis of energy efficiency options, policy, and advocacy in developing countries.

Project Description: Over the last 15 years, the increase in the number of energy analyses in developing countries has been dismally slow. This rate must be substantially accelerated if the developing countries are to "own" the energy efficiency policies and programs that they will put in place. Otherwise, there is a real risk that the effort will be seen by the developing countries as something imposed on them from the industrial world. We propose a series of programs at three-levels for addressing these issues:

Level-1:

International exchange programs in energy efficiency analysis and advocacy for non-governmental voluntary activist organizations.

This program will provide fellowships for activists from the industrial and developing countries to spend a year working in the active groups in the other countries. The main purpose of this effort is an exchange of skills and know-how, and beginnings of creation of a stronger north-south network of energy-efficiency advocacy groups. Half of the fellowship money will be used to cover salaries and expenses for the visitor, the other half will cover supporting supplies, subscriptions, computers and software, and travel expenses (both international and local). The control of this half of the money will be with the developing country organization.

Level-2:

International exchange program from developing countries.

This program will support with fellowships visits of 6 months to a year for promising professional and academic energy analysts from developing countries to institutions in the U.S. where strong energy analysis capabilities exist. The developing country experts would be typically from university faculty, ministries of energy, and national planning bodies. The institutions visited in the U.S. will be the DOE National labs and Universities. The fellowships will cover international and local travel, support to the visiting scholar at a level commensurate with their standing, and overheads for the host institution for the visit.

Level-3:

Country and regional high-level 3 day workshops on energy policy.

These workshops will involve high-level decision makers in the developing countries (at the level of deputy ministers, secretaries of agencies or departments, heads of large utilities etc.), and senior energy analysts from that country or region, with a small international participation. The objective of the workshops is to bring together energy analysts and high-level decision makers in the government on a regular basis. After the annual workshops have taken root in the region, GEEI support will be gradually decreased, and local governments will be expected to take up most of the support. The workshops will present papers commissioned from the energy analysts and discuss policy options and implications.

Project's Duration: Five years.

Training...

Project Status at Present: To be started.

Implementing Institution: Lawrence Berkeley Labs.

Other Institutions Involved: ACEEE, IIEC, NRDC, EDF, and several national labs and universities (e.g. ORNL, Princeton University) from the U.S. side. Will define the developing country institutions in the extended project proposal.

Projected Cost:

	Level-1	Level-2	Level-3	TOTAL
Year 1:	$600K	$600K	$200K	$1400K
Year 2:	$600K	$600K	$200K	$1400K
Year 3:	$600K	$600K	$200K	$1400K
Year 4:	$700K	$600K	$200K	$1500K
Year 5:	$700K	$600K	$200K	$1500K

Ability to Meet USWG Criteria

1) Ripeness: Excellent. Data and analytical and operational expertise exist on the U.S. side. Need is recognized to various degrees from the developing countries side.

2) Realizable Energy Savings Potential: Large, but over the long run.

3) Capability & Institution Building: Very significant. The whole thrust of the project is towards institution and network building within the developing countries, and developing ties with U.S. expertise.

4) Fundability: Somewhat uncertain, but some support should be possible.

5) Facilitation of Innovation & Models: Excellent. The successes and problems will be documented and will be useful templates for replication.

6) Emphasis on Concrete & Specific Projects: The project is very specific in what it aims to accomplish, and how these goals will be achieved.

7) Non-Energy Benefits: Improved dynamism towards implementation of energy efficiency opportunities is the main anticipated result of this effort. Some transfer of technology management skills in social decision making can be expected to other resource sectors.

8) Cooperation Potential: Substantial. See project description.

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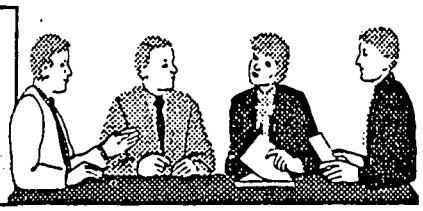
Training



Project Name: Energy Efficiency Training for Non-Governmental Organizations (NGOs).

Countries Where It Will Be Implemented: Training will be implemented in the U.S. NGOs in developing countries and Eastern Europe will be eligible to participate, providing each institution can identify a counterpart government individual who is also willing to participate.

Project Objectives: To provide NGOs with the technical expertise to initiate, carry out, and provide input to energy efficiency projects, in conjunction with government and donor agencies.

Project Description: NGOs can play a vital role in promoting energy efficiency by offering policy perspectives outside of government borrowing institutions, influencing local decision makers and end-users, and reaching populations often left out of energy-related projects. However, developing country NGOs lack the essential training in energy efficiency fundamentals. With improved human resource skills in energy efficiency, NGOs can make critical contributions to multilateral development banks (MDBs), donor agencies, and governments in the design, implementation, and evaluation of energy efficiency initiatives. Training can also provide NGOs with the technical credibility necessary to gain the confidence of government institutions, thus encouraging joint activities.

Collaboration between government agencies and NGOs would offer developing countries institutional strengths of both types of organizations. NGOs can provide critical public interest input, while government agencies have the infrastructure to implement large-scale projects, which may not ensure public participation. Despite these potential gains, there have been few instances of NGO-government collaboration in developing countries. Even if NGO-government relations are good, it is often difficult to obtain funding for energy efficiency activities. This is because most energy-related lending programs focus on increasing energy supply through the construction of generation projects, rather than through the implementation of efficiency projects.

In light of the need for both developing country NGO-government collaboration and funding for energy efficiency endeavors, four U.S. organizations active in international energy and environmental issues propose an energy efficiency training program for a select number of developing country NGO representatives and counterpart representatives from relevant government agencies.

The proposed project will begin with a five-day training program in Berkeley, California. The training will include:

- fundamentals of energy efficiency and its application for electric power generation, appliances, buildings, and industry;
- assessment of energy efficiency investment opportunities and the formulation and implementation of energy efficiency policies;
- preparation of joint NGO-government energy efficiency projects to be undertaken upon return home; and
- funding strategies for the proposed NGO energy efficiency projects.

Participants will meet in Washington, D.C. six months later to discuss proposed projects and explore potential areas of cooperation with representatives from

donor organizations, MDBs and high-level U.S. government agencies.

Project's Duration: Approximately one year and a half. Three months for preparation of training, six months for the implementation of the five-day training and subsequent donor meeting. An additional six to three months for in-country follow-up activities and any associated technical assistance.

Project Status at Present: A formal proposal exists; letters of invitation to NGOs to participate in the training are being prepared.

Implementing Institutions: Center for Global Change, International Institute for Energy Conservation, Lawrence Berkeley Laboratory, and Natural Resources Defense Council.

Other Institutions Involved: NGOs from developing countries, Eastern Europe and their government counterparts, as well as donor agency, MDB, and U.S. government officials.

Ability to Meet USWG Criteria

1) Ripeness: Developing countries are under increasing external pressure from international agencies to reduce greenhouse gas emissions, and internal pressure to reduce energy expenditures. Developing country NGOs, in conjunction with government, can play a key role in addressing these problems. With the essential training, they can provide a well-trained human resource base capable of designing, evaluating, and implementing energy efficiency projects, and providing critical input to energy-related assistance schemes. The World Bank in particular, is realizing the role NGOs play in mobilizing public support for development projects and providing alternative solutions and perspectives. Thus, the World Bank is involving NGOs in all stages of project work. In fiscal year 1990, NGOs collaborated in some 50 World Bank projects, more than tripling the average of 15 NGO projects from 1973-1987. This increase is a direct result of the World Bank's policy to expand activities with NGOs.

2) Realizable Energy Savings Potential: Energy savings can be substantial, as projects would focus on policies which have the greatest potential for economic savings such as demand-side management, transportation and industrial efficiency. An example of potential savings is illustrated by projections for energy efficiency projects in Brazil. The American Council for an Energy Efficient Economy estimates that Brazil could save $34 billion over the next 15 years by investing in energy efficient lighting, motors, and refrigerators. Similar energy and economic savings can be obtained in other areas.

3) Capability & Institution Building: Institution building, a major component of this project, will build the capability of NGOs and government agencies to cooperatively propose sound energy efficiency initiatives and perform critical analysis of energy related projects. The development of institutional linkages between NGOs and government, donor, and lending agencies provides exceptional opportunities for the cross-fertilization of ideas, balancing institutional strengths and weakness. Once developing country NGOs are proficient in working with government to identify, design, and implement energy efficiency projects, they can assist other NGOs in replicating their successes by providing similar training.

4) Fundability: The project is a prime candidate for World Bank funding, as it addresses the Bank's concern to integrate NGOs into the project evaluation process, and its stated commitment to environmentally sound economic development. Other sources of funding could be U.S. foundations, European donor agencies, and the USAID. These organizations are also recognizing the importance of collaboration with NGOs and are providing opportunities to involve them directly in the development process. Foundations have already committed much of the funding.

5) Facilitation of Innovation & Models: This project is structured to be easily replicated. NGO participants will be trained to train other NGO professionals to carry out similar energy efficiency and environment-related activities. If successful, this program can be used as a model for other NGOs, government agencies, donors, and lending institutions. Innovations can be simple to implement, as the training and dialogue are flexible in scope. Projects resulting from the training provide ample opportunity for NGO and government initiation, innovation and collaboration.

6) Emphasis on Concrete & Specific Projects: The emphasis of the training will be to develop and implement projects identified by NGOs and government agencies. Proposed projects may already be in the planning pro-

Training...

cess, or may be initiated during the proposed training. Some projects will be appropriate for donor assistance, while others may identify policy, legal, and institutional reforms needed to encourage energy efficiency. Examples include designing utility sponsored demand-side management programs, development of appliance or building efficiency standards, or preparation of energy efficiency investment plans.

7) Non-Energy Benefits: The project will lead to concrete energy investments which encompass many non-energy benefits principal of which is an expanding dialogue between developing country government agencies and NGOs. Other non-energy benefits include: human resources; diminished environmental pollution; and reduced emissions of greenhouse gases; and economic and social benefits such as increased availability of foreign exchange, which can be invested in other sectors.

8) Cooperation Potential: Cooperation potential for this project is high, as it will directly enhance cooperative relationships between NGOs and government institutions, and donor agencies. By pairing each NGO representative with a counterpart government representative, the opportunity for project success is strengthened. The training will build on these relationships as will the following meeting between NGOs, government representatives, donor agencies. Other cooperative relationships involve NGOs and the U.S. energy efficiency community. Once a project is implemented, it is likely that opportunities for future collaboration between NGOs, donor and lending institutions, and developing country government agencies will be encouraged.

ESTIMATED COST:

Initial 5-day Training in Berkeley, California	$41,750
Final 2-day Meeting in Washington, D.C	33,900
Project Administration	40,000
TOTAL	$114,650

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Training--R&D

Project Name: Energy Technology Research and Development for Developing Countries.

Countries Where It Will Be Implemented: Brazil, India, Indonesia, Mexico, Thailand; combination of country-specific and generic research and development (R&D).

Project Objectives: To promote U.S. public/private sector collaboration in improving the fit between U.S. energy technology exports and developing country market conditions and development needs.

Project Description: This project proposes to promote U.S. energy technology exports to developing countries by (a) improving the flow of information to U.S. technology manufacturers and vendors about developing country market conditions, especially in light of growing concerns about global environmental change, and (b) catalyzing U.S. public/private sector collaboration in developing or adapting technologies to fit those conditions. In some cases, the focus will be country-specific; in others, it will relate to generic technology needs.

As a first step, the project will develop detailed specifications for energy technologies well-suited to developing country needs in an era of concern about global environmental change and, in several cases, issue request for proposal (RFP's) for cost-shared private-sector R&D to develop such new technologies, with the R&D to be conducted by US private-sector firms who have the capacity to implement the technologies once developed. The RFP's may specify that US firms work in partnership with developing country counterparts, if appropriate.

Project's Duration: Five to ten years.

Project Status at Present: A direct extension of a model of public/private sector collaboration applied with notable success in the US in the late 1970's; discussed in connection with the U.S. Department of Energy National Energy Strategy (NES).

Implementing Institutions: DOE National laboratories, in collaboration with private-sector technology R&D, manufacturing, and vending firms; collaborating R&D institutions and private sector firms in developing countries.study tours and information exchanges.

Other Institutions Involved: Related university R&D programs.

Ability to Meet USWG Criteria

1)Ripeness: Energy technology export promotion is one of DOE's principal international priorities, but in many cases US energy technologies represent poor fits with developing country market conditions, especially if reducing greenhouse gas emissions is likely to become a growing priority in the future. This project is a linch-pin between the export promotion issue and the development assistance issue.

2) Realizable Energy Savings Potential: In order to meet the economic development needs of developing countries, significant investments in energy efficiency must be made. In order to support energy efficiency-related policies, suitable highly efficient end-use technologies must be employed in developing countries. Significant energy savings can and must be captured (See Goldemberg, et al.).

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3) Capability & Institution Building: If this project is tied to bilateral or multilateral cooperation (e.g., requiring that RFP's indicate specific collaboration with developing country counterparts), it can have a powerful impact on endogenous energy technology R&D and marketing institutions.

4) Fundability: Uncertain; depends heavily on US DOE interest.

5) Facilitation of Innovation & Models: Impressive potentials both (a) to break new ground in public/private sector collaboration in the interest of export promotion and (b) to fill gaps in the array of technologies that are neither fossil-fueled nor hydropower or small, robust, efficient refrigerators that are not based on CFC coolants.

6) Emphasis on Concrete & Specific Projects: Needs development, in consultation with sponsors, but candidate countries have been identified by white papers and workshops in the past several years. Individuals interested in this work include: Ogunlade Davidson, R&D for W. Africa; OLADE, in S. America; the Asian Pacific Development Center (APDC), Asia.

Projected Cost

$10 million/year at the outset; up to $100 million/year for the long term.

7) Non-Energy Benefits: A clear objective of the project and a key criterion in establishing R&D targets.

8) Cooperation Potential: Focused specifically on public/private- sector cooperation and, in addition, likely to emphasize industrialized country-developing country co-

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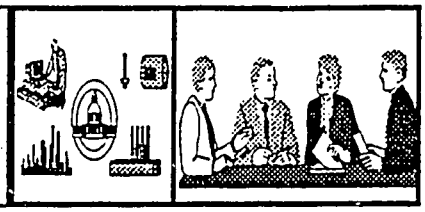

Project Name: The Establishment of a Sustainable Energy Planning Information Center/ Clearinghouse.

Country Where It Will Be Implemented: Indonesia.

Project Description: The Indonesian Energy Information Center/ Clearinghouse will facilitate information flows both within Indonesia– from the people to the government and vice versa- and internationally- - from Indonesia to other countries and vice versa. The international connections would be both South-South and North-South, since each connection has its advantage. The objectives are:
(1) To provide opportunity for NGOs as well as scientists to conduct research on sustainable energy planning-related topics in a fellowship program.
(2) To strengthen the position of NGOs in the advocacy process by supporting them with more appropriate data and information, especially on energy and environment related issues.
(3) To support the development process with more sound and substantive recommendations to the government, so that the process incorporates peoples' participation to the extent possible.
(4) To establish an NGO-scientist network to continue to foster the process. In order to empower the movement, and to make the advocacy process more effective, an Information Center is needed.

Scientists as well as NGOs will conduct research on Soft Energy Path/ Sustainable Energy Planning as part of a fellowship program. This research will prove that Indonesia still has a possibility to conserve energy, and also to reduce the energy consumption, and decrease the demand growth (which is 17% a year) down to 10% or less. In the case of Java, if the demand growth decline by 40% or more, it would indicate that nuclear power is not necessary. The reports produced by this research will also provide a base for other NGOs action plans, for example: energy conservation campaign, community education on energy limitation, etc..

To spread the information, the center will publish various periodical bulletins, both in Bahasa Indonesia (Indonesian language) and in English. The target groups will be legislators, government, NGOs, scientists, private sector, industrial sector, mass media, news offices, students, and so on. Other publications will be provided, such as leaflets, books, booklets, directories, reports, and a database system that can be retrieved with computers through the telephone line. This division will have to subscribe to some bulletin board systems such as Econet, Geonet, Greennet, etc. Output of this Information Center can be a good medium through which to conduct advocacy activities with given user groups.

Project's Duration: This institution is not expected to have a fixed project duration, but establishment of the institution will take two years.

Project Status at Present: The institution has not been established yet. It is expected to be formally started by August 1992. The organization that is submitting this proposal (Perintis) is directing the Working Group on Energy of WALHI (Friends of the Earth Indonesia). Three of Perintis' staff have research fellowships from the Working Group, and will produce reports by August 1991. WALHI's project will end by August 1992, and this project will build on WALHI's work.

Implementing Institutions: The institution will be a private sector nonprofit organization in Indonesia established by Perintis and WALHI. Perintis is the only NGO in Indonesia that undertakes advocacy

Training...

and campaign activities, and acts as a central place for NGOs working on energy issues in Indonesia. WALHI is the biggest environmental NGO in Indonesia.

Other Institutions Involved: Various organizations within Indonesia will be involved in the project. These include NGOs such as WALHI, and university-based research centers like the Center for Energy Study of Bandung Institute of Technology, governmental institutions like The Ministry of Energy and Mines, and Indonesian Committee of IPCC, NGOs. Scientists from overseas organizations such as International Development and Resources Council, Friends of the Earth Canada, Canadian Environmental Network will also be involved. The fellowships will be given to the other NGOs and scientists in Indonesia, including some scientists from overseas.

Ability to Meet USWG Criteria

1) Ripeness: Extremely high. Perintis is the only organization in Indonesia working on energy issues, and since it already has a good network and a solid base, it is the logical site for a systematic Information Center on Energy in Indonesia. The need for such a facility is great since information sharing is ad hoc and disorganized at the moment. The moment to establish such a facility is appropriate. There is also a growing awareness within the Government of Indonesia that energy is not unlimited, and that Indonesia might run out of oil, its largest single export.

Projected Cost:

US$ 300,000 for two years projected duration, or US$ 350,000 if preparation is being taken into the calculation.

2) Realizable Energy Savings Potential: It will stimulate, generate and disseminate efficiency activities by providing information. The research itself will prove that Indonesian demand growth on energy can decline up to 10% or less.

3) Capability & Institution Building: Extremely high.

4) Fundability: High.

5) Facilitation of Innovation & Models: This is the first project of its type in Indonesia.

6) Emphasis on Concrete & Specific Projects:

7) Non-Energy Benefits: This project will promote environmentally sound, sustainable energy planning for Indonesia, which can reduce the need for building more energy supply, like nuclear power plants.

8) Cooperation Potential: High.

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Training--Information

Project Name: Multimedia Service Catalog/Electronic Services Catalogue on Energy Sources and Services. An electronically stored and retrievable storage graphics and text inventory of profiles about commercially available products that are highly efficient and deliver energy, electricity and transportation amenities and services at a fraction of the cost and waste generation of a less efficient product.

Countries Where It Will Be Implemented: Worldwide application in underdeveloped and overdeveloped countries, alike.

Project Description: Sercat/Escess® is a displayable electronic catalog capable of operating on laptops and desktops. It can be configured with CD-ROM disks, or comparable large storage media, to quick access any selected profile from the large inventory. The inventory is a graphics and text cataloguing of commercially available products and services that can be ordered, which "deliver" some kind of energy service (e.g., lighting, cooling, water heating, shaft power, mobility). Included in the profile is: a spreadsheet calculation that illustrates the range of resource savings (i.e., energy, minerals, capital) and pollution prevention (e.g., SO2, NOx, CO, CO2); a datasheet on performance criteria and real world operating track record; and picture quality graphics displaying the product or service.

SERCAT provides an immense service to a range of users, most notably investors and policymakers making decisions about energy sources and services. Over the next decade the combination of a swelling global population consuming larger sums of goods will lead to great demands for energy and energy consuming devices. SERCAT is a knowledge-based, information resource that identifies cost-minimizing and pollution preventing energy service options. Full global application of this information within the next two decades could result in annual trillion dollar savings worldwide, as well as cutting a large fraction of global pollution.

The proposed project takes on the more modest task of facilitating the preparation and distribution of SERCAT to key institutions and decisionmakers (beginning with utilities, development and commercial banks, and development agencies), as well as continuing to update the service for users.

Project's Duration: One and a half years to complete SERCAT software package and construct storage disks. Three and a half years to distribute SERCAT electronic service and train users.

Project Status at Present: Electronic Catalogue software is commercially available in generic form (e.g. Display System's ECAT®), as well as Lawrence Berkeley Lab's Hypermedia Interactive Information Kiosk on Energy Efficiency. Modification of the software for SERCAT purposes is straightforward. Most of the proposed project's tasks involve using a digitizing scanner to inventory the relevant product information and images (some of photographic quality if viewed on a high-quality monitor), and modifying, or re-coding, the information into a standard format.

Another critical task is to prepare a range of illustrative calculations of the achievable savings from the particular product (with proper caveats to the user on reviewing the product's claims to ensure appropriate match for the user's intended purposes). SERCAT can be designed to serve dual functions, providing access on technology information, as well as serving as a "knowledge navigation vessel" on the range of public policies (e.g., incentives, standards, regulations, R&D) that can facilitate timely implementation of these technologies.

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Implementing Institutions: The International Institute for Energy Conservation (IIEC) Information Project has begun implementation of SERCAT. The initial work has involved gathering product information, as well as technical and economic evaluations of the hundreds of products. Both the product information and evaluations are being obtained worldwide, with the collaborative support of institutions throughout the world.

Other Institutions Involved: The IIEC Information Project is in a collaborative process with a range of institutions, the central purpose of which is to broker information and knowledge about low-cost, low-risk energy service options. These various institutions, located throughout the world, will play a valuable role in continuing to identify and evaluate energy service options, as well as in distributing SERCAT and training users.

Ability to Meet USWG Criteria

1) Ripeness: The need for an user-friendly information system on energy efficient products, services, and public policies, is keenly needed. It is currently a costly enterprise to call overseas in search of quality information. SERCAT provides a critical function of scanning the network of public agencies and private companies and

screening the information into one repository. Lack of this information results in "lost opportunities", whereby energy investment decisions are made that cost several times more than available energy efficiency improvements.

2) Realizable Energy Savings Potential: The value of information is to make more informed judgments. This project does not directly result in savings, but indirectly spurs savings through improvement of the decisonmaking process. Empirical data over the past decade indicate that roughly two to ten times more energy services can be "delivered" per dollar of investment in energy efficiency vs. expansion of conventional energy supplies. Hence, this information tool can help decisionmakers accrue tremendous energy savings per unit of investment.

3) Capability & Institution Building: Most utilities in developing countries currently use computers for operating utility expansion models. This project would augment their current computer tools so that a fully integrated resource plan could be implemented.

4) Fundability: IIEC and LBL are both currently, but independently, developing the information databases on policies and technologies, respectively. Private corporations are being approached to underwrite development costs of the technology databases, and bilateral and multilateral agencies are being contacted to underwrite development of the public policies databases. The project merits strong support by the multilateral development banks, because the more informed judgments resulting from better access to low-cost information can save orders of magnitude more funds by avoiding costly power plant investments.

5) Facilitation of Innovation & Models: Computer-aided information and knowledge-based systems are proving to be excellent means of identifying capital-minimizing and waste-minimizing development options. Computers continue to steadily drop in cost, while their capabilities continue to steadily increase in power and scope. The ability to take dense numerical and text-based knowledge and graphically illustrate it is becoming routine, and has been shown to be more easily accessible for learning new concepts.

6) Emphasis on Concrete & Specific Projects: This project strongly emphasizes concrete applications. It is readily applicable to utility planning, and decisionmaking by government officials on energy policies.

7) Non-Energy Benefits: To the degree that improved decisonmaking results from access to this information

Training...

tool, and actual energy savings are achieved, the additional benefits include large capital savings and reduction of a range of environmental pollutants.

8) Cooperation Potential: IIEC and LBL are seeking collaborative arrangements with counterparts in several countries so that the information can be translated into at least Spanish and French. The modular nature of information gathering readily lends itself to broadening the collaborative process with many institutions, each of which can provide information on more specialized topics.

Projected Costs: $500,000 per year for five years, by which time SERCAT should be self-financing through a modest access fee to provide continual updates on new product news. The access fee can be kept to a minimum by financing much of the system update costs through a modest fee to companies to include their product literature.

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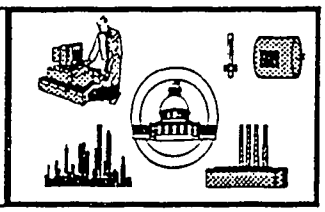

Project Name: Energy Efficiency Centers.

Countries Where It Will Be Implemented: Poland, Czechoslovakia, Russia and China.

Project Objectives: To promote energy efficiency by:

- Conducting policy and technical studies;
- Promoting joint ventures;
- Coordinating demonstration projects;
- Providing educational materials and educational services; and
- Maintaining energy data bases.

The goal is to create a national institution in each selected country to receive initial financial support drawing on U.S. funding and to help the institution become self-financing and capable of sustaining the work it is intended to conduct. The goal of the institution is to promote energy efficiency in a manner that will help the nations achieve both economic growth and environmental protection.

Project Description: The key specific activities include:

Providing policy advice: Policy analysis will be provided on energy pricing, privitization strategies and other policy options to promote energy efficiency. This activity will include:

- preparation of preliminary position papers on key issues;
- commenting as requested on proposed government or utility system energy plans, and legislation;

Provision of clearinghouse functions: This activity will include surveys, directories and databases of:

- existing energy efficiency projects, organizations, and capabilities;
- technical assistance, training, equipment and data needs, as requested;

Supporting private enterprise development: This activity will identify investment opportunities and possible partners for joint ventures as well as efforts to encourage Western investment in key energy related technology areas.

Creation and implementation of information programs: The selected institution will advise consumers and enterprises on:

- possible actions to reduce energy consumption and costs;
- results of existing efficiency programs;
- access to energy data;
- evaluation of assistance on energy technologies.

Regional activities: The institution will interact with the Regional Environment Center in Budapest and other organizations to:

- provide current information on activities in the country;
- gain access to information and insights gained through programs and projects elsewhere in the region.

Project's Duration: Three years of start-up funding; self-sufficient afterwards.

Project Status at Present: Centers have been created and have begun initial stages of operation in Warsaw, Poland, Katowice, Poland, and Prague, Czechoslovakia for a year.

Implementing Institutions: Battelle, Pacific Northwest Laboratory is working with the Polish foundation for Energy Efficiency in Warsaw, SEVEN (the Czechoslovakian Energy Efficiency Center) in Prague, and CENEF (the Center for Energy Efficiency in Moscow).

Other Institutions Involved: EPA, AID, DOE, World Wildlife Fund and Conservation Foundation; ACEEE.

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Ability to Meet USWG Criteria

1) Ripeness: The Centers accomplished a great deal during their first year in operation. Some of FEWE's many 1991 accomplishments include:

– Coordinating a least cost planning seminar for all of the 33 Polish utility companies. Soon after the seminar, FEWE drafted national legislation with the Polish National Grid Company on least cost planning for Parliamentary consideration;

– Created a lighting plan to replace incandescent street lights in Zywiece with high-pressure sodium, financed by the city with an estimated payback of one year.

– Developed appliance efficiency labelling system.

SEVEn's accomplishments are equally impressive, including:

– Provided policy advice to both the Czech Ministry of Environment and to the Federal Parliament on potential for energy savings in the country;

– Coordinated the delivery of U.S. AID funded emergency energy assistance to eight industries in the form of cost-free and low-cost efficient equipment;

– Launched the establishment of an association to bring together professionals working in the energy efficiency industry.

Clearly, both FEWE and SEVEn have made outstanding progress in the first year of operation. It is crucial to continue the impressive momentum. Also, other Centers in nascent stages, namely CENEf in Moscow and the Beijing Center, have the significant experience of FEWE and SEVEn to draw from as models for the first year of operation. Continued support for existing Centers, and start-up funding for new Center which will draw on past experiences is crucial.

2) Realizable Energy Savings Potential: 20 percent of national demand over 10 years–1 EJ per year in Poland alone at a cost of less than $2.5 per GJ.

Projected Cost:

$150,000 of core funding per year/per center for three years, plus $200,000 for management support. $1,000,000 for demonstration projects each per year.

3) Capability & Institution Building: Current directors have decades of experience as well as Ph.D.'s in technical fields.

4) Fundability: Mechanisms of direct fund transfers exist through PNL and WWF & CF (i.e., contracts and bank accounts are in place). The Centers will eventually operate through contractual agreements with government and industry.

5) Facilitation of Innovation & Models: These centers have been designated by their governments for leadership.

6) Emphasis on Concrete & Specific Models: Detailed contracts will aid specificity.

7) Non-Energy Benefits: Gross environmental problems--heavy particulate loading, salt releases to water supplies from coal mines, lead and arsenic contamination--will be avoided, as will significant greenhouse gas emissions (carbon dioxide and methane).

8) Cooperation Potential: The national governments of these countries have formally applauded the cooperative nature of the proposed projects.

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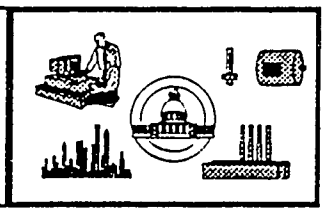

Project Name: Energy Efficiency and Environment Centers in Developing Countries.

Country(ies) Where It Will Be Implemented: Specific country is as yet undefined. However, a larger developing country is preferable, as it could assist neighboring countries. Options include: Mexico or the Philippines.

Project Objectives: To establish energy efficiency and environment centers in order to promote the implementation of energy efficient technologies in order to reduce the economic burden and to improve environmental quality.

Project Description: Energy is used inefficiently in developing countries for a variety of reasons. Lack of access to new technology, higher first cost of more efficient technology, poor maintenance, small scale of projects, poor quality and inappropriate use of fuels, etc. are some of the barriers which prevent the introduction of more efficient technology. These barriers also prevent the introduction of more environmentally benign technology.

In recent months, the Mexican government has asked industries to switch fuels and operate at 80% in order to reduce air pollution in Mexico City. Implicitly, the government has put a price tag on the cost of controlling air pollution. Future scenarios of energy use for Mexico indicate that carbon dioxide emissions from energy use will increase several-fold, and that the country may well become an oil importer by 2025. Energy efficiency improvements are crucial to reducing carbon emissions, to controlling local air pollution and to improving the productivity of energy use.

An energy efficiency and environment center which is independent of the government is needed to promote the use of more efficient and environmentally benign options. The center will serve as a catalyst for the adoption of such technology. It will provide information on energy efficient technologies, seminars and conferences on energy efficiency, conduct energy audits or train private groups to perform energy audits, help to overcome government inertia, and assist in the establishment of performance standards, among other potential activities. The center may also have test laboratories if they are not available in the country.

The Center would take on pilot demonstration projects, testing activities, which would serve to build relationships between Center staff and relevant utility/ government personnel while achieving measurable energy savings. The proposed project would establish new centers in other countries and expand the activities of existing centers in coordination with other proposed projects.

Project's Duration: GEEI participation in the project would last for two years to assist in establishing the center. After that the center is expected to become self-sufficient.

Project Status at Present: Similar centers exist in Korea, Brazil and Thailand. LBL is pursuing the establishment of centers in Mexico and the Philippines.

Implementing Institution: Lawrence Berkeley Laboratory.

Other Institutions Involved: Discussions have been held with several institutions in Mexico and the Philippines, including the ministries of energy, the utility companies, and the bureaus of product standards.

Training...

Ability to Meet USWG Criteria

1) Ripeness: Likelihood of success is very high given the interest from several agencies in the two aforementioned countries.

2) Realizable Energy Savings Potential: Potential for savings is considerable in each country. Projects are likely to get underway more quickly and savings will be more lasting with centralized technical support.

3) Capability & Institution Building: The purpose of the project is to accomplish the establishment of a center which would be self-supporting through project work. It will result in the training of staff to provide better analysis of the economics of energy efficiency, and to further the implementation of technologies to use energy more efficiently. The primary focus of the center would be to pursue activities outside the immediate influence of the government, but not necessarily in an adversarial position.

4) Fundability: Very high. Similar centers have been established elsewhere in developing countries and in Eastern Europe and they are attracting a great deal of interest.

5) Facilitation of Innovation & Models: The purpose of the center would be to pursue facilitation of innovative approaches. Its success will depend on the ability of the staff to provide new and innovative methods to improve energy efficiency.

Projected Cost:

For each center $1 to 2 million per year.

The higher figure assumes that the center will have laboratories to test energy consuming equipment and appliances.

6) Emphasis on Concrete & Specific Models: The activities of the center should result in both specific projects and in training programs to promote the use of analytical methods and other tools for improving efficiency. The success of the former will be easy to measure, but that of the latter will be more general.

7) Non-Energy Benefits: The center will undertake activities only if they have multi-purpose benefits including capital savings, increased standard of living, environmental benefits, etc.

8) Cooperation Potential: Very high. The center would require a board of directors composed of leading individuals from each of the sectors. Cooperation would be an essential part of the establishment center.

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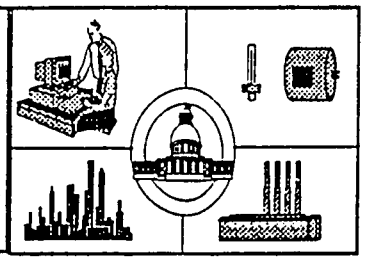
Institute



Project Name: Grant to the Brazilian National Institute for Energy Efficiency (INEE).

Country Where It Will Be Implemented: Brazil.

Project Objectives: Commitment to help in the establishment of a newly-formed non-governmental (NGO) institution dedicated to advancing energy efficiency within Brazil. The National Institute for Energy Efficiency (INEE) will promote, execute and support projects and activities to increase the efficiency of supply, distribution and final use of all forms of energy.

Project Description: The need for a non-profit NGO for Brazil dedicated to energy efficiency is clear to managers in the private and public sector. The factors that drove the establishment of INEE are many and include: economic impact of international crises of supply and cost of petroleum; increased expense of production, transportation and distribution of all energy types; increased environmental awareness; shortage of financial resources to develop new energy supply; need for strong infrastructure capable of supporting an industrial policy which demands increased competitiveness of Brazilian products; and low efficiency in many industrial facilities.

INEE plans to conduct a variety of activities to fulfill the Institute's mission of promoting more efficient supply, distribution and final use of all energy in Brazil. INEE objectives include:

1) Coordination and execution of studies and appraisals on policies and strategies for increasing energy efficiency. An INEE technical team will conduct research on new technologies, economic analysis, market potential, regulatory and fiscal incentives, legislative and educational opportunities;

2) Energy efficiency policy advocacy;

3) Integration of private and public sector initiatives to introduce and utilize new technologies and efficient equipment. This activity will encourage private sector investment in energy efficient technologies;

4) Organization of seminars, conferences and expositions to promote exchange of experiences in energy efficiency as well as to develop capability through this and other technical/policy training activities;

5) Production and distribution of books, reports, bulletins, and other materials.

INEE has been set up by leading energy efficiency advocates in Brazil. Various government agencies, utilities, and private companies pledged support. Funding from US AID or other non-Brazilian donors will enable INEE to scale-up its efforts as quickly as possible and also enable it to interact with energy efficiency experts outside Brazil (e.g., provide some hard currency for international travel, training, and exchanges).

Project's Duration: INEE is not expected to have a fixed life. It will accept a grant for any length of time.

Project Status at Present: INEE started in early 1992. The Institute is ready to implement various projects. LCUP, utility DSM policy reform and minimum efficiency standards for major energy-consuming products have been identified as ripe for implementation at INEE. Policy development work to facilitate the implementation of these projects is currently underway.

Implementing Institution: INEE is a private non-profit organization. The Institute has a board of directors and advisory council. INEE initially will be based at CEPEL, the national research institute for the electricity sector in Brazil. An office in São Paulo might also be set up. The organization is expected to become an independent institution in a

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later stage of its development.

Other Institutions Involved: INEE plans to coordinate with like-minded organizations in other countries in order to subsume existing experiences. Various agencies and programs within Brazil support INEE, including the National Energy Rationalization Program (GERE), the National Electricity Conservation Program (PROCEL), and individual utilities.

Ability to Meet USWG Criteria

1) Ripeness: Extremely high. Utilities, Brazilian government entities, the state and the private sector agree on the need for an institution dedicated to promoting energy efficiency. The decision to begin the organization within the existing structure of a non-profit research and development organization (CEPEL) affiliated with utilities will enhance intitial INEE activities. The support of U.S. and other non-Brazilian organizations with prior experience will facilitate information exchange between the U.S. and elsewhere and INEE. The institute has begun work.

2) Realizable Energy Savings Potential: While INEE will not directly install conservation measures, its activities could lead to major savings over the long run. A major objective of INEE is to support the development of projects and activities which will accrue energy savings. Also, the Institute plans to stimulate the introduction of new, efficient technologies and equipment which will result in energy savings.

3) Capability & Institution Building: Extremely high. Although INEE acts autonomously from government and state enterprises, it will cooperate with government programs such as GERE and PROCEL. As an independent NGO, the organization targets diverse markets to build capability among government, technical energy managers, members of Brazilian Congress, private sector professionals, civil institute leaders, consumers and environmental entities.

Projected Cost:

$200,000 - $500,000 as an initial multi-year grant.

4) Fundability: Extremely high. The project has strong support from Brazilian institutions and is receptive to outside support.

5) Facilitation of Innovation & Models: Extremely high. This is the first NGO dedicated to energy efficiency for Brazil. With the support existing in Brazil for the establishment of INEE, the institute could have a great impact on energy efficiency in the region.

6) Emphasis on Concrete & Specific Projects: Although the Institute will begin with more general overall goals, it exists with the support and insight of existing programs dedicated to improving energy efficiency within Brazil. Also, the Institute is in the early stages of supporting and developing demonstration projects.

7) Non-Energy Benefits: Once INEE begins to have an impact and begins to fulfill stated objectives, the Institute will serve economic benefits. Also, it will provide pollution prevention strategies to mitigate environmental problems in Brazil and the region.

8) Cooperation Potential: The establishment of the Institute represents cooperation between various organizations and individuals within and outside government. The INEE seeks contacts and exchange with like-minded organizations of other countries, as well, including those dedicated to conservation, energy efficiency, and related issues.

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Training--Utilities

Project Name: Demonstration of Energy Efficiency Projects and Activities in Karnataka (DEEPAK).

Country Where It Will Be Implemented: Karnataka State, South India.

Project Objectives: The project objectives are threefold: (1) To integrate energy efficiency and demand-side management (DSM) in developmental planning at the urban, semi-urban levels; (2) To demonstrate the scope and impact of energy efficiency programs and activities on capital mobilization for utility capacity additions; (3) To catalyze a market-driven and renewable energy industry in the State.

Project Description: Karnataka is considered one of India's most technologically advanced state. However, the state experiences major energy shortages that affect the pace of industrial and economic growth. Project DEEPAK is conceived as a pilot effort to implement and demonstrate a strategically defined package of energy efficiency practices, activities, and technologies across representative sectors in a measured geographical command area in the Karnataka.

The strategic framework provides for innovative financial schemes and incentives, policy regulation, and technology development similar to PACER. These strategies will be planned and executed through the state machinery with the active association of academia, private sector manufacturers and energy service companies.

Project DEEPAK will be confined to a geographical area in Karnataka. The area envelops the size and nature of a Taluka (a group of villages in a district representing a planning unit), and further encompasses an industrial complex (a few sugar mills and end-use industrial units), a semi-urban residential and commercial community with a total minimum connected load of 100 to 150 MWe. The project will aim at a 25-50% demand reduction through a variety of DSM and end-use efficiency programs including cogeneration. It will, both during the planning and implementation phases, involve the collaborative efforts of a wide variety of institutions including government and the private sector, financial entities at the state and district levels, academia and educational/promotional agencies.

Project's Duration: Three years.

Project Status at Present: In May 1987, a committee constituted by the Government of Karnataka (GOK) submitted its report on the Long Range Plan for Power Projects (LRPPP) in Karnataka. As per the report, the committee estimated that the GOK will be required to install 7000 MWe by the year 2000. This additional capacity would lead to a tripling of the current installed capacity of 3000 MWe. The LRPP committee estimated the capital costs for additional capacity to be US $10 billion.

Potential funding for capacity was made virtually impossible due to the additional capital costs that the GOK would have to incur in matching investments, which is required to develop a great deal of infrastructure. Adjustments to existing infrastructure would include: rehabilitation, modernization and expansion of the transmission and distribu tion facilities, coal transportation linkages by rail and

sea (Karnataka does not possess any coal reserves and has to import its total needs from eastern and central India), and a gas pipeline grid from the Western region of India to the south where Karnataka lies.

The LRPP report concedes that even with this massive investment in power supplies and associated infrastructure, the State will not entirely wipe out the present deficit and energy shortages will continue well into the 21st century.

Recognizing the impossibility of the full implementation of the committee's recommendations due to capital mobilization problems and the grievous impact that proposed power development (coal and nuclear power plants) would have on the environment, Amulya Reddy and his group at the Indian Institute of Science, Bangalore proposed a new development -focussed paradigm for energy/resource use in Karnataka.

The plan, code-named DEFENDUS (A Development-Focused End-Use Oriented Energy Plan for Karnataka), projected that it was possible to reduce energy demand substantially by the turn of the century and thereby avoid the need to install the 7000 MWe capacity proposed by the LRPP committee. Instead a mere 4000 MWe was proposed for addition, the balance being met by a combination of energy efficiency, DSM and decentralized generation through the use of renewables.

The strong interest in energy efficiency generated by the DEFENDUS plan was one impetus for developing project DEEPAK. It is crucial to continue the momentum created by DEFENDUS. Another motivation for working in Karnataka is the state's technological sophistication, as well as the capable implementational entities working at the state level.

Implementing Institutions: Several state-level institutions working as a consortia , including the Indian Institute of Science, Tata Energy Research Institute, the Energy Management Center, the Central Electricity Authority, the Confederation of Engineering Industry, the Industrial Credit and Investment Corporation of India, the Industrial Development Bank of India, the National Productivity Council, and the Rural Electrification Cooperative . It is proposed that a project secretariat be established with individuals drawn from a few key entities.

Project DEEPAK will be guided by an apex committee constituted for this purpose, and will be composed of members of the state and central Government, financial institutions, academia and private industry associations. Multilateral and bilateral donors would be invited as observers. Project DEEPAK is expected to utilize expatriate technical assistance and commodity procurement.

Ability to Meet USWG Criteria

1)Ripeness: This proposal connects directly with a number of activities that have begun. Presently, two reports (the LRPP and DEFENDUS) exist; they are quite opposite in content yet equally intent in meeting the long-term energy needs of the State. On the one hand is a capital-intensive, business-as-usual scenario extrapolating past trends of supply, consumption and inefficiency, and on the other is a new paradigm of development-focused energy planning that emphasizes efficiency in the supply, delivery and utilization of energy services. While the former treats environmental impacts as externalities, the latter is driven by environmental concerns. Project DEEPAK is a response to the need to test and validate efficiency strategies in a third world locale at a time and place where the interest is high, the debate vociferous and the need clear.

2) Realizable Energy Savings Potential: The energy savings potential in the State are very significant if one considers the rather low power end-use efficiency in virtually all applications across all the sectors. In the agricultural sector, 30-35% energy savings potential exists

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through replacement of inefficient lift irrigation pumpsets. Improved cogeneration in process plants, particularly sugar mills, is a commercial possibility. Furthermore, there are opportunities to greatly improve lighting efficiency in their residential and industrial sectors.

As per the DEFENDUS plan, it is possible to reduce energy demand substantially by the turn of the century and thereby avoid the need to install the 7000 MWe capacity proposed by the LRPPP committee. Instead, 4000 MWe is proposed for addition, the balance being met by a combination of energy efficiency, DSM and decentralized generation through renewable. Project DEEPAK will be confined to geographical area in Karnataka with a minimum connected load of 100-150 MWe. It would not be unreasonable to aim at a 25 to 50% demand reduction and energy savings through a variety of DSM and end-use energy efficiency programs including cogeneration.

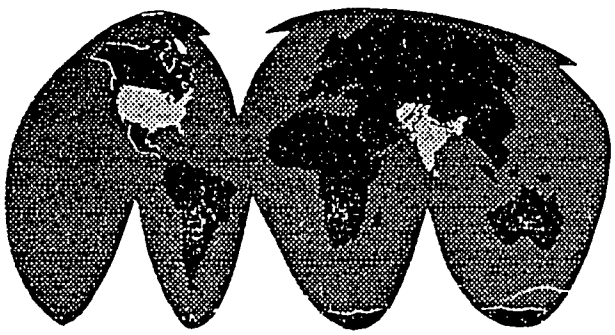
3) Capability & Institution Building: India has several institutions engaged in energy related activities, but their efforts hitherto have been fragmented while their institutional alliances are weak. Project DEEPAK will seek to provide a focus to these on-going efforts and to strengthen institutional linkages by fostering collaborative efforts within a wide variety of institutions which include: government and the private sector, NGO's, financial institutions, academia and business associations. The endeavor will involve a cross-section of the populace and promote a decentralized strategy and basis for implementation through the existing machinery.

Additionally, the project would afford testing and validation of concepts and design previously developed by AID under PACER (Program for the Acceleration of Commercial Energy Research) and EMCAT (Energy Management Consultation and Training) currently under implementation in India. Both the projects promote joint Indo-US technology cooperation and transfer in the energy and power sectors.

4) Fundability: An initial effort towards a project proposal preparation and workshop (approx. $50K) could be supported by AID and the mission at Delhi through its Karnataka project on Center for Technology Development. Costs towards subproject studies ($100K), implementation ($4.4 million) and project administration ($450K) will be sought from bilateral and multilateral donors. Since most subprojects are expected to be bankable, the amounts indicated will be in the form of loans of conditional grants; grants will be provided for proposal preparation, workshop and project administration. Furthermore, it is expected that some of the subprojects will be cost-shared with local financial/governmental/ private entities. The local financing is expected to cover over 25% ($1.3 million) of the project costs.

5) Facilitation of Innovation & Models: Project DEEPAK will serve as an excellent model for the implementation and demonstration of a strategically defined package of energy efficiency practices, activities and technologies across representative sectors in a third world country. The innovative side of the project is the integration of demand-side management and energy efficiency to developmental planning at the grass-roots level.

6) Emphasis on Concrete & Specific Projects: Project DEEPAK is a concrete, grass-roots project which would support a number of cost-shared bankable subprojects. The project will collectively demonstrate the impact of energy efficiency actions on utility capacity additions in the state. Furthermore it will, pursuant to the goal of proving the validity and economic feasibility of DEFENDUS, catalyze a multi-million dollar energy efficiency and renewable energy industry in the State.



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7) Non-Energy Benefits: In the absence of DEEPAK there is a very strong possibility that the GOK will push ahead for a super coal-fired thermal power plant (100 MWe) and a nuclear power plant at Kaiga (750 MWe). The environmental impact of these power supply projects and those from associated infrastructure projects (coal mining, rail transport, transmission, etc.) will be immense.

Project DEEPAK will catalyze business and trade in energy efficiency, decentralized renewable power systems and cogeneration. It is expected that the level of this business will be between $1.5 to 3 billion over the next decade in Karnataka state alone.

8) Cooperation Potential: Project DEEPAK will strengthen local capabilities in the design and implementation of market-driven energy efficiency projects with strong linkages to the developmental planning process. It will facilitate institutional alliances and will be implemented by a project group drawn from key institutions. For perhaps the first time in India and perhaps, in any developing country, an energy efficiency project would involve an unprecedented degree of coordinated efforts across several sectors in one geographical area. This would provide valuable experience in institution building and in fostering of alliances.

Estimated Cost

Item	Amount ($000)	
	Donor Contribution	Local Financing
Project proposal preparation, workshop	50	-
Sub-Project studies by local, national and expatriate agencies	100	25
Project Implementation**		
- Technical Assistance	1000	250
- Commodities/equipment	3000	750
- Training	250	-
- Others	150	150
Project Administration	450	125
TOTAL	5000	1300

*** Note: This pertains to hardware and associated software costs towards a number of subprojects involving typically cogeneration, end-use power efficiency, renewable and demand-side management. Since most subprojects are expected to be bankable, the amounts indicated will be in the forms of loans or conditional grants; grants will be provided for project studies, proposal preparation and project administration. Furthermore, it is expected some of the projects will be cost-shared with local financial/governmental/private entities.*

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Training--Utilities

Project Name: Training for Integrated Resource Planning Within Electric Utilities.

Country Where It Will Be Implemented: India, Indonesia, Thailand, Brazil, Mexico.

Project Objectives: (1) Identify key issues and information and training requirements with respect to implementing IRP in developing and Eastern European countries. (2) Provide assistance to develop the capacity of electric utilities to conduct integrated resource planning.

Project Description: In recent years, many electric utilities in the U.S. have developed analytical skills and insitutional mechanisms to include demand-side management (DSM) programs in overall utility long-range planning. The basic idea behind this so-called "integrated resource planning" (IRP) is to consider DSM programs that have a lower cost than capacity expansion options. LBL has had substantial involvement in analysis of key issues in IRP, and has conducted training in the area as well. While the context in which utilities operate in developing countries is different from that in the U.S., there are many aspects of IRP that, with appropriate modification, could be relevant and useful to developing country utilities.

The proposed project would assist an electric utility in one or more developing countries in developing its capacity to conduct least-cost planning. Much of the method and materials developed for an initial utility would be usable in conducting similar work in other countries. Important lessons would be learned in the process which would be invaluable as the project is extended to other countries. The project would include the following activities:

1) An executive seminar to familiarize high-level staff with the basic concepts of IRP, to review experience with IRP in the U.S., and to identify key issues affecting IRP in the local context. The seminar would serve to identify the key barriers to implementation of IRP, which would lead to strategic planning for overcoming them.

2) Training of utility staff in the procedures involved in IRP, including use of analytical tools for evaluating impacts of DSM programs, comparing DSM options with supply-side options, and integrating DSM programs into overall utility planning. Course material would be developed and refined after initial use.

3) Development or modification of analytical tools that are appropriate to the local situation. It is important to develop tools that do not require more data than is likely to be available in the local situation.

4) Identification of data requirements for assessing the impact and cost-effectiveness of various DSM options, and development of a strategic plan for acquiring key data. The project would include assistance in establishing DSM data bases, and in incorporating supply-side information necessary for integrated planning.

5) Training in integration of environmental impacts of DSM options into overall utility planning.

Project's Duration: Five years.

Project Status at Present: Although LBL has been heavily involved in analytical work related to IRP, the proposed project is a new effort.

Implementing Institutions: Lawrence Berkeley Laboratory (LBL), working in collaboration with other institutions, including Oak Ridge National Laboratory, Hagler Bailly, ACEEE, and IIEC.

Other Institutions Involved: The project would primarily involve appropriate electric utilities, though

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governmental agencies and local academic institutions could also be involved.

Ability to Meet USWG Criteria

1) Ripeness: There is a growing awareness in many developing countries and Eastern European countries to the importance of involving utilities in demand-side management activities. Most utilities are unfamiliar with such activities, however, and uncertain about how to incorporate them into their overall resource planning. In a number of countries, there is a desire on the part of utilities to become more familiar with DSM planning and IRP. In addition, the World Bank is beginning to include DSM activities in it power sector loans. Thus, the time is ripe to begin work in this area to identify key issues and training needs that would facilitate the development of appropriate types of assistance.

2) Realizable Energy Savings Potential: If successfully implemented, IRP has the potential to substantially reduce energy consumption for power generation. The savings potential will vary considerably among countries, but it seems quite plausible that implementation of IRP on a large scale has the potential to reduce growth rate in the power sector's energy consumption by half (Levine et al. for the USWG 1991).

3) Capability & Institution Building: The project is explicitly oriented toward developing utility capability to (1) assess the type of IRP that is most appropriate to the local situation, and (2) implement those aspects of IRP that are of most benefit. We envision the development of a long-term working relationship with selected utilities in which utility staff would receive both introductory and advanced training in analytical skills related to IRP.

Projected Costs

Per country: $1000 K. per year.

4) Fundability: Given its role in providing financial assistance to the power sector, and its beginning efforts in promoting electricity end-use efficiency, the World Bank is a prime target for funding.

5) Facilitation of Innovation & Models: The project could establish momentum toward a major re-orientation in the way utilities in developing countries and Eastern Europe operate. Work with the initially-selected utility would establish a model for similar efforts elsewhere; successful implementation of IRP would undoubtedly stimulate interest in other countries.

6) Emphasis on Concrete & Specific Projects: The project would intially be focused on a single utility, and begin with specific tasks as outlined in the Project Description.

7) Non-Energy Benefits: The potential for saving capital that would otherwise be needed for new power plants is large. Avoided electricity generation would also bring environmental benefits, with the exact nature of the benefits depending on the particular situation.

8) Cooperation Potential: Past contacts with electric utilities have left us confident that establishing cooperation will not be difficult.

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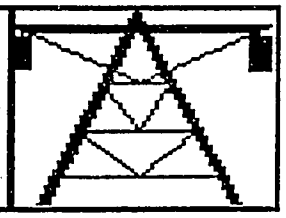
Utilities



Project Name: Least Cost Utility Planning for Poland and Czechoslovakia

Countries Where It Will Be Implemented: Poland and Czechoslovakia.

Project Objectives: A) To develop widespread interest in and commitment to electric company investment in demand resources, and; B) To encourage and facilitate the adoption of least cost utility plans for the electric sector.

Project Description: An especially attractive opportunity exists for establishing a commitment to demand side resource investment and least cost planning in Poland and Czechoslovakia. The opportunity is especially attractive because:

1) The electric sectors of Poland and Czechoslovakia are undergoing major restructuring and new planning.

2) Both Poland and Czechoslovakia have considerable excess generating capacity and are expecting strong growth in the demand for electricity before the end of the decade. There is thus ample time for the electric companies in these countries to learn and practice new planning procedures and to develop new expertise in managing demand side resources.

3) The governments of both countries are very concerned with the environmental damage being caused by their energy sectors, and recognize the role that improved energy efficiency can play in reducing that damage.

4) Several of the key electric companies in these countries, including the Czech Energy Works, have expressed a strong interest in developing least cost plans.

The Center for Energy Efficiency in Czechoslovakia (SEVEn) and the Foundation for Energy Efficiency in Poland (FEWE) are cooperating in an effort to promote least cost planning in the electric sector of their countries. These efforts are multi-faceted, and are planned to include the following activities:

1) Education, including seminars for managers of electric generation, transmission, and distribution companies;

2) Policy Development, focusing on electric sector structure, laws, and regulations necessary to create an environment for successful least cost planning;

3) Research and Analysis, to identify the potential for efficiency improvements and the programs necessary to achieve the potential, and;

4) Technical Assistance to electric sector enterprises willing to engage in least cost planning, including participation in program design and evaluation. This activity will largely be based on involving least cost planning experts from Western countries in activities based in Poland and Czechoslovakia.

The project will focus on the above activities to produce an environment and capability for developing least cost plans for the electric sector. Given the extensive restructuring taking place in both countries' economic, legal, and social systems, this undertaking is expected to be difficult. Accordingly, the project will be flexible in its strategies so that it can adjust to rapidly changing circumstances.

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Project's Duration: A multi-year effort.

Project Status: Started in July 1991 through a series of meetings with electric industry officials, and the organization of three least cost planning seminars for October, 1991.

Implementing Institutions: Somewhat uncertain because it depends upon the structures adopted for the electric industry in each country. However, the generating and distribution companies in Czechoslovakia are expected to be implementers, and the electric grid and distribution companies in Poland are expected to be implementers.

Other Institutions Involved: Czech Energy Works (Czech Republic generating company), Slovak Energy Enterprise (Slovak Republic generating company), American Council for an Energy-Efficient Economy, Polish Electric Grid, and Energopomiar (large Polish power engineering and consulting firm).

Ability to Meet USWG Criteria

1) Ripeness: Electric industry is being restructured now. Policy studies are underway for restructuring options. There is strong interest in least cost planning by the Polish Ministry of Environment, and the Czech Power Board.

2) Realizable Energy Savings Potential: Analysis is underway in both countries, but is not yet complete. Cursory analyses, visual inspections, and data indicate very large potential, substantially exceeding estimates produced for U.S. electric sector (on the basis of percentage of current demand).

3) Capability & Institution Building: All major components of the electric industry in each country are involved at this stage of the project. The project is structured to promote expertise in least cost planning in all these components. Reliance on domestic companies and experts will be emphasized.

PROJECTED COST:	
Education	150,000
Policy Development	75,000
Research and Analysis	200,000
Technical Assistance	200,000
TOTAL	625,000

4) Fundability: Early stages of the project attracted funding from U.S. foundations, a U.S. NGO, and the Czechoslovak electric power industry. Latter stages of the project, which will require much higher levels of funding, will require support from MDBs.

5) Facilitation of Innovation & Models: SEVEn and FEWE are prepared to play a role in this project. Given the level of interest in IRP and DSM, this project could provide an extemely valuable model to the region.

6) Emphasis on Concrete & Specific Projects: The project will focus on educational events, training programs, development of legislation and regulation (where necessary), all leading to the development and implementation of least cost plans.

7) Non-Energy Benefits: Large environmental benefits, large hard currency savings from avoided investments in coal and nuclear generation stations, lower energy bills for an economically pressed populace, and overall improved economic health.

8) Cooperation Potential: Extensive potential for cooperation between North American utilities and Central European electric companies. Also extensive potential for cooperation between North American least-cost planning consulting firms and their counterparts in Central Europe.

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Utilities

Project Name: Power Sector Efficiency Improvement in Central America.

Countries Where It Will Be Implemented: Costa Rica, Guatemala, others.

Project Objectives: Objectives of this project are four-fold: (1) to develop bankable proposals to multilateral lending agencies for loans to improve efficiencies in electricity production and use; (2) to document recent accomplishments in efficiency improvement in developing countries; (3) to assess realistic potentials for efficiency improvement in the context of estimates of technological potentials; (4) to further the understanding of integrated resource planning by electric utilities in developing countries.

Project Description: Like other parts of the developing world, Central America needs substantially more electricity services to support its economic and social development; but meeting these needs under current conditions is expected to require $5 to $10 billion in capital investment over the next dozen years, or $0.4 to $0.8 billion per year, even higher than an extraordinary level of investment in the 1983-87 period (totaling about $1.5 billion). This presents Central America with a very real capital crisis for its electric power sector.

Efficiency improvement is one of the most promising options for resolving what will otherwise be a conflict between energy conditions and development prospects. This project proposes to analyze efficiency improvement potentials in the power sector in several key countries, from power generation to end-use, to develop strategies for cost-effective investment in efficiency improvement; and to turn these strategies into solid proposals for investment by multilateral development assistance agencies. The first case, nearly complete, is Costa Rica; Guatemala is expected to be second.

Project's Duration: Five years.

Status of Project at Present: Detailed analysis in Costa Rica completed; follow-on project in Guatemala under discussion.

Implementing Institutions: RCG/Hagler Bailly, Oak Ridge National Laboratory (ORNL), IDEA.

Other Institutions Involved:

Ability to Meet USWG Criteria

1) Ripeness: Essentially, this project is already in midstream. The analytical stage in Costa Rica is complete, documenting impressive accomplishments and identifying further potentials for efficiency improvements in the 5-10% range. A second country--Guatemala-- is in the planning stage. This suggests a realistic prospect for a true regional initiative sensitive to differences in country needs and conditions.

2) Realizable Energy Savings Potential: Compared with other countries in the region (and, even more dramatically, other countries in the developing world), Costa Rica has reached levels of efficiency that are 20-30% higher than the norm, and further efficiency improvements are still attractive. Disseminating this success experience to other countries in the region and other regions of the world can have a dramatic impact on energy requirements, capital requirements, and environmental impacts associated with national development.

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3) Capability & Institution Building: The project is predicated on working with national electric utilities and other indigenous institutions to expand the appreciation of efficiency improvement as an option that offers a way out of a major institutional bind.

4) Fundability: Already funded by A.I.D.'s Office of Energy for Costa Rica and A.I.D.'s regional office for Guatemala. Actively under way.

5) Facilitation of Innovation & Models: Important in at least three ways: (A) Encouraging national utilities to consider efficiency improvement, including demand-side management, as a way to meet demands for increased electricity services when capital resources are scarce. (B) Encouraging regional development assistance agencies to invest in energy efficiency improvement. (C) Providing a well-documented role model and case study for other regions in the developing world.

6) Emphasis on Concrete & Specific Projects: Focused on developing specific investment proposals for particular countries.

7) Non-Energy Benefits: Expected to reduce environmental emissions associated with increasing electricity services in the region and also to free up capital investment resources for development in other sectors of national economies.

8) Cooperation Potential: Specifically focused on a beneficial collaboration between U.S. and counterpart analysts, endogenous power sector institutions, and multilateral development financing institutions.

Projected Cost:
500K in analysis and strategy development for two countries. Total investment in the $500 million range over a five-year period, including loans to fund cost-effective power-sector efficiency improvements.

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Utilities

Project Name: Demand Side Management.

Country Where It Will Be Implemented: Costa Rica.

Project Objectives: To implement Demand Side Management Techniques in the industrial, commercial, and residential sectors.

Project Description: The proposed project will finance the implementation of a Demand Side Management Program in Costa Rica. This will be a follow-up to the power sector efficiency assessment financed by USAID which identified the energy saving potential in each sector and per end-use. This project will provide a combination of grant and loan funding from donor agencies to implement the recommended pilot projects and develop program evaluation standards.

On new buildings, this project will develop energy-efficient housing designs, increase electricity efficiency in new commercial and public buildings, initiate research and demonstration of energy-efficient building techniques and technologies, build a data base on commercial electricity end-uses, and assess the need to establish minimum building energy standards. For existing appliances, this project will replace inefficient appliances with efficient ones and develop energy management training programs. For the industrial sector, this project will also increase the motor and process efficiency.

Project's Duration: The project duration is estimated to be five years, covering the period 1992-1997.

Project Status at Present: USAID has completed the Power Sector Efficiency Assessment which highlights the priorities and develops a plan of action which this project will implement. This project is very ripe. With the assessment complete, Costa Rica is prepared to develop an action plan.

Implementing Institutions: ICE and DSE will be the lead administrative and implementing agencies.

Other Institutions Involved: Both public sector and private sector institutions will play a role in this project. Public institutions include: the regulatory commission SNE, the electricity distribution companies; while private sector institutional involvement will be comprised of the Chamber of Industry and Commerce, and Atlas Electrica. These institutions will also be involved in a collaborative steering committee to discuss and analyze barriers and opportunities, and to make recommendations for specific actions.

Ability to Meet USWG Criteria

1) Ripeness: This project will build upon the current effort by the Costa Rican government to encourage energy efficiency, including the implementation of the proposed law which provides fiscal incentives for import of energy efficient equipment.

2) Realizable Energy Savings Potential: According to the power sector efficiency assessment carried out by USAID, the implementation of a recommended demand-side management program (load control and energy conservation) would result in a peak demand reduction of 213 MW, or 12 percent of the forecasted system peak for the year 2005. This represents a 16

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percent reduction of the capacity requirements (1,298 MW) under the national electric utility ICE expansion plan for the years 1990-2005.

3) Capability & Institution Building: This project will continue to strengthen DSE and ICE technical capabilities in evaluating and implementing demand-side management programs.

4) Fundability: This project will be very attractive to donor agencies targeting energy efficiency because of the quick, quantifiable, and predictable results.

5) Facilitation & Innovation of Models: This project will demonstrate some valuable aspects of the impact of the Least Cost Utility Planning Approach to power sector development. This approach has not yet been carried out to its full potential and this project will provide insights for other countries to follow.

6) Emphasis on Concrete & Specific Projects: This is a very concrete and specific project which will focus on end-use of electricity. The savings and costs will be well documented and will include targeted appliances and load control programs.

Projected Cost

$2 million over the next three years.

7) Non-Energy Benefits: This project has important environmental benefits of reducing energy production requirements, which mitigates the negative environmental impacts of energy resources exploration, development, and production.

8) Cooperation Potential: This project will promote increased cooperation between the public and private sectors of Costa Rica. It should also increase the cooperation between developing country governments and donors to establish developing country energy efficiency programs; and it will involve agencies like the Electric Power Research Institute (EPRI), electric utilities, and the European Economic Community.

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Project Name: Demand Side Management

Country Where It Will Be Implemented: Mexico.

Project Objectives: To implement demand side management (DSM) techniques in the industrial, commercial, and residential sectors.

Project Description: According to several studies undertaken by the National Energy Commission (CONAE), the University of Mexico (UNAM), and the Federal Electricity Corporation (CFE), there is a large untapped potential for saving in both electricity capacity demand (kW) and energy demand (kWh) in all end-use sectors, particularly the industrial and commercial sectors. There is ample evidence that much of Mexico's electricity-using equipment and appliances are outdated and that energy savings of up to 20 percent in current consumption could be achieved.

The proposed project would finance the implementation of a demand side management program. This project will complement the on-going A.I.D. technical assistance which is in the process of identifying the energy saving potential in each sector and developing an action plan with a set of pilot projects. This project will provide a combination of grant and loan funding from donor agencies to implement the recommended pilot projects and develop program evaluation standards. The project will be carried out under the context of Fidiecomiso which is an energy efficiency program within CFE that has recently established a private fund to support demand-side management activities in the power sector, the private sector (particularly appliance suppliers), and the electricity distribution agency Compania de Fuerza y Luz del Centro (CLFC) to prioritize activities, design and implement pilot programs (including load management, efficiency lighting, testing and labelling of appliances, etc.), and prepare a multi-year national program of the magnitude needed to make a substantial reduction in electricity demand. Although the work is on-going through the AID-funded project, funding is necessary to ensure identified pilot projects reach are implemented.

Project's Duration: The project duration is expected to be 5 years, covering the period 1993-1998.

Project Status at Present: This project is now in the design stage. USAID is in the process of carrying out a demand side management program which will highlight the priorities and develop a plan of action for this project to implement.

Implementing Institutions: CFE and CLFC will be the lead administrative and implementing agencies.

Other Institutions Involved: Public and private sector institutions will also be involved in a collaborative steering committee to discuss and analyze barriers and opportunities, and to make recommendations for specific actions. LBL and IIEC will be involved in this effort. The collaborative process will include study tours and information exchanges involving individuals in North America and elsewhere who have prior experience in DSM and IRP.

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Ability to Meet USWG Criteria

1) Ripeness: This project will build upon the existing Fideicomiso program which has demonstrated itself, and is within the Government of Mexico's commitment to energy conservation as noted in their Strategic Plan for the Promotion of Energy Efficiency.

2) Realizable Energy Savings Potential: This project could provide an energy saving of 5 to 10 percent of total energy generation, and would offset the power sector's expansion plan.

3) Capability & Institution Building: Much of the required capability and institution building for this project will be accomplished by the USAID funded demand side management program (1991-1993). This project will build capability, however, in program implementation and management.

4) Fundability: This project will be very attractive to donor agencies targeting energy efficiency or global climate change activities because of the quick, quantifiable, and predictable results.

5) Facilitation of Innovation & Models: Impacts of the least cost utility planning approach to power sector development will be demonstrated. This approach has not been carried out to its full potential and it will provide insights for other countries to follow.

6) Emphasis on Concrete & Specific Projects: This is a very concrete and specific project which will focus on the end-use of electricity. The savings and costs will be well documented and will include targeted appliances, load control programs, industrial end-use efficiency, among others.

Projected Cost:

The projected cost is estimated at between $10 to 50 million for the implementation of the Demand Side Management program as designed by US AID. The scope will consist of large and medium size industries, the commercial sector, and large residential customers. USAID would finance the preliminary studies, training study tours and workshops, and selected pilot projects, and the GEF would finance the full scale implementation.

7) Non-Energy Benefits: The project has important environmental benefits by reducing energy production requirements, thereby mitigating the negative environmental impacts of energy resources exploration, development, and production. Economic benefits of avoided energy production augment environmental benefits.

8) Cooperation Potential: This program will promote increased cooperation between the public and the private sector of Mexico. It should also increase the cooperation between donors and developing country governments in establishing developing country energy efficiency programs. The project will develop a collaborative process in an effort to implement integrated resource planning in Mexico, and will also involve agencies like the Electric Power Research Institute (EPRI), electric utilities, and the European Economic Community. Success of the Mexican collaboration will provide a valuable model for the IRP process elsewhere.

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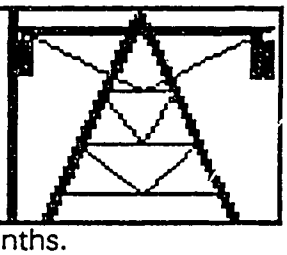

Project Name: A Preliminary Analysis of Electricity Savings Potential.

Country Where It Will Be Implemented: Argentina.

Project Objectives: Identify the principal end uses of electricity and estimate the electricity savings potential through cost-effective measures.

Project Description: Argentina's current policies of economic liberalization, public expenditure reduction, and privitization of certain state-owned companies has opened the prospects for ending a prolonged recession. A resurgence of economic activity will increase the demand for electricity beyond the present system's strained capacity. While the increased demand could be met by supply expansion, a less expensive and quicker route is to take advantage of many energy-conservation opportunities among electricity users. There are, however, no studies on where the most cost-effective opportunities are to be found and what the potential for avoided power plant construction might be.

This study proposes to arrive at a preliminary estimate of savings potential based on an analysis of existing data on electricity consumption by sectors (including weather dependence), and sales of electricity consuming equipment. The results will be useful for identifying immediate and large conservation opportunities, as well as determining areas where surveys and other studies would be required to develop least-cost strategies in the medium and long term.

Project's Duration: Nine months.

Project Status at Present: There is interest in at least one Argentine institution for conducting such a study, but no funding exists yet as the government seeks to privatize power production.

Implementing Institutions: Energy Study Groups (GESE) of the National Technological University (UTN). Since 1982, sixteen GESEs located at UTN regional campuses spread across Argentina have conducted 600 energy audits in small and medium industry. Dr. Gautam Dutt, who has conducted similar studies in India will advise the research group at the UTN.

Other Institutions Involved: It is expected that other Argentine institutions will become involved to review the results of the study and disseminate the conclusions. These include the Department of New and Renewable Energy Sources (in the Ministry of Energy), the Institute of Energy Economics (IDEE), and the Argentine Association for the Rational Use of Energy (AAPURE).

Ability to Meet USWG Criteria

1) Ripeness: In the summer of 1988-89, a major drought (that also affected temperate countries in the northern hemisphere) led to a drastic fall in hydroelectric power generation and to significant power shortages in Argentina. As the economy pulls out of a prolonged recession, electricity demand growth is likely to lead to shortages in the near term. Electricity efficiency is not only much less expensive than increasing electricity supply, but many conservation measures can also be implemented faster than construction of new power plants or hydroelectric facilities. It is then important to assess major opportunities for electricity conservation so that some conservation programs may be initiated as soon as possible.

2) Realizable Energy Saving Potential: This study should lead the way to identifying electrical savings opportunities adding up to at least one-third of the current use.

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3) Capability & Institution Building: Very high. Energy analysts at the GESE have not conducted studies of this type. Dutt will provide training in methodologies in energy analysis and supervise the project.

4) Fundability: The European Economic Community have sponsored an extensive energy survey in North Eastern Argentina which includes an energy balance disaggregated to end uses. Although the survey does not include data on the end-use efficiency it will be a useful starting point for the proposed analysis.

5) Facilitation of Innovation & Models: The project brings techniques and methodologies developed in India and elsewhere to Argentina.

6) Emphasis on Concrete & Specific Projects: The purpose of the study is to identify potential projects which will bring significant energy savings to the country. In the absence of data, specific, cost-effective projects are difficult to implement.

7) Non-Energy Benefits: Electricity savings identified in this study will reduce the possibilities of power shortages, the needs for new power plant construction and the environmental impact of energy supply growth.

8) Cooperation Potential: Very high. This study will be modeled on similar studies conducted in Brazil, India, Thailand, as well as in the U.S, and will be informed by these international experiences.

Projected Cost

$30,000, not including overhead and infrastructure (office space, computer time, vehicles, etc.) provided by UTN.

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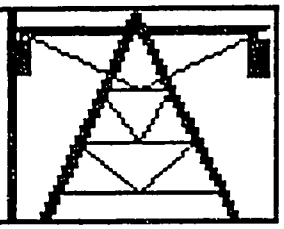

Project Name: Comprehensive Energy Efficiency Programs for Jamaica.

Country Where It Will Be Implemented: Jamaica, W.I.

Project Objectives:

1) To establish full-scale, operational, comprehensive electrical efficiency programs in Jamaica by early 1993. The programs would be developed using relevant experience gained in the Northeastern United States and other areas with operational experience.

2) To establish a repeatable model for moving energy efficiency investments quickly beyond the study phase into implementation.

3) To develop in-country capability to develop and implement full-scale programs, and to help replicate the model in other nations.

4) To establish effective mechanisms for financing operational energy efficiency programs in Jamaica and other developing countries.

Project Description: The project entails three separate phases.

1) A preliminary assessment of electrical efficiency potential in Jamaica, based on direct investment programs;

2) Building capability in Jamaica in program implementation and evaluation, and refining the preliminary assessment of savings.

3) A demonstration project involving energy efficiency improvements in over 20 selected Jamaican buildings (both existing and some under construction); the demonstration phase will inform full-scale program design and execution.

Project's Duration: Late 1989 through early-mid 1994.

Project Status at Present: The preliminary assessments of electrical efficiency potential are coming in at present. Initial findings show major opportunities to affect end-use electrical efficiency in lighting and air conditioning in the commercial sector. One technology under consideration for the demonstration phase is the use of cogeneration to cool commercial buildings.

Implementing Institutions: Jamaica Public Service; Biomass Users Network; Conservation Law Foundation. New England Electric Systems (Massachusetts) has provided some staff time and hosted a field visit from Jamaica Public Service personnel. The Resources Development Foundation provided early guidance and continues to collaborate on the project.

Other Institutions Involved: Project activities are being coordinated with ongoing World Bank/ESMAP activities addressing commercial building energy code development and implementation, appliance efficiency standards and testing development, and energy planning.

Ability to Meet USWG Criteria

1) Ripeness: Now two and a half years after start-up, the project has significant momentum, with commitment of extensive staff resources from Jamaica Public Service and the Conservation Law Foundation. The commercial retrofit demonstration program is presently underway; early results from the demonstration program are expected by late 1991; and substantial in-country capability-building has occurred. The Rockefeller Foundation has provided project funding to ensure that the demonstration and early capability-building phase proceeds smoothly.

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Estimated Cost:
The demonstration phase of this project is expected to cost about $7.5 million (US$).

2) Realizable Energy Savings Potential: Savings from project activities and the operational programs that will follow are estimated to range broadly from 25 MW to 100 MW by the year 2010. This range is about 5% to 15% of currently projected year 2000 system load.

3) Capability & Institution Building: The major goal of the project is to build Jamaican capability both to implement programs in-country and potentially help other nations do the same. The project entails training of utility staff; Jamaican private sector engineers, designers, architects, auditors, installers; and evaluation professionals in the Jamaican academic community. An additional project component entails exploring the potential for producing high-efficiency equipment (e.g. lighting, refrigerators) in Jamaica. Another aim is to investigate the feasibility of cogeneration projects using a diesel engine to generate electricity, with the waste heat driving an absorption air-conditioner.

4) Fundability: Because of the project's connection to proven energy efficiency programs, and the prospect that it will produce meaningful results quickly, the project has attracted preliminary interest from the Inter-American Development Bank (which has committed a $2.0 million loan), and the World Bank Global Environmental Facility (GEF).

5) Facilitation of Innovation & Models: The Jamaica project offers a useful model for leapfrogging extended analysis and instead utilizing real results in the field as the basis for future program planning. Too many energy efficiency initiatives in the North and South have fallen prey to "paralysis by analysis" and paper studies. The sponsors of the Jamaica project deliberately chose not to perfect the estimates of technical potential before plunging into implementation; only actual program experience can provide meaningful costs and savings data. This is a quick-learning approach that should be helpful to other nations seeking to stop doing studies and start saving kilowatt hours.

The Biomass Users Network has expressed interest in helping to transfer lessons learned in Jamaica to other South nations, possibly in conjunction with the Jamaican government and private sector.

6) Emphasis on Concrete & Specific Projects: The project is designed to result in about $40 million (1990 US$) in direct efficiency investment in Jamaican buildings over a decade to reduce electricity requirements by 15%. The early years will focus on refining the program designs through demonstration projects and on rigorously measuring program success as a power plant equivalent, including the kw and kWh savings that result from the specific buildings treated.

7) Non-Energy Benefits: Since the alternative to increased electrical efficiency in Jamaica is the construction and operation of oil-fired combustion turbines and new coal-fired generation, an aggressive energy efficiency program has been estimated to save Jamaica capital and fuel having a present value (1990) of US$ 80 million, and avoid substantial damage to the island and global environment from combustion emissions, fuel spills, ground water contamination, land use impacts, etc. The project may also demonstrate opportunities to reduce CFC use and emissions.

Project implementation will draw primarily on in-country technicians and vendors, and ultimately offers the potential for Jamaica to become a major exporter of energy efficiency analysis and implementation services.

8) Cooperation Potential: The project will bring together the state-operated utility, the private sector, a major non-U.S. energy NGO, and the academic community in program implementation. The mechanism for technology transfer will also emphasize collaboration between the utility, the private sector and end-users. For example, lighting training programs will bring together major vendors, end-users and others.

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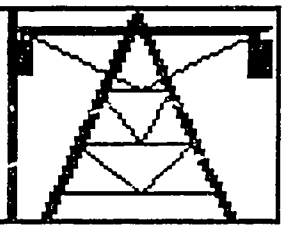

Project Name: Power Sector Efficiency Improvement in Indonesia.

Country Where It Will Be Implemented: Indonesia.

Project Objectives: (1) To promote sustained attention to efficiency improvement potentials by the Indonesian electric utility. (2) To build this kind of perspective into a World Bank environmental management capability-building project that is intended to establish a model that will be widely used and replicated in other countries.

Project Description: In connection with a major World Bank-supported effort to develop environmental management capabilities in the Indonesian electric utility, this project will focus attention on energy efficiency improvement as a key part of the institution-building and policy reform effort. Intended to create a model for other such World Bank projects in other countries in the future, the larger project began in April 1991 and will continue through 1992. It is led by Lahmeyer International GmbH, a German engineering firm, in a consortium with staff from ORNL and with P.T. Unisystem Utama, an Indonesian firm.

This particular proposal is to invest a modest amount of GEEI funding in leveraging the World Bank environmental project in the direction of giving special consideration to efficiency improvement, which is often a cost-effective alternative for reducing environmental impacts associated with providing electricity services. To a degree of breadth and depth not contemplated by the Lahmeyer work plan, such options as integrated resource planning and demand-side management programs would be presented for discussion and training, involving not only U.S. analysts but also U.S. utility counterparts. Almost certainly, the result would be that efficiency improvement would play a more prominent role in the policies, procedures, and management structures adopted by the Indonesian utility as the result of the World Bank project.

Project's Duration: Two years.

Project Status at Present: The larger project on which this activity could be piggybacked has been initiated. C. Petrich of ORNL serves as the project leader; T. Wilbanks and others at ORNL are under contract to arrange technical assistance; and efficiency improvement is within the scope of the project. All that is needed at this stage is to augment the efficiency improvement component beyond what the World Bank project would otherwise be able to afford.

Implementing Institution: Oak Ridge National Laboratory.

Other Institutions Involved: Hagler-Bailly, LBL, selected U.S. electric utilities, World Bank, interested NGOs, KONEBA (energy conservation institution in Indonesia), Indonesian Directorate General for Electric Power and New Energy, Indonesian Central Commission for EIA, Indonesian National Environmental Protection Agency.

Ability to Meet USWG Criteria

1) Ripeness: The window of opportunity will only be open for a short time, while the World Bank/Lahmeyer/ORNL project is taking shape. A commitment of resources before mid-year 1992 will influence the consequences of the larger project for utility policy.

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Much later, the opportunity will be missed.

2) Realizable Energy Savings Potential: It is likely that a decision by the Indonesian electric utility to consider efficiency improvement as an investment and programmatic alternative to supply additions would have a truly significant impact on efficiencies of production, distribution, and end-use in a diverse, rapidly growing economy. Instead of trying to add a currently estimated 10 percent of new capacity each year, the utility would likely be able to cut supply additions by a factor of two or three.

3) Capability & Institution Building: This proposal relates directly to building an institutional base for power sector efficiency improvement in a key developing country and has a high probability of affecting utility practices and procedures for the long term. By affecting the "model to be applied by the World Bank in other countries, it may encourage institution-building elsewhere as well. In addition, by inviting KONEBA (Indonesia's "national energy conservation center") to participate, the proposed project may help to enhance KONEBA's image and visibility in the country and to identify further markets for the organization's services.

4)Fundability: Only limited funds required. Base funding already committed by the World Bank.

5) Facilitation of Innovation & Models: The proposed project is especially important because the Indonesia environmental management effort is designed to establish a model for subsequent World Bank projects to develop environmental management capabilities in developing country utilities. Expanding the efficiency improvement component in Indonesia will influence the model transferred to other countries as well.

Projected Cost:
200K, including support for U.S. electric utility participation and certain training activities for Indonesian counterparts.

6) Emphasis on Concrete & Specific Projects: This is a specific activity in a specific country. Its impact can be measured by the degree to which actions by the Indonesian utility resulting from the World Bank project promote power sector efficiency improvement.

7) Non-Energy Benefits: As GEEI has documented, promoting power sector efficiency improvement reduces capital costs and environmental impacts associated with providing energy services. This is particularly important in a country with a rapidly expanding electricity demand and a generous fossil energy resource endowment.

8) Cooperation Potential: The activity will be directly connected with this and future World Bank environmental projects. Its potential for cooperation with U.S. utilities and KONEBA is also important.

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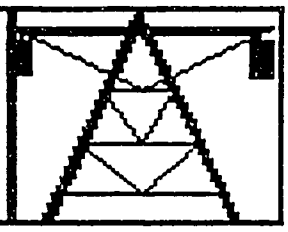

Project Name: Least Cost Energy Planning for Sri Lanka.

Country Where It Will Be Implemented: Sri Lanka.

Project Description: The Environmental Foundation Ltd., a Sri Lankan non-governmental organization (NGO), with assistance from the Natural Resources Defense Council (NRDC), a U.S. NGO, is preparing an ecologically sustainable energy master plan for the island nation of Sri Lanka. Sri Lanka has a population of 17.2 million people, with an expected increase of 50 percent over the next 35 years. Current electricity consumption is less than 200 kWh per year, 25 times less than West European nations and 50 times less than U.S. electrical consumption. Demand growth has doubled capacity in the last decade, and the high demand for electrical services is expected to continue in the coming decades. Sri Lanka has no indigenous fossil or nuclear resources, and has already developed two-thirds of its hydroelectric potential.

The master plan focuses on the economic opportunities for expanding electricity services in a least cost and low environmental risk manner through reliance on end-use, energy efficiency improvements and a select range of ecologically sustainable solar and renewable energy options. A decade of empirical evidence in other parts of the world, combined with detailed, albeit generic studies, indicate that these two energy service options could support and spur Sri Lankan economic development while minimizing environmental risks and damages.

An advisory panel of energy planners, end-use efficiency experts, finance specialists and environmentalists has been assembled to oversee preparation of the plan. EFL and NRDC will lead a coordinated campaign to advocate adoption of the plan by the government of Sri Lanka and support for its implementation by the World Bank, the Asian Development Bank, and bilateral agencies (like US AID).

Project's Duration: Three years, 1991-1993.

Project Status at Present: This project was launched in August 1990. The preparation of the energy plan is now underway. At the same time, advocacy activities have been initiated with the Sri Lankan government, World Bank, Asian Development Bank, and USAID.

Implementing Institutions: Environmental Foundation Limited (Sri Lanka), Natural Resources Defense Council (U.S.).

Other Institutions Involved: Sri Lanka Energy Managers Association, National Engineering Research and Development Centre, Natural Resources, Energy and Science Authority, Development Finance Corporation of Ceylon, Wildlife and Nature Protection Society.

Ability to Meet USWG Criteria

1) Ripeness: Project has full support from leading governmental and non-governmental institutions in Sri Lanka. EFL and NRDC have an unusual record of success in influencing policy decisions of the Sri Lankan government and MDBs on energy and forest issues

2) Realizable Energy Savings Potential: Pre-investment work in Sri Lanka indicates a potential annual savings in peak electricity demand of roughly 200-300 MW (16-24% of current capacity) through modest end-use efficiency improvements.

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Projected Cost:

$150,000

3) Capability & Institution Building: Project is intended to "jump start" Sri Lanka's fledgling energy efficiency program, which involves a wide range of government agencies, NGO's and private businesses (see e.g. "Other Institutions" above).

4) Fundability: Project is relatively low-cost and has already attracted foundation interest. A key objective of this project is to stimulate official donor (i.e. World Bank, ADB, USAID) support for national-level energy efficiency and renewable energy programs.

5) Facilitation of Innovation & Models: Project objective is to redirect long-term development and investment plans of state energy institutions-- a highly innovative concept in Sri Lanka and elsewhere in the region.

6) Emphasis on Concrete & Specific Projects: Project focused specifically on reforming Sri Lanka's energy development plans. Measurable goals will include elimination or reduction in scale of specific planned power plants, and specific government policy and budget commitments to a well-defined range of energy efficiency and renewable energy programs.

7) Non-Energy Benefits: Environmental concerns are central to the project-- proposed power projects threaten rain forests, coastal ecosystems, fisheries, and key agricultural regions. Economic benefits from improved energy efficiency are especially apparent in the face of recent oil price hikes in Sri Lanka.

8) Cooperation Potential: Project represents a highly unusual long-term partnership between Asian and U.S. NGO's. In Sri Lanka, the project represents a first-ever collaborative approach on energy issues among environmental NGOs, government agencies, and private businesses.

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Utilities

Project Name: Public Utility Demand-Side Energy Efficiency Project.

Country Where It Will Be Implemented: Djibouti.

Project Objectives: Increase the awareness and involvement of the Djibouti utility company, Electricite' de Djibouti (EdD) in the promotion of demand-side management (DSM) energy efficiency opportunities in Djibouti as a model for other African countries.

Project Description: Djibouti, a country of 400,000 people located in East Africa adjacent to Ethiopia and Somalia, consumes roughly 430 kilowatt-hours per capita per year. Nearly half of the utility's electrical output goes to the residential sector, less than 10 percent to industry and agriculture, and the remaining amount to institutional and commercial buildings. Utility rates are very high, averaging over 20 cents per kWh.

The proposed project would structure and undertake a range of activities to demonstrate to utility company personnel and other key decision-makers in Djibouti the role(s) that the utility company can play in meeting growing demand for electricity services through investment in cost-effective end-use efficiency improvements (e.g. lights, motors, appliances). This would include organizing workshops in Djibouti, short term training in the U.S. at select utility companies (i.e. Florida Power and Light) and other institutions (i.e. Florida Solar Energy Center) and on-site technical assistance in Djibouti. Particular help is needed in structuring incentive programs tailored for Djibouti for both the utility company and consumers to ensure that the full range of cost-effective efficiency opportunities are captured in a timely manner. The project builds upon the successful DSM programs undertaken by a variety of electric utilities over the past 15 years, as well as incorporating the refinements in Least-Cost Utility Planning/Integrated Resource Planning that puts demand-side efficiency investments on equal footing with supply-side expansion plans. A large resource pool of low-cost efficiency improvements continues to make it possible to deliver five to ten times as many electricity services per dollar of investment compared to investment in expanding power supply. To facilitate the most rapid expansion of desperately needed electricity services, this project will help the utility identify and implement the planning procedures and technical and managerial skills necessary to evaluate where the best marginal investments are available.

Project's Duration: 18 months.

Project Status at Present: Volunteers in Technical Assistance (VITA) presently maintains a Djibouti Energy project that has been underway since 1989. A revision of the previous national energy assessment is currently underway so baseline data will be available for this project. VITA has an energy advisor resident in Djibouti and has excellent relations with the utility company director as a result of ongoing work with both the utility company and the national scientific institute (ISERST) on development of geothermal resources.

Implementing Institutions: L'ISERST (National Science and Technology Institute) and VITA.

Other Institutions: EdD (Electricite' de Djibouti-the nation's one utility company).

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PROJECTED COST:

Approximately $150,000

Ability to Meet USWG Criteria

1) Ripeness: As a result of the limited energy production resources of the country, the corresponding high cost of electricity to consumers (averaging 28 cents/kWh) and the work done to date to sensitize the public in Djibouti regarding opportunities to expand electricity services through investment in energy efficiency improvements, the project is at the peak of ripeness and ready to be plucked from the vine.

2) Realizable Energy Savings Potential: Realizable energy savings mainly take the form of delivering five to 10 times as many electricity services per dollar of investment relative to supply-side expansion options. This least-cost planning and investment method displaces the combustion of oil, which currently provides all electrical generation.

3) Capability and Institution Building: The capability to implement the project exists at ISERST and VITA if assistance is provided from one or two utility companies in the U.S. and one or two U.S. energy training institutions. The institution-building potential is tremendous for this project both with the National Science and Technology Institute and the National Utility company.

4) Fundability: This project should be easily fundable as (a) it will be relatively inexpensive since Djibouti is a small country and (b) because of the country's small size the results of the project will be quickly evident.

5) Facilitation of Innovation & Models: The close relationship that VITA has with both the Science and Technology Institute and the utility company will permit innovative aspects as part of this project.

6) Emphasis on Concrete & Specific Projects: This project is very concrete and will have both measurable, policy-related and institution-building outputs.

7) Non-Energy Benefits: Benefits include: reduction of a range of pollutants, including the greenhouse gas carbon-dioxide (CO_2), by reducing oil consumption; minimizing capital requirements for satisfying electricity service demand; moreover, as results from this project become readily discernible, it is expected that this will result in a set of guidelines which can be applied to the utility sectors in other African countries as well.

8) Cooperation Potential: As the project will involve Djiboutian S&T Institute, Djiboutian utility company, U.S. utility company, FSEC and VITA, it should be a model of cooperation.

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Utilities

Project Name: Least Cost National Energy Planning and Development.

Country Where It Will Be Implemented: Ethiopia

Project Objectives: The project, and its six components are designed to develop a new energy path for Ethiopia. The Minister of Mines and Energy has reviewed the projects and, as a result, has designated the General Manager of the Ethiopian Energy Authority (EEA) as the coordinator of all the projects. Further, the EEA has approved the full packet of projects with a commitment of $200,000, to be co-funded for the full package cost by U.S. sources.

Project Description: Ethiopia faces a difficult economic and financial situation at the present time. There is a pressing need for adequate, affordable, and reliable supplies of domestic electricity in order to support economic and social development. However, there is a severe shortage of capital required to meet the growing demand for imported fuel and electric power facilities.

The major concern of the energy sector is to develop appropriate investments under the current economic constraints, while planning for the energy requirements of the future. On the demand side, this will require policies that promote the effective use of energy. On the supply side, this requires that investments be concentrated on the development of those domestic energy resources, including geothermal and solar alternative energy systems, that provide the greatest potential for meeting the energy requirements of Ethiopia at the least cost.

The project will complete high-priority analytical studies designed to help formulate more responsive and modern energy operations. Proposed project components include:

(1) Public utility demand-side energy efficiency to increase the awareness and involvement of the Ethiopian utility company, Ethiopian Electric, Light and Power Authority (EELPA) in the promotion of demand-side management (DSM) energy efficiency opportunities. Included in the proposed activities are workshops, on-site technical assistance, development of a DSM program plan, and utility personnel training to ensure that capability of utility staff is buiilt to meet growing demand for electricity services through investment in cost-effective end-use efficiency improvements.

(2) Solar-based rural and remote power supply will provide technical assistance for the installation of commercially available and economically attractive solar cell modules to satisfy the electrical requirements of small, dispersed rural and agricultural homes. The project is designed to provide technical assistance to the Government of Ethiopia by a) developing a solar radiation resource assessment and a continuing data base to determine the actual levels of solar radiation available; (b) designing a sample survey of potential facilities capable of using solar PV systems in the rural residential and agricultural sector; (c) based on the survey sample, conducting a feasibility study to assess the viability of manufacturing and marketing solar modules in Ethiopia; and (d) establishing financial procedures to expand solar rural systems in Ethiopia.

(3) Implementation of energy price reform aims to design, develop, and implement an appropriate and contemporary energy and electric power pricing program. The project will develop a model for Ethiopia to establish marginal cost pricing for optimizing growth.

In addition, this component will result in a program plan containing actions required for energy pricing policy implementation.

(4) Detailed energy planning, modeling, and projections will be developed to provide an appropriate methodology for balancing the diverse requirements of energy and the economy. This project component will involve design, development, and implementation of an appropriate energy model as an analytical tool for reviewing the potential impact of changing energy patterns on economic growth in Ethiopia. The modeling activity will utilize and expand existing analytical activities available at the Ethiopian Energy Authority, including use of the LEAP model. Suitable training, documentation, and technical support will be provided to the Ethiopian Energy Authority to permit all data and analytical activities to be developed by local staff. The project will result in a model in energy planning for Ethiopia to use in energy policy development and a trained Ethiopian staff for carrying out and implementing energy policy.

(5) Feasibility of increased electric power transmission will provide assistance to key local personnel in the analysis required for evaluating transmission and distribution facilities in Ethiopia. This component will result in a report on the present adequacy of the transmission and distribution facilities. The report will outline the potential for expansion of transmission and distribution integrated with future power supply planning.

(6) Pre-investment study for geothermal power production will include identifying and implementing strategies for geothermal power plant development. The vast geothermal resources in the main Ethiopian rift valley and the Afar depression, both of which constitute part of the great African rift system, could make a significant contribution to the country's energy needs. This component of the project will result in a report containing the alternative strategies for private sector participation in the development of geothermal energy; and a report with the results of a financial risk analysis which would be needed by interested investors.

Project Duration: The project represents a multi-year effort.

Project Status At Present: The project is being coordinated in-country by the General Manager of the Ethiopian Energy Authority (EEA), and the EEA has committed approximately one-third of the project funds.

Implementing Institution(s): BNF Technologies, Ethiopian Energy Authority.

Other Institutions Involved: Local technical experts, foreign consultants as needed.

Ability to Meet USWG Criteria

1) Ripeness: Ethiopia is facing a dire situation. There is a pressing need to supply energy services to consumers, with little capital resources to invest in increasing supply. The Ethiopian government's support for the project indicates the country's commitment to the project and the timeliness of funding the project.

2) Realizable Energy Savings Potential: Potential for realizing significant energy savings in the country is high. Support for this project will allow full energy savings to be realized in the future.

3) Capability and Institution Building: While the project is designed to identify priorities for establishing new energy resources in Ethiopia, from both the demand and supply sides, the project will simultaneously build the capability in-country to deliver the newly-identified energy options. Workshops and training for local staff will be conducted throughout the project.

4) Fundability: U.S. support for the project at this juncture is critical, as the Ethiopian government has already committed finances to the project.

5) Facilitation of Innovation and Models: The project is designed as a package in order to develop the concept of integrated resource planning in a comprehensive way. The project will essentially result in a new energy planning model for Ethiopia, with different options for meeting demand for energy services identified by feasibility and associated cost. The project will help to formulate a more responsive and modern energy operation in Ethiopia.

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6) Emphasis on Concrete and Specific Projects: The project identifies specific energy growth opportunities for analysis in the Ethiopian context. The resulting analysis will identfiy concrete, specific, cost-effective projects to ensure that energy growth needs are met in a least-cost way.

7) Non-Energy Benefits: The project will identify opportunities to supply energy services at the least cost, and will attempt to take into account the environmental cost when identifying energy options for the country. In addition, the project will develop local capability to implement these options.

8) Cooperation Potential: Initial discussions with the Enthiopian Energy Authority (EEA) and the Minister of Mines and Energy point to the opportunity to develop positive relationships that will ensure ongoing cooperation during and after the project's completion.

Estimated Cost (US$):	
DSM Management	128,700
Solar Remote Power	106,800
Energy Price Reform	135,800
Energy Modeling	126,600
Electric Transmission	97,800
Geothermal Power	88,800
Total Projects Cost	684,500
Ethiopian Govt Funding	200,000
Total Required	$ 484,500
US Co-Funding	

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Buildings

Project Name: Building Energy Efficiency Improvement in Czechoslovakia.

Country Where It Will Be Implemented: Czechoslovakia.

Project Objectives: (1) To demonstrate potential for buildings energy efficiency improvement in a key Eastern European country.
(2) To promote electric utility roles in end-use electricity efficiency improvement.
(3) To build a model of a long-term institutional base for energy efficiency improvement in a low/middle-income country.

Project Description: This project is intended to improve energy efficiencies in buildings in Czechoslovakia by combining end-use technology demonstrations with technical and institution-building assistance to the electric utility. The project is aimed at developing effective programs to promote and support such efficiency improvements over the long term. More specifically, it would include:

(a) retrofitting an existing multifamily residential building to demonstrate efficiency potentials through retrofits of lighting, HVAC, building materials, both electrically and thermally, and to develop local private-sector experience; and;

(b) working with local parties to design a model new multifamily residential building for the same reasons. At the same time, it would provide technical assistance, training, and other support to the Czechoslovakian utility in envisioning and designing demand-side management programs related to energy use in buildings; it would assist in dialogues about associated policy reforms, including energy pricing and efficiency standards; and it would assist in developing investment proposals for submission to potential lenders (related to utility programs, construction projects, and private-sector business development related to energy-efficient buildings). The linchpin between U.S. and Czechoslovakian institutions would be the Prague Energy Conservation Center, SEVEn, which would coordinate all in-country activities.

Project's Duration: Five years.

Project Status at Present: Related to the number of activities already under way (see "ripeness" below). Supported indirectly by ORNL funding from the DOE Office of Foreign Intelligence. Strong interest has been expressed by the Czech Power Works, the State Energy Inspectorate, Energoprojekt (the country's largest A&E firm), and the Czechoslovak energy efficiency center.

Implementing Institutions: Oak Ridge National Laboratory (ORNL), working in collaboration with a consortium of institutions including PNL, LBL, NREL, ACEEE, Hagler Bailly, IIEC, USEA and Kolar Associates. Energoprojekt would do the actual building retrofit.

Other Institutions Involved: EPRI, interested NGO's, equipment manufacturers and vendors, lending institutions.

Ability to Meet USWG Criteria

1) Ripeness: This proposal connects with a number of activities that have already begun to move. DOE's Office of Buildings and Community Systems is currently considering an international program, assisted by NREL, which is expected to focus on buildings energy efficiency improvement in Poland, Czechoslovakia, and Hungary; commitments to project activities may begin in mid-1992.

In terms of long-term impact, this is especially significant because, after its recent study tour in the U.S., sponsored by USEA and A.I.D., Czechoslovakia electric utility leaders requested a second tour focused on efficiency improvement. This indicates a readiness to consider electric utility roles, presumably including the kinds of roles that would encourage

buildings efficiency improvements in the future. Moreover, supported by EPA and others, an Energy Conservation Center has been established in Prague, which has proven itself as effective in its first year and is ready to coordinate more extensive projects. Electricity prices are currently close to marginal cost, which indicates a market primed for and in need of energy efficiency. Further, emerging GEEI activities related to training and policy reform need country-specific targets to keep them in focus. And the list goes on. A project such as this one would build on the momentum that these examples suggest--even if they are still at an early stage in their evolution--and help to connect them in very useful ways.

2) Realizable Energy Savings Potential: Inferring from more detailed studies in Poland, one can estimate that cost-effective efficiency improvements in buildings in Czechoslovakia are equivalent to at least ten percent of total current national energy consumption. This means more than 200 PJ in potential annual savings. Obviously, only a part of these represent savings in electricity generation. Assuming, however, that only about one-quarter are electric-related, they still have the potential to reduce requirements for electric generation capacity by 1500-2000 MW, or (at a conservative estimate of $500 per kW) about $1 billion in investment requirements. Even if only as little as ten percent of this potential were to be realized, the proposed project would pay off at a rate of 30-1 to 50-1.

3) Capability & Institution Building: This project would specifically support the new Prague Energy Efficiency Center, but more generally it would endeavor to build the institutional base for efficiency improvement in three ways:
(a) moving the electric utility toward roles in demand-side management and other helpful policy reforms, such as price reform;
(b) involving local private-sector firms in improving energy efficiencies in buildings, giving them new capabilities and visions of future markets for the capabilities; and
(c) encouraging public support for efficiency improvement by demonstrating how it can reduce the cost of energy services to households.

4) Fundability: With the active support of the GEEI constituency, the project is a good prospect to become a model of three-way joint funding by DOE, EPA, and A.I.D.: DOE for technology demonstrations, EPA for activities of the Prague Center, and A.I.D. for activities focused on electric utility.

5) Facilitation of Innovation & Models: This project would be especially valuable as a model if it serves as the catalyst for new utility roles in demand-side management, a key stepping-stone for end-use efficiency improvement in many countries worldwide. In addition, with Czechoslovakia and Central Europe it would accelerate the market penetration of energy-efficient technologies largely new to that region, and it has the potential to show the way in relating such activities to energy policy reform and private-sector business opportunities.

Estimated Cost

Estimated at $2.5 million over the five year period: about $1 million for the model building projects (DOE), about $1 million for utility and policy dialogue programs (A.I.D.), and about 500K for Prague Center support (EPA).

6) Emphasis on Concrete & Specific Projects: This idea is focused on a specific country, a specific utility, a specific set of buildings energy technologies, a specific set of institutional goals, and even specific buildings (to be selected). Results in terms of energy saved in the model buildings and in terms of new roles and programs adopted by the utility will be measurable, and subsequent technology penetration and energy savings can be tracked.

7)Non-Energy Benefits: Clearly, a project reducing the electricity and other energy that must be produced to provide a given level of services will reduce environmental emissions from the supply side (especially from coal-fired electricity generation) and reduce capital requirements for the energy sector. In addition, efficiency improvements in buildings will reduce pressures on household incomes during a very difficult period of economic restructuring; and a program of incentives for efficiency improvements will create private-sector economic opportunities.

8) Cooperation Potential: This project proposal is essentially focused on linkages: between electric utilities and buildings developers, managers and residents; between U.S. and Czechoslovakian counterparts; and between policy conditions and technology choices. As proposed, it is big enough in scope and time frame to embrace a wide range of participation; and it is intended to lead to further linkages with sources of investment capital. Contacts with Czechoslovakian counterparts have already been initiated, and the interest is quite strong.

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Buildings

Project Name: Development and Implementation of Building Standards.

Country Where It Will Be Implemented: Brazil.

Project Objective: The project will coordinate the implementation of efficiency standards for new commercial buildings in Brazil. Governmental programs currently working to increase electrical efficiency will collaborate with U.S. institutions which have prior experience in U.S. building standards.

Project Description: At the end of 1985, the government of Brazil established a national electricity conservation program (PROCEL). The rationale for establishing such a program evolved from a 1984 study which examined the potential for more overall efficient electricity use in Brazil (Geller, 1984). The study suggested potential for reaping significant economic and environmental benefits, including twenty-percent reductions in electricity consumption by the year 2000 with a net economic benefit of about $30 billion. PROCEL works within the electricity sector, is based at Electrobas (the national utility coordinating company), and has undertaken over 150 conservation projects implemented by state/ local utilities, university and research institutions and other organizations.

In 1990, an Executive Group for the Rational Production and Use of Energy (GERE) was established. The group, directed by the Secretary of Science and Technology, Secretary of Energy, Secretary of the Economy and two representatives from the private sector provides a forum for interaction between federal government, the energy sector, and private companies. GERE activities include utility regulation reform, energy efficiency standards, building standards, and incentives for efficiency improvements provided through tariffs, rebates and building hook-up fees. GERE and PROCEL will complement each other in the development of the building standards project.

Both programs are extremely interested in developing and promulgating efficiency standards for new commercial buildings. Initially, the standards may be mandatory for government-owned buildings and voluntary for the private sector.

In addition to the interest in building standards at the national level, researchers at the University of Campinas are studying the potential for building codes in Brazil and are developing model codes. These researchers are interested in demonstrating the viability of building codes in one particular city. The University project is going to receive limited technical assistance from Lawrence Berkeley Laboratory.

Officials in Brazil would like help with the development, analysis, and implementation of standards as well as with related activities such as setting up training and enforcement programs. This project would send experts on commercial building standards to Brazil to provide this assistance.

Project's Duration: Two years.

Project Status at Present: GERE (the national energy rationalization program) has a project to work on commercial building standards. Various technical studies have been conducted. The project at the University of Campinas began in late 1991.

Implementing Institutions: GERE, PROCEL, and the University of Campinas.

Other Institutions Involved: A national lab such as LBL and/or another organization which has worked on building standards in the U.S. could provide the necessary assistance.

Ability to Meet USWG Criteria

1) Ripeness: The project is ready for implementation. The University study will result in model codes ready for demonstration in a Brazilian city. In order to take full advantage of

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Projected Costs:

$200,000 - $300,000

the University researchers' study, demonstration of model codes and eventual implementation of building standards should be pursued in a timely manner.

2) Realizable Energy Savings Potential: PROCEL has built a strong precedent for conservation program savings with estimated direct savings of 1,070 GWh/yr as of 1989 (PROCEL, 1990). Lowered electricity demand on the order of .5-1% per year is attributed to conservation measures stimulated by PROCEL. Expanded conservation programs and policies, including comprehensive building standards and other minimum efficiency protocols (beyond simple voluntary measures), could provide extensive savings in the near future. This currently untapped potential is a major objective for future PROCEL activities; this project fulfills such an objective.

3) Capability & Institution Building: Implementing programs (PROCEL and GERE) were established by committed and influential individuals within the federal government, utility industry and energy policy community in Brazil. This precedent has established expectations for continued development of local expertise. Potential implementation of University-developed building codes coordinated with prior U.S. building standard experience could provide lasting capability for similar projects for other sectors.

4) Fundability: Good. University project is underway. Continuing this project and turning technical studies into savings is crucial.

5) Facilitation of Innovation & Models: High. This project provides an opportunity to move beyond PROCEL's rather successful standardized efficiency testing and labelling program to set efficiency requirements for new commercial buildings. Testing procedures in CEPEL, the national lab for the electricity sector, among other testing facilities, provide baseline efficiency for various products. This project, informed by U. S. experiences, will introduce standards beyond existing voluntary protocol currently established. Concurrently, retrofit standards can be addressed through this model.

6) Emphasis on Concrete & Specific Projects: High. This project is highly specific, with a focus on new commercial buildings, one component of the building sector.

7) Non-Energy Benefits: Aside from achieving electricity savings in the commercial sector, the project will build local expertise in the commercial, industrial and residential sectors, as well. As the project contributes to GERE and PROCEL's electricity efficiency programs, it indirectly serves as a pollution prevention strategy while benefiting the Brazilian economy.

8) Cooperation Potential: As the description of the PROCEL and GERE programs indicates, there is a precedent for cooperation among decision makers in Brazil. This project would augment communication and cooperation between Brazilian programs and their U.S. counterparts.

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Buildings

Project Name: CFC-Free, Energy Efficient Refrigerators for India.

Country Where It Will Be Implemented: India.

Project Objectives: To develop and commercialize, through an international collaborative effort, domestic refrigerator technologies for the Indian market that reduce CFC emissions and improve refrigerator efficiency.

Project Description: The International Institute for Energy Conservation (IIEC) and the Tata Energy Research Institute (TERI) initiated an effort to bring together representatives of the international refrigerator research and development (R&D), regulatory, and industrial community for a two day meeting in September of 1991. The participants concluded that it was premature to discuss commercializing chlorofluorocarbon (CFC)- free, energy efficient refrigerators when technologies and enabling policies are not yet in place in India. To facilitate the procedure for introducing such technologies and policies, the participants decided on a two-step mechanism to include:

(1) implementation of an evaluation and assessment program to identify CFC substitutes and refrigerator efficiency component technologies best suited to India's unique needs and conditions, and;

(2) collaboration of U.S. and Indian policy planners and decision makers to encourage the development, commercialization and market penetration of energy efficient refrigerators; the policy approaches include consumer-based incentives, scheduled development of efficiency standards, initiatives for enhancing power supply quality, and utility investments in demand side management (DSM).

With a total population of 850 million people, there are only about 7 million refrigerators now in use in Indian homes. This number is growing at a rate of more than 20% per year, thus, the market for refrigerator sales in India over the next several decades will be enormous. Meanwhile, India is expected to sign the Montreal Protocol imminently. This will commit the country to eliminate its chlorofluorocarbon (CFC) emissions. The project would reduce CFC emissions associated with the growing refrigerator industry. It would also curtail other greenhouse gas emissions from electric power generation, largely based on coal, associated with electricity usage in India.

TERI and IIEC have invited Oak Ridge National Laboratory (ORNL) to join in the effort to develop the technical evaluation and assessment components of this initiative. Both TERI and ORNL will utilize such mechanisms as CRADAs (Cooperative Research and Development Agreements between U.S. National Laboratories and U.S. industrial partners for cost-shared collaboration in R&D activities). These mechanisms will help to integrate R&D activities with the efforts of the private refrigerator industry. Subsequent commercialization will utilize relationships established in the initial stages of this project to catalyze private-sector joint ventures.

Project Duration: Five to ten years.

Project Status At Present: On the heels of the September meeting, preparation for implementing the next stage in the process has begun. IIEC and TERI are preparing strategy papers to set this next stage in motion. Attendees of the September meeting discussed reconvening in the Spring of 1992 in New Delhi. In consultation with TERI, ORNL is developing assessment approaches and testing procedures appropriate for Indian industry. IIEC, TERI, and ORNL will bring their testing and training efforts to the meeting in India in the Spring of 1992.

Implementing Institutions: ORNL and its CRADA private-sector partners; TERI and Indian private-sector partners; IIEC and U.S. industry; DOE/ Conservation.

Other Institutions Involved: A.I.D., EPA.

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Ability to Meet USWG Criteria

1) Ripeness: Groundwork for future collaboration was set during the September meeting; it is crucial to seize on relationships between Indian manufacturers and U.S. counterparts established in September and continue, in a timely manner, what began then.

In addition, India will soon join in the Montreal Protocol, as amended, and will then be pursuing technology and policy initiatives to reduce its rate of increase in CFC emissions. R.K. Pachauri, Director of TERI, believes that the next year will be an ideal time to offer proposals for collaborative work toward this end. Moreover, other activities of this type will evolve over the next several years, possibly related to results of UNCED as well as to collaboration linked to private sector roles. This project will test and document a very attractive alternative for collaboration.

2) Realizable Energy Savings Potential: Based on current growth rates in the Indian refrigerator market, 100 million households are expected to buy their first refrigerator in the next twenty years. If the experience of the U.S. industry over the past decade can be replicated over the next twenty year period in India, the efficiency of the Indian products can improve by 100%. This means potential savings of 25 billion kilowatt hours (kWh) per year relative to current trends.

3) Capability & Institution Building: The two-phase approach will build capacity necessary to commercialize this technology, both in the Indian industry and in the government. It will establish a testing procedure useful to Indian industry in selecting new technologies. It will also provide training necessary for implementing policies, such as appliance standards, which facilitate the commercialization of efficient end-use technologies.

4) Fundability: The formative stages of this initiative, including the September '91 meeting, were supported by the Rockefeller Foundation and the US Agency for International Development.

Estimated Costs:

$5-10 million over ten years for the joint activity, from initial R&D planning to prototype production and testing.

The next stage focuses on the capacity building in Indian institutions and industry necessary to propel the development and commercialization of environmentally attractive, energy efficient technologies. Both the U.S. Department of Energy and the Rockefeller Foundation have expressed interest in this project. TERI believes that the Indian contribution to the collaborative can eventually be funded from the Montreal Protocol fund.

5) Facilitation of Innovation & Models: The project is important in three regards: (a) as an illustration of an appropriate industrialized country response to a well-focused developing country request; (b) as an exploration of the CRADA-type model for R&D/industry linkages with developing countries; and (c) as an innovative approach to South-North R&D collaboration that may be of interest in other initiatives besides this alone. Furthermore, innovative refrigerator technologies developed for the Indian market may well be appropriate for other developing country markets as well.

6) Emphasis on Concrete & Specific Projects: The objective of this project is to develop a specific technology for a specific market for a specific purpose.

7) Non-Energy Benefits: The introduction of a CFC-free, highly efficient refrigerator to the Indian market will avoid emission of CFCs linked to the depletion of the ozone layer while averting the production of greenhouse gases (including CFCs and CO_2). The electricity shortages in India currently constrain economic growth. Reducing new electricity demand growth will preserve capital for economic growth.

8) Cooperation Potential: See above. This project is founded on direct South-North and public-private cooperation.

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Buildings

Project Name: Energy Efficiency in Commercial Buildings in Select South-east Asian Countries.

Countries Where It Will Be Implemented: Indonesia or Thailand based on readiness and ability to implement policies.

Project Objectives: To develop and implement policies to increase the energy efficiency of new commercial buildings in developing countries.

Project Description: Commercial buildings currently account for approximately one-third of total electricity use in developing countries. As the income levels of countries rise, construction of commercial buildings occurs at a rapid rate.

On a per dollar basis, installing highly efficient energy-consuming devices in commercial buildings "delivers" several times more energy services than investment in more expensive power generation to deliver electricity to an average, inefficient device. More efficient lighting systems, lighting controls, improved glazing and window coatings, more efficient air conditioners, and a variety of other measures can cut electricity use by 40% or more at a cost far less than that of electricity. Cost-effective energy savings through retrofit of existing buildings can also be highly beneficial.

Because of various market imperfections and institutional barriers, it is essential that policies and programs be designed to support efforts in developing countries to capture these cost-effective savings. Urgent attention is especially needed for new buildings, because: (1) it is much less expensive to design a new commercial building to use energy more efficiently than to modify a building after its constructed; and (2) commercial buildings have long lifetimes (75 years or more), and will continue to use energy over that entire period.

The specific tasks that are needed include:

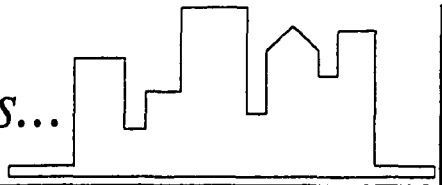
- training in technical, economic, and analytic facets of energy use in buildings;
- surveys of the energy performance of commercial buildings and of both physical and operational characteristics of buildings affecting energy use;
- analysis of the economics of energy efficiency improvements in the commercial building stock of the country;
- completion of research to develop a model energy conservation code that can be applied in many developing countries, as well as accompanying training material;
- support for implementation of programs and policies;
- documentation of impacts of energy efficient design in commercial buildings.

This project will be initiated in one or more countries, with an explicit design to replicate the model effort to other countries and regions. The work will be carried out collaboratively with partners from the developing countries' key institutions. The major goal is to spur policy innovations and reforms in country(ies) that result in establishing full indigenous capability to perform ongoing analyses of energy efficient opportunities, as well as design and implement the programs and incentives vital to capturing these investment opportuinities.

Project's Duration: Ten years (to achieve acceptance of energy codes in many countries).

Project Status At Present: Major effort completed in the Association of Southeast Asian Nations (ASEAN): new

Buildings...



effort being initiated, involving a workshop to stimulate interest among developing countries and policy development in at least one country.

Implementing Institutions: Lawrence Berkeley Laboratory, a world leader for two decades in cutting edge work on energy efficiency improvements in buildigns.

Other Institutions Involved: Institutions in developing countries will be involved to analyze energy use in commercial buildings, to design the model code, and develop policy instruments and programs for their country. Other institutions can be called upon for specialized needs (e.g., code-developing bodies like ASHRAE, CBM, IES & CIE, NFC, etc).

Ability to Meet USWG Criteria

1) Ripeness: High electricity growth rates throughout Southeast Asia are doubling the need for generating capacity roughly every decade, and in a number of countries every five years. Low-cost efficiency improvements, two to 10 times less the cost of new power plants, can satisfy a significant fraction of this growth. Moreover, the willingness of ASEAN countries to pursue both technical research and policy reform indicates considerable capability and interest in promoting energy efficiency. The project needs to take advantage of the participants from ASEAN to spread the word about the benefits of energy efficiency gains in new buildings. The talent to direct the effort exists at LBL and other institutions, and it is prepared to engage in this activity immediately.

2) Realizable Energy Savings Potential: Large energy savings: buildings consume upwards of 40% of electricity in developing countries, and savings in new buildings can exceed 40%. This project is aimed at translating technical knowledge into policies, resulting in substantial energy and capital savings.

3) Capability & Institution Building: The project will promote intimate involvement of institutions in developing countries, including building code officials, builders, architects, researchers, energy and utility officials, and non-governmental organizations. The project design calls for providing the necessary resources so that these institutions can organize themselves to develop and implement an energy code for buildings. Thus, a major part of the effort involves strengthening existing institutions to achieve higher levels of efficiency in commercial buildings.

PROJECTED COST:
$1 Million per year over ten years would be sufficient to create insitutions in ten or more countries to insure buildings are significantly more energy efficient than at present.

4) Fundability: An initial effort is funded by U.S. AID. However, given the the magnitude of commercial building growth underway in developing countries, this project makes considerable sense for the World Bank and MDB to support. The several million dollars needed to complete the project promises to return several tens of billions of dollars in capital savings and operating costs over the next two decades.

5) Facilitation of Innovation & Models: This project addresses an especially important area in which models of programs to transfer among developing countries are critically needed. To date, most international effort on energy conservation have focussed on the industrial sector. New buildings offer equally large savings, and an active program should be designed to be a model for other nations.

6) Emphasis on Concrete & Specific Projects: The specific objective of this project is to have a model code developed and implemented, with energy savings from the code documented.

7) Non-Energy Benefits: The project will achieve large electricity savings, which in turn will lead to large reductions in capital requirements and operating costs, as well as a range of pollution emissions to humans and the environment. Additional balance of payment savings will accrue to many developing countries that depend on imported oil or coal for electricity. Equally important, increased energy efficiency in new buildings is an important way to free-up precious capital, making it available for a variety of other important objectiveslike educaiton, health, sanitation and economic development.

8) Cooperation Potential: See above (institution building).

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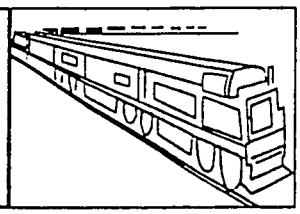
Transport



Project Name: Transportation System Planning Guidebook, Based on a Review of Transportation System Elements in Selected Brazilian cities.

Countries Where It Will Be Implemented: Transportation System Planning Guidebook can be useful to all urban areas, especially fast-growing regions. By the year 2000 there will be nearly 300 metropolitan areas with one million or more people and the size of the population living in urban areas in developing countries will exceed that of rural areas for the first time in history.

Project Objectives: Prepare and distribute an integrated transportation system/ land use planning guide based on an analysis of successful innovations in urban transportation system planning. The innovations to be studied include sound land-use design practices that integrate multi-modal transport options into a well-connected intermodal transport system. In depth case study assessments of successful transportation systems in Brazilian cities such as, Curitiba, Porto Alegre, Belo Horizante, and Sao Paulo will provide the Guidebook's substance.

Project Description: The International Institute for Energy Conservation (IIEC) will send a 1 or 2-person team to Brazil to initiate a collaborative effort with the selected cities' urban transportation planners and transit experts to document innovative transportation planning and design elements. The team will gather data on cost and benefits (e.g. capital and energy savings, pollution prevention, and other identified economic values). Other components will also be examined, i.e. aspects of public discussion, incorporation of viewpoints into the decisionmaking process, and the need to design for ongoing improvements and continuous changes in the planning process.

Project's Duration: (A) On site visit and data assessment – 3 months; (B) Prepare Guidebook – 6 months; (C) Publishing and distribution – 6 months.

Project Status At Present: The transport system of Curitiba, Brazil demonstrates the city's commitment to designing a transportation system that moves people, goods and information in a least-cost manner by relying on a variety of integrated modal options. This includes walkways and bikeways well-connected to bus and light rail transit systems, reducing the need for more costly, polluting, and traffic congesting automobiles. Curitiba's transit system is currently used by an impressive 70 percent of its residents. Despite having the second highest per capita vehicle ownership rate in Brazil, Curitiba's vehicle fuel consumption is significantly less than other similarly sized cities in Brazil, due to the excellently designed transit system. Furthermore, other cities in Brazil have also initiated innovative transit systems resulting in positive impacts on the cities' development. These cities offer valuable insights to other cities seeking to satisfy fast-growing demand for transport services in a least-cost, low-polluting manner. This project will document the elements necessary to understand and replicate these models.

Implementing Institutions: The Transportation Planning Guidebook will be targeted to urban planners and transportation experts in cities worldwide coping with rapidly expanding demand for transport services. Because there are so many key elements of these Brazilian transport systems that could be emulated elsewhere, it is anticipated that cities from both industrialized and developing countries in all regions of the world could benefit from this guidebook.

Other Institutions Involved: The Guidebook will be prepared jointly by ORNL, IIEC, and transportation planners in Curitiba, and other cities' urban and transportation planners.

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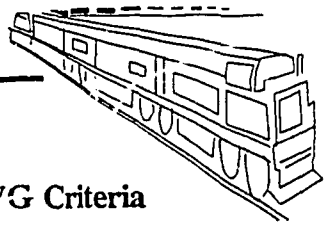

Ability to Meet USWG Criteria

1) Ripeness Rapid urbanization is occurring in developing countries. The total population living in these urban areas will reach 2 billion people by the year 2000, double the number in 1980. The successful transportation planning processes in Curitiba and other Brazilian cities, distilled into a Guidebook, can help planners in other urban areas satisfy the rising demand for transport services while avoiding enormous monetary, energy and environmental expenditures. It is a timely opportunity to gain vitally important transport planning information.

2) Realizable Energy Savings Potential: Experience shows that comprehensive transport planning which incorporates a wide range of practical and cost-effective modal options achieves a sizable displacement of vehicle miles travelled (VMT) into passenger miles travelled (PMT). The result is a greater level of transport services at a lower overall level of resource consumption. The Guidebook will document illustrative savings. Implementation of these insights worldwide could achieve multi-billion dollar annual savings.

3) *Capability& Institution Building:* The Guidebook is based on examples from developing country cities like Curitiba, among the world's best operating transportation systems. Thus, the Guidebook will promote developing city-to-developing city knowledge and information transfer.

4) *Fundability*: Preparation and distribution of the Guidebook offers an extraordinarily low-cost means for the multi-lateral development bank Urban and Transportation sectors and bilateral agencies to invest in innovative ways of satisfying transport services in a cost- and pollution-minimizing manner.

PROJECTED COST:

(A) On site data collection	$50,000
(B) Guide book preparation	50,000
(C) Distribution	50,000
Total Project Cost	$150,000

5) *Facilitation & Innovation of Models:* The Guidebook will document highly innovative "least-cost" methods and planning insights on how to satisfy transport service demands. By concentrating on translating experiences into workable projects for other cities, the guidebook will be a unique contribution to the information currently available to city planners worldwide.

6) *Emphasis on Concrete & Specific Projects* The project is a concrete, "hands-on, how-to" Guidebook that promotes immediate actions. It will initially be distributed through the GEEI network, and subsequently used to help city planners and aid agencies prepare environmentally sound, energy efficient transport projects.

7) *Non-Energy Benefits*: Empirical findings indicate that an integrated land-use and transport planning process provides a valuable pollution prevention component. Large reductions in smog, acid rain and greenhouse gases are achieved, providing cost-free health and ecological benefits. Minimization of congestion and gridlock saves time and enhances productivity.

8) *Cooperation Potential::* Substantial collaboration with urban and transport planners in Brazil, as well as throughout other developing country urban areas. Mayor Jaime Lerner of Curitiba has expressed his support and enthusiasm for the project.

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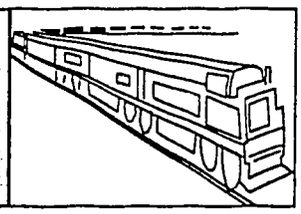

Project Name: Urban Transportation Energy Efficiency Study.

Country Where It Will Be Implemented: Brazil.

Project Objective: Support a comprehensive study of options for increasing energy efficiency and reducing fuel use in urban transportation in São Paulo, Brazil.

Project Description: Government officials in Brazil are interested in understanding what policy options are available for reducing urban transport energy use, how much different options cost and save, and other, associated characteristics. The kinds of options under consideration include vehicle efficiency standards, efficiency-based variable sales taxes, vehicle maintenance programs, mass transit programs, and even road maintenance programs.

A study based at the University of São Paulo and the University of Campinas will examine urban transport in Br. It will consider various transport modes, trends in urban transport, vehicle technologies, energy use and pollutant emissions, urban transport planning, and conservation options. Some case studies, including projections of future energy use in particular cities, will be included in the study. The study has received partial funds from Brazilian institutions and from the European Economic Community. The project is seeking additional funds.

Project's Duration: Two years.

Project Status At Present: Mobility in Brazil is projected to increase from an average of 1.4 motorized trips per inhabitant in the late 1980s to 2.1 by 2000. Issues of congestion, pollution, long-term energy costs and availability, and capital constraints have created considerable interest in examining all transport options. Useful data has been collected on fuel supplies and domestic production, as well as overviews of urban and collective transport policy in Brazil.

Implementing Institutions: The Energy Institutes at the University of São Paulo and the University of Campinas would execute the study.

Other Institutions Involved: International transportation experts may get involved in the study.

Ability to Meet USWG Criteria

1) Ripeness: The substantial current and projected growth in mobility makes this project highly timely.

2) Realizable Energy Savings Potential: The policy analysis to be prepared under this project could produce substantial indirect savings in the long run.

3) Capability & Institution Building: This project provides substantial opportunities to build lasting capability and expertise in policy planning and analysis, especially since it is a University-based study.

4) Fundability: The project has elicited support from within Brazil and from the European community. This is a highly fundable project. The project has received partial funding, and is scheduled to begin in the next six months.

5) Facilitation of Innovation & Models: The city of Curitiba, Brazil has set an impressive standard for urban transportation planning in the country. Although Curitiba has high per capita automobile ownership, 70% of Curitiba residents use the bus system daily. The planning and policy options undertaken by Curitiba can inform the process of discerning which policy options suit São Paulo.

The work done in São Paulo could influence transportation policy and planning in other urban areas in Brazil and in the rest of the region. The work done in São Paulo could influence transportation policy and planning in urban areas in Brazil and in the rest of the region.

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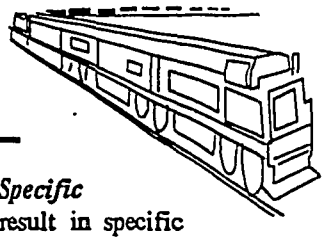

6) Emphasis on Concrete & Specific Projects: The project will result in specific policy recommendations for reducing urban transport energy use.

7) Non-Energy Benefits:: High. Policy opportunities for reducing energy use will also serve to prevent pollution and minimize traffic congestion. The project will also build capability and expertise in the crucial area of transportation policy analysis.

8) Cooperation Potential: The University-based study, and the policy recommendations which will result from the study, evolved from a specific need within the Government. This cooperation between Government and the University Energy Institutes could influence future collaboration for work in other sectors.

Projected Costs:

$300,000

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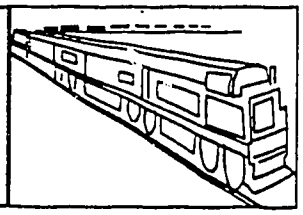

Project Name: Beira Low-Cost Vehicle Demonstration Project (BLCVDP).

Country Where It Will Be Implemented: Mozambique.

Project Objectives: To provide women farmers and refugee camp workers with low-cost, sustainable transportation options using bicycles and load-carrying modified-bicycle carts.

Project Description: The urgent transportation needs of Mozambique can be met most effectively through the provision of bicycles and institutional support systems for bicycle maintenance. The larger part of the project focuses on women farmers and seeks to improve their mobility and ease of transporting their produce to market. Currently, women are confronted with bearing heavy loads on foot. Bicycles with attached carts greatly ease the burdens of these farmers.

The other focus of the BLCVDP is directed toward the refugee camp administrators, responsible for distributing food, providing basic health care, running schools, and supporting some small industries.

The project will also strengthen the current privatization and decentralization trends in the country and generate employment by providing business skills and training to a private bicycle enterprise in Beira.

Lastly, through its research component, the project will measure the effect better transportation has on population, especially on women in agricultural associations. The project will persuade policy makers on both local and national levels that bicycles and load-carrying carts are a crucial component of an integrated, energy-efficient transportation system.

Project's Duration: Three years beginning in 1990.

Project Status At Present: The Beira Low-Cost Vehicle Demonstration Project is currently in Phase I (the demonstration phase).

Implementing Institutions: The Institute for Transportation and Development Policy.

Other Institutions Involved: Government of Mozambique, Green Zones Cooperative of Beira (Mozambique), Garcia Reis LTD, The World Bank (expected).

Ability to Meet USWG Criteria

1) Ripeness: Only about two-thirds of the demand for public transport is being met in the Beira region of Mozambique, according to the Urban Transport Study commissioned by the government of Mozambique. Meanwhile, less than one percent of the population has access to private vehicles. Compounding this problem, according to a World Bank study, is the introduction of central planning in 1978 which has meant that scarce fuel and vehicles have been allocated to large priority industries at the expense of small enterprises and cooperatives. While some private sector transport is available, these vehicles are infrequent, expensive, often costing more than a day's wages, and overcrowded. BLCVDP has received support from many sources, and partial project funding has already been received, also indicating great interest in the project's implementation.

2) Realizable Energy Savings Potential: According to the Urban Transport Study mentioned above, the cost per passenger kilometer of load-carrying bicycle transport in Mozambique is less than 45% that for bus transport and requires 60% less foreign exchange. This is true without considering the higher cost of rebuilding the necessary road infrastructure which has been severely damaged by war and lack of maintenance. Given the severely damaged road network, the high cost and scarcity of automotive spare parts and fuel, urgent transportation needs

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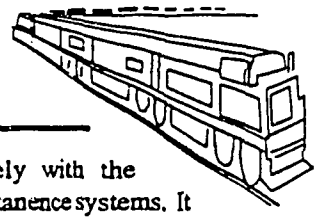

could be met more effectively with the provision of bicycles and maintanence systems. It is expected that the demonstration phase of this project will influence decision makers to further expand this and similar projects.

3) Capability & Institution Building: For this project, BLCVDP works not only with other non-governmental organizations, but also with the World Bank, a local cooperative, and private business. The project serves to build institutional relationships between various organizations interested in improving transportation options in Mozambique. Success of the project will generate interest from other NGO's and governments. BLCVDP is designed to be self-sustaining by the completion of the final phase.

4) Fundability: Phase I of the project was funded by a grant from the USA for Africa Foundation; Phase II funding is currently being sought from foundations and private sources; and Phase III of the project is expected through a World Bank Social Dimensions grant. Private donations and smaller foundation grants have been received or solicited.

5) Facilitation of Innovation & Models: In the long run, this integrated approach incorporating human-powered transportation into Mozambique will provide users greater mobility through sustainable means; strengthen the current privatization and decentralization trends in the country; generate employment by providing business skills and training; and, through its research component, measure the effect transportation has on the population, especially women in agricultural associations. These benefits will help persuade decisionmakers locally, nationally, and internationally that bicycles and load-carrying carts are a crucial component of an integrated transportation system.

6) Emphasis on Concrete and Specific Projects: Project is very concrete, leading to rapid expansion of transportation services that are very low-cost, sustainable, and easily expandable.

Projected Cost:

$100,000 per year over three year period.

7) Non-Energy Benefits: As noted above, this project demonstrates substantial capital savings (or, conversely, how to more rapidly expand transport services per dollar of investment). It is a pollution prevention strategy, par excellence. Estimated mileage for a bicycle is around 2000 miles per gallon (based on extra kilocalories of food for the bicyclist), yet bicycles generate none of the smog, acid rain and greenhouse gas pollutants associated with motorized transport options.

8) Cooperation Potential: Very high because the project is based on spurring a local bicycle manufacturing, import, sales, and repair industry.

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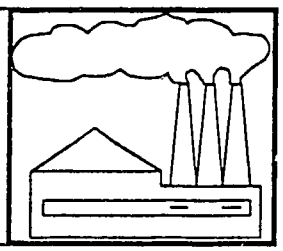
Industry



Project Name: Efficient Use of Energy in Small and Medium Industry.

Country Where It Will Be Implemented: Argentina.

Project Objectives: To quantify the savings potential in small and medium industry and determine possible barriers to realize energy savings. To offer more support to industry to facilitate greater energy savings.

Project Description: The Energy Study Groups (GESE) set up in 1982 at various regional campuses of the National Technological University (UTN) have conducted over 600 energy audits in small and medium industry. Audit recommendations were limited to measures requiring little or no investment, and concentrated on fuel rather than electricity savings. There has been little systematic follow-up to document energy savings realized.

Energy savings may be increased by extending the scope of the energy audit, incorporating financing mechanisms such as utility participation in investments required for conservation and load management, and addressing other barriers to energy conservation. The project consists of the following tasks:

- Survey a significant sample of industries audited, to determine the extent to which audit recommendations were followed and to measure energy savings realized. Possible barriers to implementation of conservation measures will also be identified in this process.

- Conduct more-intensive diagnostics in 50 industries to disaggregate energy consumption by end uses and determine the energy savings potential up to the cost effectiveness limit from a societal perspective.

- Create the necessary infrastructure to deliver higher levels of energy conservation, through the following steps:

- Advise and train technical personnel within the industry in order to implement audit recommendations.

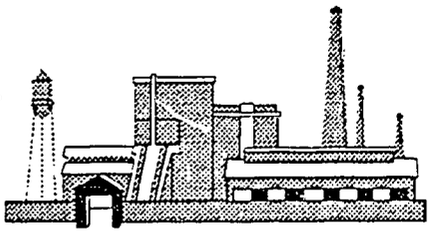
- Coordinate alternatives to financing energy conservation measures. (At least one bank has agreed to finance energy conservation measures identified by the GESE.)

- Conduct quality control on measures installed.

Project's Duration: 18 months.

Project Status at Present: Conventional energy audits are continuing. Some members of GESE are participating in a training program on the technology and economics of electricity conservation.

Implementing Institutions: Energy Studies Group of the National Technological University, Argentina. Three regional campuses around Greater



Buenos Aires will be involved in the project proposed.

Other Institutions Involved: No other institutions will be formally involved in the project. Other Argentine groups promoting energy conservation in Argentina (e.g. the National Institute of Industrial Technology, Argentine Association for the Rational Use of Energy, and other GESEs within the National Technological University) will be kept informed on the progress in this project. Members of GESE have received training on industrial energy conservation from various member countries of the European Economic Community and Japan. The project hopes to benefit from the experience of groups in the U.S., India, and other countries.

Ability to Meet USWG Criteria

1) Ripeness: In the past couple of years, government programs to control inflation by balancing the government budget have led to sharp increases in energy prices. Industrial electricity prices in Argentina are among the highest in the world, and although Argentina is self sufficient in petroleum, petroleum prices are comparable to those in Western Europe. While industries are threatened by these increases, the pricing increases the potential for cost effective energy savings even from the user's perspective.

The economic stability resulting from government policies has created an environment favorable to industrial investments including those in energy conservation. The time is ripe for increasing the technical capability of energy conservation professionals in order to be able to provide the necessary services.

2) Realizable Energy Savings Potential: GESE's energy audit recommendations so far, based on low-first-cost measures, were estimated to reduce energy conservation by 10 to 20 percent. Through more extensive audits and including additional measures that are cost effective under current energy prices, energy savings of 25 to 40 percent should be feasible.

3) Capability & Institution Building: Past efforts of the GESE have concentrated on fuel (rather than electricity) savings where most of the low-cost measures are to be found. In the present phase, technical assistance to the groups would increase their capability by introducing additional measures related to electricity conservation and cogeneration. Since the project will be located within a Technological University, creation of better-trained energy conservation professionals will be an outcome of the project.

4) Fundability: The previous government in Argentina gave priority to energy conservation, and the GESEs are equipped with substantial energy diagnostic equipment, computers and vans. Faced with major capital shortages to rehabilitate existing electricity generation and transmission infrastructure or to construct new power plants, investing in electricity savings is financially and economically attractive. International funding agencies are already financing a number of structural adjustment programs to make the Argentine economy more efficient. Some of this funding should address energy efficiency as well.

5) Facilitation of Innovation & Models: The project will include the development of integrated conservation delivery mechanisms that do not exist in most countries. The Argentine experience will be useful to other countries in the region including the Southern Cone Common Market (MERCOSUR) now in formation.

6) Emphasis on Concrete & Specific Projects: The project will take a backwards and forwards look at energy conservation in small and medium-sized industries. It will document energy savings from past

energy audits and identify barriers to energy conservation; it will also develop and test improved conservation delivery mechanisms to increase energy savings.

7) Non-Energy Benefits: Significant energy savings will lead to reduced environmental impacts in the production, distribution and use of energy. Reducing operating costs will make the industry more competitive. New energy-efficient technologies identified in the project will provide opportunities for suppliers of these technologies from industrialized countries.

8) Cooperation Potential: The improved procedures to be developed will benefit from international experts in energy efficiency. The results will be available to other organizations in Argentina and elsewhere involved in industrial energy conservation.

Projected Costs:

$150,000

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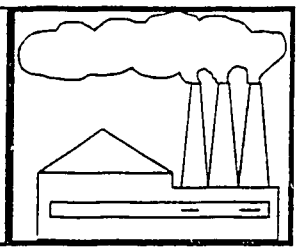
Industry



Project Name: Nationwide Industrial Combustion Tuning.

Countries Where It Will Be Implemented: India, China, Brazil, Mexico or Pakistan.

Project Objectives: To improve the efficiency of industrial combustors (boilers and furnaces) in order to reduce energy consumption and exhaust emissions.

Project Description: Energy audits in many developing and Eastern European countries have found that the efficiency of industrial combustors can typically be improved by 3-5%. This improvement leads to a reduction in CO2 of 3-5% and of carbon monoxide and hydrocarbon emissions of 30-50%. Combustion tuning is deficient in developing countries due to lack of understanding of the combustion process and lack of accurate tuning equipment, e.g. either portable or fixed combustion analysis equipment. Combustion tuning programs have been successfully pilot testes in Pakistan and Egypt. What is required at this point is to conduct a combustion tuning program on a nationwide basis to demonstrate its efficacy as a model for other countries.

The project would be modeled after the successful pilot program in Pakistan. It would contain the following basic elements:

- limited offer of free boiler/furnace tune-ups to create awareness and help establish a commercial market;

- workshops around the country on boiler/furnace energy efficiency to train future program recipients, to train program deliverers, and to further increase awareness and understanding;

- sale of portable combustion analyzers to 20-30% of the market;

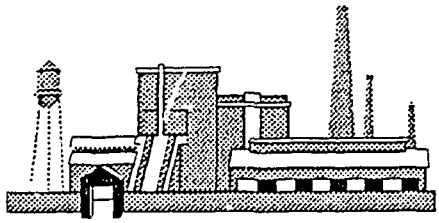
- contracting with a number of private firms to conduct boiler/furnace tune-ups on a commercial basis;

- establishment of repair and maintenance capability for the combustion analyzers procurement and sale of fixed combustion control equipment where warranted.

Project's Duration: The program duration depends to some extent on the size of the combustion population. If the project were to complete and evaluate the Pakistan program, it would take about three more years. Completing a combustor efficiency program in India or China would take 5-7 years; in Brazil or Mexico, 4-5 years.

Project Status at Present: This program has been successfully pilot tested in Pakistan under the ENERCON project. In two years the program was able to achieve commercial viability; 51 portable combustion analyzers were sold with one-third cost subsidy; two fixed combustion control demonstrations were completed; approximately 1,000 engineers and technicians were trained in boiler energy efficiency; 630 combustors were tuned producing an average efficiency improvement of 7.9%.

Program administration procedures had been completely worked out, training manuals and course materials prepared, and a body of relevant



National Productivity Council. Private sector firms would conduct the tune-ups and eventually this would become a line of business for them. Repair and maintenance capabilities would also be established in private firms.

Implementing Institutions: The administrating agency would be the federal agency responsible for energy conservation or industrial productivity. In the case of Pakistan, it would be ENERCON, the National Energy Conservation Centre.

Other Institutions Involved: Donor agencies would be involved in providing the funds to establish and evaluate the program, and assist with its replication in other countries.

Ability to Meet USWG Criteria

1) Ripeness: Because this program has been successfully pilot tested and the technology is very straight forward, this approach to energy efficiency is ready to be implemented in almost any developing country. If funding were available to expand the Pakistan program to a nationwide effort, the project could be completed in three years and would require only a month start-up time.

2) Realizable Energy Savings Potential: The average efficiency improvement achieved on over 600 combustors in Pakistan was 7.9% per combustor. The savings in India and China might be expected to be about the same, assuming the level of boiler/furnace maintenance and operation to be similar to that in Pakistan. The savings would be expected to be closer to 5% in countries with higher levels of plant maintenance, such as Brazil, Thailand, or Eastern European countries.

3) Capability & Institution Building: Boiler/Furnace tuning using electronic combustion analyzers is one of the fastest means of creating awareness within the industrial sector regarding the benefits of energy conservation. It produces immediate energy savings which the plant owner sees reflected in his next monthly fuel bill. In the Pakistan project, energy savings averaged 6.6% of the plants fuel bills. Boiler/furnace tuning is not a difficult skill to learn, so experienced engineers are not necessary. The equipment is relatively low-cost, the return on investment high, so it is completely easy to commercialize/privatize the program. The boiler/furnace tune-up often becomes the staring point for industrial plants to begin their energy conservation programs, as well as a starting point for private firms to enter the energy conservation business.

4) Fundability: The program is very attractive and should be easily fundable. It would be about $100,000 administrative grant to the administrative agency. Assuming 1,000 electronic combustion analyzers were procured at a cost of $1,5000 each, the procurement cost would be $1.5 million. Assuming a 10% cost reduction as an incentive, this would involve a $150,000 grant and $1,350,000 loan to the administering agency. Another $100,000 in funding would also be required for training, development of a repair and maintenance capability, and evaluation.

5) Facilitation of Innovation & Models: If a nationwide combustion tuning program can be successfully implemented, the model could then be considered for implementing on a global basis. Virtually no programs are being developed for global implementation, i.e., simultaneous implementation in many countries. This program is an excellent potential model for global implementation because of its simplicity and effectiveness. It is not inconceivable that a global combustion efficiency program could be completed in 10 years, reducing industrial energy consumption by 5% in developing countries and CO and HC emissions by 40%. This is exactly the kind of global impact the energy conservation movement needs to show that it can make a significant contribution to ameliorating global climate change.

6) Emphasis on Concrete & Specific Projects: As described above, the proposed project is very concrete, with documented energy savings.

7) Non-Energy Benefits: The project yields a reduction in CO_2 equal to the reduction in energy consumption and a reduction in hydrocarbon and carbon monoxide emissions approximately 10 times the reduction in energy consumption. In addition, the

Industry...

project is very effective at raising the level of awareness within the industrial sector regarding the effectiveness of energy efficiency improvements. It also creates a large market for US-produced combustion analysis and control equipment, such as that produced by EES, Westinghouse, Honeywell, Johnson Controls, and others.

8) Cooperation Potential: The proposed project has excellent potential for facilitating a closer and more cooperative relationship between developing country governments and private industrialists because the program produces a win-win situation, is simple and practical experience is gained.

PROJECTED COST:

Portable combustion analyzers:	1,000
@$1,500 ea.	$1,500,000
(90% of this would be a loan)	
Fixed combustion controls:	100
@ $20,000 ea.	$2,000,000
(90% of this would be a loan)	
Administration:	$100,000
Training (50% cost recoverable):	$80,000
Repair and Maintenance Capability:	$50,000
Evaluation:	$50,000
Total	$3,780,000

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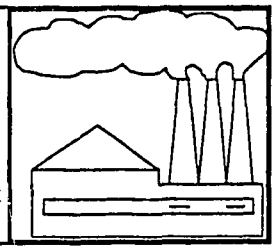

Project Name: Steam System Retrofit Program.

Country Where It Will Be Implemented: Pakistan.

Project Objectives: To reduce energy consumption in the industrial sector of Pakistan by reducing thermal energy losses in steam systems.

Project Description: A pilot Steam System Retrofit Program was conducted in Pakistan under the USAID-funded ENERCON Project. Ten plants were retrofitted at an average cost of $8,000/plant, with energy savings of 7.5%, yielding a 5 month payback period. Steam system audits were conducted at no cost to the plant, but the plant was required to pay two-thirds of the costs of the retrofit materials. Three private firms were trained in the conduct of steam system surveys and retrofit. The program was administered by ENERCON, the National Energy Conservation Center.

The proposed project would implement the above described program on a nationwide basis. The project would be administered by ENERCON and implemented in much the same manner as the pilot program, although the program participants could be required to pay a larger portion of the actual costs of the retrofit. The proposed project would require a combination of plant and loan funding from donor agencies. The grant portion would fund ENERCON's administrative expenses which include advertising, hiring contractors, monitoring quality control, and processing requests and payments, as well as implementing any incentives for program participation. The loan portion would fund the purchase of material. The loan would be secured by the Government of Pakistan and paid back via payments from firms receiving the retrofit service. Firms would be required to pay for the retrofit in two installments, one after the audit and one upon receipt of the materials, as in the pilot program. Implementation would be done by private sector firms.

Project's Duration: There are over 2,000 industrial plants with steam systems in Pakistan, and most of these are candidates for this service. Assuming a target of 1,200 plants, at the rate of 200 plants per year, the program would take six years to complete. Given that the program has been completely pilot tested, program start-up would take less than three months.

Project Status at Present: ENERCON is currently conducting steam system retrofit but at the rate of only six per year because of lack of funds. With additional funds, the program could be quickly expanded to a level of approximately 200 plants/year.

Implementing Institutions: ENERCON would be the lead administrative agency. The audits and retrofit would be done by private firms.

Other Institutions Involved: Other institutions which would be involved include the State Bank of Pakistan, which would approve the loan; the Economic Coordinating Committee, which would approve both the loan and grant; the Ministry of Finance, which would oversee the financial accounts of the project.

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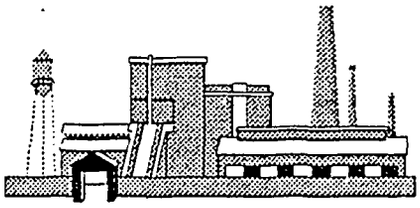

Ability to Meet USWG Criteria

1) Ripeness: This project has been successfully pilot tested, program administration worked out, private firms trained, and the industrial community made aware of its benefits. It could be fully operational within two months with sufficient funds.

2) Realizable Energy Savings Potential: The program could reduce energy consumption by 7.5% in participating industrial plants. If the program reached two-thirds of the industrial plants, industrial energy consumption, and corresponding emissions, would be reduced by 5%.

3) Capability & Institution Building: Much of the required capability and institution building for this project has already been accomplished by the USAID-funded ENERCON Project. Few additional funds need to be spent for institution building.

4) Fundability: The project would appear to be quite attractive to donor agencies targeting energy efficiency or global climate change activities because of the rapid and predictable results, and because much of the more difficult and uncertain institution building aspects have already been completed. There is potential to establish a revolving fund for plants to purchase equipment once initial savings have been demonstrated. Based on a payback of 5 months, and the development of a revolving fund, an initial loan of $1.6 million would suffice to start the project.

5) Facilitation of Innovation & Models: The Steam System Retrofit Program is an ideal project to demonstrate the efficacy of the "mass production approach" to energy conservation in developing countries. Although this approach has been successfully tested on a pilot basis, it has not been conducted on a full scale, nationwide basis in any developing country. If this approach can be successfully carried out on a nationwide basis, it will provide a model for many developing countries and for donor agencies prepared to provide large amounts of funds, mostly on a loan basis, to reduce energy consumption and carbon dioxide emissions.

Projected Cost:

At an average of $8,000/plant for 1,300 plants, the program would cost $10.4 million. If program participants were given a 10% incentive, the program would require approximately a $1 million grant and a $9 million loan. In addition, ENERCON would require approximately $100,000 to administer the program over the six year period. Potential exists for establishing a self-sustaining revolving fund.

6) Emphasis on Concrete & Specific Projects: This is a very concrete and specific project. The savings can be easily monitored and measured; the costs will be very well known.

7) Non-Energy Benefits: This project will reduce emissions from industrial plants in proportion to the energy reduction, approximately 5% of industrial emissions. The audits will require about 55 man years of professional-level work and the retrofit about 200 man years of moderately skilled labor.

8) Cooperation Potential: The program will promote increased cooperation between the industrial sector and government in Pakistan. It should also increase the cooperation between donors and developing country governments in developing concrete energy efficiency programs.

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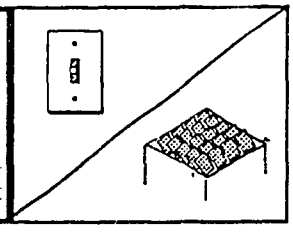

Project Name: Solar Electricity for Community Development

Country Where Project Will Be Implemented: Zimbabwe.

Project Objectives: The project, coordinated by the Biomass User's Network Africa Regional Office (BUN-ARO) will assist the development of solar electric (PV) markets in off-grid areas of Zimbabwe using rural-based PV agents.

Specific objectives include:

1) Establishment of a solar electrification extension network that coordinates between rurally-based solar technicians, end-users, community groups and city-based sources of expertise, technology and spare parts;

2) Provision of technical and material support for the test marketing of PV/battery systems and efficient appliances that address the lighting, communication, entertainment, and cottage industry requirements of low income groups. The project will assist local agencies to develop PV applications for rural end-users in the agriculture, education, entrepreneurial, domestic and administrative sectors;

3) Establishment of a renewable energy awareness-raising campaign among community end-users;

4) Identification, monitoring and support for existing renewable energy technologies in the area, and cooperation with other PV dissemination efforts sponsored by the government or NGO's;

5) Formulation of locally-based credit mechanisms by which organizations and individuals with limited incomes can pay for PV systems;

6) Provision of support for income generating activities within the PV training and dissemination network.

Project Description: The availability of cost-effective electric lighting, radios and televisions, water pumps, small electric tools, and office and entertainment appliances are critical to the infrastructure and development of any community. However, even if community groups or individuals can afford such important end-use appliances, they often cannot afford the electricity necessary to power them. This is especially true for dispersed rural communities in Africa, where extension of grid-based electric supply is not economically viable and where generators are too large, expensive, maintenance-intensive and noisy to meet the needs of rural households, businesses and institutions. Decentralized solar electricity is the most viable alternative for small-scale power supply in many off-grid rural communities. In Zimbabwe and other African countries, commercial and government initiatives to introduce solar electric (PV) technology are well under way.

Two chief barriers to the spread of the technology to rural areas are, one, a lack of affordable units that meet the needs of local people, and, two, a lack of awareness of the potential of solar electricity for community development and income generation in rural areas themselves. Despite the high state of development of Zimbabwe's urban private sector, the spread of solar electricity to rural areas is still constrained by the large information, social, financial and spatial barriers between rural markets and urban suppliers. Experience in other developing countries (i.e. Dominican Republic, Sri Lanka, Kenya) indicates that expansion of the PV market to rural areas is significantly accelerated by market seeding and credit-building efforts based in the communities themselves. However, because of inadequate resources and shortages of trained manpower, urban-based companies cannot effectively respond to the requirements of rural people, especially women and other groups with limited incomes.

The goal of this three year project is to enable rural communities to gain better access to electrical energy services using solar electric systems which are adapted to community needs and financial realities. Supported by the project office in Harare, rurally-based renewable

energy agents in three target districts will demonstrate and spread awareness of proven solar electric applications in the agriculture, health, education, micro-enterprise and domestic sectors. The central strategy of the program is to train, provide design and technical assistance, and generally help put in place a photovoltaic (PV) and battery network linking urban-based solar electric suppliers with rural agents who market, install, and maintain systems.

During the project's first year, three extension agents (or "market seeders") will be put through initial training in renewable energy technology and then sited in offices proximate to rural community markets. From these regional bases, they will conduct market research to determine the most effective methods of disseminating energy services in the Zimbabwe setting. Maintaining communication between rural communities and urban companies, the renewable energy agents will catalyze efforts to down-size and finance the technology so that it is available to abroad cross section of rural people.

Project Duration: Three years.

Project Status at Present: The Zimbabwe government, with the involvement of BUN-ARO and RDF, has negotiated for a US $7 million GEF allocation for the "Photovoltaics for Household and Community Use in Zimbabwe." The project expects to facilitate the installation of 25,000 small PV systems in rural areas of Zimbabwe over a five year period, and to simultaneously test three concurrent PV implementation models. The UNDP/GEF project envisages that one of its three rural delivery strategies should be an NGO model exportable to rural areas of Zimbabwe and southern Africa. This project is designed, as a separate initiative, to cooperate with the GEF project to address the dissemination, training, grass roots credit and system down-sizing issues that the GEF project (which will be implemented through PV companies in Harare) is unable to resolve.

Implementing Institutions: Biomass User's Network Africa Regional Office (BUN-ARO) will house, administer and coordinate the project through its office in Harare. Resources Development Foundation (New York) will provide consultant technical support and project management. The project will cooperate with rural NGO and local PV suppliers who have interest in setting up a solar dissemination network in the country.

Ability to Meet USWG Criteria

Ripeness: Solar electricity is a viable rural power supply alternative for off-grid areas. The technology is no longer experimental —experiences in the Dominican Republic, Sri Lanka, the South Pacific, and Kenya demonstrate that solar electric powered lighting systems work well in developing country settings. Zimbabwe, located in one of the sunniest parts of the globe, is in the first stages of setting up a solar electric industry. Today, solar electricity plays an increasingly important role in supply of electricity to niches where the Zimbabwe Electric Supply Authority (ZESA) cannot economically extend grid power. ZESA has acknowledged this role for PV in conjunction with its own diminished role in power supply to remote rural areas.

There are at least a dozen solar electric companies in Zimbabwe, most of which are based in Harare, the capital city. Solar modules have been locally manufactured since 1988. Already, Zimbabwe's solar companies have installed over three thousand PV systems. However, the private sector is unable to adequately meet the requirements of rural populations based as it is in urban areas and constrained by market forces. There is a need for a model dissemination and credit network that conveys unbiased information about PV technologies to rural people, and that conveys information about rural requirements and constraints back to the city-based PV companies.

Realizable Energy Savings Potential: Assuming that the average household in Zimbabwe uses about 50 liters of kerosine per year for lighting, a program that successfully implemented 50,000 solar electric lighting systems would save about 2000 tons of carbon emissions per year. Considering that the same "average" families use about 100 dry cell batteries per year, the project would lower the number of throw away dry cells entering the waste stream by 5 million. More importantly, this program will stimulate demand for compact fluorescent lamps and efficient appliances, and, with cooperation from the utility, could open up the market for grid-connected users to adopt more efficient lamps and appliances. 50,000 solar electric lighting systems would require 100,000 - 200,000 fluorescent lamps, which Zimbabwe is already capable of manufacturing.

Capability & Institution Building: The project will work with local community development organizations and entrepreneurs to organize viable solar credit groups and businesses. The project will also cooperate with solar businesses based in Harare to design systems appropriate the needs of rural customers.

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Fundability: The project has a good chance of qualifying for concessionary funding from the UNDP/GEFPV/Zimbabwe project, which will require support in its rural outreach. The project will provide an ideal opportunity to apply the successful lessons learned from PV rural electrification in Dominican Republic, Kenya and Sri Lanka.

Facilitation of Innovation & Models: The project will create a replicable model of a PV dissemination chain that can be adopted by local industry, and transferred to neighboring countries. Furthermore, the project will provide incentives for local entrepreneurs and designers to innovate based on the demands of rural people with whom the project's extension workers will be in direct contact.

Emphasis on Concrete & Specific Projects: Three extension workers based in rural areas will actively demonstrate and implement various uses of solar electricity in three regions. The project will provide grants for collaborative efforts between local industry and communities. It will also seed credit mechanisms which enable local groups and individuals to finance PV power.

Non-Energy Benefits: Employment opportunities created in rural areas for PV installers, marketing agents, financiers and for community PV end-users. Access to electricity promotes literacy, health, cottage industry and increases quality of life. Solar electricity is a sustainable, non-polluting source of energy which can be implemented and maintained within the community.

Projected Costs:
The expected duration of the project is three years. The initial year's expenditure will be $260K. Based on initial field experiences, a detailed two year work plan and budget will be submitted to the donors in the third quarter of the first year. This budget is expected to be between $400-500K for the remaining two years.

Co-operation Potential: Good opportunity for South-South cooperation by bringing in technical expertise from Kenya, Sri Lanka, Botswana and elsewhere. The project will also help ensure that the UNDP/GEF project is successful and can be adapted for other regional countries.

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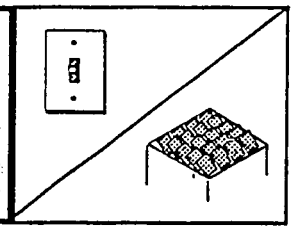
Solar--Rural



Project Name: Solar-Based Rural Electrification in the Caribbean and Central America.

Countries Where It Will Be Implemented: Belize, Costa Rica, Dominican Republic, Guatemala, and Honduras. These countries have a combined unelectrified rural population of about 9.6 million people inhabiting approximately 6 million homes. Experience in these and other Caribbean Basin countries indicates that a total of 25% of these households would purchase small (20-100Wp) photovoltaic (PV) systems if sufficient financing was made accessible. The potential near-term market for rural residential PV systems in these countries is approximately 400,000 units.

Project Objectives: To make photovoltaic systems available to rural homeowners by building local institutional support (i.e. small PV installation businesses and community development NGOs) and by establishing a user financing mechanism.

Project Description: Because of the tremendous expense to run transmission and distribution lines to low-density rural households, many countries continue to face high percentages of their populations without access to any electricity. Current prices for photovoltaic technology now make it possible to satisfy the small, dispersed electric loads typical of household and small commercial applications. Systems provide DC electricity sufficient to power several lamps, radio, television, and in some cases, pumps and other small machinery.

Two major impediments are the lack of sufficient and accessible user financing and the need for trained small business entrepreneurs to install and maintain the systems. This proposal would provide $5 million of targeted financing for equipment supply businesses and solar electric system buyers. This project will also provide training for local technicians, entrepreneurs and development professionals, enabling them to manage all the basic aspects of a solar-based rural electrification program.

There are a number of anticipated results from the project. Revolving funds totalling $5 million, managed by NGOs, would directly finance 40,000 systems over a five year period, assuming an average loan amount of $400 and an average loan term of three years. At an average system size of 40Wp and price of $500.00, this project would result in 1.6 MWp of installed capacity valued at $20 million. Approximately 100 technicians would be trained to establish around 30 qualified installation businesses in the region. Technical assistance and training would be provided for 15-20 local NGOs. This project is designed to address 10% of the total near-market and would stimulate further commercial activity and financing, leading to deeper market penetration.

Project's Duration: 1992-1997. Revolving funds would continue to finance systems after 1997.

Project Status At Present: A successful pilot project in the Dominican Republic has resulted in nearly 2000 PV installations. Several Dominican and Honduran NGOs have initiated solar-based rural electrification programs which will provide the basis for this expansion.

Implementing Institutions: Enersol Associates, Inc., with various partner NGOs experienced in rural credit programs, including: the Association

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for the Development of the Province Espaillat (ADEPE); the Association for the Development of the Province of Duarte; the Association for the Development of the Province of San Jose de Ocoa; and the Association for the Development of Solar Energy, all in the Dominican Republic; as well as a number of NGOs in other countries in Central America.

Other Institutions Involved: U.S. PV industry, local importers, rural installation businesses, Sandia National Laboratories, U.S. Peace Corps, several private foundations.

Ability to Meet USWG Criteria

1) Ripeness: This project has developed over 6 years. Various institutions have indicated readiness to assist the up-scaling of the project from a national to a regional level.

2) Realizable Energy Savings Potential: Systems have a payback of three to five years, and are installed with efficient appliances and lighting so people are in the habit of saving energy. Typical consumption is 6-12 KWH/month.

3) Capability & Institution Building: Enersol has a strong track record of successful solar-based rural electrification. The major focus is on building local small businesses and community development organizations.

4) Fundability: The project follows normal funding practices already in use by major banks and NGOs, and Enersol has been awarded U.S. Dept. of Energy-sponsored contracts, as well as receiving major foundation support.

PROJECTED COST: 5 Year Project

Revolving Credit Funds (grant or concessional loans)	**$5,000,000**
Institutional Development (grants)	
Energy Enterprises (sm. business loans, training)	**250,000**
NGOs (training, organizational development)	**750,000**
TOTAL	**$6,000,000**

5) Facilitation of Innovation & Models: Enersol's Solar-Based Rural Electrification Concept (SO-BASEC) model is widely studied and Enersol is committed to the ongoing development of sound approaches to the wide dissemination of the model.

6) Emphasis on Concrete & Specific Projects: Results are measured in terms of the number of systems installed, development professionals and technicians trained, and geographical penetration.

7) Non-Energy Benefits: Employment and income generation, non-polluting, economically viable, community organization, improved rural standard of living for about 20-25 percent of the present unelectrified population (potential).

8) Cooperation Potential: Enersol is compiling a database of NGOs, businesses and government institutions in the region that could play a role in the project. The project is known for the level of community participation and innovation in meeting developing country needs.

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Pricing

Project Name: Implementation of Energy Price Reform.

Countries Where It Will Be Implemented: Candidate countries include Czechoslovakia, Egypt, and Guatemala.

Project Objectives: (1) To promote energy price reform in one or more countries where artificially low energy prices discourage energy efficiency improvement.
(2) To develop a model of success experience with price reform to counter impressions of developing country policymakers that price reform with destabilization is impossible.

Project Description: For one or more developing or Eastern European countries committed to energy price reform, this project will establish a structure and process for policy dialogue (e.g., workshops and "straw man" policy discussion), provide analytical and institution-building assistance as policy options are considered, and help to develop information systems for documenting the effects of reforms that are adopted. The emphasis will be on identifying policy options that are realistic possibilities for implementation in the national political context, together with raising the awareness of policymakers of alternative courses of action and related international experience, rather than merely estimating what "rational" prices should be.

Whenever possible, the project will be connected directly to other GEEI project activities, such as the proposed buildings energy efficiency project in Czechoslovakia (where the need for electricity price reform is known to be an incentive for utility roles in efficiency improvement).

In recognition of the fact that price reform is a long term process, this project will be guided by interest expressed to the Working Group from contacts and sponsoring agencies conducting work in these countries.

Project's Duration: Three years.

Project Status at Present: Such field projects are the logical next step for energy price reform programs and activities supported by AID over the past 3-4 years (undertaken by Hagler-Bailly, ORNL, and others).

Implementing Institution: Oak Ridge National Laboratory in collaboration with RCG/Hagler-Bailly.

Other Institutions Involved: A wide range of consultants, including DeLucia and Associates.

Ability to Meet USWG Criteria

1) Ripeness: The information base and resource pool are relatively well-defined, and the needs are clear. Whenever a country indicates a real willingness to contemplate significant price reforms, we can help. Political stability will always be an uncertainty, of course, but the fundamental challenge is to come up with approaches that are both effective and politically realistic (e.g., tying price increases to efficiency improvements, institutional performance improvements, and transitional assistance to seriously impacted parties).

2) Realizable Energy Savings Potential: In the industrialized countries, energy prices account for more than half of the energy savings since the 1973 oil embargo, according to most analyses. This suggests that meaningful price reform is likely to be one of the most powerful of all

incentives for efficiency improvement in developing (or Eastern European) countries where energy is presently underpriced.

3) Capability & Institution Building: In each country, the project will be focused on one or more local institutions involved directly in the price reform process. For instance, it might connect with a government ministry responsible for policy reform and a governmental or non-governmental institution that can provide long-term analytical support. More generally, the project will be designed to increase the information and technical support to local policymakers who are advocates of price reform, helping to enhance their effectiveness within the domestic policy dialogue.

4) Fundability: Funding requirements for one or two model programs are modest. If a success experience results, subsequent funding should be forthcoming from AID, international development assistance agencies, and others.

5) Facilitation of Innovation & Models: A project that facilitates the implementation of an effective energy price reform program in a country that has been considered a poor prospect (because of political sensitivities) is likely to have dramatic impact on the energy policy dialogue enterprise worldwide.

Projected Cost:
300K for two country-specific projects.

6) Emphasis on Concrete & Specific Models: This project will focus on energy price reform dialogue and strategy development for one or two specific countries that express an interest in such a collaboration.

7) Non-Energy Benefits: In countries with serious energy pricing problems, price reform will reduce heavy financial burdens on the macroeconomy (associated with the price subsidy), which is good for the development process across the board. In addition, capital and environmental benefits in resulting energy savings are quite obvious.

8) Cooperation Potential: A variety of cooperation might be involved, including South-South dialogues with developing countries who have successfully implemented price reforms; but the most attractive prospect is to establish a model of how to take policy dialogue a giant step beyond rhetoric and threats about the consequences of a lack of reform to creative positive collaboration in identifying realistic strategies for making progress.

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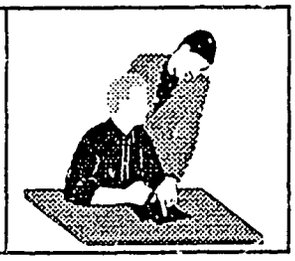
Analysis



Project Name: Analysis of Conservation Potential of Energy-Efficient Technologies

Countries Where It Will Be Implemented: South Asia region, newly industrializing countries, Central America, China, and Brazil, and India.

Project Objectives: Region-specific or country-specific analysis of several energy-efficient technologies from the viewpoint of their conservation potential. The project would target three countries and five technologies, analyze conservation potential for the country and region, and thus create an analytical framework through which to implement projects and programs achieving significant energy savings.

Project Description: The analyses will involve detailed characterization of the technologies, regional (or country) energy systems, economics, and policy issues. Conservation potential will be quantified, and diffusion policy options will be explored. Upon completion, the country and region will have the analytical tools to demonstrate energy efficiency. Illustrative technologies of interest are the following.

- Cooking systems in developing countries have significant implications for global warming. In low income developing countries, as much as 30% of the national energy consumption is devoted to cooking. Furthermore, as living standards improve, fossil (or fossil based) fuels replace biofuels. Technological and policy options relevant to this transition must be assessed, particularly since the cost of conserving carbon with efficient fuel wood cookstoves is only 0.5 US cents per kg.

- Advanced windows reduce air conditioning in commercial buildings. Energy consumption for air conditioning of commercial buildings is accelerating due to rapid urbanization in developing countries. Windows with high thermal resistance and spectrally selective transmittance appear to have very large potential for displacing air conditioning electricity consumption.

- Refrigerators, windows, air conditioners, and other electric appliances tend to have poor efficiencies in developing countries for numerous economic reasons. As their market penetration accelerates, the need to introduce energy-efficient models becomes more urgent, especially in light of long appliance lifetimes.

- Technological options for mitigation of urban heat islands are likely to be of significant impact for reducing building cooling loads in warm climate countries.

Results will be presented in a series of journal quality papers, and in regional seminars to be organized in years 4 and 5. Travel for collecting data, and meetings with regional experts will be necessary for 2 to 5.

Project's Duration: 5 years.

Project Status at Present: Some analysis (e.g., for compact fluorescent lamps for India and Brazil) has been undertaken. These analyses illustrated the significant economic, energy and environmental benefits to investing, for example, in CFL and low-E window plants as opposed capitalizing a power generation facility. Much more remains to be done.

Analysis...

Implementing Institutions: LBL, ORNL, in collaboration with individuals in Brazil, China, and India.

Other Institutions Involved: Will involve developing country institutions to participate cooperatively in the data gathering and analysis. Dr. Jyoti Painuly at the Indira Gandhi Insitute of Development Research has expressed interest in the project. Dr Gilberto Jannuzzi at UNICAMP in Brazil would also be involved there.

Projected Cost:

Year 1:	5FTE	$800K
Year 2:	6FTE	$1200K
Year 3:	6FTE	$1200K
Year 4:	6FTE	$1500K
Year 5:	6FTE	$1500K

Ability to Meet USWG Criteria

1) Ripeness: Excellent. Data and analytical expertise exist regarding the technologies' characteristics, economics, and the context in which the technologies may be placed and operated.

2) Realizable Energy Savings Potential: Large. As the Brazilian and Indian analyses suggest, significant energy savings potential exists.

3) Capability & Institution Building: Individuals from the developing country institutions will be trained in analytical methodology. The project results will be presented to Finance Ministries, and utilities in order to set the stage for projects and programs which will realize the efficiency potential identified in the analysis. Also, the results of the analysis will be transferred through the network developed by the U.S. Working Group through its collaboration with developing country institutions worldwide.

4) Fundability: Somewhat uncertain, but some support should be possible. The project results will assess the cost-effectiveness of developing a strong manufacturing base for energy efficient technologies in LDCs. This type of investment analysis should attract funding from various sources.

5) Facilitation of Innovation & Models: This is the first step needed to identify the technologies and savings potential. Without this, target technologies for implementation can not be identified. Although the project itself does not contain implementation models, it will set the framework and create potential for numerous projects. The project will offer LDC utilities in the target countries the substantive assessments necessary to determine savings potential for investments in energy efficiency.

6) Emphasis on Concrete & Specific Models: The project is very specific in terms of both technologies and regions (or countries) in which their placement will be assessed.

7) Non-Energy Benefits: Capital savings, environmental benefits, private sector development and improved standard of living is likely to result from implementation. This is the essential first step before implementation can be addressed.

8) Cooperation Potential: Substantial both in the analytical work, and in the implementation projects that will spin off from this.

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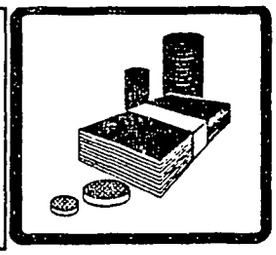
Financing



Project Name: Financing Efficiency--Improving Equipment Use in Developing Countries.

Countries Where It Will Be Implemented: Dominican Republic, Philippines, India, Eastern Europe, others.

Project Objectives: The project is meant to develop specific models, on a country-by-country basis, which will create successes for implementing further work of this type. Specfically, objectives include:
(1) To identify innovative mechanisms for financing the use of relatively small efficiency-improving technologies in developing countries, especially by lower-income users.
(2) To promote the consideration by major lending institutions of such mechanisms.
(3) To implement appropriate mechanisms in individual countries in order to accelerate efficiency improvement and provide learning.

Project Description: Building on recent experience with a renewable energy project in the Dominican Republic, this project is focused on the problem of promoting the use of relatively small efficiency-improving technologies where the end user must find a way to make a higher front-end investment than he/she can finance under current conditions. Such a problem often arises for end-use equipment ranging from efficient motors to refrigeration equipment, lighting equipment, and others. Clearly, finding effective ways to finance such options is a key to progress with efficiency improvement in developing countries and Eastern Europe.

Innovative mechanisms to be explored include the use of NGO's as intermediaries (as in the very successful project which financed photovoltaic systems for village electrification in the Dominican Republic,) and the use of electric utilities as intermediaries (as in the case of efficient lighting technologies in some parts of the US). Activities include identifying and elaborating on alternative models, discussing the models with multilateral development banks and other lending institutions, and developing two country-specific prototype projects.

Project's Duration: Three years.

Project Status at Present: A renewable energy equivalent is already under way, as one of ORNL's contributions to the interagency CORECT committee (sponsored by DOE) and the REAT project of AID's Office of Energy. This project would simply extend the activity to efficiency improvement as well.

Implementing Institutions: ORNL, LBL, PNL, Hagler-Bailly, USECRE, IIEC, IDEA, VITA.

Other Institutions Involved: Non-U.S. program designers, particularly individuals in LDCs with a demonstrated interest. Financial institutions.

Ability to Meet USWG Criteria

1) Ripeness: This proposed project is an opportunity to take advantage of momentum already developed through CORECT activities, focused on small renewable energy technologies, in order to address a critical issue for efficiency improvement.

2) Realizable Energy Savings Potential: Depending on the proportion of national energy consumption that is accounted for by small end-use technologies, the potential impact over the next ten years could be very sizable--not so much in raising the threshold of eventual market penetration of efficiency-improving technologies as in

Financing...

accelerating the movement toward that threshold during the anticipated near-term capital crisis for the energy sector in many countries.

3) Capability & Institution Building: This project is focused specifically on financial institution building. In the Dominican Republic's case, innovative mechanisms have also had an important positive impact on infrastructures for supporting new technology use: i.e., technical use assistance, maintenance, and problem- solving.

4) Fundability: A good prospect for funding by lending institutions as well as by development assistance institutions.

5) Facilitation of Innovation & Models: The central purpose is to identify, document, promote, and implement innovative institutional mechanisms.

6) Emphasis on Concrete & Specific Projects: The project would both draw from actual projects that are exploring innovative mechanisms and undertake two new country-specific projects to extend this experience.

7) Non-Energy Benefits: The most striking benefit would be improvements in the quality of life of small energy end-users because they are able to adopt energy technologies with lower life-cycle costs--as a result of mechanisms that remove financial impediments.

8) Cooperation Potential: The project is based on efforts to develop more effective linkages between large-scale agencies, intermediary institutions in developing countries, and energy end-users.

Estimated Cost:

110K in the first year; 200-300K per year for the second and third years.

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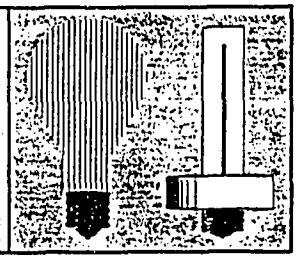
Lighting



Project Name: Promoting Energy-Efficient Lighting and Appliances for Households.

Countries Where It Will Be Implemented: Thailand, India or Indonesia.

Project Objectives: Provide assistance to develop local capacity to design and implement policies and programs to improve energy efficiency of residential lighting and appliances on a large scale in one or more countries.

Project Description: Electricity use for residential lighting and appliances is growing rapidly in many developing countries, contributing to utilities' difficulties in keeping up with demand. Various studies by LBL and others have found that improving the energy efficiency of lighting and appliances is very cost-effective compared to the cost of electricity supply.

The proposed project would involve a number of activities directed toward the goal of implementing policies and programs to improve lighting and appliance efficiency on a large scale. Activities would be conducted in one or more countries, depending on funding. All activities would be conducted in close collaboration with institutions in the target country; development of analytical skills and training in use of analytical tools would be a major objective of the project. The activities for each country would include:

1) Design, execution, and analysis of a household survey to provide statistically valid information on patterns of electricity use and ownership and characteristics of end-use devices.

2) Analysis of the characteristics of appliances currently being produced or imported, including estimation of the manufacturing costs and energy savings associated with various design options.

3) Identification of design options whose cost of conserved energy is less than the marginal cost of supplying electricity to households.

4) Analysis of the impacts of introducing appliances and lighting with cost-effective design changes on a large scale, with particular emphasis on financial impacts for consumers and electric utilities, national macroeconomic impacts, and environmental impacts.

5) Design of policies to bring about large-scale introduction of more efficient lighting and appliances, based in part on relevant experiences in other countries, with modifications as appropriate to the local situation. This activity would be conducted in conjunction with government officials, and perhaps include involvement of the appliances industry as well.

6) Development of appliance testing capacity, including assistance in establishing testing procedures and facilities and in initial phases of the testing program.

7) Assistance in securing financing to accelerate introduction of more efficient lighting and appliances. Approaches may include loans for industries to retool to manufacture more efficient appliances and/or to utility companies to implement incentive programs.

Project's Duration: Two years.

Project Status at Present: The project is related to a number of activities already planned or underway. LBL is planning to initiate work in this area in Mexico and the Philippines. LBL has been or is currently involved in assessment of opportunities for improving the efficiency of residential lighting and appliances in the Philippines, Indonesia, Thai-

land, Malaysia, and Egypt.

Implementing Institution: Lawrence Berkeley Laboratory (LBL), working in collaboration with other institutions, including RCG/Hagler-Bailly, IIEC, and ACEEE.

Other Institutions Involved: The project would involve appropriate government agencies, electric utilities, academic institutions, equipment manufacturers, and interested NGO's.

Projected Cost:

Per country: $500 K per year.

Ability to Meet USWG Criteria

1) Ripeness: Since LBL is already involved in projects similar to the one proposed, and has considerable experience and expertise in the area of residential energy efficiency, the project has a high likelihood of meeting its objectives. In addition, the countries that the project would target already have an awareness of the need to improve energy efficiency in the residential sector, as well as institutions in place that have interest in design and implementation of sound policies.

2) Realizable Energy Savings Potential: Potential for savings is considerable, and improvement of lighting and appliance efficiency is likely to be slow without intervention in the market.

3) Capability & Institution Building: The project is explicitly oriented toward developing local capacity to collect and analyze information necessary to design sound policies and programs, especially in the relevant governmental agencies and/or electric utilities.

4) Fundability: Similar projects have attracted funding from a variety of sources, so the proposed projects should have a good chance of attracting funding.

5) Facilitation of Innovation & Models: The project would be likely to foster both policy and technology innovation, and result in commercialization of improved residential end-use technologies.

6) Emphasis on Concrete & Specific Models: Although the specific site for this project is not yet determined, when implemented the project will have well-defined goals the success of which can eventually be measured as policies and programs are implemented.

7) Non-Energy Benefits: The potential for saving capital that would otherwise be needed for new power plants is large. The project would benefit a utility's financial situation in other ways by saving electricity that is subsidized and thus sold at a loss in most countries. Avoided electricity generation would also bring environmental benefits, with the exact nature of the benefits depending on the particular situation.

8) Cooperation Potential: As mentioned above, governments in many countries are keenly aware of the importance of improving the efficiency of residential lighting and appliances. Our experience with related projects in various countries leads us to expect that governments would welcome the opportunity for assistance in developing their capability to design and implement effective programs.

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Environment

Project Name: Damage Valuation of Environmental Impacts From Power Generation Projects in Pakistan.

Country(ies) Where It Will Be Implemented: Pakistan initially, then expanded to others.

Project Objectives: This project will estimate the economic value of the environmental damage resulting from power generation emissions and effluents from one or more proposed power projects in Pakistan. This type of analysis sets a framework for assessing energy projects by integrating environmental damage and economic resources. These valuations will be used to develop rational trade-offs between capital costs, energy efficiency, emissions, and financing alternatives.

The methodologies used here will then be developed into a handbook and set of computer programs that will provide detailed approaches, models, and data to expand these valuations to other projects in other countries. It will focus on transferring environmental damage valuation methodologies to developing countries, and adapting these methodologies to the particular problems (especially lack of accurate data) these countries often have.

Project Description: This project will have two phases:

PHASE 1: The initial phase will estimate the value of the physical impacts of emissions from a specific power generation plant on human mortality and morbidity, crops, materials, fauna, and visibility. Damage valuation methodologies developed in the U.S. and other industrialized countries over the past 20 years will be applied to a specific power generation plant in Pakistan in order to calculate damage. The plant will be selected with the agreement of the appropriate Pakistani, World Bank, and other bilateral aid offices on the basis of timeliness, importance, and data availability.

The methodologies, computer models, and other techniques will be adapted to the information available or collectable for that specific site in Pakistan. Uncertainties in approach, data, or valuation of damage resulting from pollution will be specifically identified, and ranges of damage valuation calculated where appropriate. Cost/benefit trade-offs will be developed for various energy efficiency options and environmental control options. The option having the lowest life cycle cost (including explicitly the costs of environmental damage) will be identified.

PHASE 2: Upon completion of Phase 1, a review of the results will follow, which will focus on the results' credibility and application to Pakistan and to funding agencies, and the efficacy of using these results to decide among energy efficiency and environmental alternatives. Modifications will be made if necessary, and a handbook will be developed for use on similar projects in other developing countries.

This handbook will provide detailed information needed to make informed decisions, will indicate where and how the information can be obtained, will discuss the analytic methodologies (including copies of PC-based computer models) for evaluating the information. Also, the handbook will estimate ranges of damage valuations, discuss how to handle uncertainty in data valuations, and how to incorporate results in decisions. This handbook will be widely distributed, in coordination with seminars and workshops showing how it is to be used.

Project's Duration: Phase 1: 3-6 months, depending on project characteristics and data availability.
Phase 2: 6-9 months after completion of Phase 1.

Environment...

Project Status at Present:

· At least 4 Pakistani power projects are under consideration by the government and the World Bank which would be good candidates for application of an environmental damage valuation.

· Data for the Karachi area necessary for damage valuation assessment has been collected as part of other efforts.

Implementing Institutions: World Bank Global Environmental Fund, Global Energy Efficiency Initiative.

Other Institutions Involved: Government of Pakistan, U.S. Agency for International Development

Projected Cost:

The costs of this valuation will be approximately $100,000 to $200,000 per plant. The cost of developing the handbook will be approximately $80,000. A program for a country such as Pakistan including three major plant evaluations per year plus training will be $500,000 per year initially, reducing by $100,000 each year thereafter as local expertise is developed and takes over the program.

Ability to Meet USWG Criteria

1) Ripeness: Very good. Large projects that can use the valuations are currently under assessment by the government and the World Bank. They are early enough in the design so that changes can be made to improve energy efficiency, environmental performance, and site selection at reasonable costs. Many countries and multilateral and bilateral assistance organizations have indicated environmental considerations will be included in future planning.

2) Realizable Energy Savings Potential: Very good. Higher energy efficiency will generally result in lower emissions per unit of useful energy, and thus in addition will accrue savings above direct energy costs. Therefore the more efficient technology will appear even more cost effective than if only fuel cost savings were considered.

3) Capability & Institution Building: Very good. The Phase 2 portion of this effort is designed to develop the government and non-government capabilities in these countries to perform environmental damage valuations. Even in Phase 1, including Pakistani government officials in the assessment will help them understand and apply the methodologies.

4) Fundability: Good. This type of assessment has become invaluable for environmental assessments of projects in developed countries, and badly needed in developing countries if they are to properly incorporate environmental considerations into development. However it will require institutional changes on the part of assistance agencies to redirect traditional project evaluation techniques.

5) Facilitation of Innovation & Models: Excellent. This will expand the use of advance damage valuation techniques and computer models used in the U.S. and other developed countries. It will also spur the use of advanced energy and environmental technologies by identifying and quantifying their actual benefits to the society.

6) Emphasis on Concrete & Specific Projects: Excellent. Phase 1 will be performed on projects already identified by the Pakistani government and the World Bank. Results should be readily identifiable in terms of energy saved and pollution avoided.

7) Non-Energy Benefits: Excellent. The major benefits of this approach will be to reduce environmental insults of power generation by estimating and including their costs into the decisionmaking process.

8) Cooperation Potential: Excellent. Many bilateral and multilateral assistance organizations, developing country and Eastern European governments, private sector firms, and non-governmental organizations have expressed major interest and announced major initiatives on improving the environment. Damage valuation is extremely important for allowing these organizations to set priorities and make the most effective use of limited resources.

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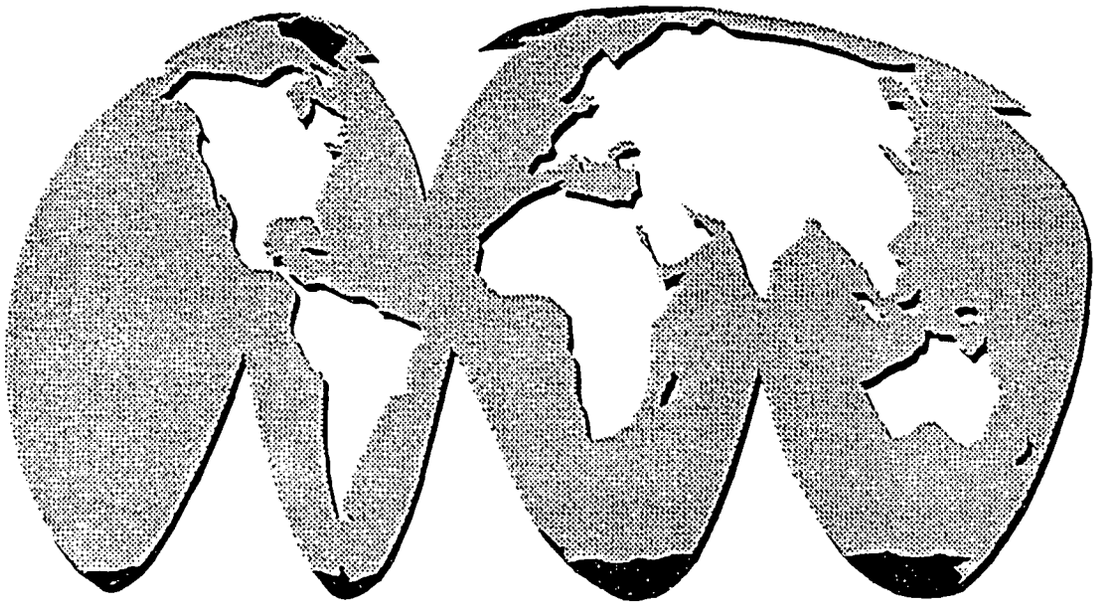
Training Workshop on Integrated Resource Planning for the Power Sector



November 16th to 20th, 1992
Berkeley, California

co-sponsored by:
Center for Global Change
International Institute for Energy Conservation
Lawrence Berkeley Laboratory
Natural Resources Defense Council
Oak Ridge National Laboratory

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Background

The following information reviews the accomplishments achieved to date in preparing and implementing an NGO training course on energy efficiency for developing country participants, conducted by five sponsoring organizations, with funds provided by the Moriah Fund (and the Charles Stewart Mott Foundation and U.S. Agency for International Development).

Over the course of 1992 representatives from the sponsoring organizations -- the International Institute for Energy Conservation (IIEC), the Center for Global Change, University of Maryland (CGC), Lawrence Berkeley Laboratory (LBL), the Natural Resources Defense Council (NRDC), and Oak Ridge National Laboratory (ORNL) -- conmmunicated by phone, fax, mail and visits to coordinate and organize the November 16-21, 1992, workshop held at Lawrence Berkeley Laboratory. A list of representatives from each sponsoring organization is attached.

The sponsors faced two critical decisions in designing the workshop: 1) the scope of the workshop, which obviously could not cover all energy efficiency issues in the one-week timeframe; and 2) determining the level of expertise required of the developing country participants. There were several givens. First, keep the workshop size manageable by limiting it to less than 10 countries. Second, for each country, pair a non-governmental organization (NGO) advocate with a governmental or industry professional as a method for encouraging action subsequent to the training workshop.

IRP focus of training workshop

After much deliberation, it was decided to limit the scope of the workshop to electric utility Integrated Resource Planning (IRP), foregoing transportation and non-utility energy issues to another time. All of the sponsoring institutions have extensive expertise in utility IRP, and the majority of developing country NGOs who expressed early interest in the workshop also noted electric utility planning as a key concern. According to World Bank studies, developing country and Eastern European nations face a need for $1 trillion of power plant investments this decade. Yet, the adoption of IRP would identify energy efficiency investment opportunities that would satisfy a large fraction of these electricity services, resulting in multi-hundred billion dollar savings and cost-free reductions in a range of environmental pollutants.

Second, it was decided that there should be a minimal threshold of expertise required of the participants. The NGO participant should have an understanding of the value of IRP, and be either currently active in promoting IRP in their country, or his/her organization committed to doing so subsequent to attending the training workshop. Similarly, the government and/or utility professional should be committed to pursuing IRP within their organizations. Hence, candidates who were neophytes (e.g, did not know the difference between a kiloWatt and a kiloWatt-hour) were discouraged.

Between the sponsoring organizations a list of potential countries, organizations and candidates was assembled. The sponsors looked first to those countries in which they have been working, since this meant ongoing collaboration with these groups was likely to occur subsequent to the training workshop. At least two or more of the sponsoring

organizations are active in the countries of the candidates finally selected to receive invitations. The final selection included representatives from: Africa (AFREPREN/ Botswana); Asia (India, Sri Lanka); Central/Eastern Europe (Poland, Russia); and Latin America (Chile, Mexico). An annotated list of the participants is attached.

Invitations were sent to seven NGOs and seven government and/or utility representatives in the seven countries. Three of the initial invitees had conflicts, but recommended substitute colleagues. Each of the participants was then sent a detailed survey, as a means of gauging their current level of knowledge about IRP, as well as their interest level in different topics to be covered at the workshop. The survey also included a detailed set of questions about their country's utility situation (i.e., decisionmaking process, market conditions, government policies, regulatory oversight, etc.). Finally, the survey inquired as to their professional skills (e.g., professional training, computer and analytic skills). All of this information was valuable for preparing the participants on what information to bring with them to the conference, as well as helping the sponsors in shaping the content of the week. A copy of the survey is attached.

THE WORKSHOP

The training workshop on electric utility Integrated Resource Planning and Demand-Side Management (IRP/DSM) was held at Lawrence Berkeley Laboratory (LBL) from November 16-21, 1992. The rationale for holding the intitial workshop at LBL is explained in the attached survey which went out to all the participants. It proved to be an extremely good choice.

Two additional teams from India were represented (as a result of additional funding from U.S. AID and from the Energy Foundation in conjunction with Dr. Amulya Reddy, Director of the International Energy Initiative). This resulted in representation from two Indian states, Maharastra and Karnataka, as well as from the national level.

All the cosponsors, observers (i.e., AID), participants, and speakers concluded that the workshop was an outstanding success. Substantial activity is expected to result from the various team members in the coming months based on insights from the workshop.

AGENDA

The one-week agenda (see attachment) was at once too much and too little. Most participants believe two weeks is preferable, as much for getting acquainted and building trust among participants, as for digesting the sea of information and being able to ask cogent follow-up questions. Each participant received a large volume of IRP/DSM materials and reprints, and over the course of the week they were each given an enormous "working library" of reports, articles, software, fact sheets, and studies. By the end of the workshop, each participant had a huge box of materials to take back with them. One of the summary volumes of materials is attached.

Country presentations by participants

Everyone liked and profited from the first day, which was entirely devoted to presentations by the country teams on electric conditions in their respective countries.

Each country had prepared good overviews, which were prompted by a survey of questions that IIEC had faxed to each team months prior to the workshop. A number of the presentations were so rich in detail that they could easily have taken the entire day.

Energy link w/ economic development

Monday evening Harvey Sachs (CGC) and Glen Prickett (NRDC) led an informal discussion with all non-U.S. participants on the larger links between electrical services and economic development, and on the similarities and differences among the participants' national situations. A lively roundtable discussion ensued until late in the evening.

Technologies and analytic methods

Tuesday focused on technologies and assessment methods. The great value of holding the conference at LBL became quickly apparent, as one LBL staff expert after another made brief, but powerful presentations. This allowed the various participants to select and chose among the many speakers to meet with later and discuss a particular topic in greater detail. Clearly this could not have been accommodated in a remote location, or even if the workshop had been held at a hotel somewhere in the Bay area.

Noted utility banquet speaker

The Tuesday evening banquet featured Carl Weinberg, Director of Research on Solar/Renewable Technologies at Pacific Gas & Electric utility. He gave an eloquent speech on ***The Electric Utility -- Industry Trends, A Strategic Response***. Weinberg captivated the audience with his insights on the planning and investment revolution in which utilities find themselves engaged. The "distributed utility" approach that Weinberg detailed, which relies on energy efficiency and dispersed , small scale solar, renewable and natural gas technology options, proved extremely relevant to the developing country participants.

Government programs, and IRP process

Wednesday morning focused on government electricity efficiency programs (equipment testing and labeling, and appliance and building standards), with excellent presentation by experts from NRDC and LBL. The afternoon was devoted to an outstanding overview of utility DSM and IRP concepts, issues and analysis techniques by LBL's Joe Eto and Florentin Krause, and ORNL's Larry Hill. Eto and Krause were considered by many to be among the best presentations of the week. Wednesday night consisted of an informal demonstration on IRP software by Dan Kirshner of the Environmental Defense Fund (the ELFIN software is provided free to developing countries).

DSM program experience

Most of Thursday focused on the utility experience of designing, implementing, and evaluating DSM programs. IIEC's Michael Totten started the day with an overview of the best lessons learned by utilities on how to get high participation by customers as well as high penetration of all cost-effective measures. This was followed by presentations on specific programs for motors, lights, and appliances. The participants expressed a strong desire for considerably more time to be spent on this aspect of the

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training. They want details on planning budgets, estimating staffing requirements, preparing timelines and schedules, etc. This would clearly require another week.

Thursday afternoon also focused on DSM programs in developing and transitional countries, with the group fascinated with the BELLE project discussed by LBL's Ashok Gadgil. Several teams expressed an earnest interest in undertaking a BELLE-like project in their countries as one of the outcomes of this workshop. An LBL staff presentation also reviewed the findings on Transmission and Distribution losses in China, illustrating that IRP requires focusing on the utility and power system as well as the end uses. Sachs (CGC) reviewed contributions by participants that operations and maintenance issues may be keys to improved overall efficiencies in their countries, and summarized some ongoing work by other organizations on alternatives to grid-connected electrification, such as house-scale photovoltaic systems.

Thursday night was left open for the teams to develop presentations for Friday on what they each proposed as follow-up projects and activities to the workshop. The Friday presentations were incredibly fruitful. Considerable thought and attention had gone into virtually all the presentations.[1] The viewgraphs presented by the various team members are attached.

Presentations of developing country work plans

Working agendas were prepared and presented by each of the country teams on projects to be initiated over the next 10 months. These projects range from country and/or regional IRP/DSM workshops to actual implementation of DSM programs (in Maharastra and Poland). Detailed reports on the proposed projects will be submitted to the cosponsors in early 1993. A proposal is also being prepared to continue the IRP/DSM training via electronic network. This will offer a cost-effective means for the cosponsors to continue working with the participants to refine and further their projects. Of particular value will be to use the electronic network to continue forwarding key reports at a fraction of the cost of xerox and overseas mail (see more explanation below).

Tour of Bay area energy installations

On Saturday, two-thirds of the participants stayed to tour the Altamont Wind Farms, as well as PG&E's impressive Pacific Energy Center showcasing DSM technologies and design tools, and then visited NRDC's super-efficient headquarters. Many felt this tour was quite valuable, and encouraged integrating such side trips earlier in the week.

NEXT MEETING

The participants will re-convene in Washington, DC in the Fall of 1993 to report on the progress of their projects, as well as interact with potential funding sources at the World Bank , AID, and other institutions like the Inter-American Development Bank and the IFC.

All the participants expressed strong interest in serving as a collaborative network to further IRP and DSM within their countries and regions, and see a valuable role to be

[1] Unfortunately, the Mexico NGO team member had to leave on Thursday, so no Mexican presentation was given. However, the Mexican team is committed to developing projects over the next several months.

Michael Totten (IIEC) shared with the group the possibility of continuing the training workshop "online" through various global computer networks that reach most cities in the world. IIEC is working with the Institute for Global Communication's (IGC) Energy Climate Information Exchange (ECIX) project to electronically connect institutions worldwide. IIEC is establishing InfoTree (INFOrmation TRansfer network on Energy Efficiency), that will be accessible via Econet. Two key components comprise the InfoTree system:

1. CLEARINGHOUSE: Functioning as an electronic archive, users will be able to search for information by key words, or review a list of publications that are available electronically and then download desired documents to their computer. IIEC will be responsible for tracking and maintaining information to be included in the clearinghouse.

2. ELECTRONIC FORUM

The forum will be a "bulletin-board" system in which users post questions which IIEC or other conference participants answer. The forum will also provide announcements of key conferences, publications, workshops, news bulletins, and other activities.

played by IIEC and the other cosponsors in organizing regional training workshops and helping to design programs for implementation.

Online Computer Training via Linked Networks

The actual documents that will be placed in the electronic system will be both IIEC publications and those from a number of institutions worldwide that have already expressed a willingness to provide valuable materials in electronic format. Some of these are:

- American Council for an Energy-Efficient Economy;
- American Institute of Architects;
- Association of Energy Engineers;
- Asia Institute of Technology's Library & Documentation Center;
- U.S. Department of Energy Bonneville Power Admin.;
- Conservation and Renewable Energy Information and Referral Service;
- Edison Electric Institute;
- Energy-Efficient Building Assoc.;
- Canadian Govt's Dept. of Energy, Resources;
- Florida Solar Energy Center;
- Intl Assoc. of Energy-Efficient Lighting;
- Illuminating Engineering Society of North America;
- Lawrence Berkeley Laboratory;
- Northwest Power Planning Council;
- Passive Solar Industries Council;
- U.S. Department of Energy Office of Scientific and Technical Information;
- Power Smart Inc.;
- Rocky Mountain Institute;
- United Nations Industrial Development Organization;
- U.S. Environmental Protection Agency;
- Wisconsin Center for Demand-Side Research.

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The IGC is part of the Association for Progressive Communications (APC), which maintains several international computer networks including EcoNet, PeaceNet, and ConflictNet in the United States; GreenNet in England; Pegasus in Australia; Chasque in Uruguay, NordNet in Sweden; and GlasNet in Russia. These networks are connected to the international network, Internet (operating in 120 countries), as well as a variety of national and regional networks such as Costech in Tanzania, KiwiNet in Hong Kong, Econnect in Czechoslovakia, Dix in Estonia, and CIER in China. Computers comprising these networks are connected primarily with high-speed telephone lines. Computers connected to any of these networks can communicate with computers on all other networks, meaning that with a simple computer modem, one can access literally millions of other computers, databases, and information resources.

International computer networks are a cheap, rapid, and reliable way of communicating. Electronic networks can provide communication services instantly and at relatively low cost. Postal services and fax machines are inefficient in terms of time and cost, and require significantly more energy and natural resources than electronic networks to operate. For example, IIEC estimates that it costs $25 to print and ship their Technical Information Directory around the word, while it can be downloaded from Econet for 25 cents.

Both ECIX and Volunteers in Technical Assistance (VITA) have agreed to assist IIEC connect institutions in industrializing countries and in Eastern and Central Europe. While many institutions can access one of the IGC or other regional networks, there may be some cases where it is prohibitively expensive to connect directly. In these cases, VITA, a non-profit organization based in Arlington, Virginia that works to electronically connect international organizations, will help IIEC establish direct modem links with the institutions and provide indirect access to InfoTree services.

CONCLUSION

As noted above, the participants came away from the training workshop quite impressed with the caliber of the presentations, which conveyed considerable depth and breadth of the subjects covered in just one brief week. All the participants agreed that two to three weeks would be preferable. All thought that the location of the workshop was very valuable because it allowed further interaction with the large pool of experts working at LBL.

At the same time, all the participants strongly urged that regional training workshops be held. They feel that there needs to be far more professionals involved, both from the NGO organizations and from the government and/or utility institutions. The participants all expressed a willingness to host and help organize a regional IRP training workshop.

Moreover, the participants strongly welcome electronic networking as a means of continuing the training "online." They often find it frustrating to track down additional information or experts, which is vital for sustaining their daily efforts to further IRP in their countries. Most felt additional funding was necessary to establish and maintain access to computer networks, but felt it would be very cost-effective relative to the expenses incurred phoning, faxing, mailing and visiting experts around the world.

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NGO TRAINING WORKSHOP
Demand-Side Management and Integrated Resource Planning
November 16th to 20th, 1992
at Lawrence Berkeley Laboratory

9 Pairs of Country Participants from 7 Countries

Participant List

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Stephen Karekezi was formerly regional energy advisor for U.S. AID in East and Southern Africa and undertook numerous energy consultancy assignments for UNEP, UNDP, SIDA, and the Dutch Ministry of Foreign Affairs, the Government of Uganda, and NORAD. He is currently the Executive Secretary of the International Foundation for Woodstove Dissemination (FWD) as well as the Network Facilitator for the African Energy Policy Research Network (AFREPREN). He is co-editor of two major volumes on energy entitled Energy for Rural Development, and Energy Management in Africa and was in 1990 selected the co-winner of the Swedish-based Innovations for Development Association (IDEA) award in the category of energy.

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Mr. Kukharkin is currently working as visiting research staff at the Center for Energy and Environmental Studies at Princeton University. He received his PhD in plasma physics from the Moscow Institute of Physics and Technology in 1992, receiving a Master's Degree equivalent from the same Institute in 1989. Besides his work in plasma physics, Mr. Kukharkin has a particular interest in energy and the environment, with an emphasis on the comparative analysis of energy technologies and their impacts on the global environment, and prospects for the use of renewable sources of energy. Mr. Kukharkin has presented a number of papers on the subject of energy, with titles such as "Energy Supply and Demand: How Can We Satisfy and Manage Them?", and "Energy in Future: Need for a New Approach".

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Ing. Miranda is the director of the energy efficiency program for the National Energy Commission (Comisión Nacional de Energía, CNE) in Chile. Ing. Miranda graduated with a degree in electrical civil engineering from the University of Chile with high honors with a degree in electrical civil engineering. He did postgraduate work in business administration in the department of civil and industrial engineering also at the University of Chile. Professional activities include the design and development of information systems, consulting and management of production systems, planning and control of projects, development of projects on consultation and performance of businesses. Current duties as director of the energy efficiency program for CNE include national coordinator of international projects for CNE in the area of the rational use of energy, and coordinator of the program for the efficient use of energy promoted by CNE.

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Mr. Guerra is the Director of the Autonomous Institute for Ecological Research. The Institute was founded in 1985, and works in many different capacities to research, develop and implement various technical and policy options to control and prevent pollution, and to manage biotic and non-biotic natural resources in a more integrated way. Activities of the Instit range from providing environmental impact studies, to organizing events and forums, and p ishing various books, magazines, and others.

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Ing. Herrera is the coordinator for the normalization and evaluation at the Trust Fund for Support of the Energy Saving Program of the Electric Sector (Fideicomiso de Apoyo al Programa de Ahorro de Energia del Sector Electrico, FIDE). He received a civil engineering degree from the National University of Mexico (UNAM) and did postgraduate studies in Engineering and Business Administration at the same institution. Ing. Herrera also studied English and French at the University of Ottawa, in Ontario, Canada. He is the vice president of the Panamerican Federation of Engineering Societies (UPADI) and is a life member of other various engineering societies. Ing. Herrera has participated and given papers at several national and international energy and environmental congresses.

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Training Workshop on Integrated Resource Planning

November 16th to 20th, 1992
at
Lawrence Berkeley Laboratory
cosponsored by
Center for Global Change (CGC)
International Institute for Energy Conservation (IIEC)
Lawrence Berkeley Laboratory (LBL)
Natural Resources Defense Council (NRDC)
Oak Ridge National Laboratory (ORNL)

Participants

The purpose of the five day advanced training workshop is to bring together eight pairs of energy professionals from countries in Africa, Asia, Latin America and Central/Eastern Europe to focus on the application of Integrated Resource Planning (IRP) and Demand-Side Management (DSM) within their respective countries and regions. The pairs are comprised of a government professional and a non-governmental professional (affilitated with a non-profit organization or university) who are actively engaged in shaping the decisionmaking process in regards to the delivery of utility electricity services.

Location

LBL has been chosen as the location site because of the proximity to a range of experts and institutions on IRP/DSM components who can be tapped to participate in the workshop. These institutions include, for example, LBL's Center for Building Science, the California Institute for Energy Efficiency (CIEE), the Electric Power Research Institute (EPRI), Pacific Gas & Electric (PG&E) and its Pacific Energy Center, the California Public Utility Commission, Sacramento Municipal Utility District, the California Energy Commission, a number of manufacturers of super-efficient products (e.g., window glazings by Southwall and Airco Coatings, electronic ballasts by XO Industries, smart metering by Metricom), the Energy Project of NRDC, and key members of the California IRP Collaborative and the California Compact (a collaborative promoting compact fluorescent lamp technology).

IRP/DSM focus

It is being proposed that the five days concentrate on the key components of IRP/DSM. Because of the complexity of this issue, it is not possible to treat all aspects in comprehensive depth and breath. So, depending on the questionaire responses by the participants (see below), the speakers will focus on those aspects that the majority of participants feel are most important. A loose-leaf binder of additional materials will be prepared and made available that cover all aspects of IRP/DSM in more substantive detail, so that all participants will be able to leave with a more thorough overview.

Workshop format

It must be emphasized, however, that the workshop format is not "experts" lecturing participants. Rather, the format is designed around a collaborative effort to bring together colleagues in North America who have considerable experience with IRP/DSM with colleagues in other regions of the developing world who believe IRP/DSM to be applicable in their respective countries. Clearly, the success of the workshop will turn on how well-prepared each participant comes to the workshop and how well-focused the IRP/DSM speakers are to the specific needs of the participants.

It is proposed that the first day (Monday) be entirely devoted to case study presentations made by the participants from the visiting countries (Botswana/Africa, Chile, India, Mexico, Poland, Russia, and Sri Lanka). This will help to focus the next three days on the most pertinent issues raised at the outset. Then, on Friday, the particpants from the visiting countries would make final presentations, sharing their insights on what was useful and applicable given the constraints and opportunities in their respective countries, and recommendations of what else would be valuable to focus on in future workshops.

Questionaire and Information list

To help facilitate preparation, the cosponsors have prepared a questionaire for the participants to fill out which will help the workshop organizers secure the most appropriate speakers. The organizers have also prepared a list of information that would be most valuable for the participants to secure and bring with them that will help focus the workshop discussions.

Expected outcome

The expected outcome of the workshop is to establish long-term working relationships between the paired participants and IRP/DSM professionals in the U.S. who can help the participants advance IRP/DSM in their respective

countries. Each of the cosponsors have been paired with one or more of the invited country teams (see attached list for pairings). The respective cosponsor will be in contact prior to the November workshop to assist in developing the case studies.

A second workshop is proposed to be held in Washington, DC, roughly six months after the LBL workshop. This second workshop would focus on advancing bankable and fundable projects to the World Bank (and how to do likewise at the regional multilateral development banks and UN agencies) and bilateral agencies like U.S. AID.

Questionaire to be filled out by Participants

PLEASE FILL OUT AND FAX BY AUGUST 15TH TO:

Michael Totten, IIEC

FAX: 1-202-842-1565

WORKSHOP CONTENT

While the workshop will cover all ofd the essential elements of IRP/DSM, we want to know the specific interests and background of the participants. This survey will enable us to focus the presentations and discussion in the areas of highest interest. The responses will be compiled and used to develop an agenda matching the needs and preferences of the participants.

Please rank the components for familiarity/interest:
"1" (low familiarity or low interest)
"2" (some familiarity or some interest)
"3" (high familiarity or high interest)

EXAMPLE: 3/1 industrial process equipment
[indicates high familiarity with the component, and low interest in the worlskp addressing this component]

EXAMPLE: 2/2 load management research
[indicates some familiarity with the component, and some interest in the workshop addressing this component]

IRP/DSM COMPONENTS

_____Assessing energy-saving improvement opportunities
- _____lighting
- _____space heating
- _____space cooling
- _____water heating
- _____refrigeration
- _____electric motors/industrial drive equipment
- _____appliances
- _____office equipment (computers, printers, copiers, etc.)
- _____industrial/agricultural process equipment
- _____district heating and cooling systems

_____Transmission & Distribution
_____power plant operation and maintenance
_____other (i.e.,_____)

_____Performing Cost-of-Saved Energy (CSE) and Cost-of-Avoided-Capacity calculations
_____selecting discount rates
_____use of nominal and real dollars
_____using present value and levelized cost methods

_____Developing Conservation Supply Curves

_____Methods for determining quantifiable environmental costs and benefits

_____Developing range of electricity demand forecasts based on economic, demographic, fuel price assumptions and electric generating resources and costs
_____estimating residential demand
_____estimating commercial/institutional demand
_____estimating industrial demand
_____estimating agricultural demand

_____Developing Utility Resource Portfolios

_____Integrated Resource Planning models

_____Designing utility DSM programs

_____Estimating utility DSM program costs

_____Utility DSM program organization
_____market research
_____marketing plan
_____load management research
_____end-use metering/data analysis
_____program delivery mechanism
_____training and technical assistance
_____program management
_____pilot/demonstration tests
_____research and development needs
_____information programs

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_____Utility incentive mechanisms and payment calculation methods
- _____onsite energy surveys and technical assistance
- _____giveaways
- _____cash rebates
- _____low/no interest financing
- _____direct installation
- _____cooperation with trade allies (architects, engineers, builders, community organizations)
- _____no down payment lease arrangements
- _____direct incentives to product manufacturers of energy consuming equipment (e.g., Golden Carrot Incentives)

_____DSM program monitoring techniques
- _____pre- and post-participation consumption

_____DSM program savings measurement & verification methodologies

_____DSM program evaluation methodologies
- _____participation rates of customers, comparative success of some DSM programs and incentives better than others

_____Regulatory or utility oversight procedures
- _____marginal pricing, time-of-use rate structures
- _____economic tests for assessing DSM programs
- _____treatment of uncertainty and risk
  - _____scenario analysis
  - _____sensitivity analysis
  - _____portfolio analysis
  - _____probabilistic analysis
- _____inclusion of non-energy effects of resources
- _____inclusion of marketing, competition, and private sector partners (e.g. bidding and performance contracting with Energy Service Companies-ESCOs)

_____Developing IRP/DSM Collaboratives, advisory panels, alliances that identify "win-win" opportunities

_____Developing Golden Carrot Incentive Consortia (i.e., utilities provide incentives to manufacturers of energy-consuming devices to produce high-efficiency units)

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_____Relationship to government standards & programs
- _____technology testing procedures
- _____building codes and standards
- _____appliance labels and standards
- _____motor, lighting, office equipment labels & standards
- _____research, development, demonstration, and commercialization of technologies
- _____information & technology transfer
- _____training, technical assistance mechanisms
- _____education materials and consumer awareness campaigns
- _____home energy rating systems
- _____energy efficient mortgage systems
- _____EPA-type Green Lights program (spurring voluntary lighting improvements that earn 20% or better returns on investment)
- _____import tariffs and duties structure impact on availability of efficient technologies

_____Transmission & Distribution loss reductions

_____Power Supply alternatives & efficiency improvement options

_____Distributed, small-scale power systems
_____Other components of interest or comments (i.e._____

_____

_____

INFORMATION TO BRING TO WORKSHOP

As noted above, case studies prepared by each country team would help to focus the week's activities on those aspects that are most relevant to the conditions that each country faces.

Similarly, workshop interaction can be greatly enhanced if each participant **shipped in advance** or brought with them to the workshop information about the current and projected status of electricity conditions in their respective

countries. Of particular value would include information on:

Current conditions

What is the level of installed capacity (MW)?
What is the resource mix (% coal, oil, hydro, wood, etc.)?
What are consumption percentages by sector (residential, commercial, institutional, industrial, agricultural)?
What has been the historical growth rates (by sector)?
What is per capita electricity consumption (averaged over all sectors)?
What is per household consumption (excluding non-household sector consumption)?
What percentage of households have electricity?
What are current and projected utility rates (by customer class)?
What is the projected electricity growth rate over the next decade or two (by customer class)?
What is the projected resource mix over this period?
What are the projected costs to achieve this growth (capital and lifecycle costs)?
What are the environmental pollution level estimates for current and projected levels (CO_2, SO_2, NO_x, particulates)?

Regulatory oversight

How many governmental bodies are responsible for overviewing the decisionmaking process for expanding electrical generation?

If there is a regulatory agency, how is it structured and functions? How large is the staff and budget? How enforceable are its decisions? Are regulatory changes underway, and if so, what kind of specific changes are being examined and proposed?

If a finance ministry is involved, how often, and in what specific ways, does it interact with the utility?

If an energy ministry is involved, what specific tasks does it perform separate from the utility? How many staff are assigned?

If an environmental ministry is involved, what rules and regulations, and what enforcement mechanisms and penalty system, are in place that deal with electric utilities?

If the only decisionmaker is the public utility, to what government entity does it

turn for funds, financing and overview?

If a private utility, what agency regulates oversight?

How is electric pricing set?

Utility decisionmaking

What is the electric planning process, as reflected in annual reports, prepared documents, or forecasting plans?

What computer software (mainframe, mini-computer, or desktop) is used or plans to be used to prepare long-range plans and evaluate cost-effective investment options?

What pilot programs or demonstrations in DSM have been tried or are being proposed? Any documentation available?

Are pollution control measures being used or factored in to future expansion? If so, what kinds of measures and at what projected cost (especially on a per kWh basis)?

Market conditions

What kinds of energy efficient products are available in local markets?

How do they compare in price to less efficient products?

What electricity-consuming products are produced domestically?

What domestic manufacturing capability currently produces efficient products for use or export? What products? How many are produced?

What is the import duty and tariff structure for various efficient products? What agency determines tariff rates? Are the import duties similar or different than power supply equiment?

Are there serious technical problems that prevent products from currently being used (e.g., low voltage starts and wide voltage fluctuation that may adversely affect electronic equipment)?

Government policies

What is the government's official policy on energy efficiency?

Is electricity policy all governed at the national level, or do regional, provincial and local government agencies have decision-making powers?

Are there legislators promoting energy efficient legislation? What kinds of policies, based on recommendations from what source?

Which government agencies promote energy efficiency? In what ways (e.g., information campaigns, training workshops, demonstrations and pilot programs, technical assistance)? What is the staff size and budget? Have there been any evaluations of the results of these efforts?

Are there any voluntary or mandatory efficiency standards (buildings, appliances, motors, lights, etc.) currently in place or under consideration?

Please indicate your analytic skills:

_____managerial
_____economics
_____engineering (specialization:_____)
_____finance
_____analytic (specialization_____)
_____science (specialization:_____)
_____policy (specialization:_____)

Other:_____
_____
_____.

Please indicate your computer and software skills:

I use the following kinds of computer equipment:

_____
_____
_____.

I am familiar with the following software packages:

_____
_____
_____
_____.

NAME_____

TITLE_____

ORGANIZATION_____

ADDRESS_____

_____

CITY_____ STATE_____

COUNTRY_____ ZIPCODE_____

PHONE_____ FAX_____

IRP/DSM components: Assessing energy-saving improvement opportunities				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	2	3
POLAND	1	2	1	2
KENYA	2	2		
BOTSWANA			2	2
INDIA	1	2	2	2
SRI LANKA	2	2	2	2
MEXICO				
CHILE	2	3	2	2

Performing Cost-of-Saved Energy and Cost-of-Avoided Capacity calculations				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	2	3	1	3
POLAND	1	3	2	3
KENYA	2	3	N/A	N/A
BOTSWANA	N/A	N/A	2	3
INDIA	2	2	2	2
SRI LANKA	1	3	1	3
MEXICO				
CHILE	3	1	1	3

Developing Conservation Supply Curves				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	3
POLAND	2	3	1	2
KENYA	2	3		
BOTSWANA			1	3

INDIA	3	3	1	1
SRI LANKA	1	3	1	3
MEXICO				
CHILE	1	3	2	3

Methods for determining quantifiable environmental costs and benefits				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	3
POLAND	1	3	1	3
KENYA	1	3		
BOTSWANA			1	3
INDIA	2	3	2	3
SRI LANKA	2	3	1	3
MEXICO				
CHILE	2	3	1	3

Developing range of electricity demand forecasts based on economics, demographics, fuel price assumptions and electric generating resources and costs				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	3
POLAND	2	3	2	3
KENYA	2	2		
BOTSWANA			2	3
INDIA	2	2	2	3
SRI LANKA	1	3	1	3
MEXICO				
CHILE	2	3	1	3

Developing utility resource portfolios

COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	3
POLAND	1	2	1	2
KENYA	2	2		
BOTSWANA			1	3
INDIA	0	0	2	3
SRI LANKA	1	2	1	3
MEXICO				
CHILE	1	2	1	3

Integrated Resource Planning models				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	2	3	1	3
POLAND	2	3	2	3
KENYA	2	2		
BOTSWANA			1	3
INDIA	2	1	2	3
SRI LANKA	1	3	1	2
MEXICO				
CHILE	2	3	1	3

Designing utility DSM Programs				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	3
POLAND	2	3	1	3
KENYA	2	2		
BOTSWANA			1	3
INDIA	2	3	3	3
SRI LANKA	1	3	1	3
MEXICO				

CHILE	1	3	1	3

Estimating utility DSM program costs				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	3
POLAND	2	3	1	3
KENYA	2	2		
BOTSWANA			1	3
INDIA	2	3	3	3
SRI LANKA	1	2	1	3
MEXICO				
CHILE	1	3	1	3

DSM program organization				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	2	3	2	3
POLAND	1	3	1	2
KENYA	2	3		
BOTSWANA			1	3
INDIA	2	3	2	3
SRI LANKA	1	3	1	3
MEXICO				
CHILE	1	3	1	3

Utility incentive mechanisms and payment calculation methods				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	2
POLAND	2	3	1	2

KENYA	2	3		
BOTSWANA			2	3
INDIA	2	3	1	2
SRI LANKA	1	2	1	3
MEXICO				
CHILE	2	3	1	3

DSM program monitoring techniques				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	3
POLAND	1	3	1	3
KENYA	2	2		
BOTSWANA			1	3
INDIA	1	1	2	2
SRI LANKA	1	3	1	3
MEXICO				
CHILE	2	3	1	2

DSM program savings measurement and verification methodologies				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	3
POLAND	1	3	1	3
KENYA	2	2		
BOTSWANA			1	3
INDIA	1	1	2	3
SRI LANKA	1	3	1	3
MEXICO				
CHILE	2	3	1	2

DSM program evaluation methodologies

COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	2	3	1	3
POLAND	2	3	1	3
KENYA	2	2		
BOTSWANA			2	3
INDIA	1	3	2	3
SRI LANKA	1	3	1	3
MEXICO				
CHILE	2	3	1	2

Reulatory or utility oversight procedures

COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	2	3	1	3
POLAND	1	3	1	2
KENYA	2	3		
BOTSWANA			1	3
INDIA	2	2	1	2
SRI LANKA	1	3	1	3
MEXICO				
CHILE	2	3	1	3

Developing IRP/DSM collaboratives, advisory panels, alliances that identify "win-win" opportunities

COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	3
POLAND	0	0	1	2
KENYA	2	3		
BOTSWANA			1	3
INDIA	2	2	1	2

SRI LANKA	1	2	1	3
MEXICO				
CHILE	1	3	1	3

Developing "Golden Carrot" incentive consortia (i.e. utilities provide incentives to manufacturers to produce high-efficiency energy-consuming appliances and other devices).

COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	1
POLAND	0	0	1	2
KENYA	2	3		
BOTSWANA			1	2
INDIA	2	1	1	2
SRI LANKA	1	2	1	3
MEXICO				
CHILE	1	3	1	2

Relationship to government standards and programs

COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	1	3
POLAND	1	3	1	3
KENYA	1	3		
BOTSWANA			2	3
INDIA	2	2	1	3
SRI LANKA	2	1	1	3
MEXICO				
CHILE	2	3	1	3

Transmission and Distribution loss reductions

COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest

RUSSIA	1	3	3	3
POLAND	1	2	2	3
KENYA	2	2		
BOTSWANA			2	3
INDIA	1	2	3	3
SRI LANKA	0	0	1	2
MEXICO				
CHILE	1	3	1	2

Power supply alternatives and efficiency improvement options				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	3	3
POLAND	2	3	2	3
KENYA	2	2		
BOTSWANA			1	3
INDIA	--	--	3	3
SRI LANKA	1	3	1	2
MEXICO				
CHILE	2	3	2	3

Distributed, small-scale power systems				
COUNTRY	NGO participant		Utility/Gov't participant	
	Familiarity	Interest	Familiarity	Interest
RUSSIA	1	3	3	3
POLAND	1	3	2	3
KENYA	3	1		
BOTSWANA			2	3
INDIA	2	3	2	3
SRI LANKA	1	3	1	2
MEXICO				
CHILE	1	3	1	2

NOTES: Other Areas of Interest and Critical Need Areas:

RUSSIA: Perevoschikov, CENEf--Models and computer analysis for IRP/DSM assessment; Chekalin, gov't rep: standards and labeling. High familiarity with metering and analysis, low familiarity with training, technical assistance and program management. Low familiarity with all efficient techs.

POLAND: Although the FEWE (Polish NGO) rep, Dr. Adam Gula, has theoretical knowledge of the concepts described above, he lacks hands on experience. He is looking to develop the tools through which he can implement and gain hands-on experience. The utility representative from Poland, Kwiatkowski, must start at the beginning. He is trained in engineering. Both representatives have worked on IBM PCs, Fortran and Quattro Pro, Pascal. Low familiarity with all efficient tech

KENYA/BOTSWANA: The Kenyan NGO representative, Steve Karekezi, is most interested in institutional and human resource implications of IRP/DSM, eg the calibre and number of qualified personnel required to initiate and implement an IRP/DSM program for a medium-sized African country; Ben Ramasedi, utility rep from Botswana, is interested in the concept of power pools to improve efficiency and reduce environmental damage by sharing resources that have a reduced environmental impact. Esp high interest in motors/ industrial equipment and agric. equipment.

INDIA: Both participants are engineers. High interest/famil in lighting, water hting; Low famil/ high interest in appliances, T&D losses, ind/agr process eqpmt. Low interest/fam in office eqpmt. High famil with using present value and levelized cost, low famil with selecting discount rates.

SRI LANKA: High famil/interest in space cooling and lighting; low famil/ interest in space hting and dist hting and cooling; low famil and high interest in reduction of T&D losses. Govt rep, Daranagama, skilled manager/chem engineer. Knows spreadsheets and word processing.

MEXICO: Never submitted surveys...

CHILE: Miranda, govt repres., interested in regulatory role to ensure cogen is utilized. High fam/interest in space heating, lighting, refrigeration, electric motors, ind/agr eqpmt. Low familiarity space cooling, ind/agr processing equipment, dist heating and cooling, power plant oper and maintenance; high interest in oil or coal substitution. NGO contact, Pedro Maldonado, skilled in economics, engineering, Mac computers.

UNCED/GEEI TRIP REPORT

From June 1 to 14, Mia Birk and John Lebens, representing IIEC as the Secretariat of the U.S. Working Group of the Global Energy Efficiency Initiative, organized and participated in various events at the Global Forum for NGOs in Rio de Janeiro, Brazil. Deirdre Lord from IIEC and Alan Poole, under contract to U.S. AID, were instrumental in organizing the following GEEI events.

GEEI Conference

On Monday, June 8, from 9:00 a.m. to 1:00 p.m., the GEEI sponsored the conference, "A Call to Action." Our host was the newly-formed Brazilian National Institute for Energy Efficiency (INEE), and the location of the conference was the electricity-generating authority building, FURNAS. The conference was well attended by over 40 people from around the world, most who were already involved in energy conservation. A large portion of the audience was Brazilian, coming from INEE, FURNAS, and PROCEL, the Brazilian National Electricity Conservation Program. The english presentations, questions, and answers were simultaneously translated into portuguese, while the portuguese language participants were translated into english.

The conference opened with introductory remarks from INEE's Marcos Jose Marques, who facilitated the first panel. The first presentation was a slide show delivered by Mia Birk from IIEC. The slides described GEEI, its purpose and activities, and technology and policy options to improve the efficiency of energy use worldwide. Ms. Birk's presentation of the GEEI was followed by a panel of experts discussing energy-efficiency opportunities and barriers. The panel included Scott Sklar, Executive Director of the U.S. Export Council for Renewable Energy and the Solar Energy Industries Association, Dr. David Jhirad, Senior Energy Advisor at the Office of Energy and Infrastructure, U.S. Agency for International Development, and John Lebens, Director of IIEC's Latin America office in Santiago, Chile. Among the topics presented were the growing demand for energy in developing countries, utility incentives to invest in energy efficiency, components necessary for a quality demand-side management effort, and successful projects combining renewable energy sources and energy efficiency technologies. This panel was followed by a coffee break and an audience discussion session, with questions asked on such topics as how to include reduction of transmission and distribution losses from power supply into energy efficiency strategies.

The second panel was chaired by INEE's Jayme Buarque de Holanda. Two subject matters were discussed on this panel. The first was the role of the World Bank in the energy lending picture, opened by Howard Geller, Executive Director of the American Council for an Energy-Efficient Economy (ACEEE), and followed by Ian Johnson, Administrator of the Global Environmental Facility (GEF). The second panel topic focused on Brazilian activities in energy conservation through short talks by Leoncio Cardoso Neto from Abilux, a Brazilian lighting trade alliance, and Mario Santos from PROCEL, the Brazilian National Electricity Conservation Program. The presentation of these topics was followed by another audience discussion session, which mainly focused

attention on the GEF program and its possible future directions. Other discussion topics focused on Brazil and its burgeoning energy conservation activities.

The participation and sponsorship of INEE, PROCEL, and Abilux set the stage for the following day's activity, a one-day workshop, "Implementing Energy Efficiency," sponsored by INEE. John Lebens attended this workshop.

The GEEI conference was meant to be followed up by a press conference hosted by Mayor Jaime Lerner of Curitiba, Brazil and Brazilian Senator Teotonio Vilela. Unfortunately, neither showed up, nor did any members of the press. The inconvenient location of the FURNAS auditorium was a major factor in this disappointment, as was the intense competition for press attention from the hundreds of events.

GEEI Booth

The GEEI booth was located in Flamengo Park, the site of the Global Forum. Initially the booth was located directly adjacent to the booth of ACEEE and Lawrence Berkeley Laboratory (LBL). Individuals from both ACEEE and LBL are GEEI members. The booth was decorated with 7 laminated GEEI posters displaying: 1) the GEEI logo and list of members, 2) the projected capital savings from an energy efficiency investment scenario versus a reference scenario (assumes some energy efficiency improvements), 3) the projected CO_2 emissions reductions from an energy efficiency scenario, 4) the potential energy savings from building design and technology improvements, 5) the potential energy savings from reducing the urban heat island effect, 6) the potential savings in the transportation sector from mass transit and land-use planning improvements, and 7) the potential energy savings from industrial efficiency improvements such as high-efficiency motors. We also displayed examples of energy-efficient lighting and window technologies. Unfortunately, at the end of the first week, the GEEI booth suffered the theft of the 7 posters. Subsequently, we decided to combine our booth with the ACEEE/LBL booth. The flow of inquiries from Global Forum attendees was unabated throughout the conference.

The booth was staffed with assistance from several volunteer colleagues in addition to the IIEC staff. Literature from GEEI, including brochures, the GEEI report, and GEEI project portfolios was distributed to interested parties and the general public. We also distributed literature from other GEEI members, including ACEEE, LBL, IIEC, the U.S. Office of Technology Assessment, the U.S. Export Council for Renewable Energy, the Stockholm Initiative on Energy, the Environment, and Sustainable Development (sponsored by U.S. AID, et. al.), Institute of Transportation and Development Policy, the Alliance to Save Energy, and Biomass Users' Network.

Other activities:

Ecotech: John Lebens and Mia Birk both gave presentations at Ecotech, a week-long conference sponsored by the State of Rio de Janeiro. Ms. Birk outlined IIEC's transportation case studies in Asia, and Mr. Lebens discussed his work in Chile on

improving energy efficiency.

"Sustainable Transportation Strategies and Development": Ms. Birk helped to organize and run this 2 day seminar sponsored by the Brazilian NGO Institute of Technology for the Citizen. The final panel provided an opportunity to call for involvement of the participants in the GEEI.

Other GEEI member activities: Mr. Lebens and Ms. Birk both attended seminars sponsored by such GEEI members as the U.S. Export Council for Renewable Energy/Solar Energy Industries Association, Tata Energy Research Institute/Stockholm Environment Institute, Conservation International, INEE and the Danish Organization for Renewable Energy, At the Danish meeting, an international network of NGO's working in energy efficiency and renewable energy (International Network for Sustainable Energy - ENFORSE) was organized. Howard Geller and Alden Meyer are the U.S. contacts.

World Bank policy paper press event: During the last GEEI meeting, it was decided that significant attention should be paid to publicizing the World Bank's recent draft energy policy papers, which, among other shortcomings, downplayed the importance of IRP. Howard Geller and John Lebens arranged a press conference at the International Press Center of the Global Forum, but received the attention of only two reporters, one Brazilian and one North American. The reporters spent more than an hour in the interview.

Exporting Green Lights to Brazil: Bill Nitze, Howard Geller, Alan Poole, John Lebens and INEE representatives met with Israel Klabin of a newly-formed Brazilian foundation to discuss the possibility of implementing a "Green Lights" program modeled after the U.S.EPA's program. With Mr. Klabin were five or six other representatives of the Brazilian business community interested in environment and energy matters. The U.S. EPA has already expressed an interest in providing technical assistance for such an endeavor. This meeting was seen as a first positive step, and follow-up has already commenced.

Trip Report by Michael Totten
International Institute for Energy Conservation
on the presentations made at the
AFREPREN Conference on IRP/DSM
April 6-8, 1993

From April 6 to 8, 1992, the African Energy Policy & Research Network (AFREPREN) convened an Africa-wide conference on energy efficiency, comprised of energy professionals from NGOs, academic institutions, and government ministries from more than a dozen countries. The conference was held in Gaboron, Botswana. AFREPREN requested the participation of a representative from the U.S. Working Group for Global Energy Efficiency. Michael Totten, Senior Associate for Policy with the International Institute for Energy Conservation (IIEC is the Secretariat of the U.S. Working Group) attended.

AFREPREN is a leading organization in Africa supporting the adoption of innovative public policies and market-oriented incentives to foster greater reliance on cost-effective energy efficient products and services. The objective of attending the AFREPREN conference was two-fold. First, it provided an opportunity to fully explain the function and scope of activities being undertaken by the U.S. Working Group. AFREPREN members have already expressed their interest in the Working Group, and believe its activities to be valuable in furthering their own efforts throughout Africa.

Second, AFREPREN has a strong interest in fostering the implementation of Integrated Resource Planning (IRP) by African utilities. Fostering IRP is also one of the central goals of the Working Group. Attending the conference provided an opportunity for Michael Totten to present a workshop on IRP to the participants.

Michael Totten made two presentations at the AFREPREN conference:

1. On the function and scope of activities of the Working Group;

2. On the process and experience of implementing Integrated Resource Planning. A copy of the presentation is attached.

Possible Follow-up Actions Explored

Totten discussed with a number of AFREPREN members possible projects they could prepare that the U.S. Working Group could present to various funding sources. Currently, AFREPREN's sole source of funding is the Swedish development agency. A number of members also expressed interest in participating in the NGO Training Course on IRP/DSM that several U.S. Working Group organizations are planning

(IIEC, NRDC, LBL, ORNL, and the Center for Global Change, with partial funding from AID).

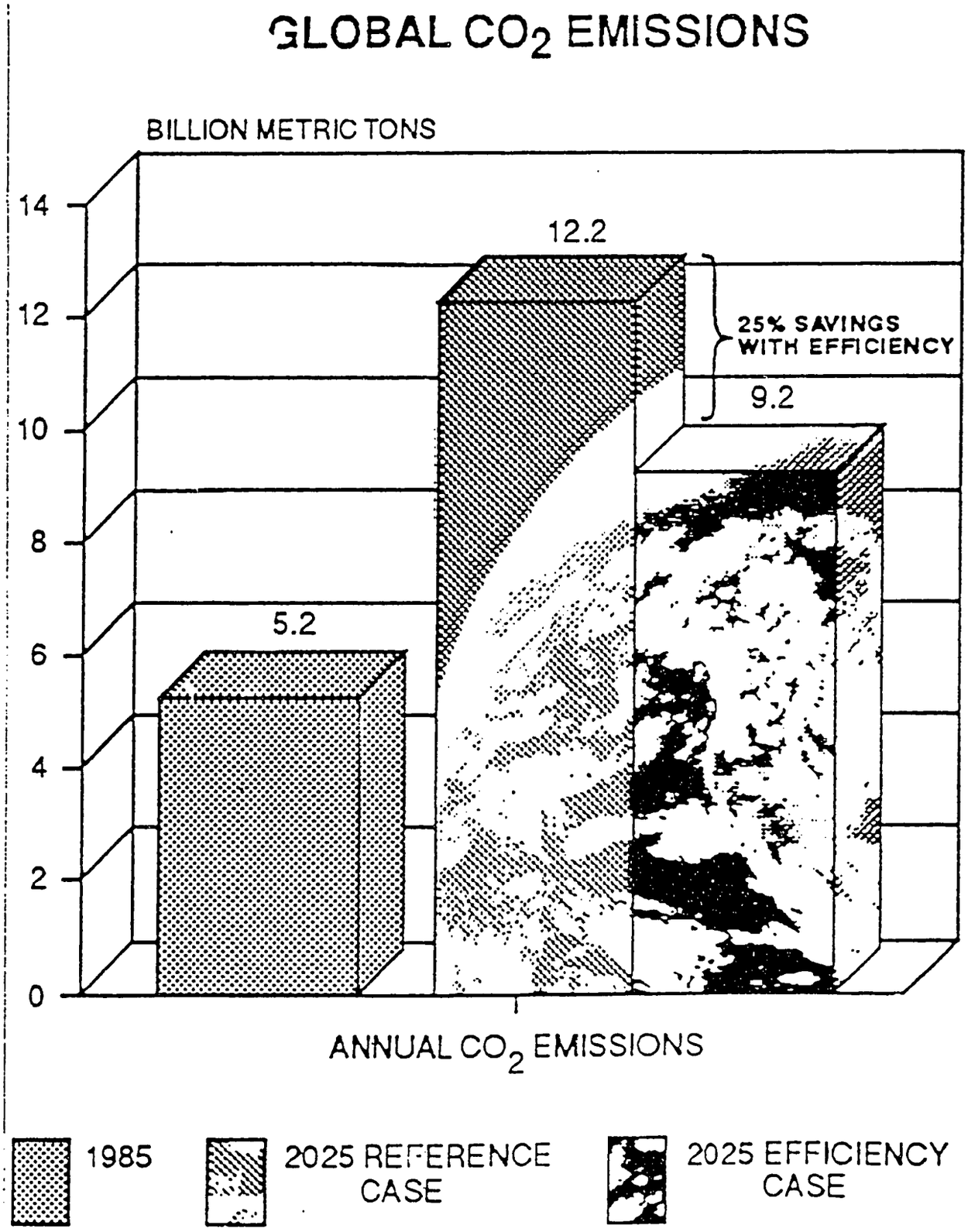
African Development Bank

While enroute to Gaborone, Botswana for the AFREPREN conference a stopover in Abidjan, Cote D'Ivoire offered an opportunity for a presentation to be made at the African Development Bank and AID on the function and scope of activities of the U.S. Working Group. Mr. Totten spent two days in Abidjan, Ivory Coast, making presentations to a number of the African Development Bank's senior officials and energy professionals, as well as AID/REDSO staff, including:

Elsadig Mahmoud Musa, Chief, Infrastructure & Industry Development, Policy Division, Central Projects Dept.
Knut Opsal, Social & Environment Policy Division, Central Projects Dept.
Oumar Aw
Dr. Kweku Andah, Chief Training Division
G. Henry Andrews, Training Center
Tiégoué Amadou Ouattara, Advisor
B Fikru, Senior Power Engineer
Mima S. Nedelcovych, U.S. Executive Director
Dinesh Purohit, Power Engineer, Infrastructure & Industry Dept.
Dulal Datta, Chief, Engineering & Environment Division, REDSO/WCA, AID

Possible Follow-up Actions Explored

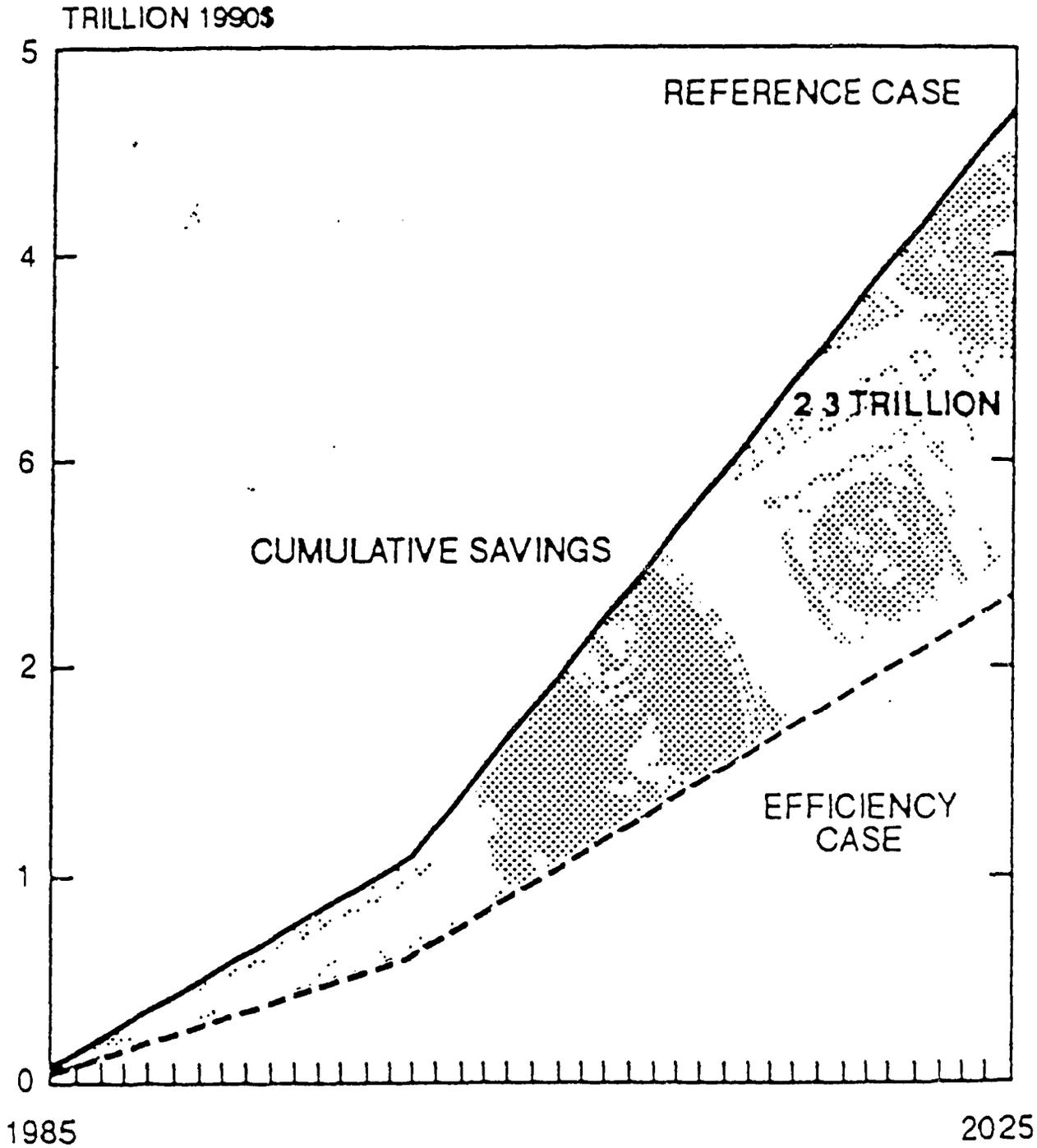
Both AID/REDSO and a number of staff at the AfDB expressed interest in conducting a workshop on DSM to be held during the summer. AfDB is in the process of preparing a new energy policy, to which this workshop could help add input.



ource: ENE[illegible] EFFICIENCY, DEVELOPING COUNTRIE[illegible]ND EASTERN EUROPE, BY LEVINE ET A[illegible] 1991.

DEVELOPING/E. EUROPE NATIONS CAPITAL DEMANDS FOR ENERGY

1985-2025

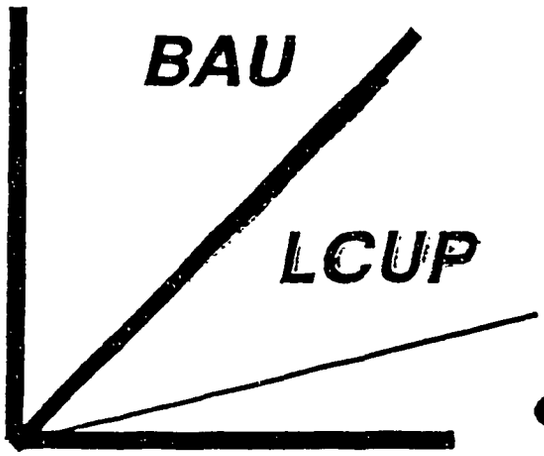


Source: *ENERGY EFFICIENCY, DEVELOPING COUNTRIES, AND EASTERN EUROPE*, BY LEVINE ET AL., 1991.

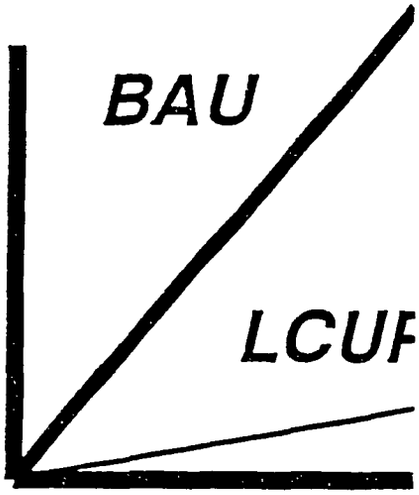
174

The Art of the Long View

Business-As-Usual (BAU) vs. Least-Cost Utility Plan (LCUP)

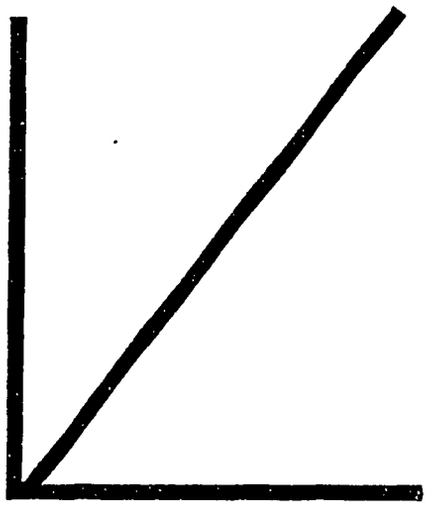


Resources

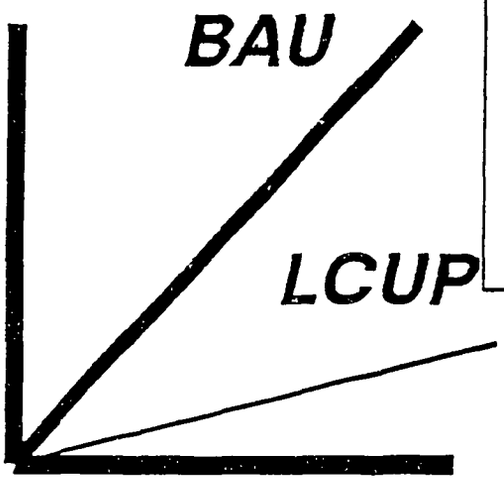


Capital

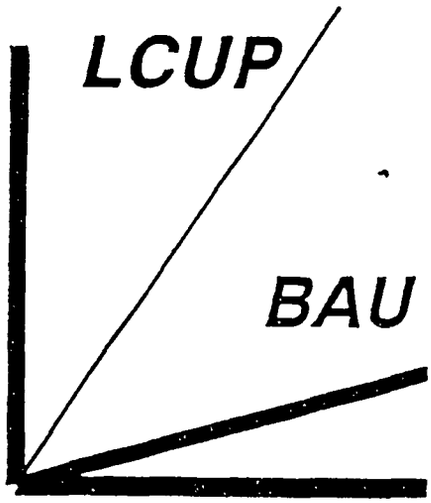
Goal



Electricity Services



Pollution



Employmen

W H Y ?

Electric utilities like Pacific Gas & Electric (PG&E)
Will meet 75% of new demand
with energy efficiency through the year 2000

151

WHY?

Thailand government Mandated the Electric Utilities Implement A Multi-Billion Dollar Demand-Side Management Program this decade

182

WHY?

Electric utilities like Bonneville Power Administration (BPA) Provide a 10 percent Credit for Conservation In Planning Power Expansion

WHY?

Utilities created a $30 Million capital pool For manufacturing Super-efficient, Ozone-Free Refrigerators

184

WHY ?

Utilities like
Southern Calif Edison
Pay Builders
$30 per square meter
to install super-windows

185

WHY?

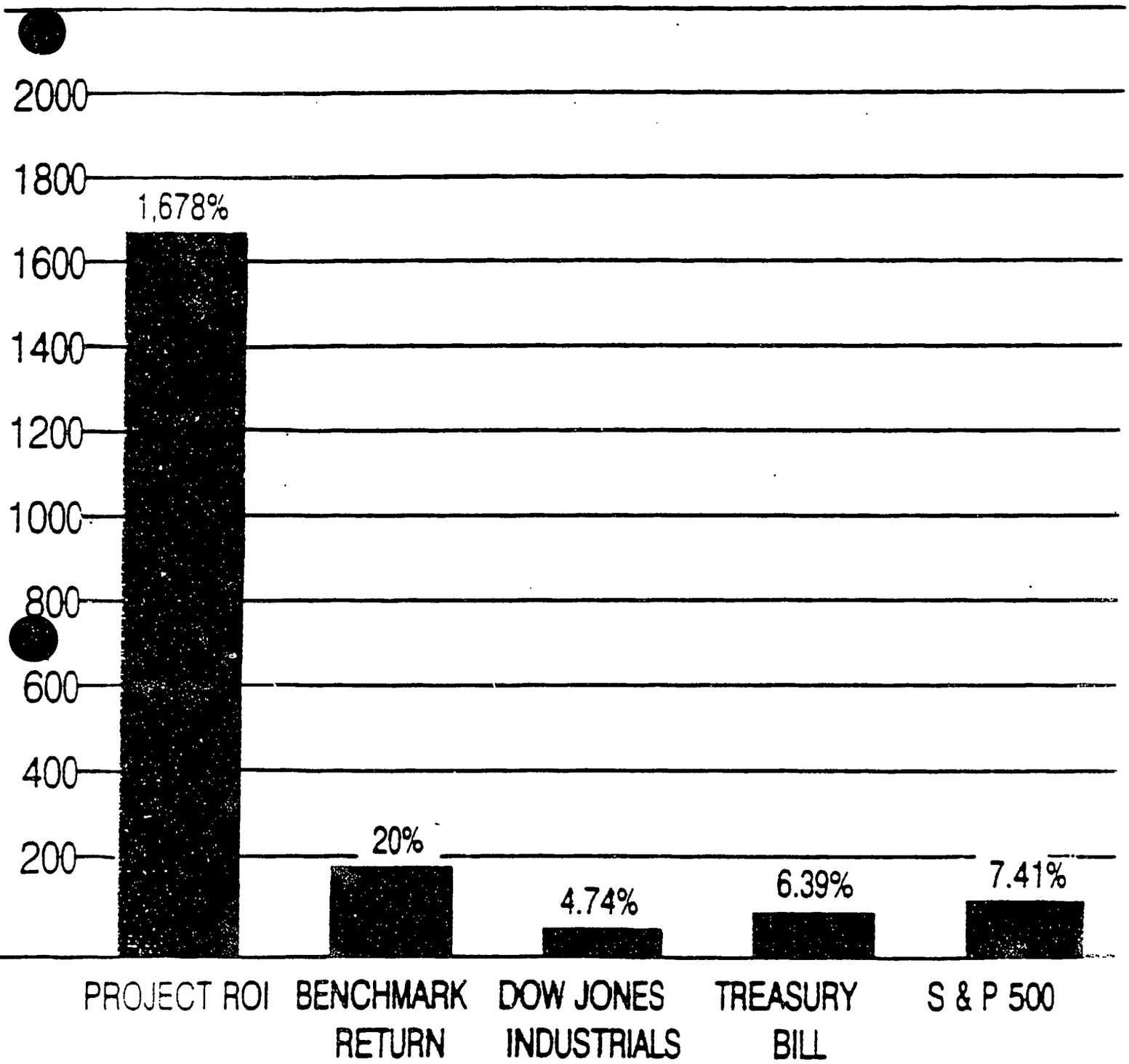
Electric utilities like B.C. Hydro provide Incentives of $10 per Horsepower for customers To install efficient motors

186

WHY?

U.S. Electric utilities
Provided $500 million
To customers in 1991
For installing efficient
lighting components

Energy Investment Index: *SUNY Binghamton*



ECO-ROI:

2,032,755 Lbs. of CO_2 Eliminated

21,976 Lbs. of SO_2 Eliminated

9,614 Lbs. of NOx Eliminated

182

Mexico
Energy Resources

- 68 billion barrels of crude oil equiv (boe)
- 740 million tons of coal reserves (4.7 bil boe)
- 10,600 tons uranium reserves
- 80 TWh/yr hydro resources (22 GW)
- 4 GW geothermal potential
- 16 TWh/yr from sugar cane cogeneration
- Undetermined solar
- 800 TWh/yr End-Use Efficiency Potential

Source: IIEC Information Project & World Bank tables.

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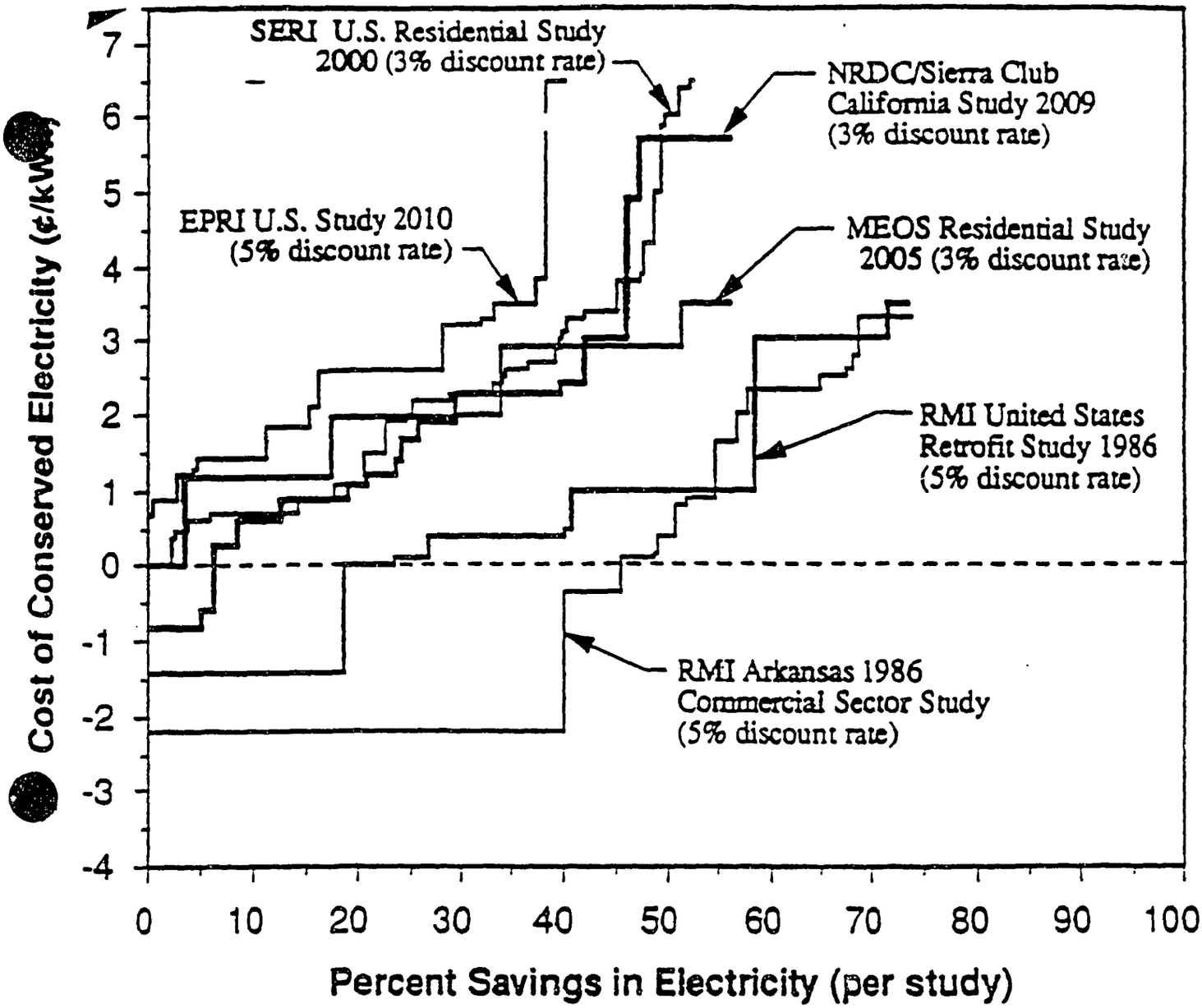
DSM Benefits to Mexico...

- Enhances competitive edge of domestic industries, manufacturing firms, and commercial businesses by reducing cost of producing goods and services
- Creates new industries manufacturing and marketing end-use efficiency products, for domestic and export markets
- Mimimizes rate shock as LRMC take effect
- Expands utility expertise and opens regional and global marketing opportunities to help Caribbean, Central and South American utilities implement DSM programs
- Conserves biodiversity by making it possible to defer ecologically sensitive hydro projects
- Improves Mexican economy by providing more value at lower cost

A Dozen Benefits to Mexico
From Integrating Demand-Side Management (DSM) into LCUP

- Five times more electricity services per peso of investment vs. powerplants
- Prevention of millions of tons of acid rain, urban smog, and greenhouse gas pollutants at zero or negative cost
- Several times more jobs generated per peso invested in DSM vs. powerplant
- Reduced foreign capital requirements
- Millions of barrels of oil freed-up for export market, improving balance of payments, increased hard currency, and aiding debt and deficit reduction
- Helps extend Transmission & Distribution capabilities and reliability, lowers T&D capital and operating expenditures

SOURCE: IIEC Information Project



A Collection of Efficiency Supply Curves Indicating the Technical Potential for Electricity Savings in the United States. These curves imply that for an average cost of less than 2 ¢/kWh it is technically possible to save 40-75% of annual electricity use within the United States. The Electric Power Research Institute (EPRI) study examined all sectors of the U.S. in the year 2010. The Natural Resources Defense Council/Sierra Club study examined commercial lighting and residential lighting and appliances in California in year 2009. The MEOS study examined residential lighting and appliances. The Solar Energy Research Institute study examined all sectors of the U.S. in the year 2000, but only the residential electricity efficiency supply curve is reproduced here. Rocky Mountain Institute examined retrofitting the entire U.S. and the Arkansas commercial sector using 1986 as a base year.

Source: *Efficient Electricity Use: Estimates of Maximum Energy Savings*, prepared by Barakat & Chamberlin, Inc., EPRI CU-6746, March 1990 (and personal communication A. Rosenfeld with A. Faruqui, Barakat & Chamberlin, Inc.). *Initiating Least-Cost Planning in California: Preliminary Methodology and Analysis*, D. Goldstein, R. Mowris, B. Davis, K. Dolan, Natural Resources Defense Council and The Sierra Club, prepared for the California Energy Commission, Docket No. 88-ER-8, February 1990. *A New Prosperity, Building a Sustainable Future*, The Solar Energy Research Institute (SERI) Solar/Conservation Study, Brick House Publishing, Andover MA, 1981, and *Competitek*, A. B. Lovins, R. Sardinsky, P. Kieman, T. Flanigan, B. Bancroft, M. Shepard, Rocky Mountain Institute (RMI), 1986, Analysis of Michigan's Demand-Side

MARKET SHORTCOMINGS

- Producer & consumer SUBSIDIES
  over $40 billion/yr in U.S.
  50% underpriced some countries

- 10-fold PAYBACK GAP
  producers 15–30 yr payback
  consumers 0.5–2 yr payback

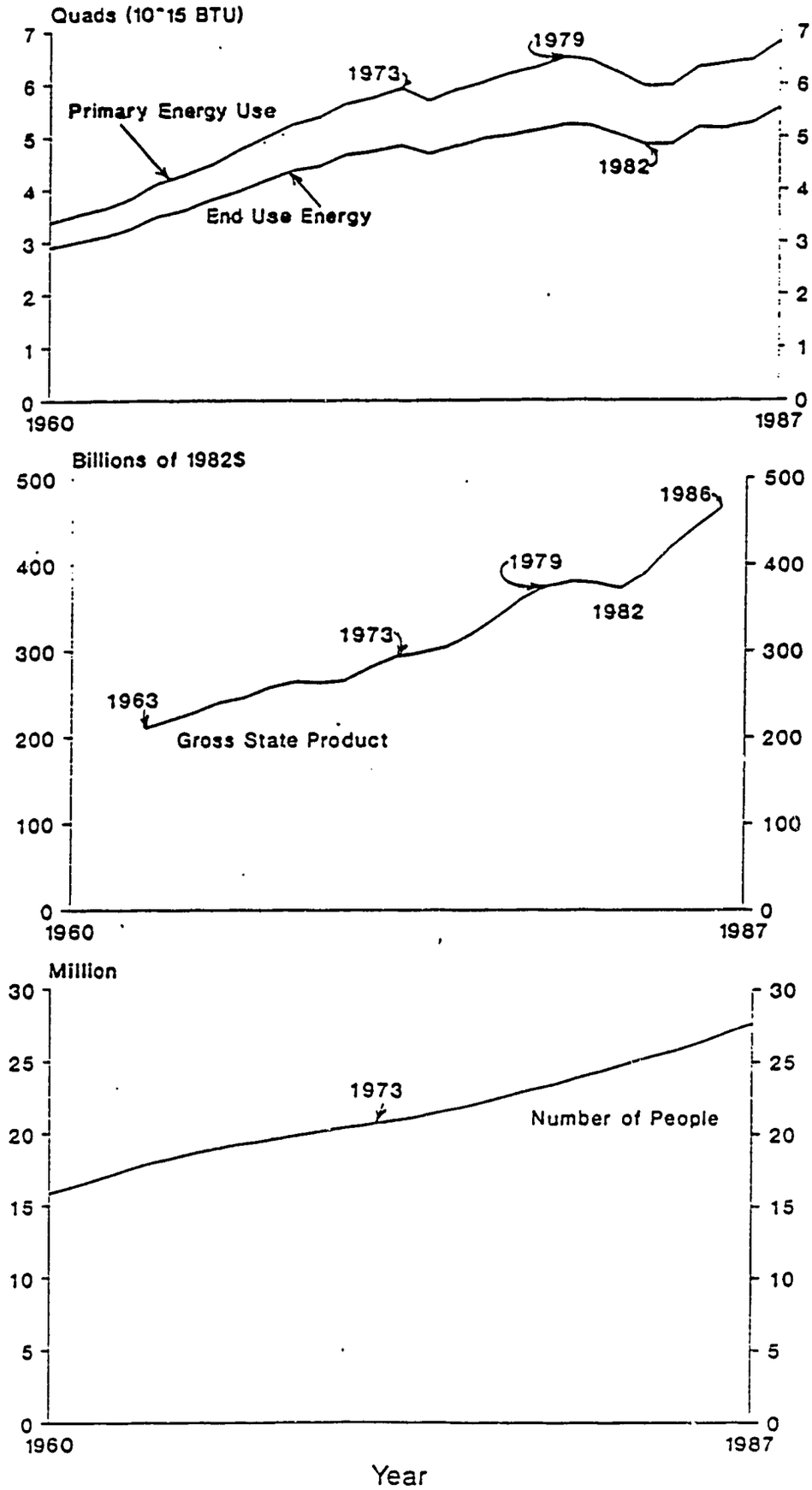
- EFFICIENCY GAP
  demand–side options ignored

- EXTERNALITIES EXCLU*DED*
  health damage
  ecological degradation
  energy (in)security

- Poverty ignored

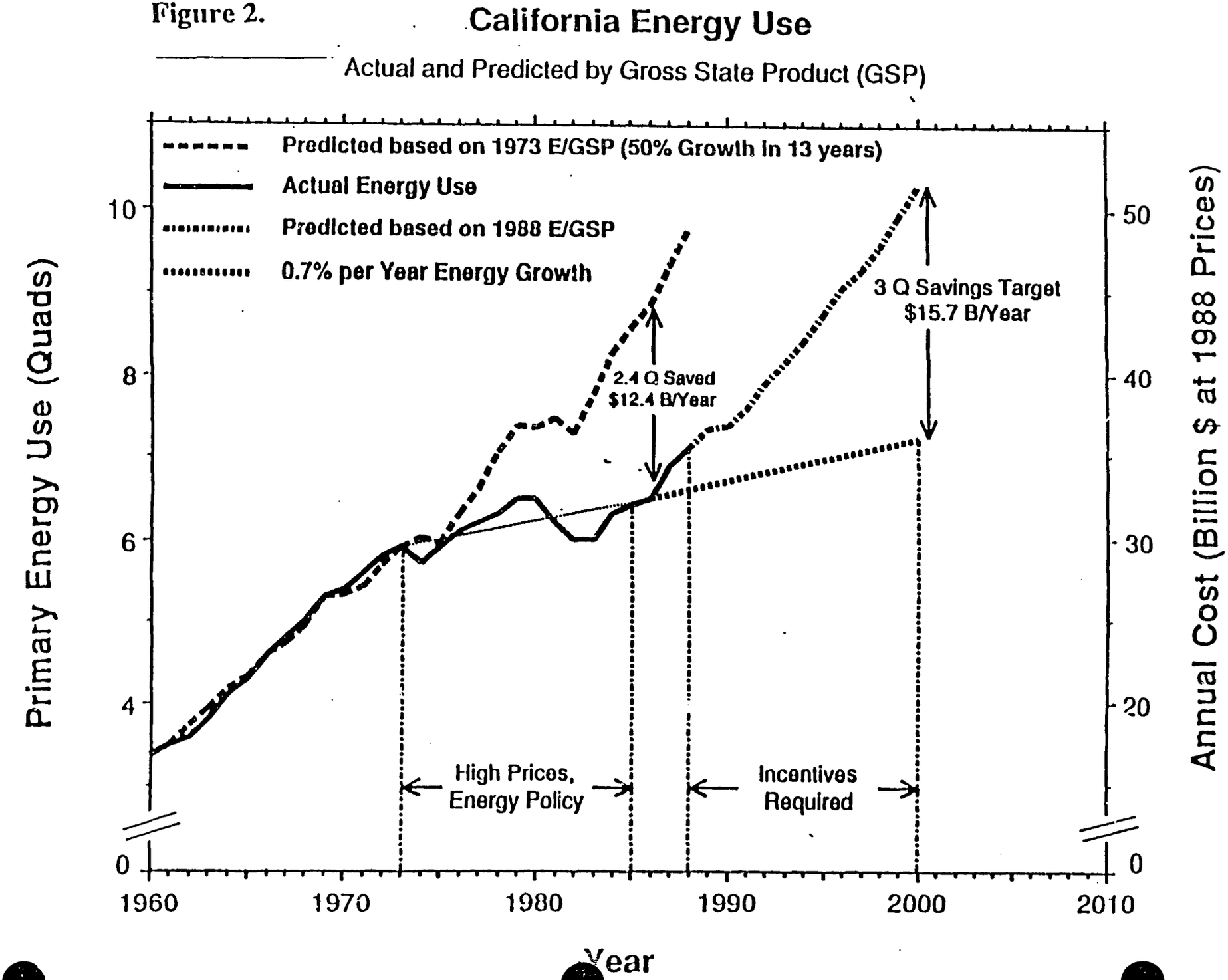
FIGURE A-2.1

STATEWIDE ENERGY USE, GROSS STATE PRODUCT AND POPULATION



From 1973 - 1986, energy use in California rose 9%, population grew 31%, and gross state product climbed 58%.

Figure 2.


California Energy Use
Actual and Predicted by Gross State Product (GSP)
Predicted based on 1973 E/GSP (50% Growth in 13 years)
Actual Energy Use
Predicted based on 1988 E/GSP
0.7% per Year Energy Growth
2.4 Q Saved
$12.4 B/Year
3 Q Savings Target
$15.7 B/Year
High Prices,
Energy Policy
Incentives
Required
Primary Energy Use (Quads)
Annual Cost (Billion $ at 1988 Prices)
Year
0
4
6
8
10
20
30
40
50
1960
1970
1980
1990
2000
2010

Source: Meier, Rosenfeld, and Wright. "Supplying Energy Through Greater Efficiency" (1983)

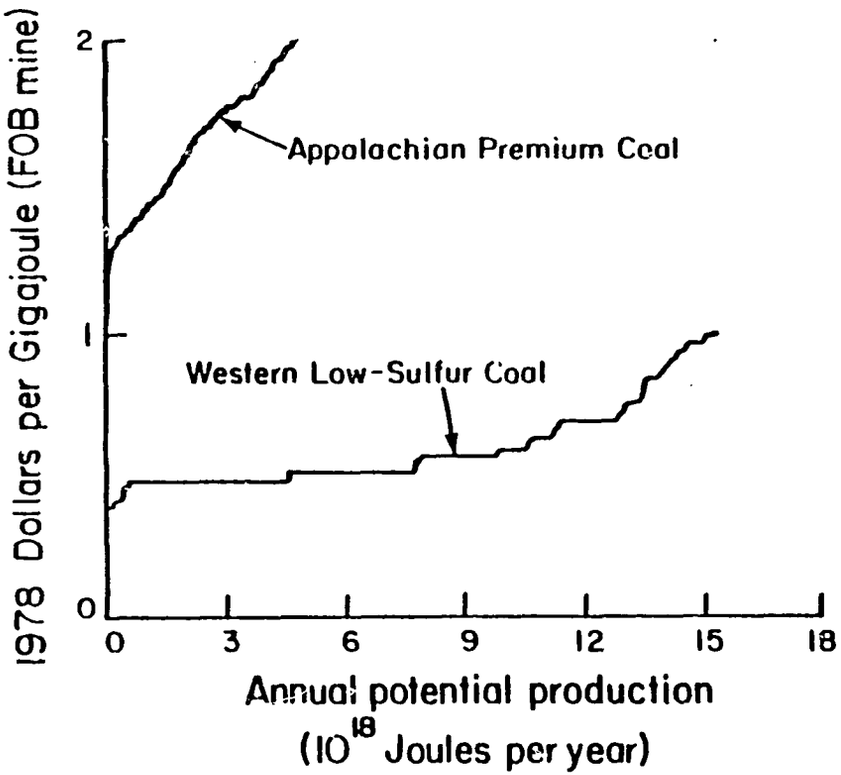


Figure 2-3
Supply curves for two grades of coal. The reserves of Western coal are cheaper and three times as large as the reserves of Appalachian coal. (Source: EIA 1978)

served by that measure; the horizontal coordinate (x-value) is the cumulative energy saved annually by that measure and all measures preceding it in the supply curve. Figure 2-4 shows this scheme. Determining the y-value requires engineering and economic data; determining the x-value requires research into the characteristics of the energy-using stock. We discuss these two types of investigations in detail in the next two sections.

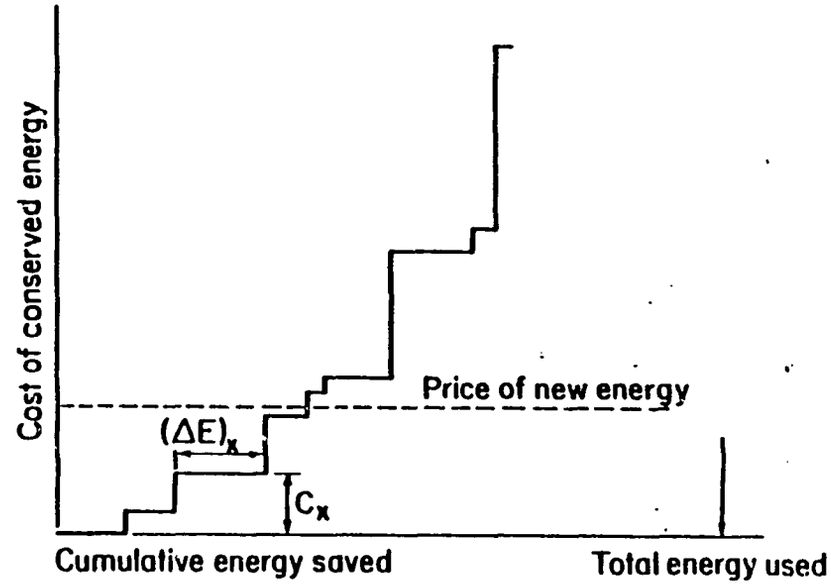


Figure 2-4
A schematic supply curve of conserved energy. Implementation of "measure x" will save energy, $(\Delta E)_x$, at a cost per unit of conserved energy, C_x.

The Cost of Conserved Energy

To establish the unit cost of the conserved energy, such as cents per kWh, the *annual* investment in conservation (for materials and labor) is divided by the annual energy savings:

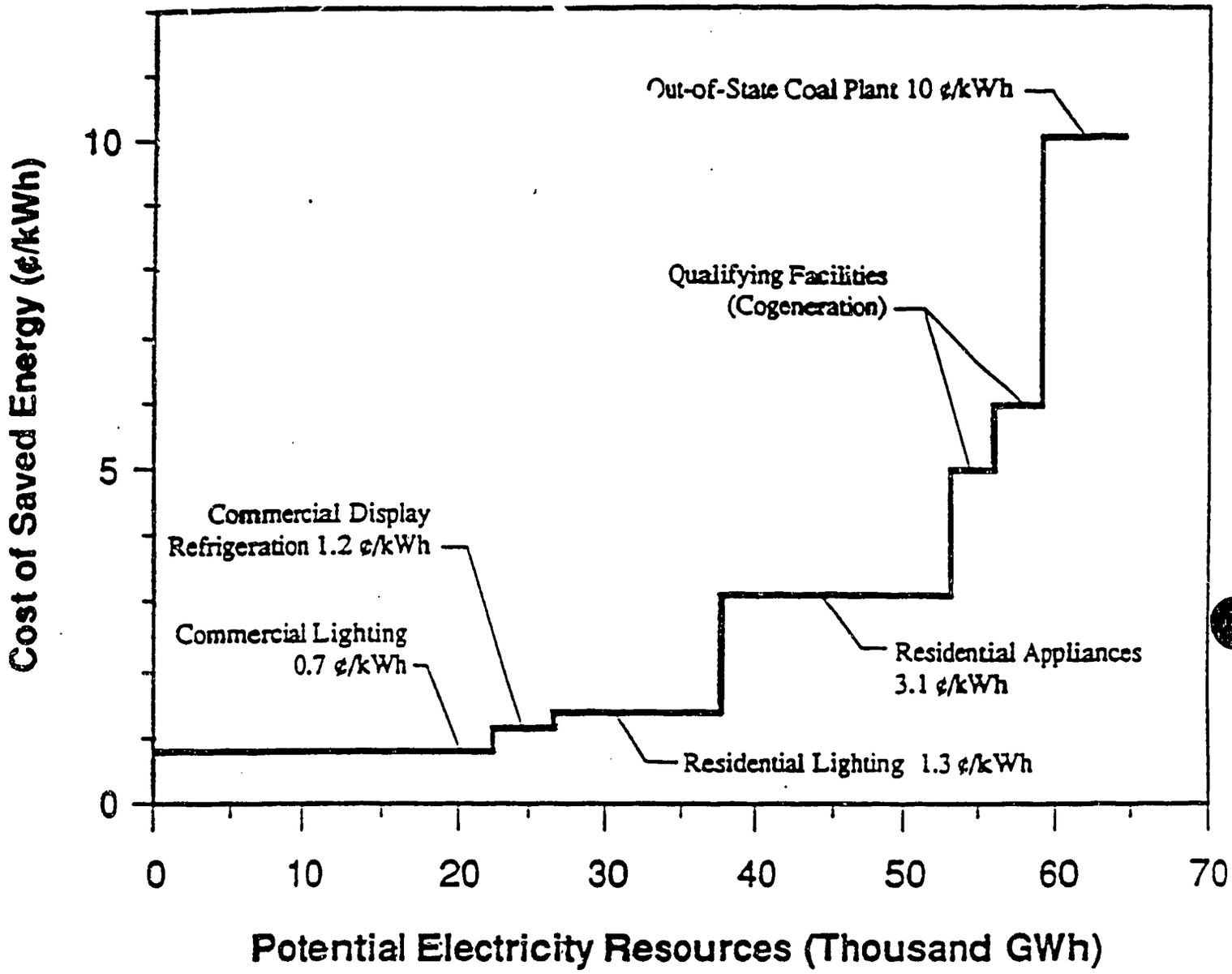
$$\text{cost of conserved energy} = \frac{\text{annual investment (\$ per year)}}{\text{annual energy saved (kWh per year)}}.$$

Since investment actually occurs just once, it must be annualized by multiplying it by the capital recovery factor,

$$\frac{d}{1-(1+d)^{-n}}$$

IV-2

Figure C-4

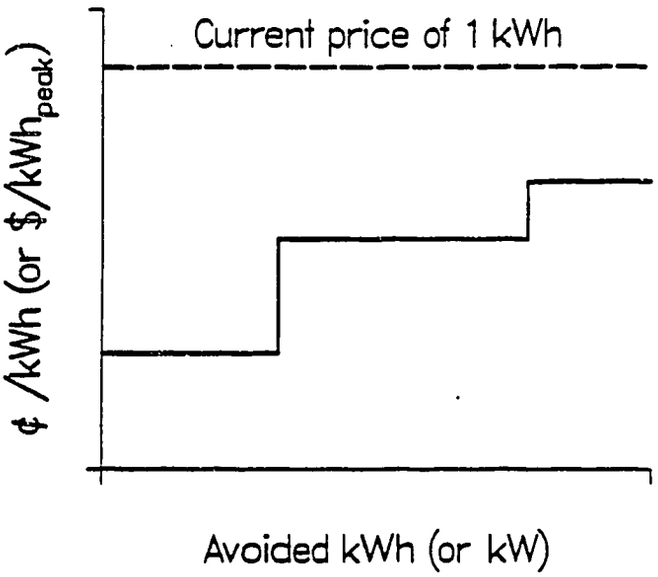


Least-Cost Supply Curve: Comparing Improved Electricity-Efficiency to Conventional Sources of Supply. The average costs and availability of energy savings for commercial lighting, commercial display refrigeration, residential lighting, and residential appliances are compared to hypothetical QF and out-of-state coal resources. No new supply options should be considered until all cost-effective efficiency options have been exhausted.

A. Technology Cost Data.
+ Prototype Simulations (DOE.2)
+ CPS.3 Ordering

⇓

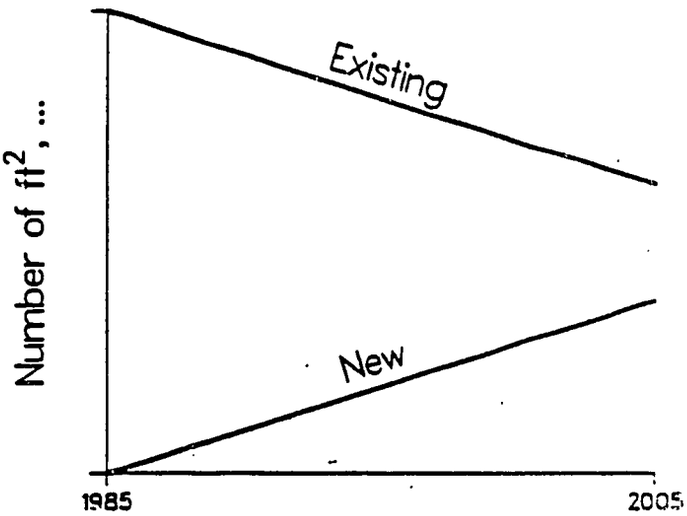
Micro–Supply Curves



B. Stocks and Flows of Buildings, Equipment, ...

⇓

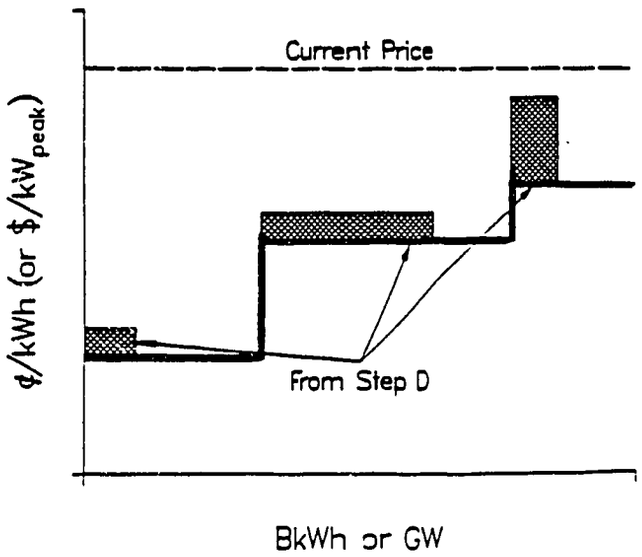
Base Case Forecast
and Data for Frozen Efficiency



C. Micro–Supply Curves
+ Stocks and Flows via CPS.3

⇓

Macro–Supply Curves



D. Program Experience Library

⇓

Customer Response Curves

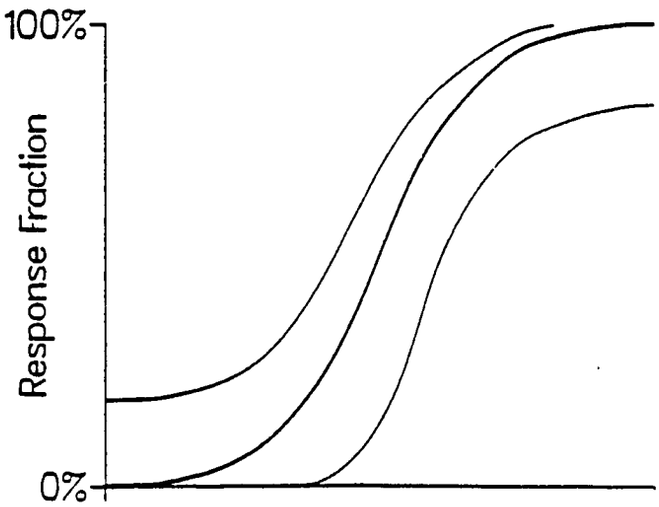
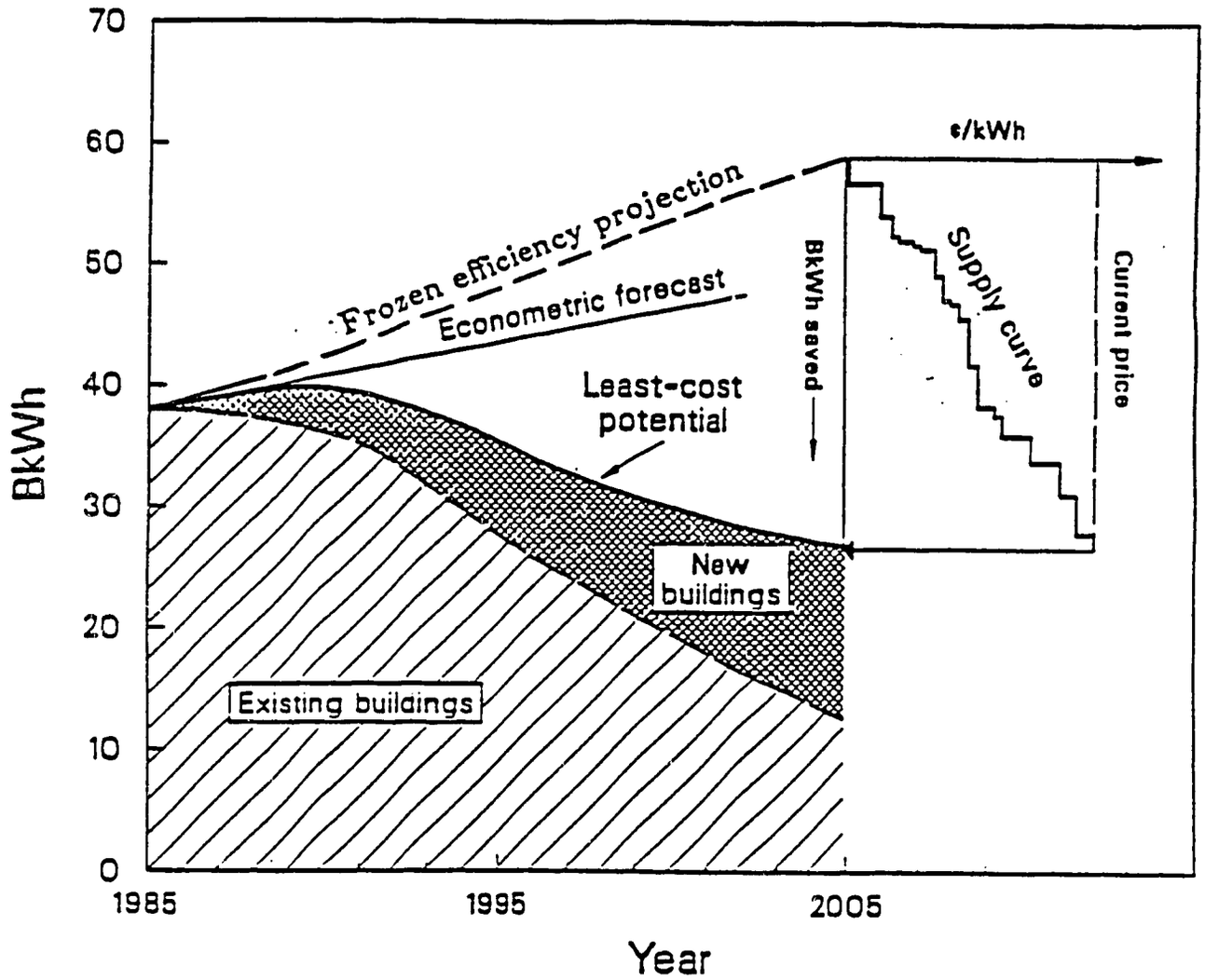


Fig. 10 Sample Relationship of Frozen Efficiency Projection, Econometric Forecasts, and Supply Curve, turned on its side and hung from the Data Case to yield Least-Cost Potential. The shape of the curve is from SERI Solar/Conservation Study, but magnitude is scaled to match 1985 Michigan BkWh use.



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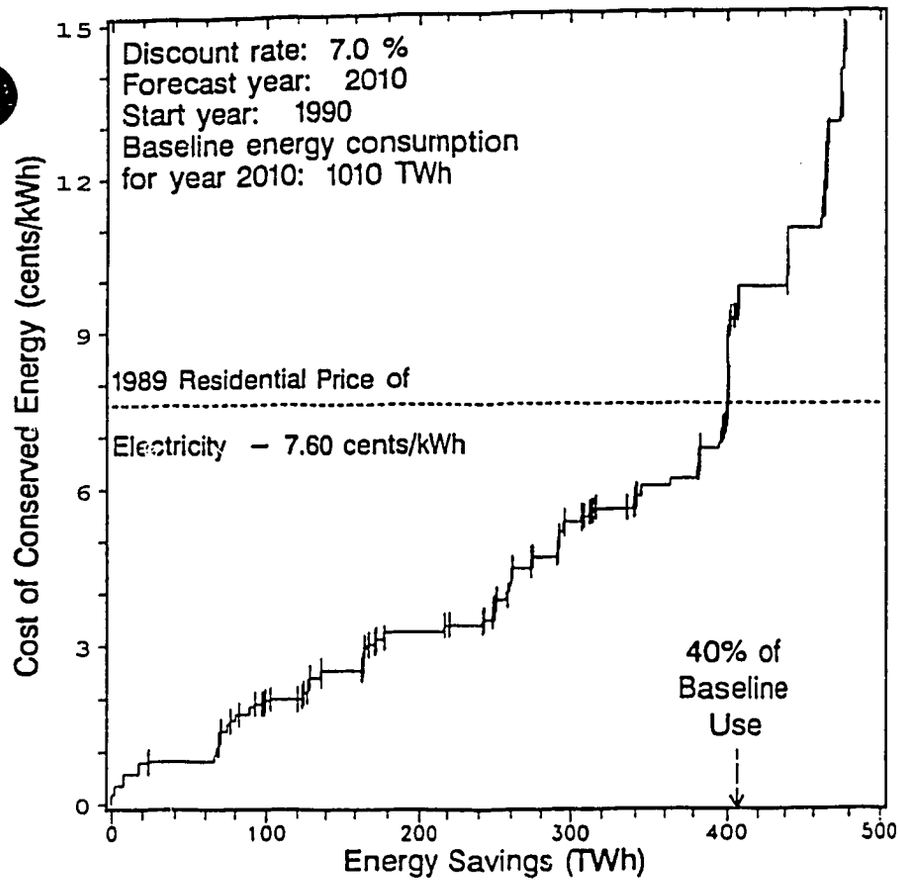


Figure 1. A supply curve of conserved electricity. Each step represents a conservation measure. Its height is the measure's CCE and its width is the estimated savings in the year 2010.

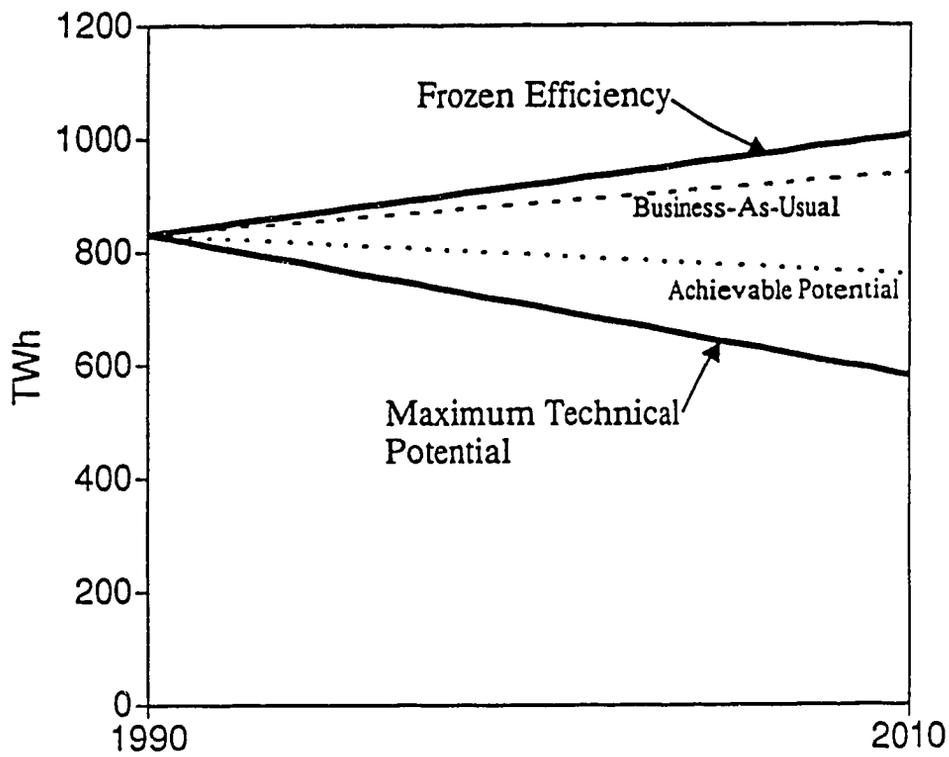


Figure 2. Electricity use over time for the baseline ("frozen efficiency") forecast, an LBL "business-as-usual" forecast, the achievable conservation potential, and the technical potential.

efine the total resource cost perspective formally, as follows:

$$B_{tr} = \sum_{i=1}^{N} \frac{\sum_{j=1}^{M} (\Delta E_{ij} * AC_{ij})}{(1 + DR_{tr})^{i}}$$

$$C_{tr} = \sum_{i=1}^{N} \frac{DC_i + PA_i}{(1 + DR_{tr})^{i}}$$

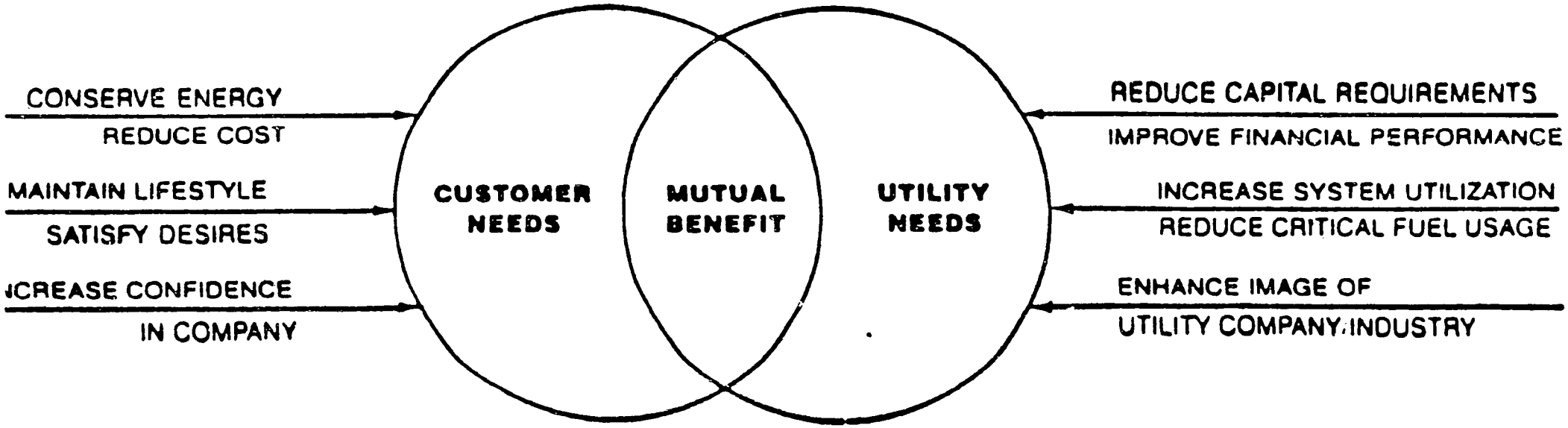
:

B_{tr}	= Total Resource benefit
C_{tr}	= Total Resource cost
ΔE_{ij}	= Change in energy use in year i for fuel j
AC_{ij}	= Avoided cost of energy in year i for fuel j
DC_i	= Direct costs of participation in year i
PA_i	= Program administrative costs in year i
DR_{tr}	= Utility discount rate, expressed as a decimal fraction
N	= number of years
M	= number of fuel types

iple, the total resource cost will also capture other less readily quantifiable benefits a

IRP/DSM Utility Benefits

- Lowest Total Cost of Production
- Lowest Long Run Tariffs
- Reduces Customers Bills
- Increases Disposable Income
- Reduces Demand Uncertainty
- Reduces Risk of Over-/Underbuilding
- Reduces Environmental Impact
- Reduces Social Conflict
- Creates Efficiency Industry



Schematic showing potential benefits, to both utilities and their customers, of demand-side management programs.[1] Such programs offer new and important opportunities on the customer side of the meter for many electric utilities.

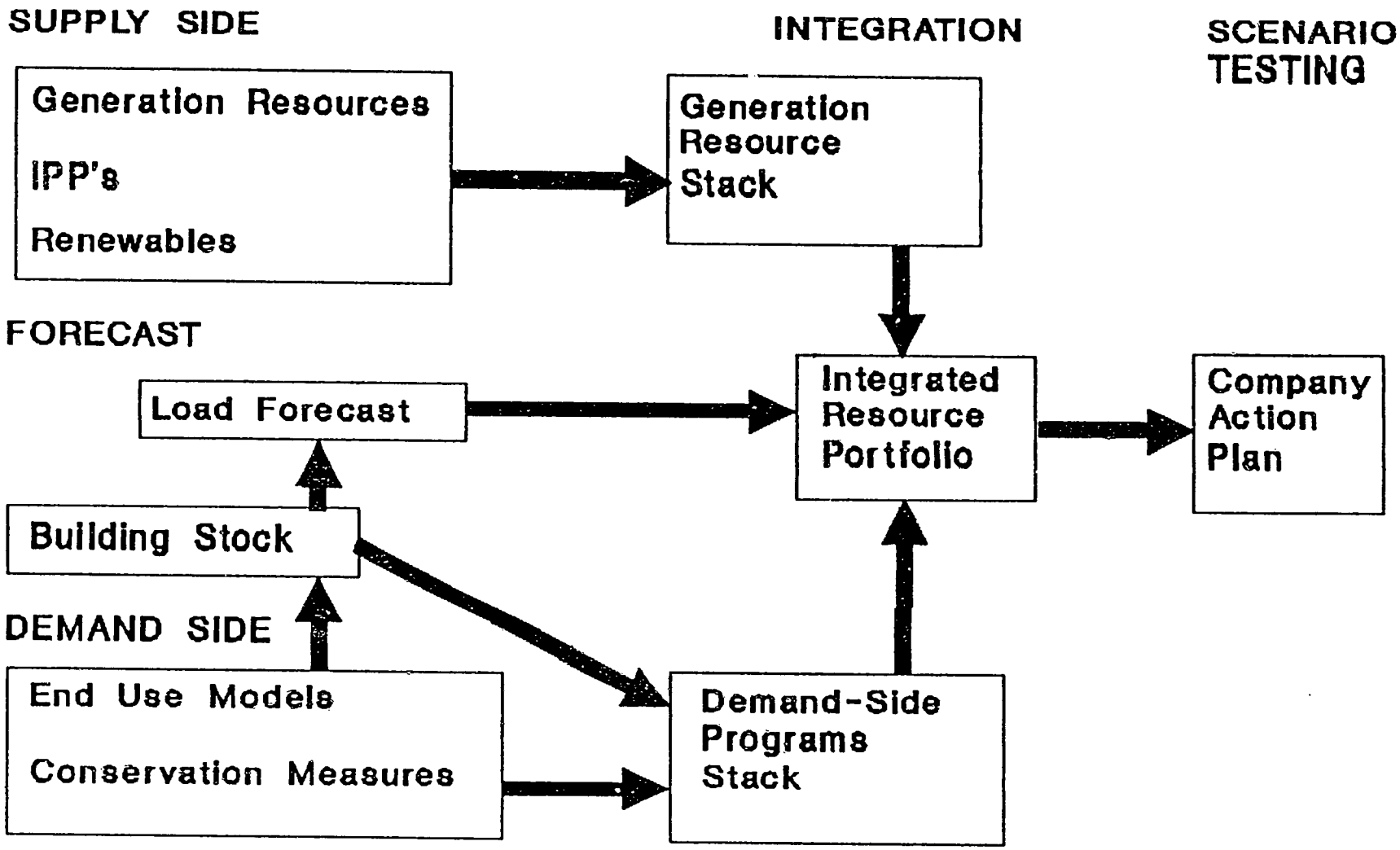


Figure 1. Least Cost Planning Process

Table 1. Planning uncertainties associated with external factors

Inflation and interest rates	Little effect on either demand or supply projects that are completed in a few years; possible large increases in construction costs for facilities that take many years to complete.
Fossil-fuel prices	Fuel-price increases raise the value of demand-side programs and of generating facilities that use fuels other than those whose prices increase; raise operating costs for plants that use the particular fuel.
Economic and load growth rates	Higher economic and load growth increases the value of all resources because the need for power is greater; also increases need for additional resources. Higher growth also increases benefits from (saved energy provided by) demand-side management (DSM) programs aimed at new buildings.
Amount and cost of purchased power	Greater supplies and lower costs of power from other sources reduce the value of and need for company-owned resources (both demand and supply).
Regulatory policies	Environmental regulations increase the cost of electricity generation or reduce the availability of certain fuels (e.g., restrictions on coal use because of concern about acid rain and global warming); problems with radon could increase the cost of conservation programs. Economic regulations could affect the financial incentives to utilities to acquire different types of resources. Regulations could affect the degree of competition among suppliers for electricity production and transmission.

Source: Hirst and Schweitzer 1988.

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AN ELECTRICITY-SAVING SUCCESS STORY

Of ~141 GW of U.S. electrical savings achieved during 1973-83, EPRI ascribes 13 GW to demand-side management programs and 128 GW to "composite price effect," though in practice the two are very hard to distinguish. (An additional 100-GW load reduction from lower-than-expected economic growth has been factored out.) Yet the actual potential saving is enormously larger. An existence proof, not even using the latest techniques:

When Southern California Edison Co.'s peak load was ~14 GW in the mid-1980s, SCE was reducing its long-term (10-y) forecast peak load by nearly 1.2 GW/y -- ~45% through its own programs, costing 0.3¢/kW-h for efficiency and \$30-odd/kW_p for load management, and ~55% through state programs, mainly building and appliance standards, which cost the utility nothing. Absent this state action, SCE could have achieved similar results at program costs of about zero to ~0.6¢/kW-h.

If <u>all</u> Americans saved electricity at the <u>same speed and cost</u> at which the ~10 million people served by Southern California Edison Company actually <u>did</u> save electricity during 1983-85, then national forecast needs for long-run power supplies would decrease by ~40 GW <u>per year</u>. The total program cost for utilities to achieve those savings would then average ~0.1-0.2¢/kW-h -- about <u>one percent</u> of the cost of new power stations.

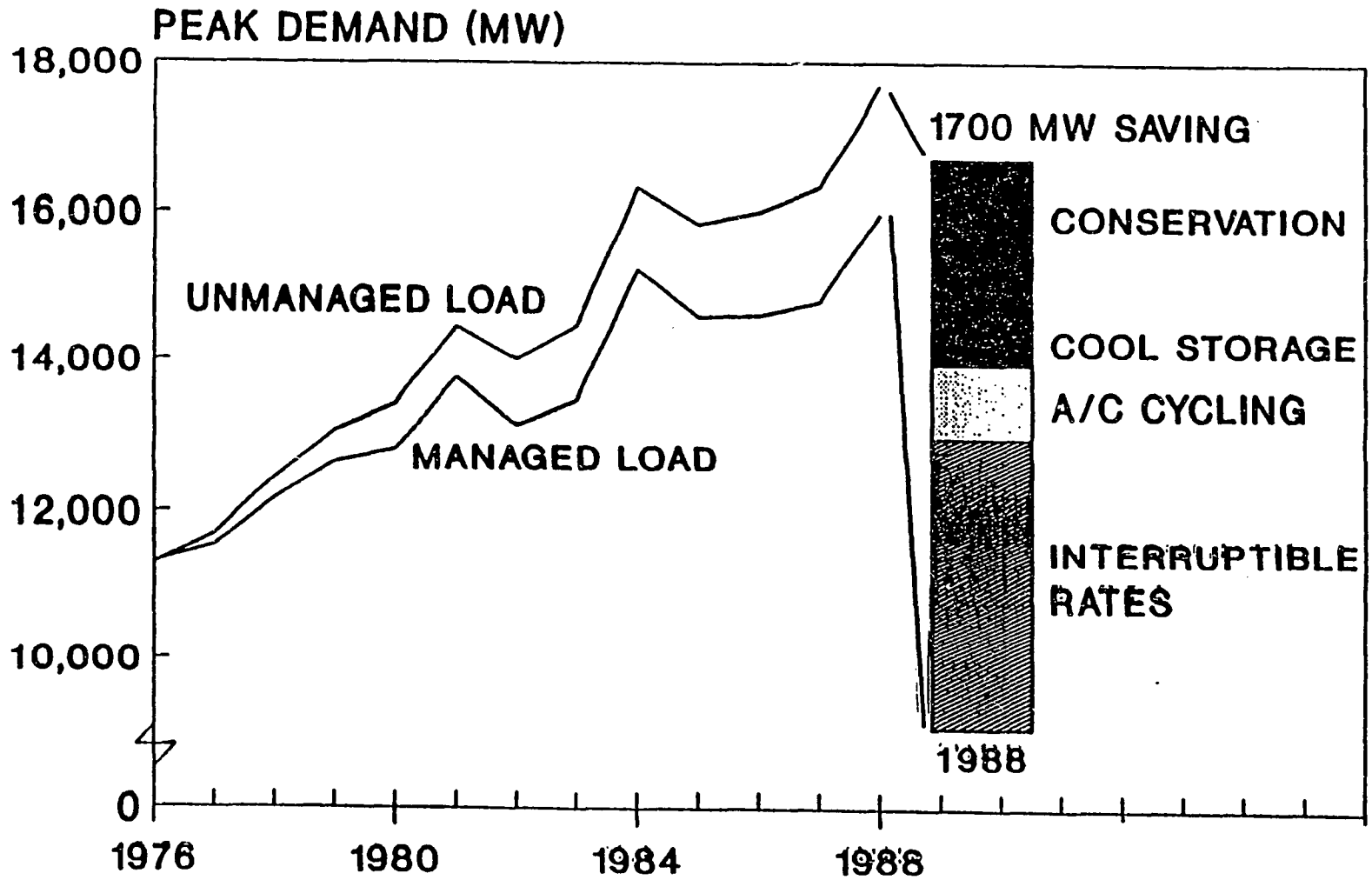


Fig. 2. Electricity savings achieved by Southern California Edison (1989) because of the DSM programs.

ENERGY EFFICIENCY FOR ECONOMIC DEVELOPMENT

A nine-year weatherization program by Osage Municipal Utilities, Osage, Iowa (pop. ~4,000) reduced the utility's costs so much more than its revenues that it was simultaneously able to:

- prepay all its debt,
- build up a multi-million-dollar cash surplus,
- have five rate cuts, totalling 32% real, in five years,
- thereby attract two big factories to town, and
- keep >$1,000 per household per year recirculating in the local economy -- money that had earlier gone out of town, and usually out of state, to buy utility inputs -- and thereby create what a Wall Street Journal reporter found was an oasis of relative prosperity amid regional hard times.

Percentage of Gross Revenues Spent to Save Electricity by Selected U.S. Utilities

	1990	1991	1992	1993
New England El. System	3.8%	>5%	~6%	~7%
Central Maine Pwr. Co.	~7%			
Burlington El. Dept.	~7%	rising		
Ctrl. Vermont Pbl. Srv.	~5-7%			~14%
Bonneville Pwr. Admn.*	4.1%	5.8%	~7%	8%
Pacific Gas & El. Co.**	2%	>2%	more...	

**Bonneville, a large (mainly hydro-based) Federal wholesale utility operating under strict least-cost investment criteria, has allocated 83% of its 1992-93 resource acquisition budget to end-use efficiency and only 8% to new supply. Its expanding understanding of demand-side opportunities continues to push off supply expansions into the indefinite future, always beyond the horizon of the resource plan.*

***PG&E, the largest U.S. investor-owned utility (with a large hydro/geothermal resource base), expects to get 2.5 GW, or at least 75%, of its projected 1990-2000 marginal resource needs from demand-side options, and all the rest from private, alternative, renewables-plus-advanced-gas-cycle supplies. For the first time in four decades, PG&E has not a single central thermal plant in its resource plan.*

RESIDENTIAL ENERGY USE IN CALIFORNIA, 1987

Residential Electrical Use

End Use	Sector and Fuel Type	End Use Energy (GWH)	End Use Energy (Quads)	Primary Energy (Quads)	Percer of Tot: Energ Us
Miscellaneous	*RE*	16819.8	0.0574	0.1483	2.2
Refrigeration: Res	*RE*	12489.1	0.0426	0.1101	1.6
Space Heating	*RE*	4670.2	0.0159	0.0412	0.6
Clothes Dryer	*RE*	4198.2	0.0143	0.0370	0.5
Central A/C	*RE*	3375.1	0.0115	0.0298	0.4
Color TV	*RE*	2950.2	0.0101	0.0260	0.4
Cooking	*RE*	2745.4	0.0094	0.0242	0.4
Freezer	*RE*	2405.8	0.0082	0.0212	0.3
Pool (Pump)	*RE*	2082.3	0.0071	0.0184	0.3
Water Heating (Basic)	*RE*	1967.6	0.0067	0.0173	0.3
Water Bed	*RE*	1728.0	0.0059	0.0152	0.2
Dish Washer Motor	*RE*	1463.9	0.0050	0.0129	0.2
Furnace Fan	*RE*	997.8	0.0034	0.0088	0.1
Hot Water Clthwash	*RE*	807.7	0.0028	0.0071	0.1
Roon A/C	*RE*	576.7	0.0020	0.0051	0.1
Cloth Washer Motor	*RE*	569.6	0.0019	0.0050	0.1
Pool (Solar)	*RE*	536.4	0.0018	0.0047	0.1
Htwatr Dishwash	*RE*	488.6	0.0017	0.0043	0.1
Evap A/C	*RE*	370.6	0.0013	0.0033	0.0
Solr Water Heater Pmp	*RE*	94.8	0.0003	0.0008	0.0
Solar Water Heating	*RE*	27.2	0.0001	0.0002	0.0
Residential Electrical Use		**61365**	**0.2094**	**0.5409**	**7.8%**

Electrical Generation and T&D Losses (QUADS) **0.3315**

As a percentage of:

Residential electrical energy use:	61.3%
Residential energy use:	27.6%
Statewide energy use:	4.8%

INDUSTRIAL ENERGY USE IN CALIFORNIA, 1987

Industrial Electrical Use

End Use	Sector and Fuel Type	End Use Energy (GWH)	End Use Energy (Quads)	Primary Energy (Quads)	Percent of Total Energy Use
Agric & H20 Pumping	*BLELEC4CAST*	16231.0	0.0554	0.1431	2.1%
Process Industries	*BLELEC4CAST*	13741.0	0.0469	0.1211	1.8%
Motors	*ASSINDELECT*	10019.0	0.0342	0.0883	1.3%
Trans.,Comm.,& Util	*BLELEC4CAST*	9844.0	0.0336	0.0868	1.3%
Air Cond & Vent	*ASSINDELECT*	7446.2	0.0254	0.0656	1.0%
Other Industries	*BLELEC4CAST*	6731.0	0.0230	0.0593	0.9%
Lighting	*ASSINDELECT*	4667.3	0.0159	0.0411	0.6%
Process Heat-Elect	*ASSINDELECT*	3395.6	0.0116	0.0299	0.4%
Pollution Cntrl	*ASSINDELECT*	2040.6	0.0070	0.0180	0.3%
Street Lighting	*BLELEC4CAST*	1382.0	0.0047	0.0122	0.2%
Unclass. Industries	*BLELEC4CAST*	1214.0	0.0041	0.0107	0.2%
Refrigeration	*ASSINDELECT*	946.4	0.0032	0.0083	0.1%
Process Electric	*ASSINDELECT*	363.0	0.0012	0.0032	0.0%
Miscellaneous	*ASSINDELECT*	109.9	0.0004	0.0010	0.0%
Industrial Electrical Use		**78131.0**	**0.2666**	**0.6886**	**10.0%**

Electrical Generation and T&D Losses (QUADS) **0.4220**

As a percentage of:

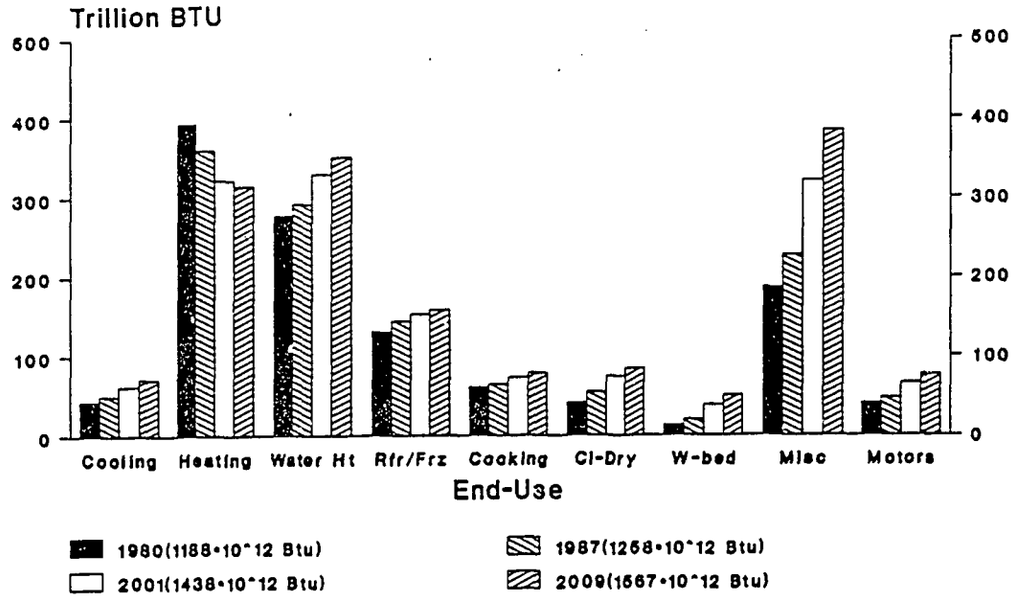
Industrial electrical energy use:	**61.3%**
Industrial energy use:	**20.4%**
Statewide energy use:	**6.1%**

Industrial Natural Gas Use

End Use	Sector and Fuel Type	End Use Energy (Quads)	Primary Energy (Quads)	Percent of Total Energy Use
Process Industries	*BLGAS4CAST*	0.1932	0.2029	2.9%
Mining & Extraction	*BLGAS4CAST*	0.1319	0.1385	2.0%
Process Heat-Gas	*ASSINDGAS*	0.1294	0.1359	2.0%
Space Heating-Gas	*ASSINDGAS*	0.0330	0.0347	0.5%
Trans,Comm, & Util	*BLGAS4CAST*	0.0206	0.0217	0.3%
Agric & H20 Pumping	*BLGAS4CAST*	0.0113	0.0118	0.2%
Unclass. Industries	*BLGAS4CAST*	0.0046	0.0048	0.1%
Pollution Cntrl Gas	*ASSINDGAS*	0.0040	0.0042	0.1%
Industrial Natural Gas Use		0.5280	0.5544	8.0%

FIGURE 4-7

STATEWIDE PRIMARY RESIDENTIAL ENERGY USE

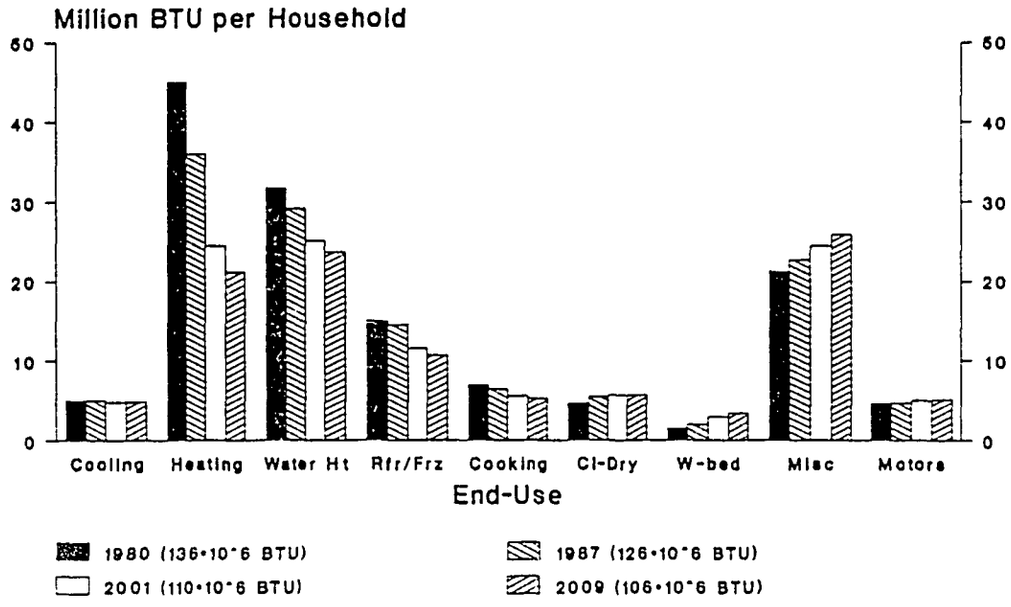


The numbers in parentheses are the combined electricity and natural gas use for each forecast year

Source: *"California Energy Demand, 1989-2009," California Energy Commission.*

FIGURE 4-8

STATEWIDE PRIMARY ENERGY USE PER HOUSEHOLD



The numbers in parentheses are the combined electricity and natural gas use per household

Source: *"California Energy Demand, 1989-2009," California Energy Commission.*

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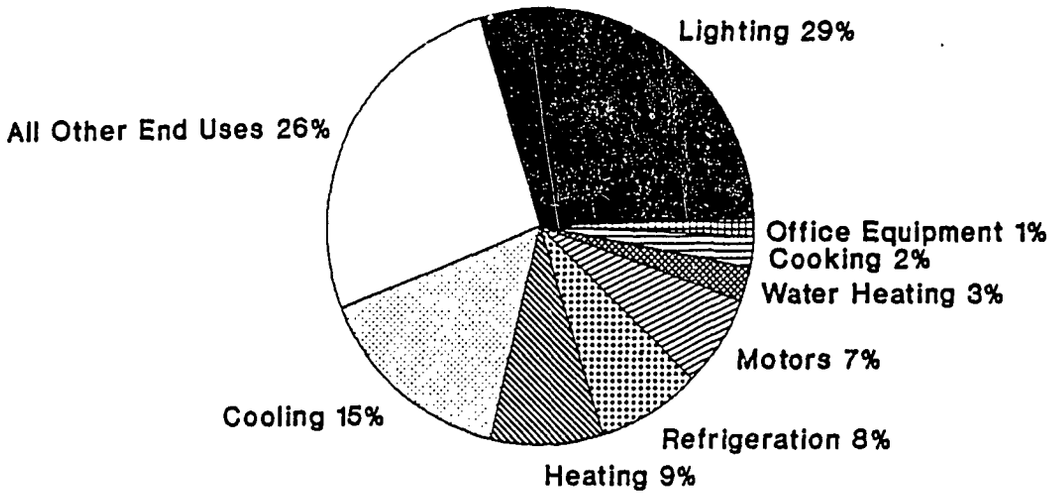
FIGURE 5-1

LARGEST COMMERCIAL ENERGY END USES IN CALIFORNIA: 1987

Total commercial energy: 0.8 quads

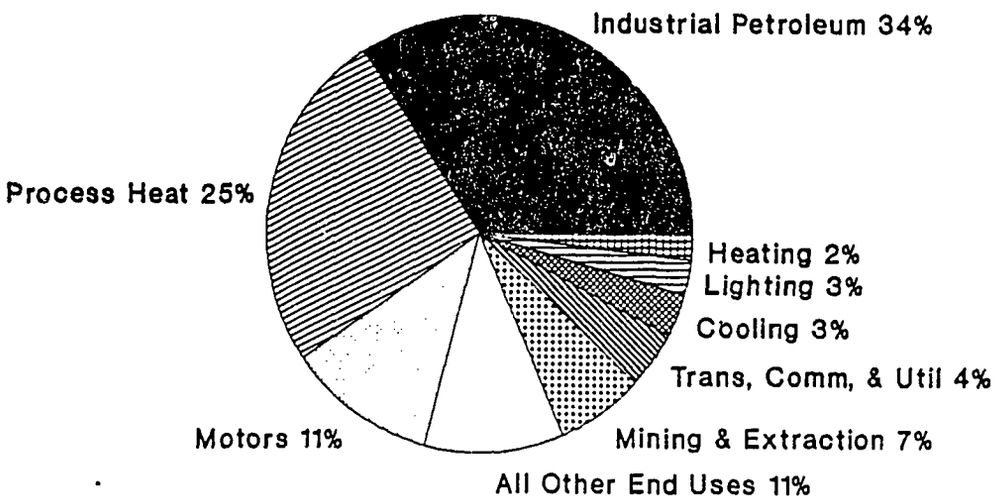


Source: 1989 Fuels Report, California Energy Commission; California Energy Demand, 1989-2009, California Energy Commission. See also Appendix A-4.

FIGURE 5-2

LARGEST INDUSTRIAL ENERGY END USES IN CALIFORNIA: 1987

Total industrial energy: 2.1 quads



Source: 1989 Fuels Report, California Energy Commission; California Energy Demand, 1989-2009, California Energy Commission. See also Appendix A-4.

ıb[illegible]0. DSM program categories defined by the California Public Utilities Commission (1989)

ɔNSERVATION	LOAD MANAGEMENT
ɜsidential	Residential
Information programs	Air-conditioner cycling
Energy management services	Time-of-use rates
Weatherization retrofit incentives	Pool pump timer
New construction	Other
Appliance efficiency incentives	Nonresidential
Direct assistance	Air-conditioner cycling
Master meter	Interruptible rates
Other	Time-of-use rates
onresidential	Thermal energy storage
Information programs	Other
Energy management services	
Commercial[a]	FUEL SUBSTITUTION
Industrial[a]	Residential
Agricultural	Nonresidential
E[illegible]gy management incentives	
Commercial[a]	LOAD BUILDING (and RETENTION)
Industrial[a]	Residential
Agricultural	Nonresidential
New construction	
Street Lighting	MEASUREMENT AND EVALUATION
Other	Load metering
ystem efficiency	Customer surveys
Conservation voltage reduction	New-technology assessments
Other	Program evaluation
	Other

[a]These classes are split further into large and medium/small.

IMPLEMENTING NEGAWATTS

OLD METHODS: finance or market negawatts

- Public information (exhortation and education)
- Targeted technical information (builders, designers)
- Low- or no-interest loans (usually for weatherization)
- Gifts ("full financing"--cheaper than loans)
- Rebates (targeted, or generic for <u>any</u> kW_p or kW-h)
  - To buyer, seller, other trade allies, combinations
  - Coupled with scrappage of old devices
  - For beating minimum equipment standards
- Equipment leasing (20¢/lamp-month...)
- Third-party investors and utility service companies

NEW METHODS: make a market in negawatts

- Competitive bidding processes
  - Industrial modernization grants
  - Generalized ("all-source") auctions
- Fungible savings (with transmission credit?)
  - Wheeling between customers, utilities, & nations
  - Arbitrage between cost of megawatts & negawatts
- Negawatt/megawatt spot, futures, & options markets
- Peak-load covenants traded in secondary markets
- Efficiency cross-marketing
  - By electric utilities
  - By gas utilities
- Performance-linked hookup fees for new buildings
- Targeted mass retrofits, esp. of commercial lighting

plus sales/profits decoupling, exemplary rewards,
and predictable cost recovery to utility
plus quality control, tariff reform, barrier removal,....

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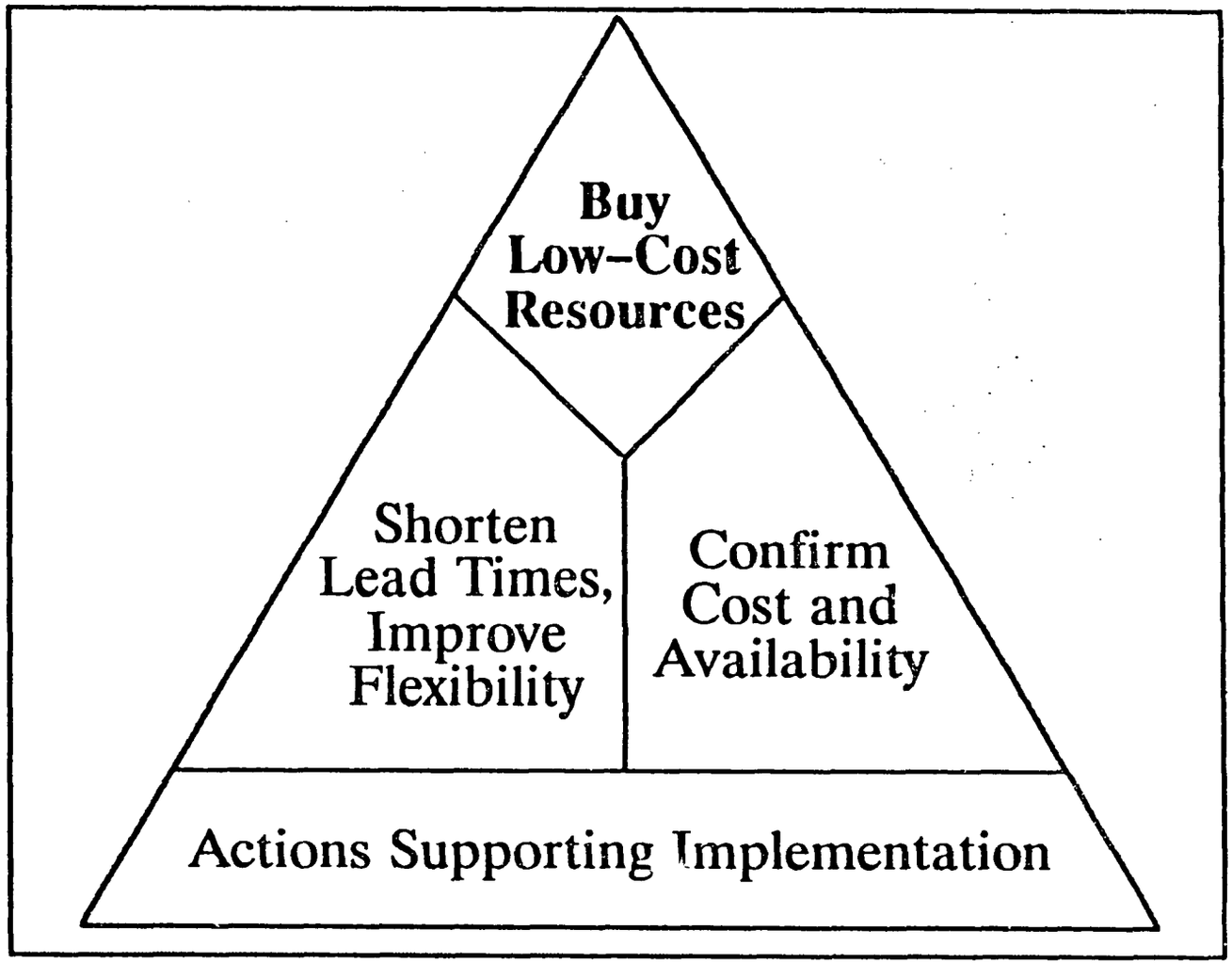
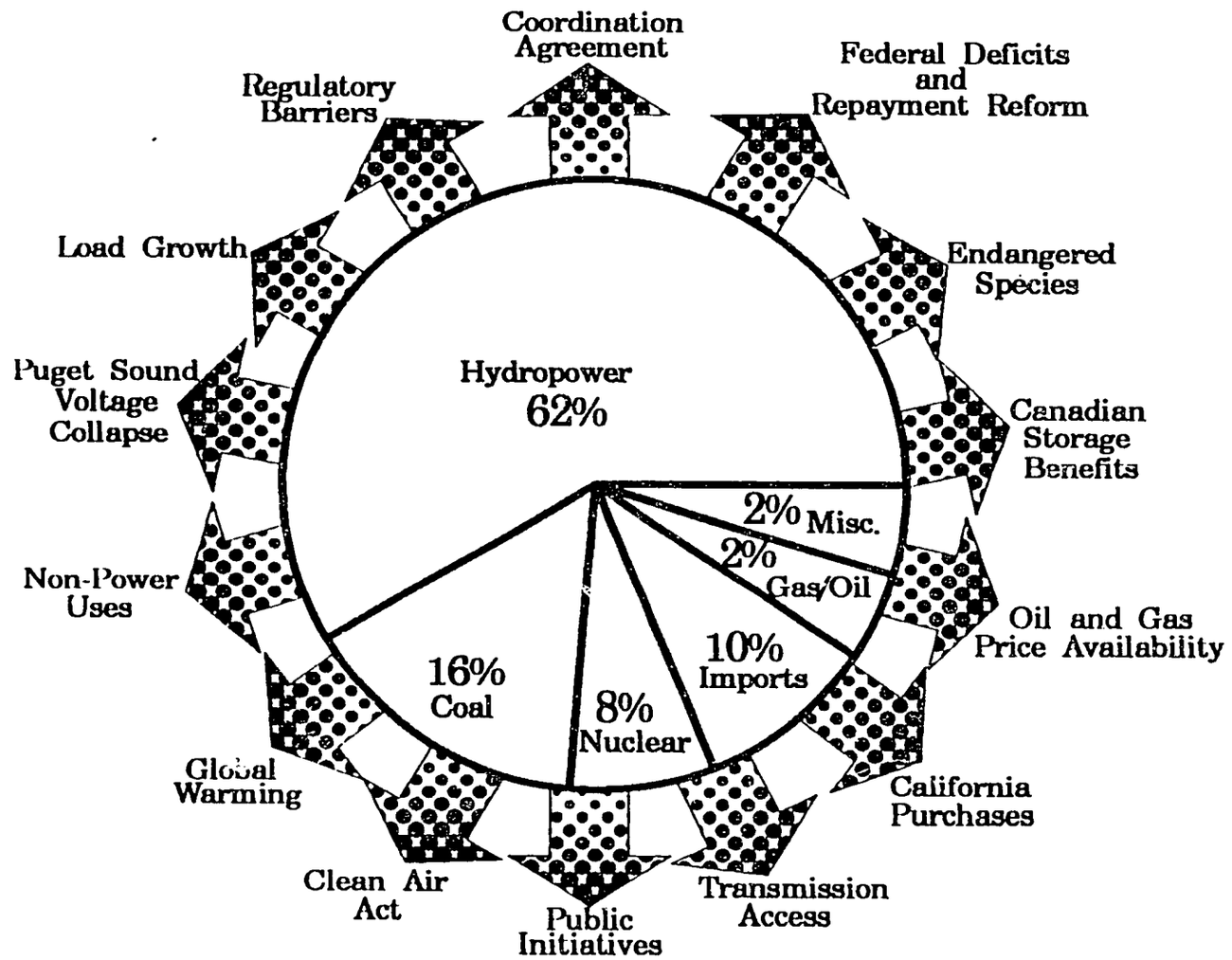
Action Plan

Figure 1
Four Objectives



System
Under Stress

gure 3
ıe Pacific Northwest
ıwer System Must
ıpe with Many
ıallenges



High Scenario

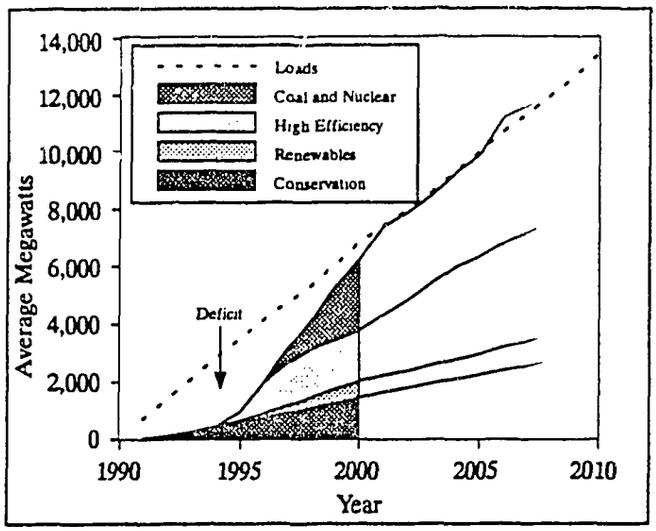


Figure 7
Large Deficits in the 1990s

2,300 megawatts, if made up at 4 cents per kilowatt-hour, would cost the region more than $800 million. If power isn't available from outside the region, because everyone else also is attempting to buy it, power curtailments would be likely. The first to suffer would be the aluminum industry, because part of its power is interruptible. But other consumers also could be cut off.

2. Medium-High Scenario: Growth Moderates

Under this scenario, much of the growth described above takes place, but not at such a frenetic pace. Lumber and plywood production falls from current levels, but by the end of the decade, the industry is again on an upswing.

The economy is still very healthy. Several Northwest cities continue to turn up in the list of most liveable places, drawing people from less attractive regions. The Northwest's physical beauty continues to make the region a mecca for tourists. New convention facilities—with their promise of side trips to mountains, sea and rivers—bring in big-ticket conferences.

Overall, employment is increasing 40 percent faster than the national average, and high-technology and commercial industries also are growing fast. Non-manufacturing employment increases nearly 60 percent.

At this economic pace, electric loads are increasing at a rate of 1.6 percent or about 350 megawatts per year.

This is sufficient growth to mean a power deficit until 1998, with a maximum deficit of more than 800 megawatts in 1995. Efficiency improvements supply 1,350 megawatts in the next decade; renewables contribute 500; high-efficiency resources kick in 1,000 megawatts; and conventional thermal resources provide 1,100 megawatts. (See Figure 8.)

3. Medium-Low Scenario: Economy Slows

In the medium-low growth scenario, the nation and the region experience a recession in the early 1990s. The region recovers slowly, and employment growth falls slightly behind the national rate. Migration into the region drops off. Population growth now is due almost entirely to the resident birth rate, which still exceeds the death rate.

Economies in the nation's "sunbelt" pick up, and industrial investment is drawn away from a lethargic Northwest. Aluminum plants run at two-thirds of their capacity as world prices for the product weaken. Employment in

Medium-High Scenario

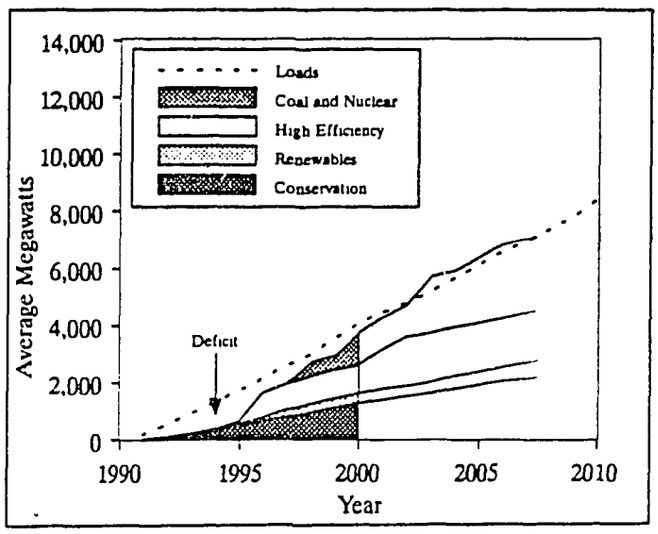


Figure 8
Smaller Deficits in the 1990s

the lumber and wood products industries drops off by 30 percent.

Even with this slowed economy, the region still needs new resources by the end of the decade. Conservation will take care of the bulk of this need, with 960 megawatts acquired by 2000, and the region develops an additional 300 megawatts of renewables and 60 megawatts of cogeneration during the 1990s. (See Figure 9.)

4. Low Scenario: Recession Deepens

The recession, which has spread across the country, settles deeply in the Northwest, and the region never fully recovers. The Cold War was won, and defense budgets are cut. Boeing's contracts for new planes evaporate. There are massive layoffs in the aerospace industry, with employment dropping by 30 percent. That is still better than the lumber and wood products industry, which sees a 40–percent drop.

The aluminum industry is at a quarter of its operating capacity, and there is serious talk of closing Northwest plants.

Even with a solid service industry, the ripple effects of a sinking economy are strong, and regional unemployment increases. With jobs scarce, the Northwest begins to lose population; people look to the South and East for better opportunities.

In this case, conservation more than accommodates the region's needs through the end of the decade. (See Figure 10.)

Medium-Low Scenario

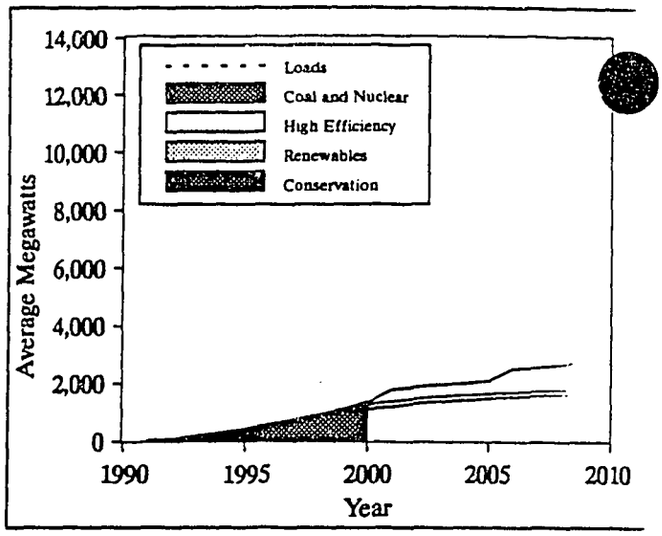


Figure 9 Conservation Meets Most Needs in the 1990s

Resource Scenarios

The challenge for power planners is that they don't get to pick any of these scenarios; any one (or, most likely, some other) could happen. Furthermore, the economic scenarios are only one part of the equation. There are other scenarios as well. In a very real sense, the uncertainties that have the most impact are likely to be the ones we know the least about. By developing and testing a series of alternative *resource* scenarios, the Council was able to identify the most significant resource-related risks the region might face and compile the best resource mix to counteract these risks.

To do this, the Council shifted resources around, testing the power system's sensitivity to changes in any one of them. This was an opportunity to explore more fully the effects on the region of calling on different resources with different lead times, different costs and different envi-

Low Scenario

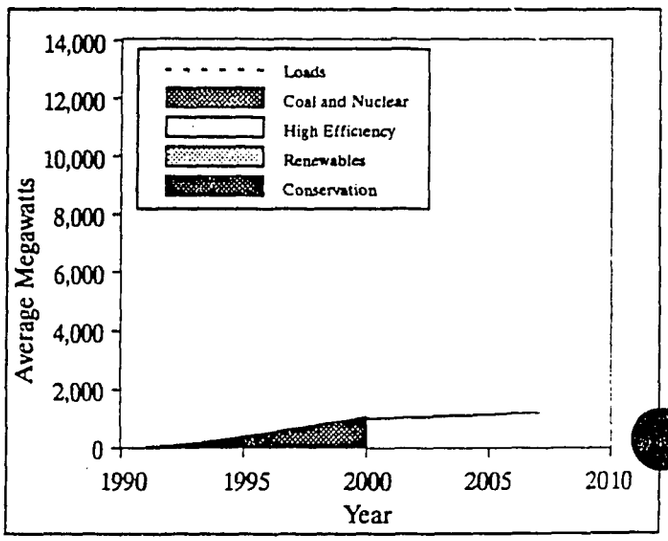
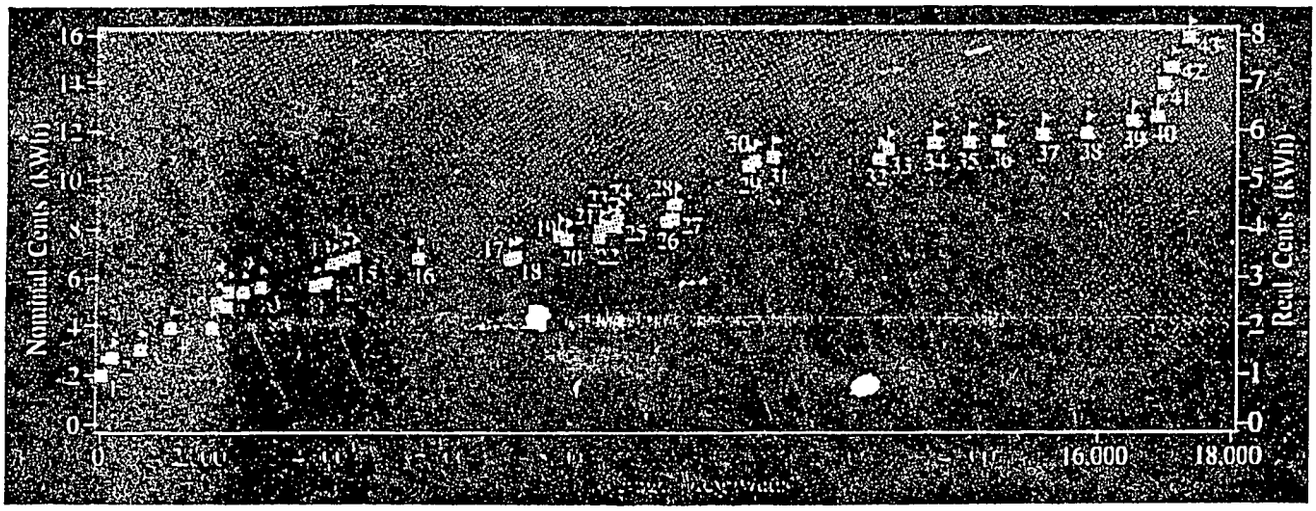


Figure 10 Conservation Meets all Needs

Resource Supply

Figure 5
How Much at What Cost?



	Available Resource	High Forecast Megawatts	Levelized Nominal Cost	Levelized Real Cost	Resource Category
1.	Conservation Voltage Regulation	100	1.4	0.7	Conservation
2.	Hydro Efficiency Improvements	110	2.2	1.1	Renewable
3.	Industrial 1	491	2.6	1.3	Conservation
4.	Water Heat	472	3.5	1.8	Conservation
5.	New Commercial Model Conservation Standards	647	3.7	1.9	Conservation
6.	Irrigation	43	4.6	2.3	Conservation
7.	Commercial Renovations and Remodel	144	4.6	2.3	Conservation
8.	Small Hydro 1	90	5.0	2.5	Renewable
9.	Transmission and Distribution Efficiency Improvements	200	5.1	2.6	Conservation
10.	Industrial 2	308	5.3	2.7	Conservation
11.	Existing Commercial	859	5.4	2.7	Conservation
12.	New Single-Family Residential Model Conservation Standards	213	5.6	2.8	Conservation
13.	Multifamily Residential Weatherization	57	6.3	3.2	Conservation
14.	Single-Family Residential Weatherization	124	6.4	3.2	Conservation
15.	New Manufactured Housing	131	6.5	3.3	Conservation
16.	Hydrofirming (Combined-Cycle 1)	1,070	6.6	3.3	High Efficiency
17.	Hydrofirming (Combined-Cycle 2)	1,430	6.6	3.3	High Efficiency
18.	New Multifamily Residential Model Conservation Standards	20	6.7	3.4	Conservation
19.	WNP-3	868	7.3	3.7	Thermal
20.	Thermal Plant Efficiency Improvements	56	7.4	3.7	High Efficiency
21.	Cogeneration 1 (Biomass Fueled)	480	7.5	3.8	Renewable
22.	Cogeneration 2	57	7.6	3.9	High Efficiency
23.	New Residential Lighting	63	7.9	4.0	Conservation
24.	Hot Water Heat Pumps	136	8.0	4.1	Conservation
25.	Municipal Solid Waste	30	8.1	4.1	Renewable
26.	WNP-1	818	8.1	4.1	Thermal
27.	Small Hydro 2	100	8.2	4.2	Renewable
28.	Existing Residential Lighting	26	8.8	4.5	Conservation
29.	Cogeneration 3	1,130	10.3	5.3	High Efficiency
30.	Wind 1	29	10.5	5.3	Renewable
31.	Geothermal	350	10.7	5.4	Renewable
32.	Eastern Montana Coal Gasification	1,704	10.7	5.5	Thermal
33.	Small Hydro 3	130	11.1	5.6	Renewable
34.	Eastern Washington Coal Gasification	745	11.3	5.7	Thermal
35.	Cogeneration 4	540	11.3	5.7	High Efficiency
36.	Expensive Conservation	412	11.4	5.8	Conservation
37.	Eastern Oregon Coal Gasification	745	11.5	5.8	Thermal
38.	Western Washington/Oregon Coal Gasification	750	11.7	5.9	Thermal
39.	Nevada Coal Gasification	716	12.2	6.2	Thermal
40.	Wind 2	376	12.3	6.3	Renewable
41.	Small Hydro 4	90	13.7	6.9	Renewable
42.	Biomass	90	14.5	7.4	Renewable
43.	Wind 3	253	15.7	8.0	Renewable
44.	Solar Thermal	480	16.0	8.0	Renewable
45.	Ocean Wave Power	N/A	16.0	8.0	Renewable
46.	Solar Photovoltaics	On-Site Applications	30.0	15.0	Renewable

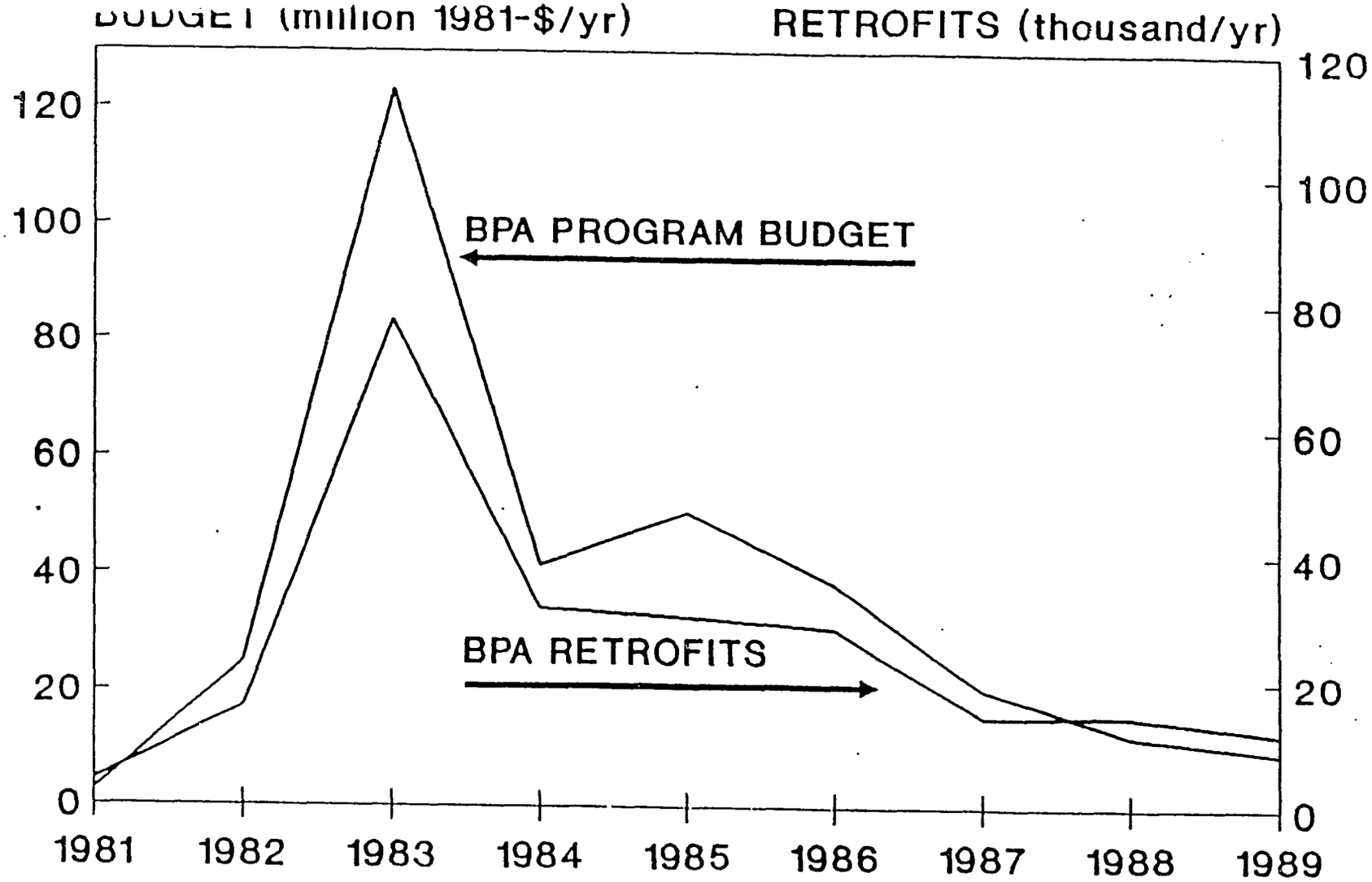


Fig. 2. Program participation depends on budgets. Participation in the Bonneville Power Administration's (BPA) residential retrofit program dropped sharply in 1984 when BPA cut its program budget.

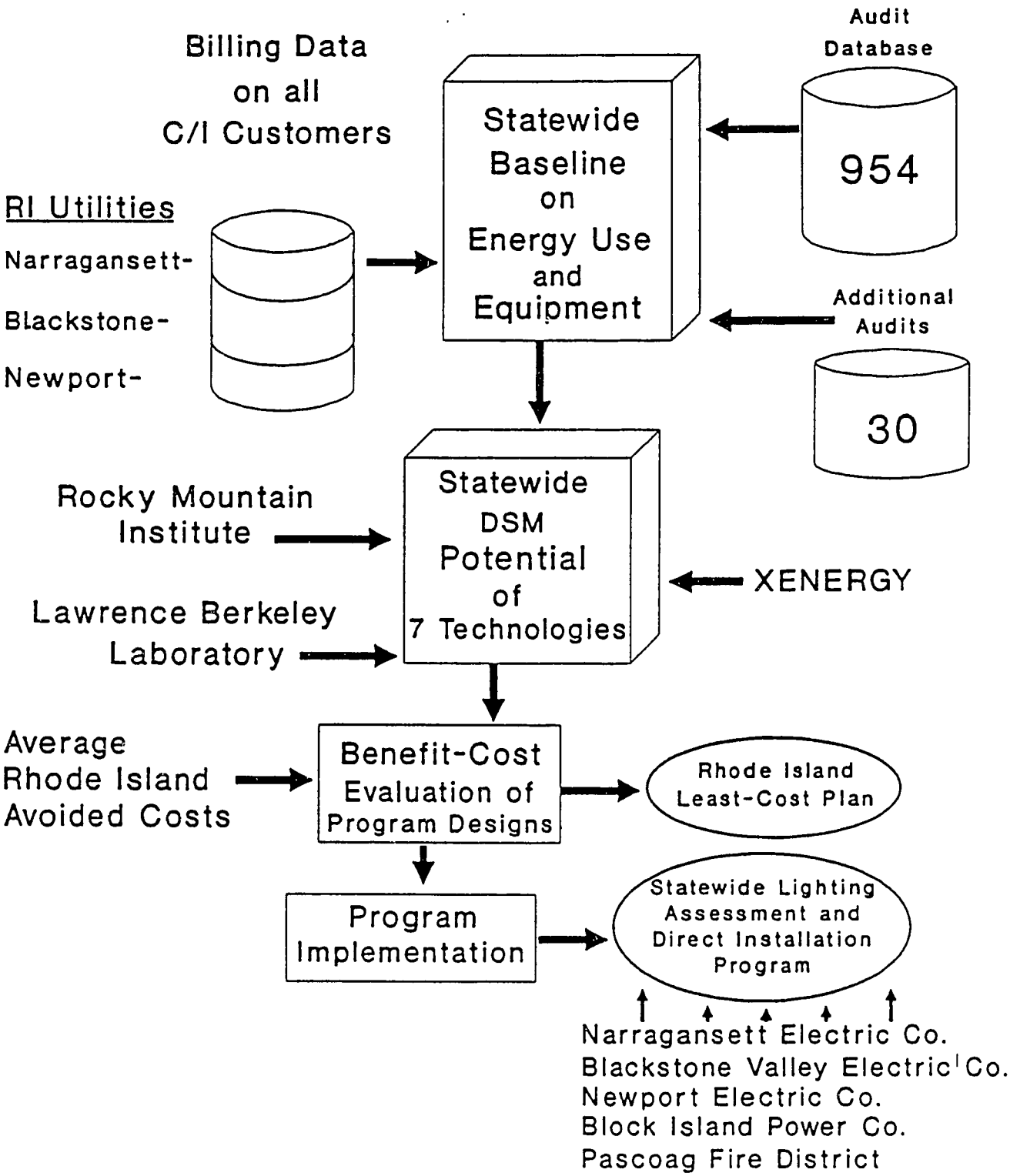


Fig. 4. Rhode Island DSM planning methodology.

Figure 1. Market Structure

		Demand	Supply
Upstream ↑	Production	Architects/Building Owners Appliance Manufacturers HVAC, Motor, Lighting Vendors	Power Generation Vendors Fuel Suppliers Lenders/Investors
↓	Distribution	Wholesale: Builders Dealers Trade Allies	Wholesale: Private Developer (QF or IPP)
Downstream		Retail: Utility DSM ESCO	
	Consumption	Ultimate Customer	Utility Buyer

Table 5. Planning uncertainties associated with demand and supply resources

Demand-side resources	Supply resources
Customer participation in programs, costs, and effectiveness of different marketing strategies	Construction time and cost
Customer adoption of recommended DSM actions	Regulatory approvals: Siting Environmental Need for power
Program performance (effects on load levels and load shapes): Durability Measurement Attribution	Operating costs: Fuel Operations and maintenance Additions and improvements
Public attitudes towards energy efficiency and utility DSM programs	Reliability: Forced outages Premature retirement
	Public attitudes towards facility

Source: Hirst and Schweitzer (1988).

These are real problems, and utilities are correct to be concerned about the performance of DSM programs. The way to deal with these uncertainties is to conduct extensive market and technical research

The incentive is set such that the present value of project costs and project benefits are equal.

Therefore:

$$I_{PV} = C_{PV} - S_{PV} \qquad (1)$$

where I_{PV} is the present value of the incentive payment, C_{PV} is the present value of the project costs, and S_{PV} is the present value of the energy savings.

The present value for project costs is calculated from initial costs (C_I) and operations and maintenance costs (C_O) as follows:

$$C_{PV} = C_I + (C_O)_{PV} \qquad (2)$$

For a rate of return (bid by the developers) of 25%, and a contract term of 7 years, Equation 2 becomes:

$$C_{PV} = C_I + \sum_{i=1}^{7}\left(\frac{C_O/(1+0.25)}{(1+0.25)^i}\right) \qquad (3)$$

or, since the present worth factor for a seven year income stream discounted at 25% is 3.16:

$$C_{PV} = C_I + (C_O \times 3.16)$$

Likewise, energy savings are calculated as:

$$S_{PV} = \sum_{i=1}^{7}\left(\frac{S_i}{(1+0.25)^i}\right) \qquad (4)$$

Using the above formulas, an example project incentive can be calculated. For a project with $100,000 initial cost, $2000 annual maintenance costs, and $20,000 of annual energy savings:

$$I_{PV} = \$100{,}000 + (\$2000 \times 3.16) - (\$20{,}000 \times 3.16)$$

$$= \$43{,}120$$

This incentive would be paid to the sponsor in equal amounts over the term of the contract (in this case, seven years), using an interest rate equal to the bid ROR (25% in this example). The annual incentive payment in this case, where the 25% capital recovery factor over seven years is .3163, is calculated as:

$$\$43{,}120 \times .3163 = \$13{,}641 \text{ per year}$$

Figure 1. Incentive Payment Calculation Methodology for BPA Purchase of Energy Savings Program

Table 3. Types of demand-side management programs

General information programs (e.g., mass media, bill stuffers, and direct mailings)
Onsite energy audits and technical assistance (e.g., home energy audits, design assistance from architects and engineers, and workshops)
Financial incentives (e.g., rebates, low-interest loans, and rate discounts)
Direct installation (e.g., water-heater wraps and low-flow showerheads)
Cooperation with trade allies (e.g., manufacturers and dealers, architects, engineers, builders, and community organizations)

DSM Program Characteristic	Essential Feature	Optional Feature
Bidding	Price set by auction.	Payment may be for delivered kW or kWh, for completed measur
erformance-Based	Payment only for measured, delivered kW or kWh.	Price may be set by auction, or by other methods.

Figure 4. Alternative Delivery Mechanisms for Utility DSM Programs

Utility Provided ←	Who Provides Services	→ Third-Party Provided
In-House Utility DSM Program	3rd Party Role in Utility DSM program	Performance Contracting
	• Turn-key Time & Materials • Fixed Price Utility-specified Turnkey DSM Program	DSM Bidding • Franchised Solicitations • "Open" Solicitations

Adapted from EPRI, "Utility Demand-Side Competitive Procurements Methods," 1991.

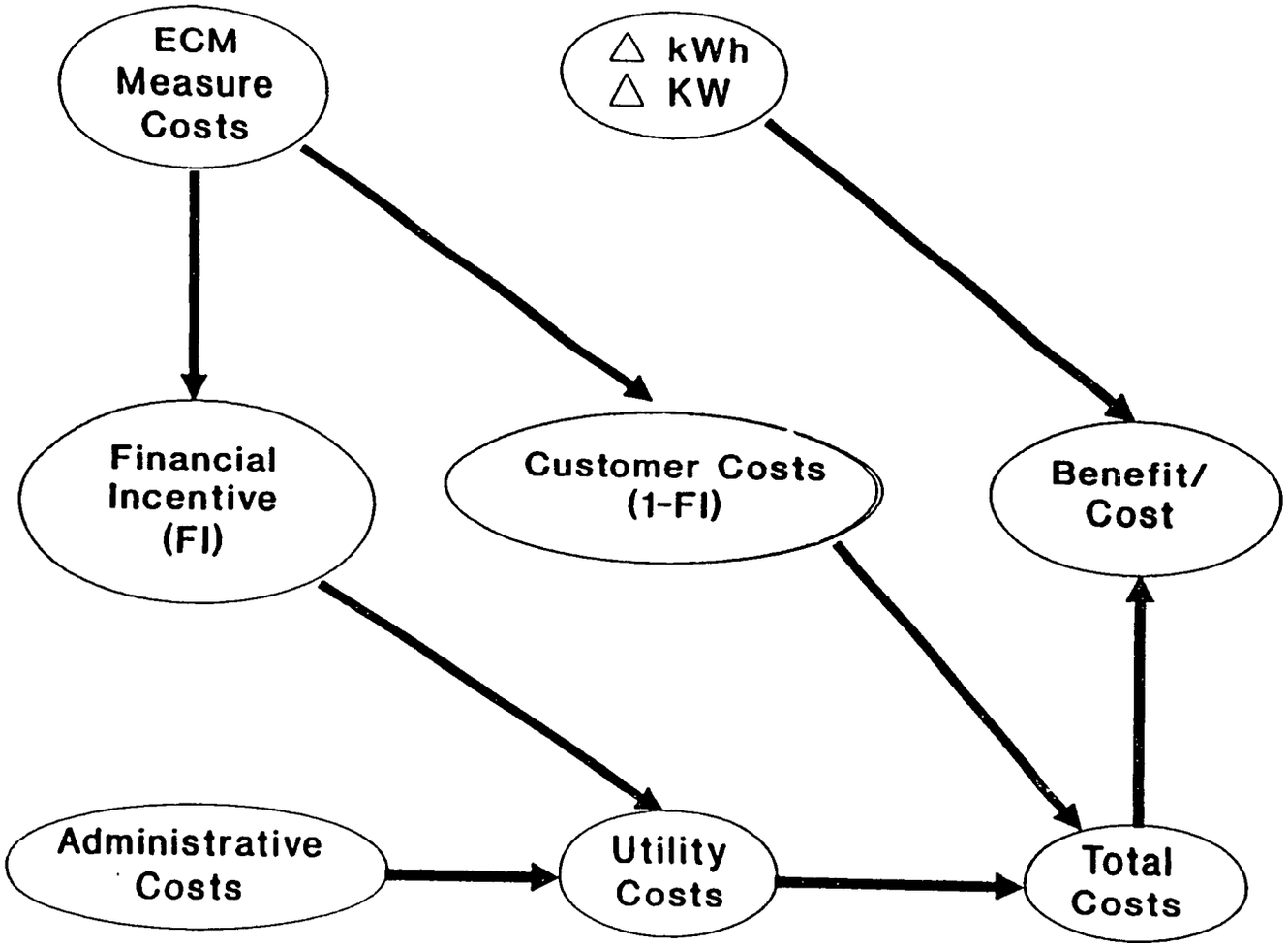
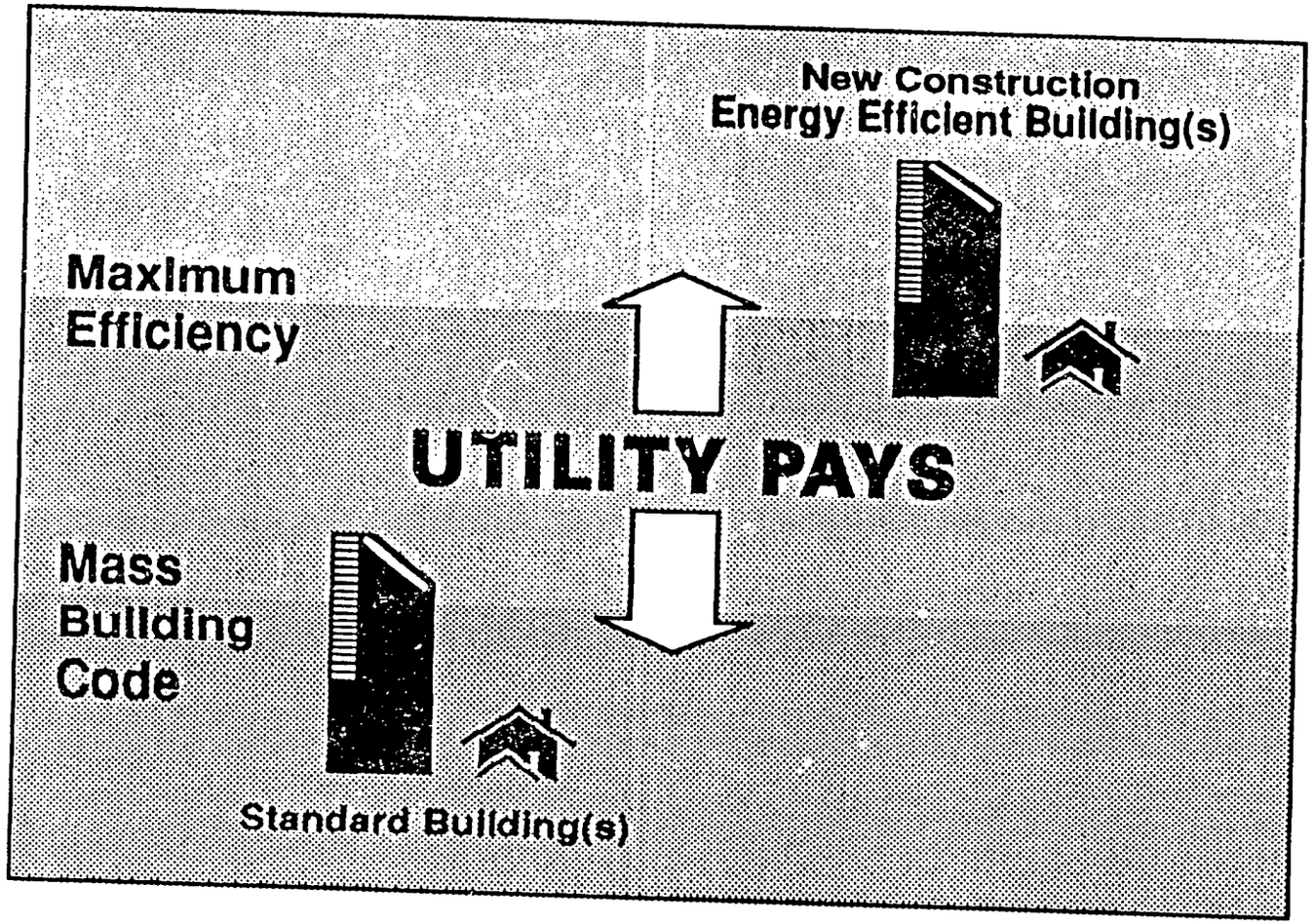


Fig. 2. Total program costs may be distributed in a variety of ways.



ıre 2. New Commercial Construction

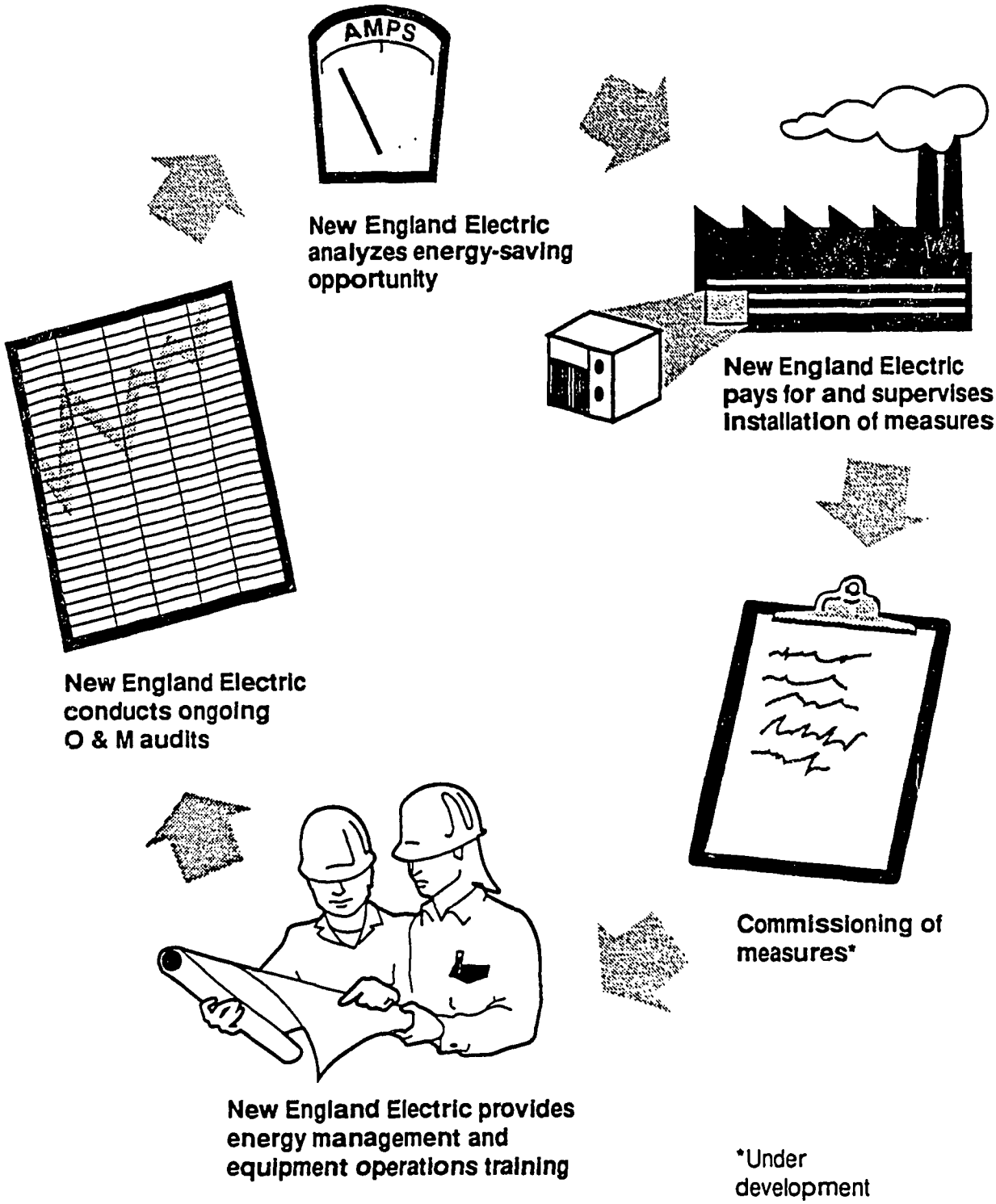
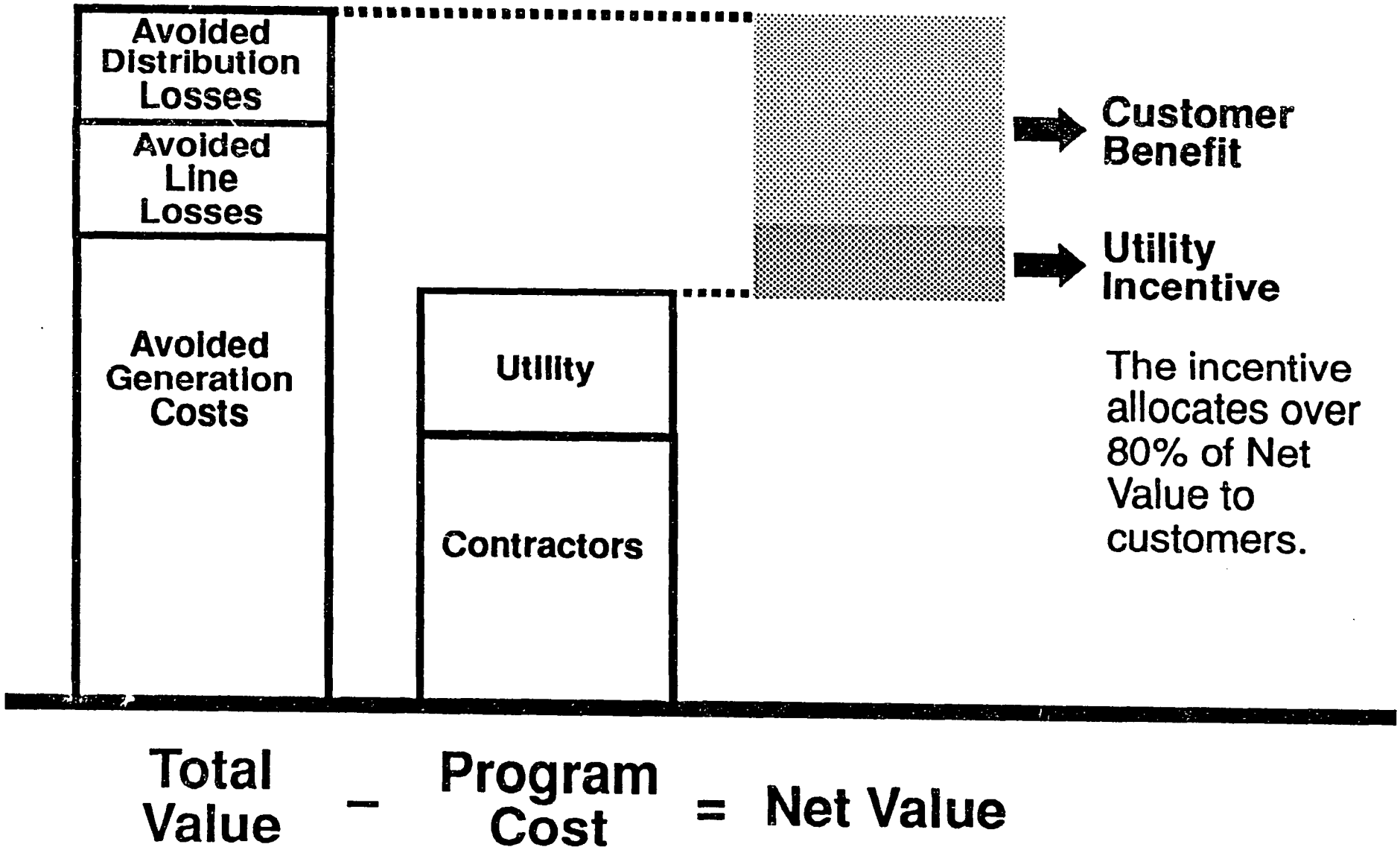


Figure 3. Energy Initiative



'igure 4. The Incentive Structure is Based on the Difference Between the Value of the Conservation and the of the Conservation

These concerns are the driving factors in an ongoing debate about regulatory reforms. Several proposals have been made that incorporate one or more of the following elements:

1. Utility recovery of the net lost revenue (difference between revenue foregone because of reduced consumption and reduction in variable operating costs) associated with DSM programs;*

2. Recovery of the utility costs to operate DSM programs, either by expensing or ratebasing such costs; and

3. Provision of financial incentives to utility shareholders (i.e., increased earnings) for exemplary performance in delivery of DSM services.

LESSONS LEARNED
U.S. DSM PROGRAM EXPERIENCE

1. AUDIT ONLY PROGRAMS HAVE LOW SAVINGS
2. LOANS REACH ONLY A FEW CUSTOMERS
3. COMPREHENSIVE PROGRAMS HAVE HIGH PARTICIPATION LEVELS
4. UTILITY PAYMENTS OF 60 % OR MORE PROMOTE GREATEST PARTICIPATION
5. PARTICIPATION RATES MUST EXCEED 50 % IF SIGNIFICANT SAVINGS ARE WANTED
6. LOST OPPORTUNITIES MUST BE AVOIDED
7. ACTIVE PROGRAM EVALUATION IS CRITICAL

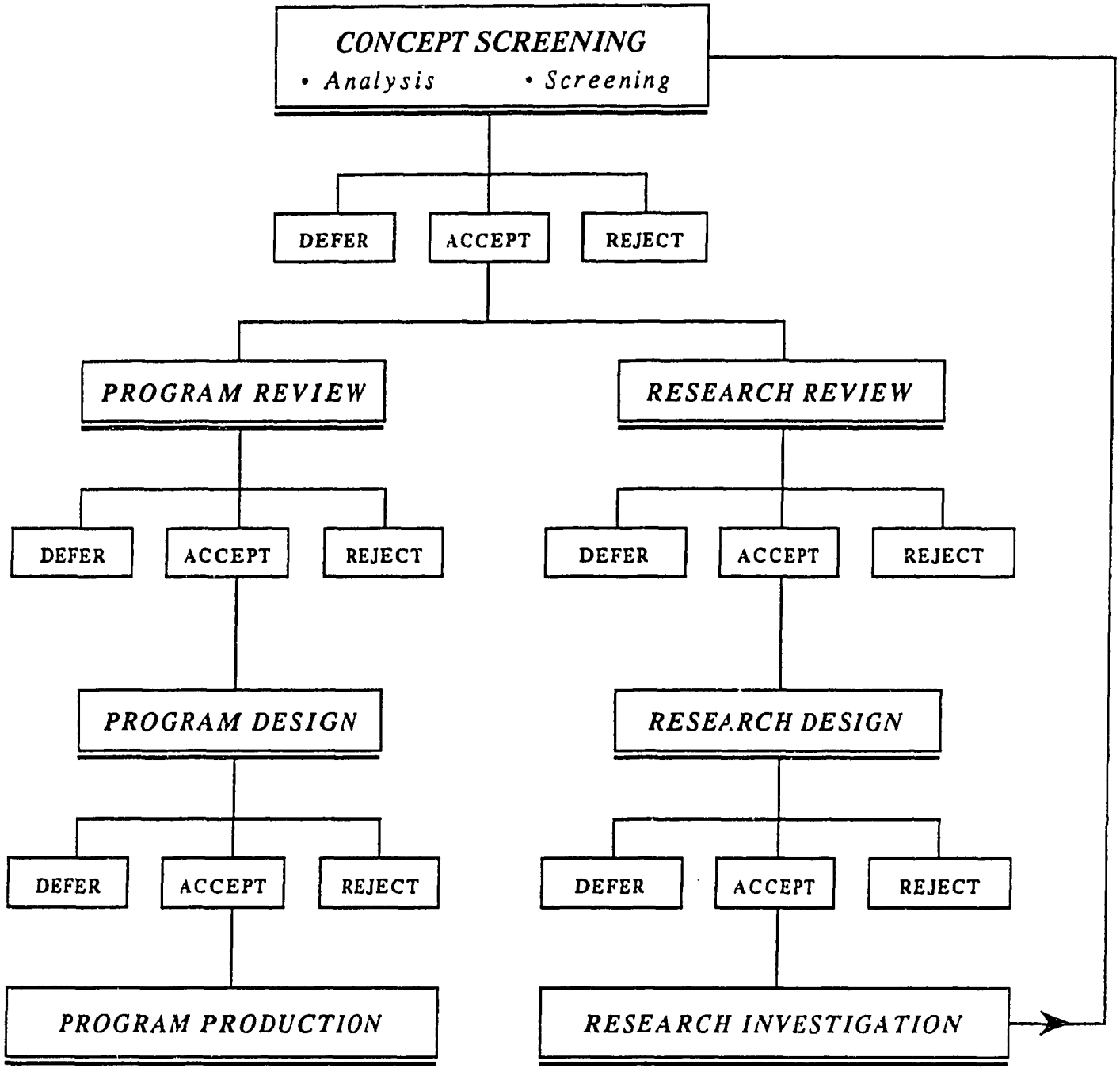


Figure 1. Concept Screening

Figure 9-2—Typical Market Penetration Profile of New Technology

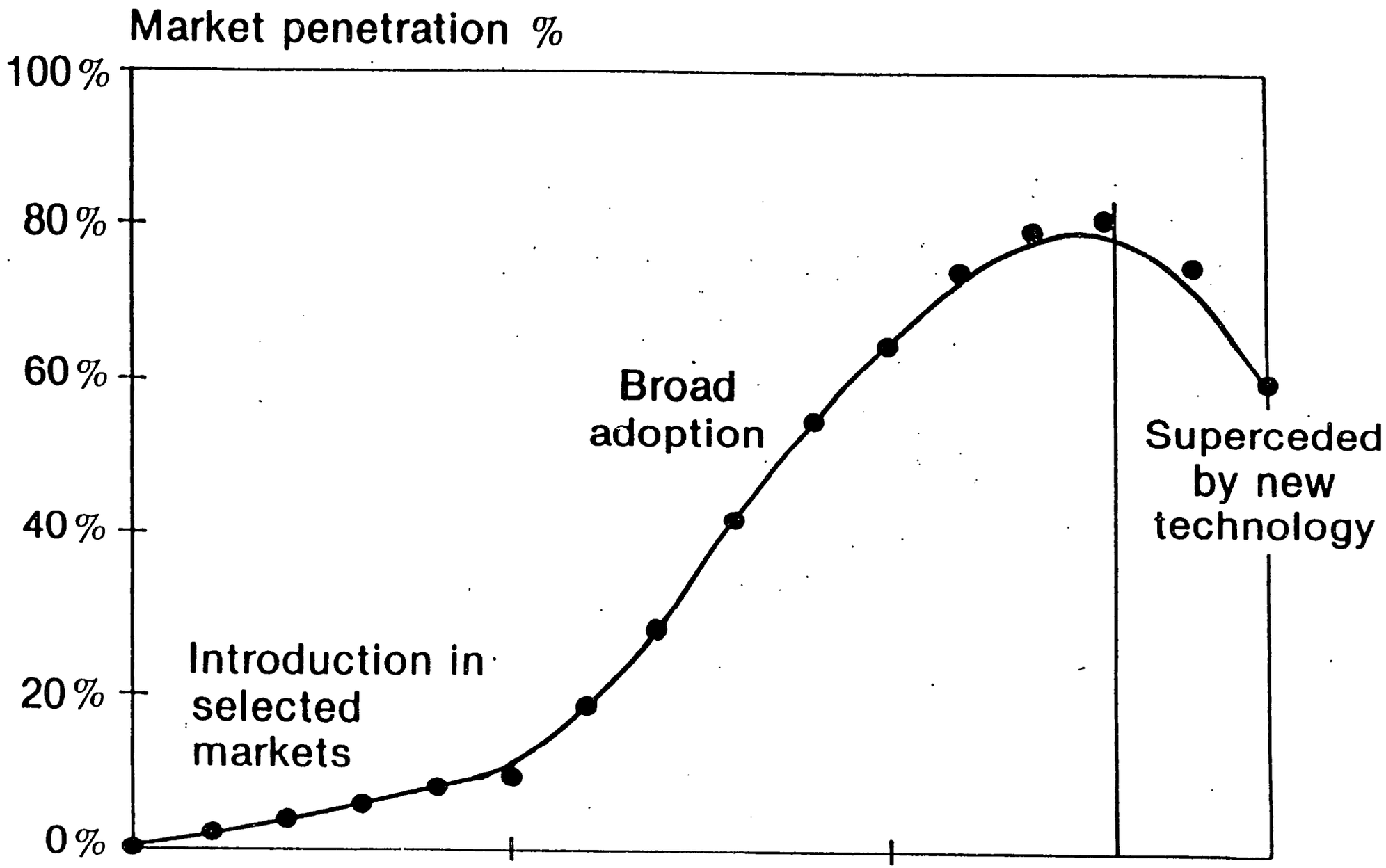


Table 9. Comparison of recent efforts to collect DSM-program data[a]

Data element	CA	ME	MA	NY	NORDAX	EIA
Time period(s) covered						
Historical						
Annual	X	X	X	X	X	
Cumulative		X	X		X	
Future			X	X		X
Program effects						
Energy savings (MW and GWh)						
Net	X		?		?	
Total	X	X	?	X	X	?
Number of participants	?	X	X	X	X	
Number of eligible customers			X	X	X	
Number of technology (end-use) units installed	X	X			X	
Details on utility costs		X		X	X	
Customer costs	X	X	X		X	
Cost-effectiveness tests	X			X		
Program characteristics						
Type (e.g., load-shape objective)	X	X		?	X	
Services provided (e.g., information, incentives)	?		X	?	X	
Program participation						
Customer class	X	?	X		X	
Building type or SIC code	X	?	X		X	
End use	X	X	X	X	X	
Marketing methods used	?		X	X	X	

[a]An X means that the data-collection form includes this element, a blank space means that the form does not include the element, and a ? means that this element is included but its definition is not clear.

Sources: California PUC (1989), Maine PUC (1988), Massachusetts Department of Public Utilities (1989), New York Department of Public Service (1990), NORDAX (1989), and EIA (1989b).

Table 5. **Definitions of program cost categories in the NORDAX Data Collection Survey**

Development Costs: The costs incurred to prepare the start-up of a program. This preparatory activity usually begins before active implementation of the program and may continue into one (usually) or more implementation phases. Typical costs include market research, load research, creating the program concept and definition, defining eligibility, and staff development and training.

Administrative Fixed Costs: The costs incurred (regardless of the number of participants) in managing and evaluating the program including the labor cost of planners, processing, and other personnel, administrative equipment and material and costs.

Administrative Variable Costs: The costs incurred in conducting the program including the labor cost of planners, processors, and other personnel and material and/or equipment which fluctuate according to the number of participants. For example, in an audit program, the time to conduct one audit and process the results.

Fixed Marketing Costs: The costs of DSM program promotion which do not vary with the number of participants generated. These costs would include the administrative labor required to prepare and implement the promotional strategy and the equipment and materials required to initiate the marketing effort.

Variable Marketing Costs: The costs of promoting a DSM program which fluctuate with the level of participation generated. These costs include the production cost of promotion materials, incentive costs paid to participants, and marketing labor costs.

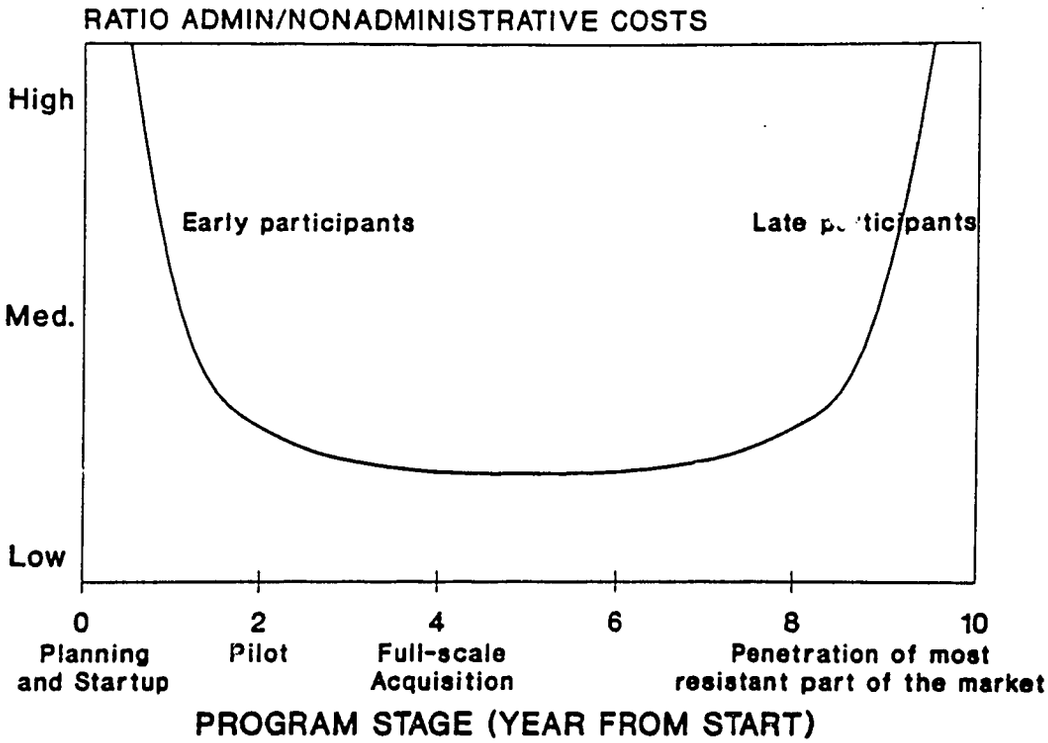


Fig. 5. Administrative costs by stage of program development.

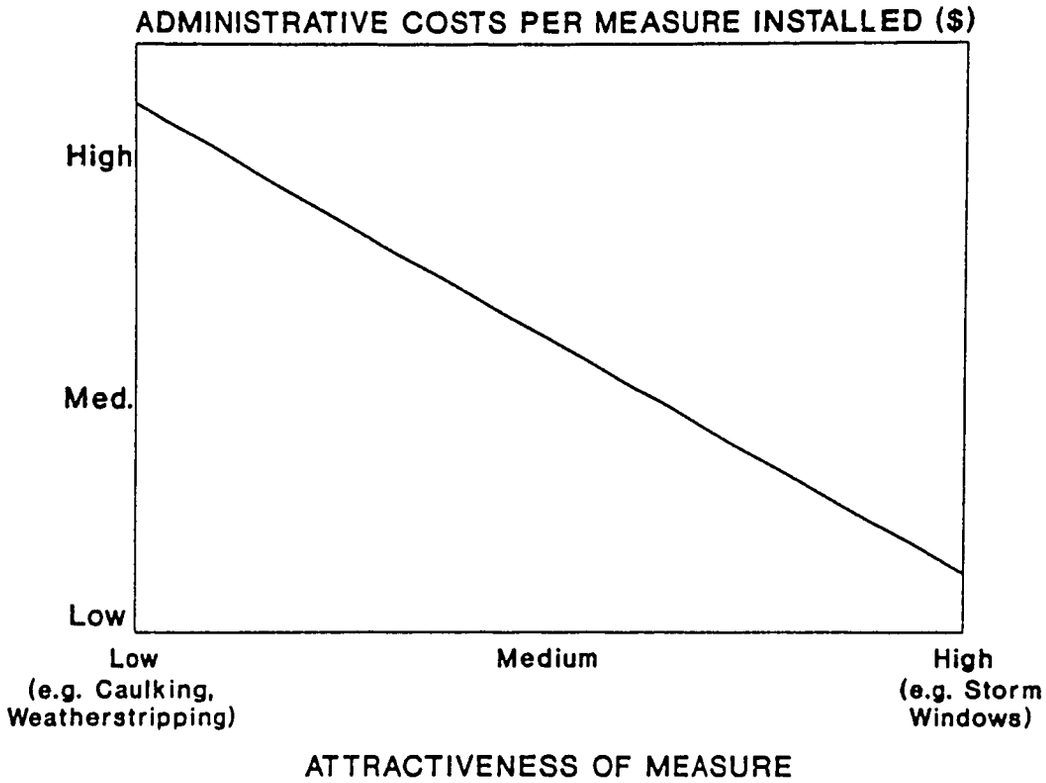


Fig. 6. Administrative costs by attractiveness of measure to customers.

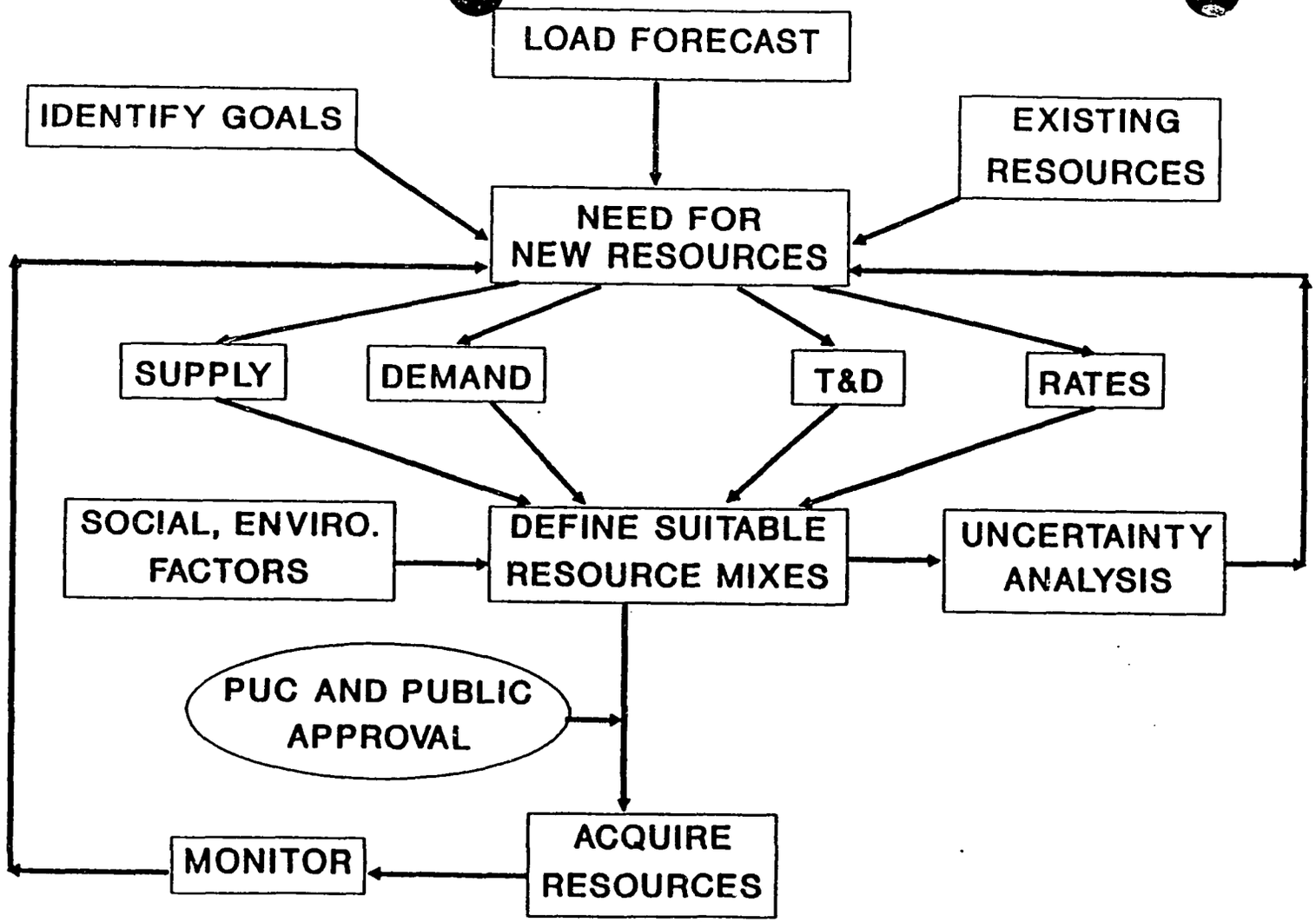


Fig. 8. Schematic showing the basic elements of integrated resource planning for elec utilities.

Table 3. Numerical examples of definitions of market penetration rates for a retrofit market. Assumed attrition rates are 3% (top) and 1% (bottom).

year (A)	Eligible units[a] (B)	Units removed from stock by attrition (C)	Number of participants (D)	Cumulative number of participants (E)	Annual rate[d] (F)	% of Cumulative rate (% current stock)[e] (G)	(% of base year stock with attrition)[f] (H)	(% of base year stock no attrition)[g] (I)
1	1000	30[b]	10	10	1	1	1	1
2	960	29	20	30	2	3	3	3
3	911	27	40	70	4	8	7	7
4	844	25	50	120	6	14	13	12
5	769	23	50	170	7	22	19	17
6	695	21	40	210	6	30	24	21
7	635	19	20	230	3	36	27	23
8	596	18	15	245	3	41	30	25
9	563	17	7	252	1	45	31	25
10	536	16	0	252	0	47	32	25
1	1000	10[c]	10	10	1	1	1	1
2	980	10	20	30	2	3	3	3
3	950	10	40	70	4	7	7	7
4	901	9	50	120	6	13	12	12
5	842	8	50	170	6	20	18	17
6	783	8	40	210	5	27	22	21
7	735	7	20	230	3	31	24	23
8	708	7	15	245	2	35	26	25
9	686	7	7	252	1	37	27	25
10	672	7	0	252	0	37	27	25

[a] $B_i = B_{i-1} - C_{i-1} - D_{i-1}$

[b] Units retired at a rate of 3%/year ($C_i = 0.03 * B_i$)

[c] Units retired at rate of 1%/year ($C_i = 0.01 * B_i$)

[d] $(D_i / B_i) * 100$

[e] $(E_i / B_i) * 100$

[f] $(E_i / (B_i + E_i)) * 100$

[g] $(E_i / 1000) * 100$

Table 7. Variation in annual market penetration rates (%/year)

	Average	Minimum	Maxim
Residential			
Audit[a]	3.2	0.03	31
Incentive[a]	5.5	0.02	59
Direct load control[a]	26.0	0.01	100
Time-of-use rates[a]	24.0	0.1	100
Home energy rating systems[b]	40.0	2.0	100
Commercial			
Audit[c]	3.6	0.01	50
Incentive[c]	2.4	0.13	32
Direct load control[c]	0.3	0.12	0.
Time-of-use rates[c]	1.1	0.10	100

[a]EPRI 1988a and 1988b.
[b]Vine and Harris 1988.

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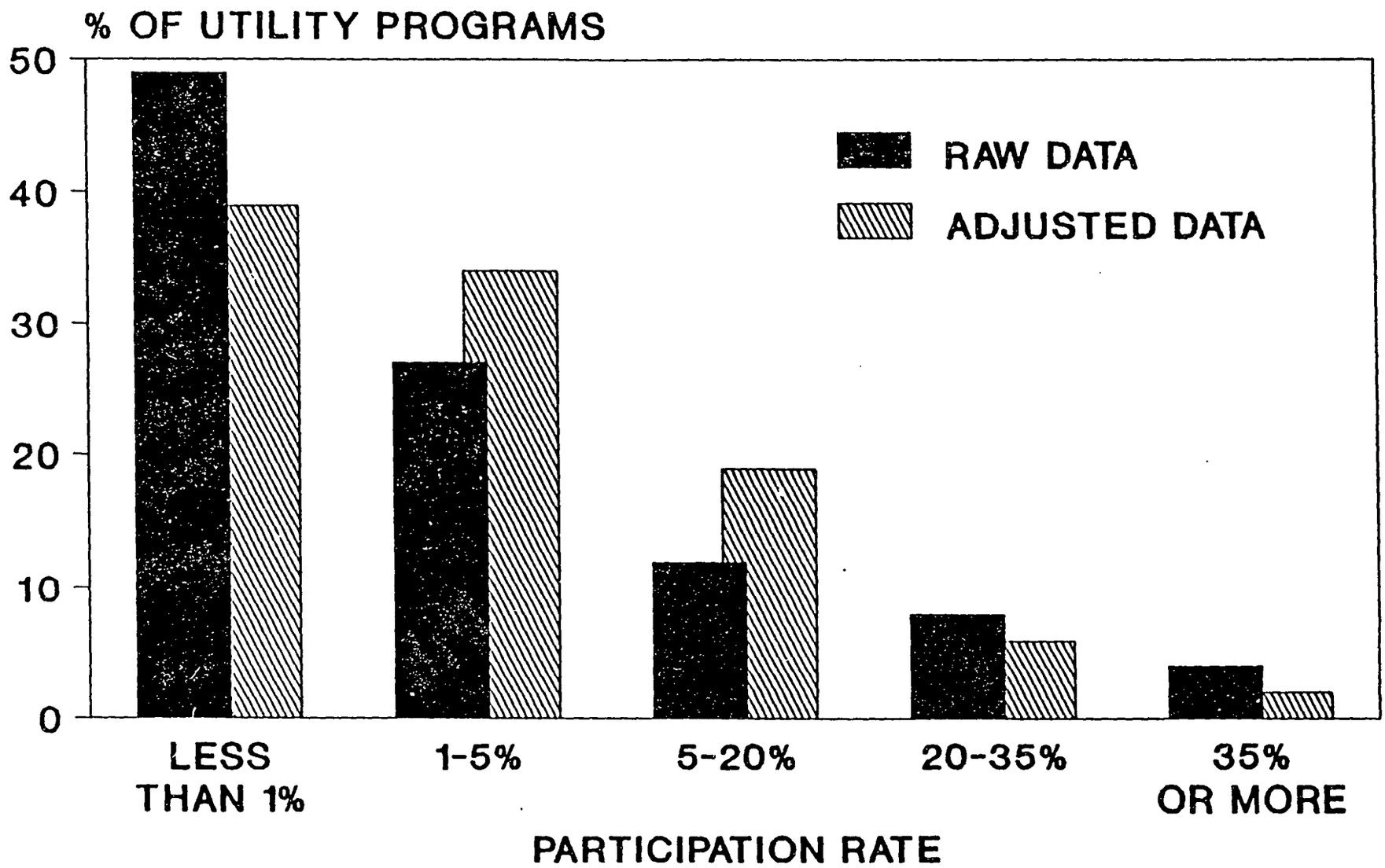


Fig. 1. Distribution of annual participation rates in residential financial incer programs. The black bars show actual results reported by utilities and cross-hatched bars show hypothetical results after adjustment for differe in definitions and program design and operation.

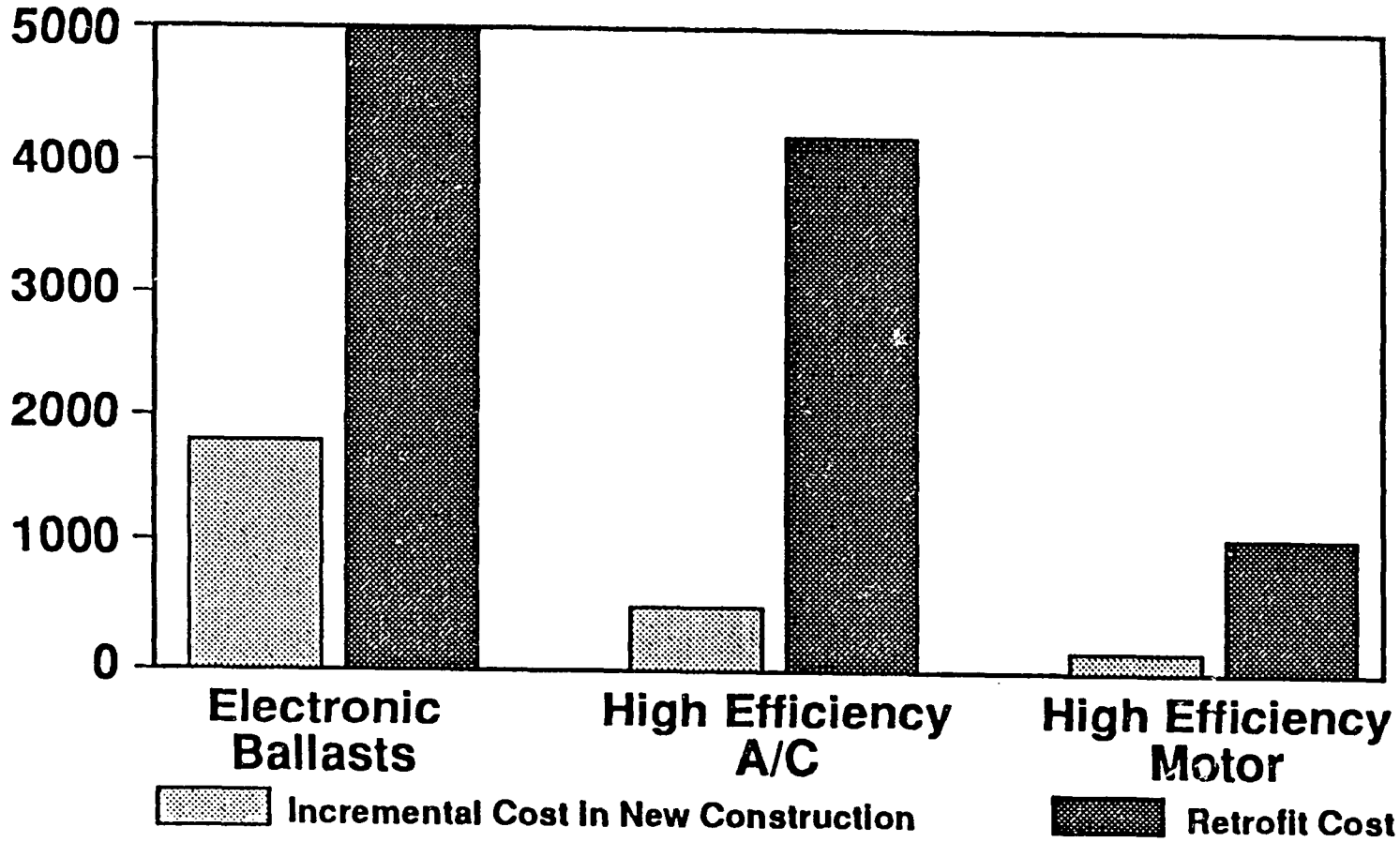
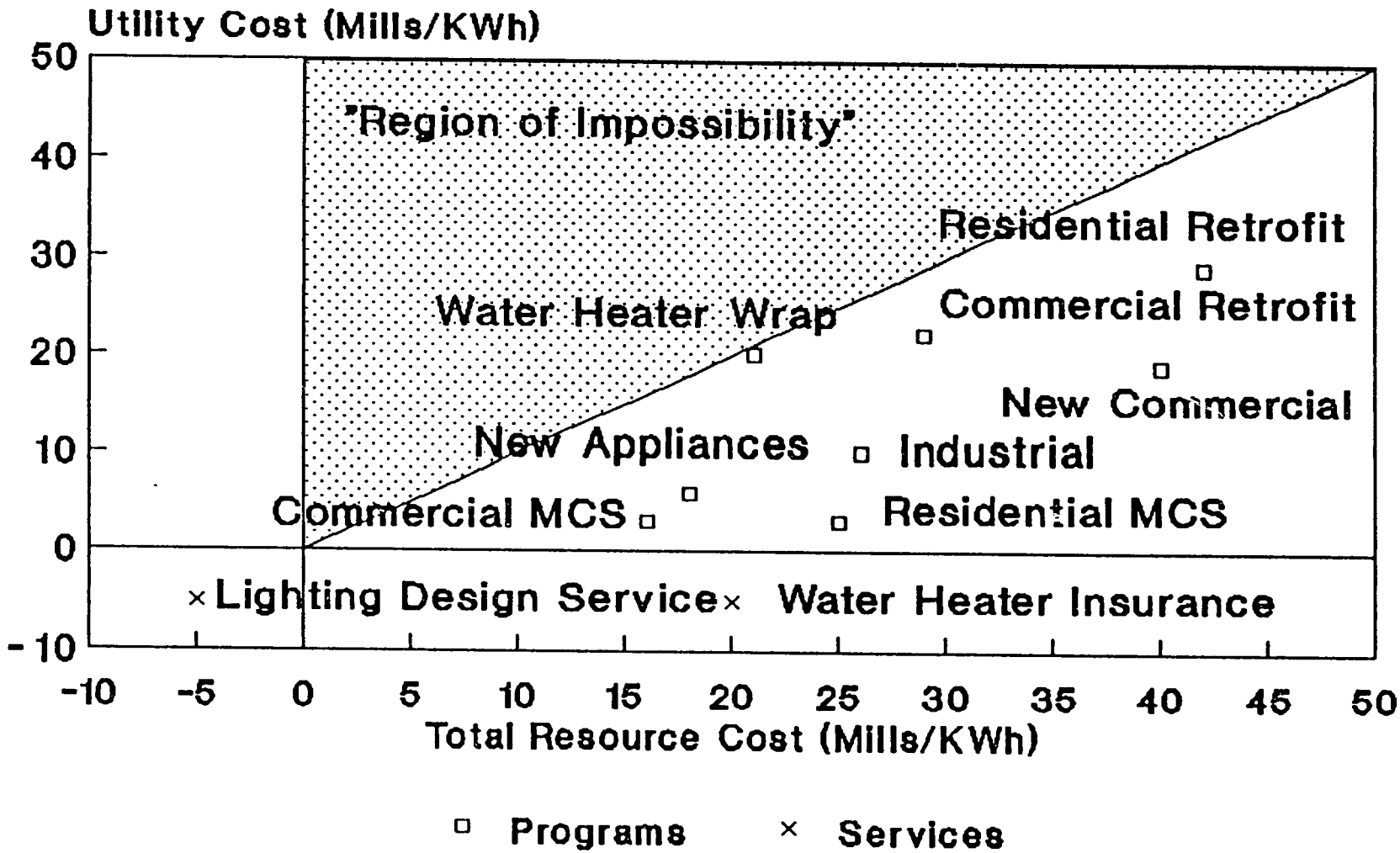


Figure 1. Cost of Energy Efficiency Measures (New Construction vs. Retrofit)



gure 4. Price Impact Map

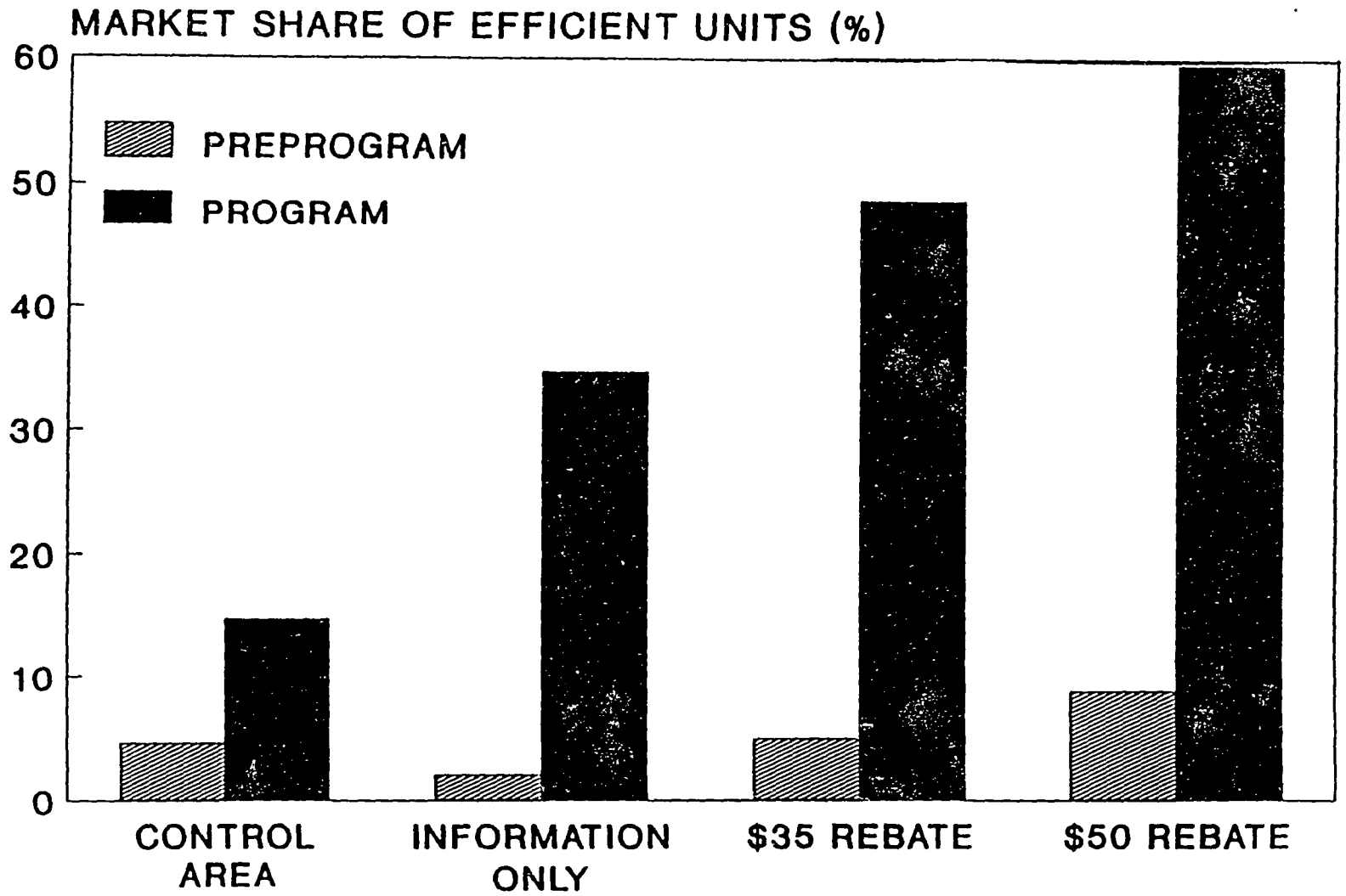
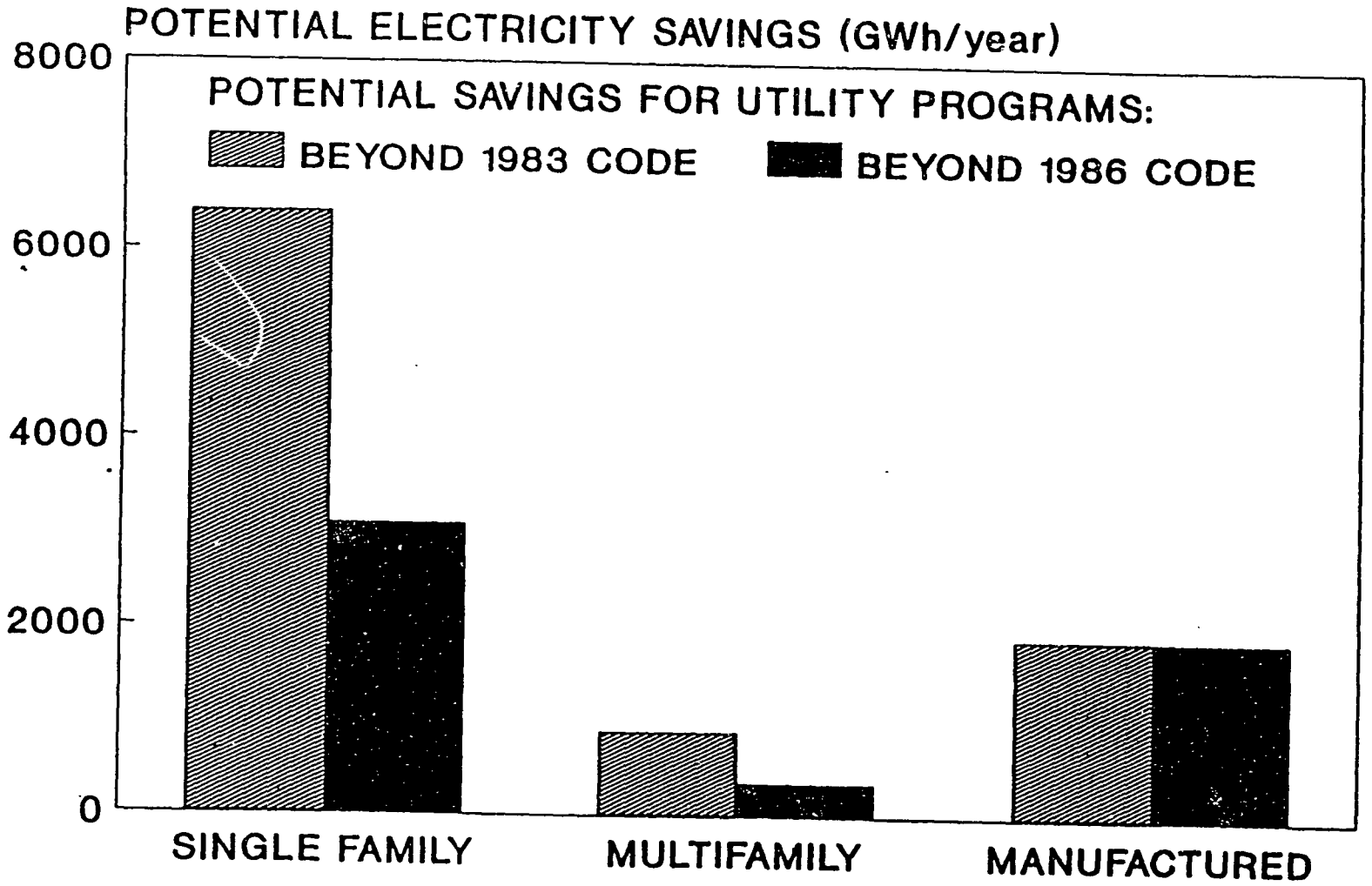


Fig. 6. Market shares of high-efficiency refrigerators before and during pilot program by New York State Electric and Gas Corporation (Kreitler and Davis 1987



. 7. **Potential electricity savings in new homes constructed in the Pacific Northwest, relative to building codes in effect in 1983 and relative to codes in effect in 1986 (Northwest Power Planning Council 1989b).**

Table 3. Risk-Reducing Benefits of Enabling Research - Program Concept: Motive Power Optimization

RISK-REDUCING BENEFITS OF ENABLING RESEARCH

PROGRAM CONCEPT: MOTIVE POWER OPTIMIZATION

SOURCES OF RISK & UNCERTAINTY	DEGREE OF UNCERTAINTY NOW PRESENT	IMPACT OF RISK ON PROGRAM SUCCESS	LIKELY SUCCESS OF ENABLING RESEARCH IN REDUCING RISK IF UNDERTAKEN	SINGLE MOST CRITICAL ISSUE TO BE ADDRESSED
Size of available technical market potential	2	1	4	Realistic savings contribution of adjustable speed drives, given equipment sizing, duty cycle and line balancing constraints.
Optimal mix of incentive information and other program features	3	3	3	Combining persuasive justification for integrated approach with "can't ignore" financial inducements without "giving the store away".
Ultimate level of market acceptance	3	4	3	Logisitical feasibility and customer appeal of an encompassing (and expensive) A-Z efficiency program.
Optimal program delivery strategy	2	2	4	Best use of factory/process design, architects and engineers, vendors and equipment manufacturers, in the implementation process.
Total cost of program deployment	1	1	3	Minimize rebates and incentive payment outlays so as to contain cost without losing marginal applications.

KEY

DEGREE or IMPACT: *(1)* Little or none *(2)* Some *(3)* Significant *(4)* Extreme

RESEARCH SUCCESS: *(1)* Of speculative value *(2)* Reduce risk somewhat *(3))* Reduce risk significantly *(4)* Virtually eliminate risk

Table 5. Analytical techniques used to treat uncertainty

Scenario analysis	Alternative, internally consistent, futures are first constructed. Then resource options are identified to meet each of these futures. Best options can then be combined into a unified plan.
Sensitivity analysis	Preferred plan (combination of options) is first identified. Key factors are then varied to see how the plan responds to these variations.
Portfolio analysis	Multiple plans are developed, each of which meets different corporate goals. Often, these plans are then subjected to sensitivity analysis.
Probabilistic analysis	Probabilities are assigned to different values of key uncertain variables, and outcomes are identified that are associated with the different values of the key factors in combination. Results include the expected outcome and cumulative probability distribution for key factors, such as electricity prices and net present value of revenue requirements.

Table 4. Methods used to measure electricity savings

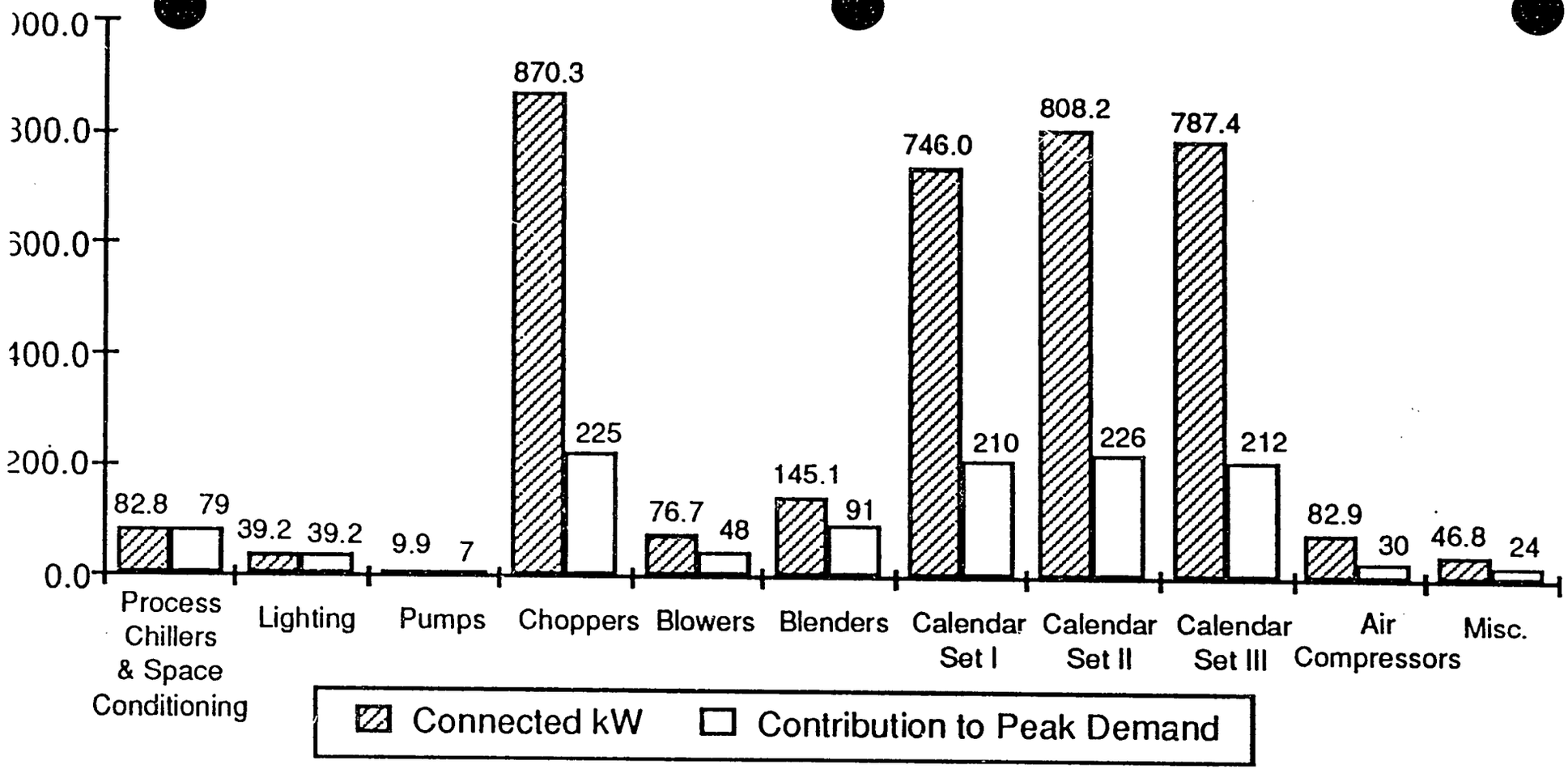
Approach	Explanation[a]	Advantages	Disadvantages
DSM-action-specific factors	Standard factors for certain actions are determined beforehand, which form the basis for estimation.	Very simple, no ambiguity, very low administrative cost.	Valid for only some devices, could yield estimates of savings not realized if factors are incorrect or inappropriate or if devices fail to perform as expected.
Engineering calculations	Calculations of expected electricity savings are performed for each device in each building, may involve simple formulas or computer models.	Simple, no ambiguity, low administrative cost.	Could yield estimates of savings not realized if calculations are incorrect or inappropriate or if equipment fails to perform as expected.
Periodic measurements of electricity use	Monitor electricity use before and after participation for short times (e.g., a few days), also measure other relevant factors (e.g., operating hours for equipment, heating degree days) for a longer time (e.g., up to a year).	Measures electricity savings (both kWh and kW) for well-defined, short time periods. Modest cost.	Could yield estimates of savings not realized if measurements taken incorrectly or at atypical times, or if building use changes. Difficult to apply to devices that are season- or weather-dependent.
Analysis of monthly electricity bills	Obtain electricity bills for a year before and a year after participation, adjust annual electricity use for weather and other relevant factors, compute difference between pre- and post-participation use in kWh/year.	Measures actual changes in electricity use, permits adjustment for changes in weather and other factors, requires little primary data collection.	Provides no estimate of demand (kW) reductions. Analysis of monthly billing data can yield ambiguous results. Estimates of kWh savings affected by changes in facility use unrelated to devices installed.
End-use, load-research monitoring	Monitor specific circuits affected by new systems to record kW-demand both before and after participation.	Measures actual changes in electricity use and demand (kWh and kW) for specific end uses affected by program. Combine kW information with other data to adjust for changes in weather and other factors.	Most expensive and time consuming method. Large amounts of data require sophisticated computer programs and analysts to interpret. Results may be affected by changes in facility use unrelated to equipment installed.

[a]The latter three approaches can use pre- vs post-participation data for program participants, data for participants vs a comparison group, or both methods.

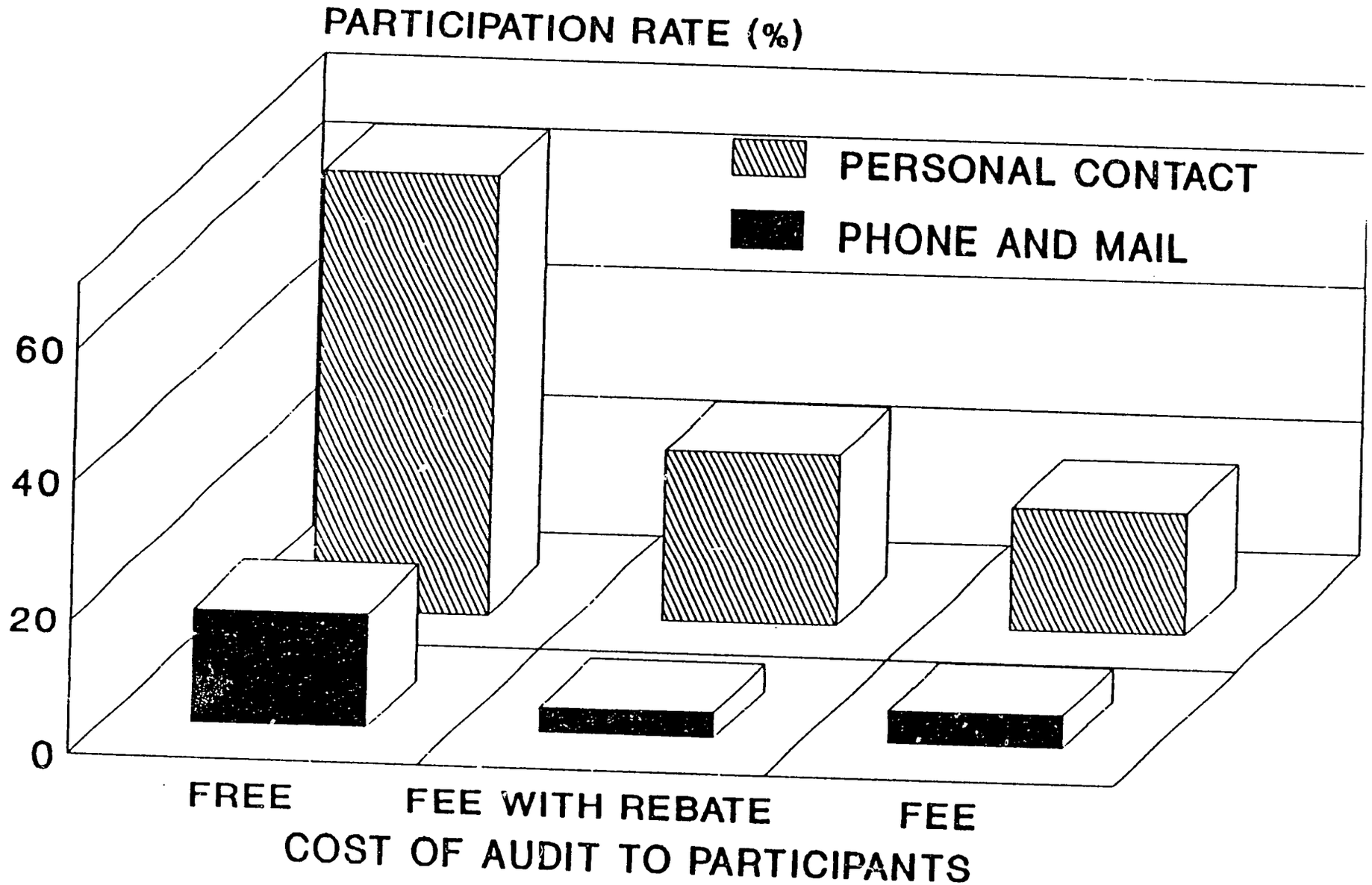
Table 6. Sample of methods used for verification of kWh savings in the Boston Edison Company ENCORE Program

Action	Verification method
Convert incandescent lights to fluorescent lights	1. Customer estimates number of hours that lights burn. 2. Contractor measures kW-demand of random sample of lighting fixtures before retrofit. 3. Contractor similarly measures kW-demand after retrofit. 4. kW-demand/fixture multiplied by number of fixtures, both pre- and post-retrofit. 5. Difference in kW, pre- and post-retrofit, multiplied by number of burn hours to determine kWh savings/month.
Resize pulleys and belts for HVAC fans, install energy-efficient motors, install HVAC controls, install occupancy sensors and efficient lamps	1. Electricity use adjusted for number of days in billing cycle. 2. Electric space heating use adjusted on the basis of ratio of DD-historical period/DD-reference period, where DD refers to either heating or cooling degree days, both to base 65°F. 3. Electricity use adjusted for changes in building use, both in conditioned floor area and hours of occupancy. 4. Electricity savings equals reference billing period consumption minus current billing period non-weather-sensitive kWh adjusted for changes in building use minus current billing period weather-sensitive kWh adjusted for changes in DD.
Install control system for chiller	1. Pre-retrofit electricity use (kWh/ton-hr) is computed, based on measurements of electricity use and of chilled water supply and return temperatures for at least 40 hours, and on manufacturer data on chilled water flow rate. 2. Similar measurements are made after retrofit. 3. Electricity savings equals difference in pre- and post-retrofit kWh/ton-hr times the base period ton-hr adjusted for any increases in ton-hr requirements.
Install variable-frequency drives on HVAC motors	1. Compute preretrofit electricity use (kWh/month) by measuring electricity use for 8 hours for each unit, computing kWh/hr, and multiplying by the number of operating hours. 2. Similar measurements are made after retrofit. 3. Electricity savings equals difference in pre- and post-retrofit kWh/month adjusted for any increase in operating hours.
Install system to control perimeter baseboard electric heating system	1. Record kW-demand of selected heating circuits at 30-minute intervals for 30 days. 2. Similar measurements are made after retrofit, also for 30 days. 3. HDD data are obtained for the two 30-day periods and for the 40-year average annual total. 4. Electricity savings equals kWh/HDD-pre minus kWh/HDD-post, the difference multiplied by HDD-annual.

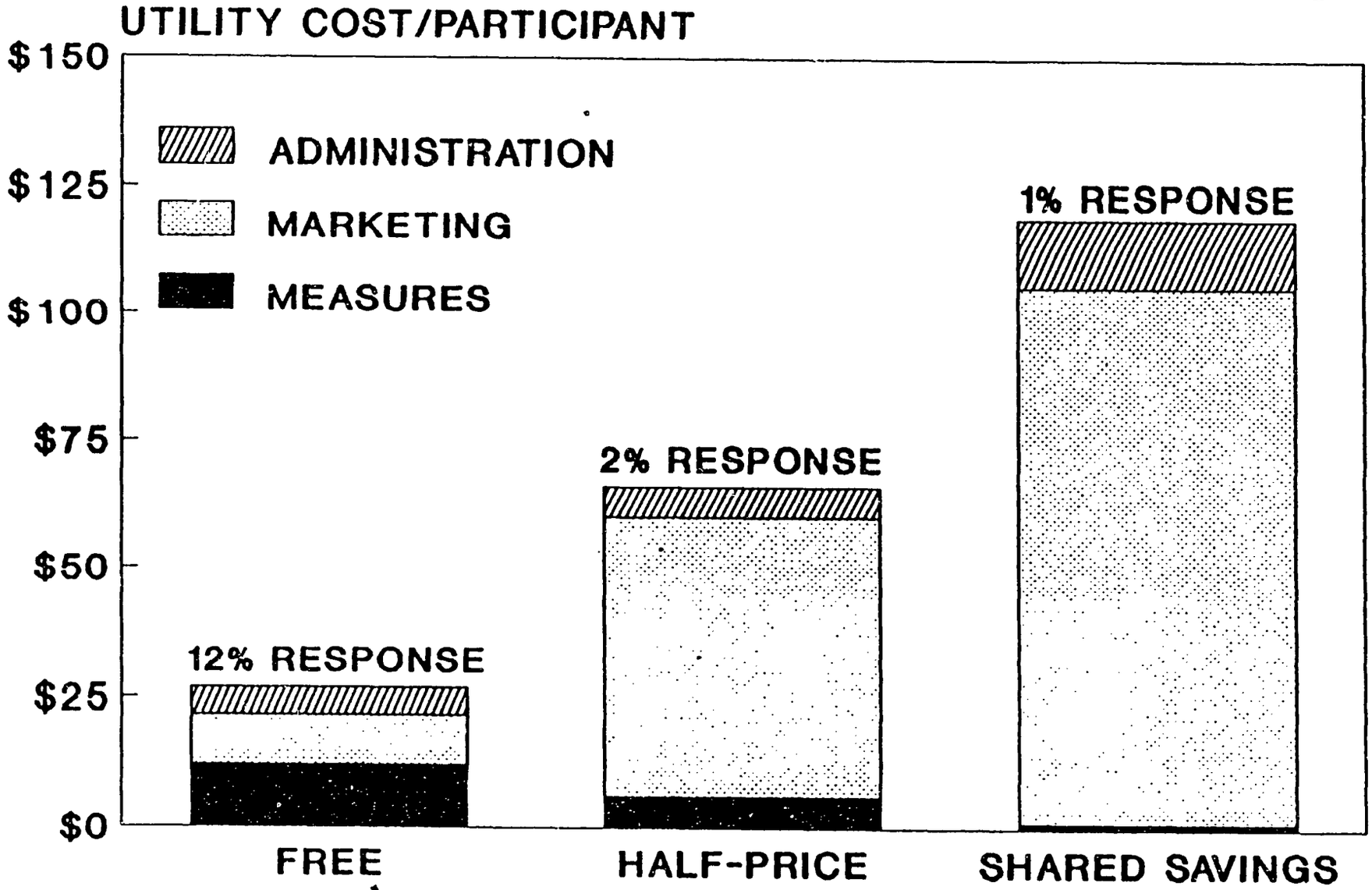
Source: Boston Edison Company (1989)



ıre 1. Connected Loads and Contribution to Peak Demand for a Sample Customer



ig. 5. Percentages of commercial customers accepting an energy audit o New York State Electric and Gas Corporation, by marketing appr cost to the customer (Xene y 1989).



	FREE	HALF-PRICE	SHARED SAVINGS
COST (cents/kWh)	0.8	2.1	3.7
SAVINGS (GWh/year)	140	25	13

5. Comparison of costs to Niagara Mohawk for low-cost measures offe

Table 8. Maximum cumulative market penetration rates in residential and commercial/industrial sector

Program type and sponsor	Highest cumulative rate
Residential retrofit	
Financial incentive for retrofit	
Hood River Conservation Project[a]	over 90%
Fitchberg, Massachusetts[b]	60%
Several major California utilities[c]	50%
Water heater wraps	
New England Electric System[d]	52%
Seattle City Light[e]	60%
Residential construction	
Home energy rating systems	
Gulf Power[f]	95%[g]
Public Service of New Mexico[h]	100%[g]
Kansas City Power and Light[h]	100%[g]
Commercial/industrial retrofit	
Audit and load control	
Sacramento Municipal Utility District[i]	50%
High-efficiency lighting	
New England Electric System[j]	60%[k]
Sacramento Municipal Utility District[l]	57%
City of Austin[l]	50%
Commercial/industrial construction	
Energy-efficiency awards and design assistance	
Florida Power Corporation[f]	20%[g]

[a]Hirst 1989.
[b]Sant, Bakke, and Naill 1984.
[c]Schultz 1989.
[d]Snellman 1989

Table 10. Characteristics associated with high program participation rates

Program context
- High commitment of sponsor (including top management)
- Not supply constrained (enough budget, manpower, and materials to meet demand)
- Rising energy prices
- Expected energy shortages
- Favorable political and social climate

Program features
- Trusted, credible sponsor (e.g., local community groups, trade allies)
- Simplicity and convenience (one-step, direct installation)
- Financial incentives (no cost to customer)
- Marketing
  - Most effective techniques used (direct personal contact, door-to-door canvassing, telemarketing)
  - Market segmentation used
  - Targeted groups involved in program planning
  - Features matched to customer needs by market segment
  - Variety of barriers addressed
- Duration (program lasts 5 years or more)
- Sales training and rewards for program personnel
- Communication factors
  - Vivid, personalized information
  - Peer testimonials
  - Stress current loss instead of future gains
- Risk reduction
  - Quality control
  - Warranties
  - Guaranteed savings

Customer characteristics
- Residential
  - High income
  - High education
  - Middle-aged
  - Homeowner
  - Attitudes and lifestyle match program features
- Commercial
  - Large size
  - Hotel/motel

Community characteristics
- Rural, often with public power
- Well-integrated
- Conservation ethic

PERFORMANCE-BASED UTILITY INCENTIVES

- **Collaborative agreed on following guidelines:**
  - Define Eligible programs
  - Measurement of energy savings & participation levels - but acknowledge current limitations
  - Minimum performance requirements & accountability
  - Stability - pilot incentive mechanism should last for 2-3 years
  - Avoid "cream skimming"
  - Quantify rate impacts

MEASUREMENT & EVALUATION GUIDELINES

- **Subcommittee of "experts" on measurement & evaluation of DSM programs**

- **Link between incentives and program evaluation activities**

  — Approval of financial incentives includes adoption of a 3-year evaluation plan

  — Goal: improve accuracy of load impact estimates

  — Satisfactory completion of plan activities is precondition for extension of incentive mechanism after third year

- **Load impacts of DSM programs/measures**

  — Per unit estimates will be pre-specified and held constant for first three years

  — After third year, avg. load impacts will be adjusted to reflect results of measurement plan

PROGRAM IMPACT PARAMETERS

- **Evaluation plans must describe approach in following areas:**

- **Load Impacts**
  - First-year annual savings
  - End-use load shape
  - Net-to-gross factor
  - Rebound effect
  - Useful Life
  - Persistence of savings

- Participation Level

- Utility costs

- Total costs

Table 3

USEFUL LIVES OF RESIDENTIAL
ENERGY CONSERVATION MEASURES (YEARS)
(Compiled from utility and CEC sources)

	PG&E	SCE	SDG&E	SCG	CEC RCS[1]	Consensus
Caulking	20	10	--	10	20	10
Weatherstripping	10	10	--	10	20	10
Ceiling insulation	20	*	35	22	25	25
Wall insulation	--	30	--	22	20	25
Low-flow showerheads	10	--	--	--	20	10
Water faucet aerators	20	--	--	--	--	10
Duct wrap/insulation	15	--	--	*	15	15
Water heater blanket	10	--	--	*	20	10
Fluorescent bulbs	9	10	--	--	--	10
Window shade awnings	10	--	--	--	--	10
High-efficiency A/C	20	15	18	--	20	18
Central heat pump	--	15	--	--	18	18
Evaporative coolers	--	15	--	--	--	15
Clock thermostat	25	10	--	*	20	15
High-efficiency refrigerator	20	15	10	--	20	20
High-efficiency central furnace	20	--	10	19	20	20
Whole house fan	--	15	--	--	15	15
Double glazing						25
Storm windows						15
Window film tinting						10
Furnace retrofit					19	15
Efficient gas water heater				11	15	15

Key:
* = measure offered in program, but no estimate available.
-- = no estimate available or measure not offered in program.
[1]RCS = estimate used during the implementation of Residential Conservation Service Audits.

Table 2

ACCEPTABLE POST-IMPLEMENTATION MEASUREMENT ACTIVITIES FOR CONSERVATION AND LOAD MANAGEMENT PROGRAMS

Program impact parameter	Judg-ment	Engin-eering	Statistical (Bills)	Metered	Customer Survey	Other Market Data	Utility Accounting Records
Load Impacts:							
First-year, annual		X	X	X		X	
Load shape			X	X			
Net-to-gross	X		X		X	X	
Rebound effect			X		X		
Useful life		X		X	X	X	
Persistence/decay	X	X	X	X			
Participation level							X
Utility Costs							X
Total Costs		X			X	X	X

NOTE: Each term used in this table is defined in the Glossary.

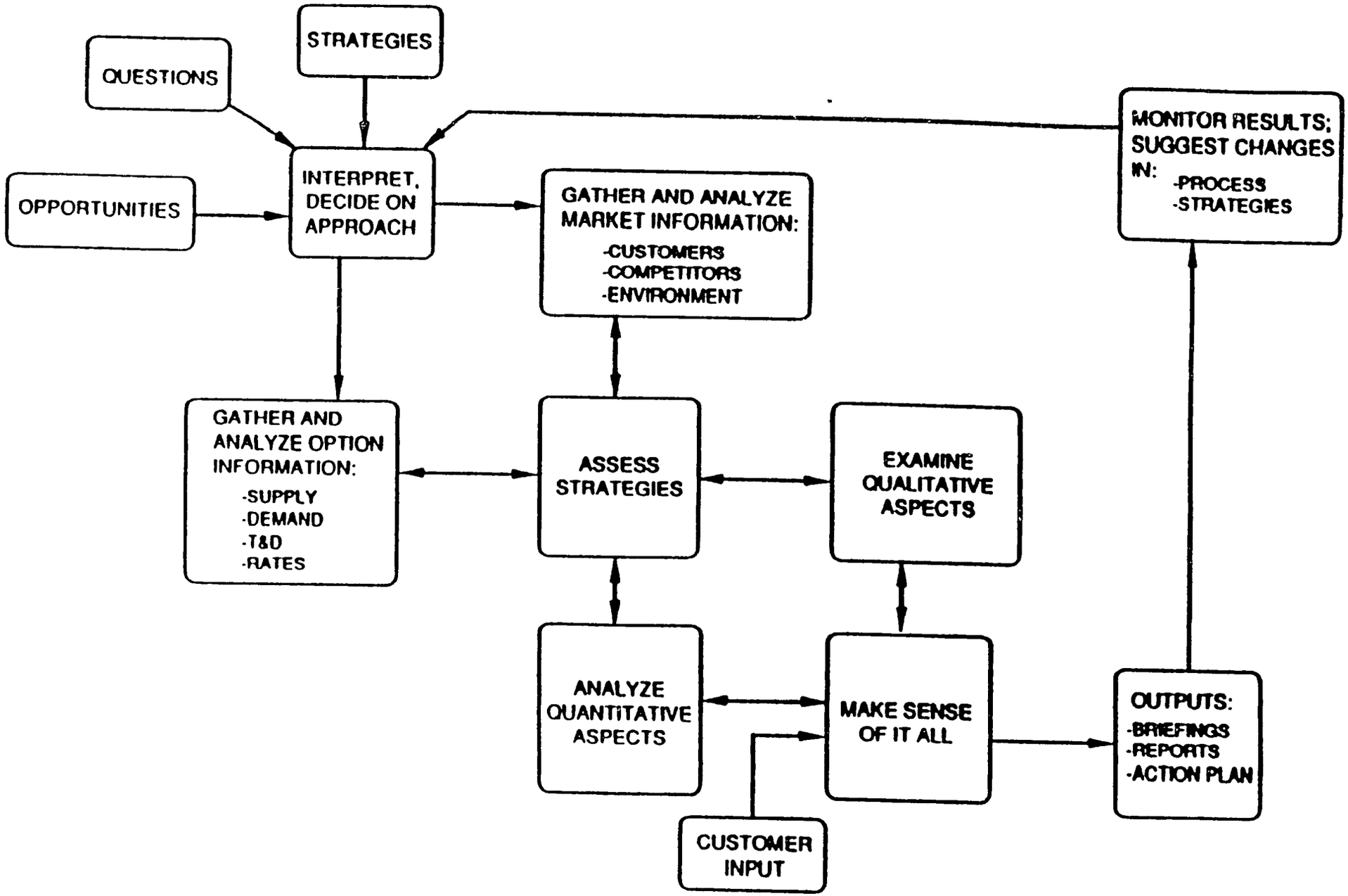
Table 1

ACCEPTABLE PRE-IMPLEMENTATION MEASUREMENT ACTIVITIES
FOR CONSERVATION AND LOAD MANAGEMENT PROGRAMS

Program Impact Parameter	Judg-ment	Engin-eering	Statistical (Bills)	Metered	Customer Survey	Other Market Data	Utility Accounting Records
Load Impacts:							
First-year, annual		X	X	X		X	
Load shape	X	X		X			
Net-to-gross	X		X		X		
Rebound effect	(Not included in preprogram load impact estimation procedures.)						
Useful life	X	X		X	X	X	
Persistence	X	X	X	X			
Participation Level	X					X	
Utility Costs	X						X
Total Costs	X	X			X	X	X

NOTE: Each term used in this table is defined in the Glossary.

222



. 1. Diagram of Demand and Resource Evaluation (DARE) program at [illegible]get Sound Power & Light Com[illegible]

Table 2. Membership in DARE Advisory Panel

State Government

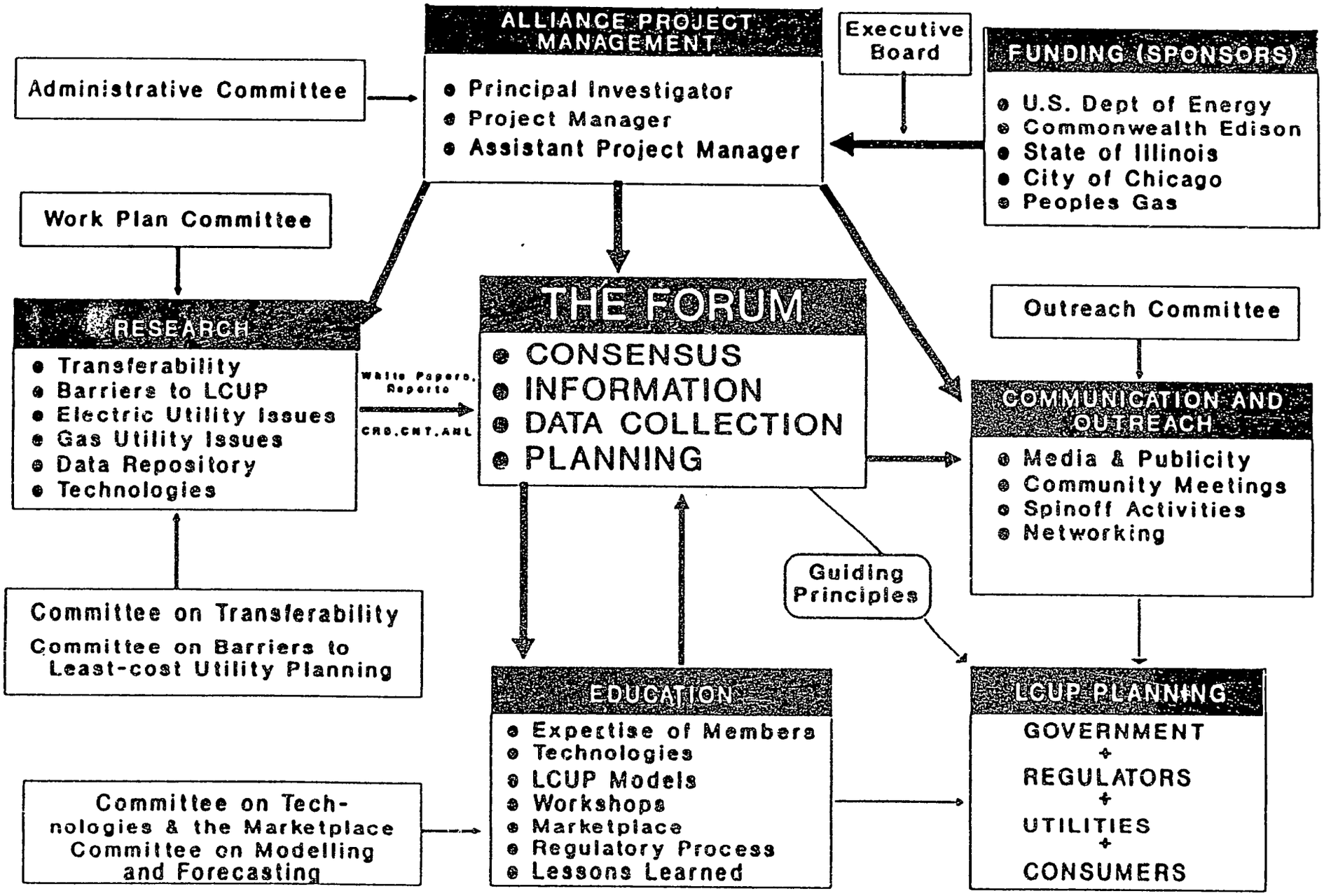
Washington Utilities and Transportation Commission
Washington State Energy Office
Attorney General, Public Counsel
House Energy and Utilities Committee
Senate Energy and Utilities Committee

Regional Energy Organizations

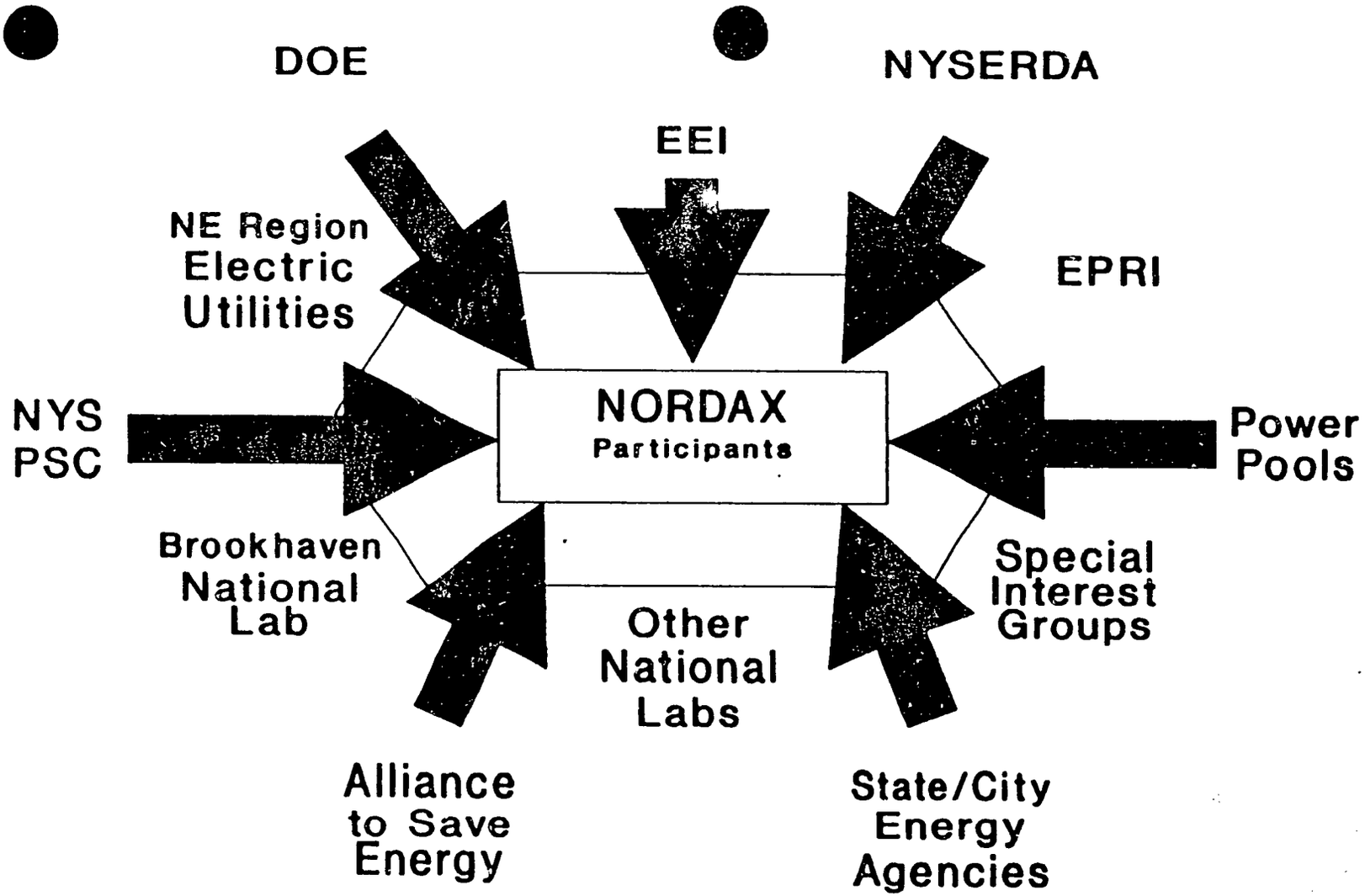
Northwest Power Planning Council
Bonneville Power Administration

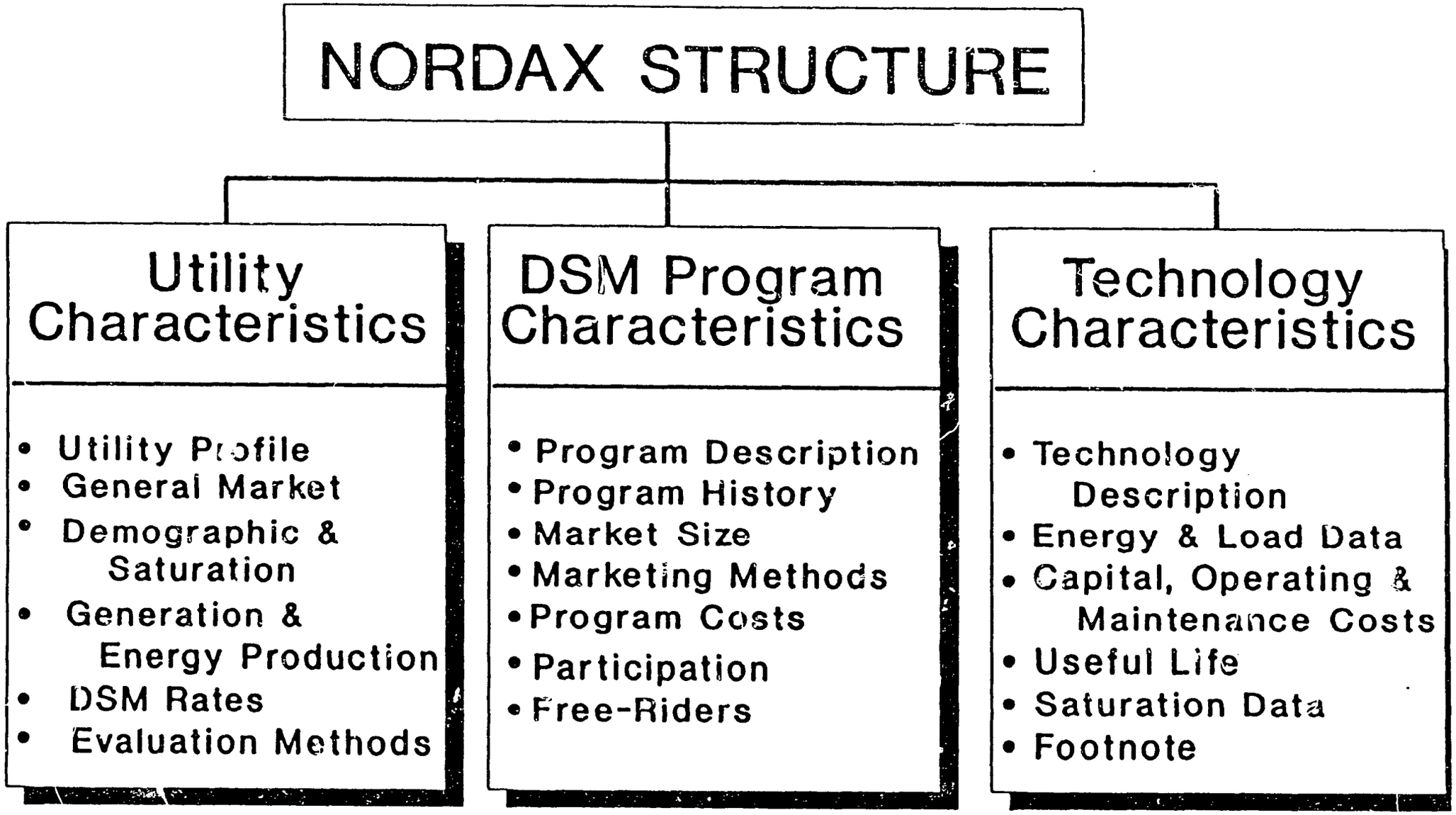
Special Interest Groups

The Boeing Company
Industrial Customers of Northwest Utilities
Northwest Conservation Act Coalition
Evergreen Legal Services



g. 7. Structure of the Northern Illinois Alliance to support least-cost utility


DOE
NYSERDA
EEI
NE Region Electric Utilities
EPRI
NYS PSC
NORDAX
Participants
Power Pools
Brookhaven National Lab
Special Interest Groups
Other National Labs
Alliance to Save Energy
State/City Energy Agencies



3. Structure of the NORDAX data base.

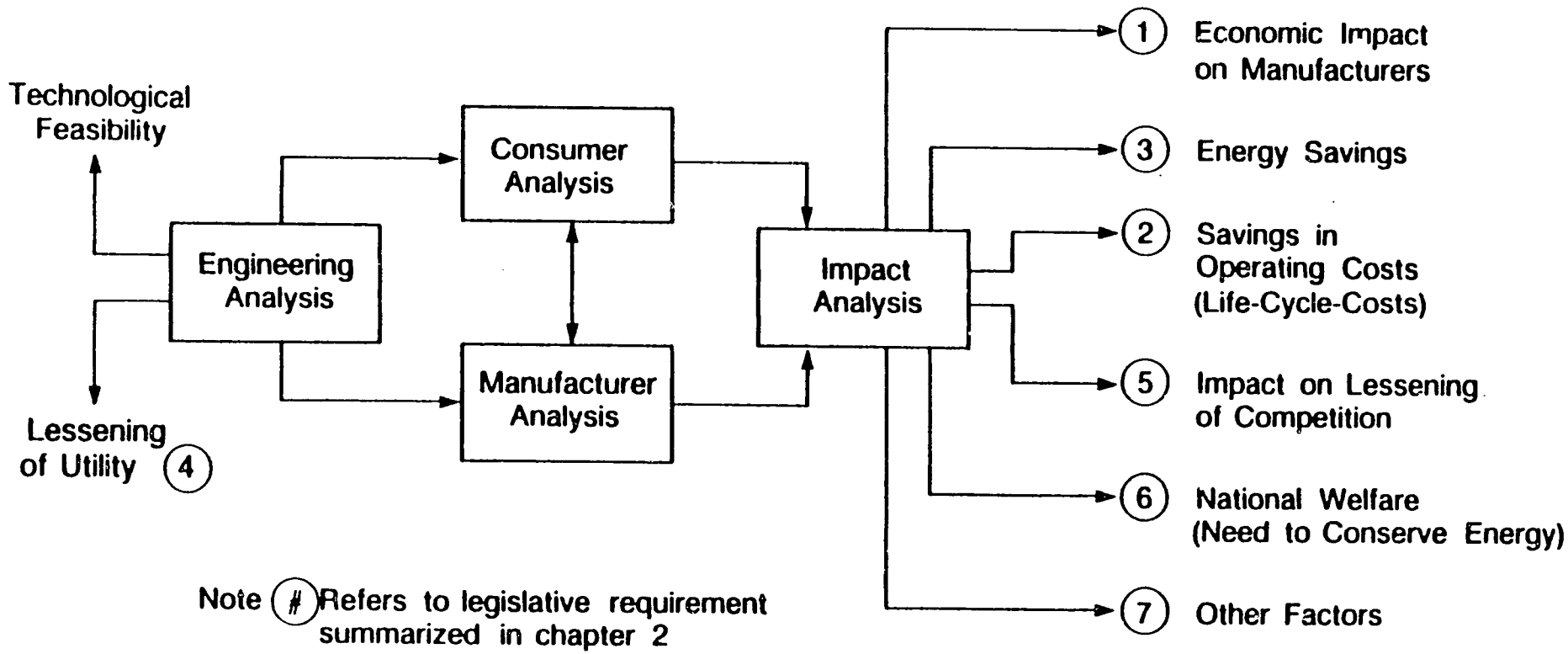


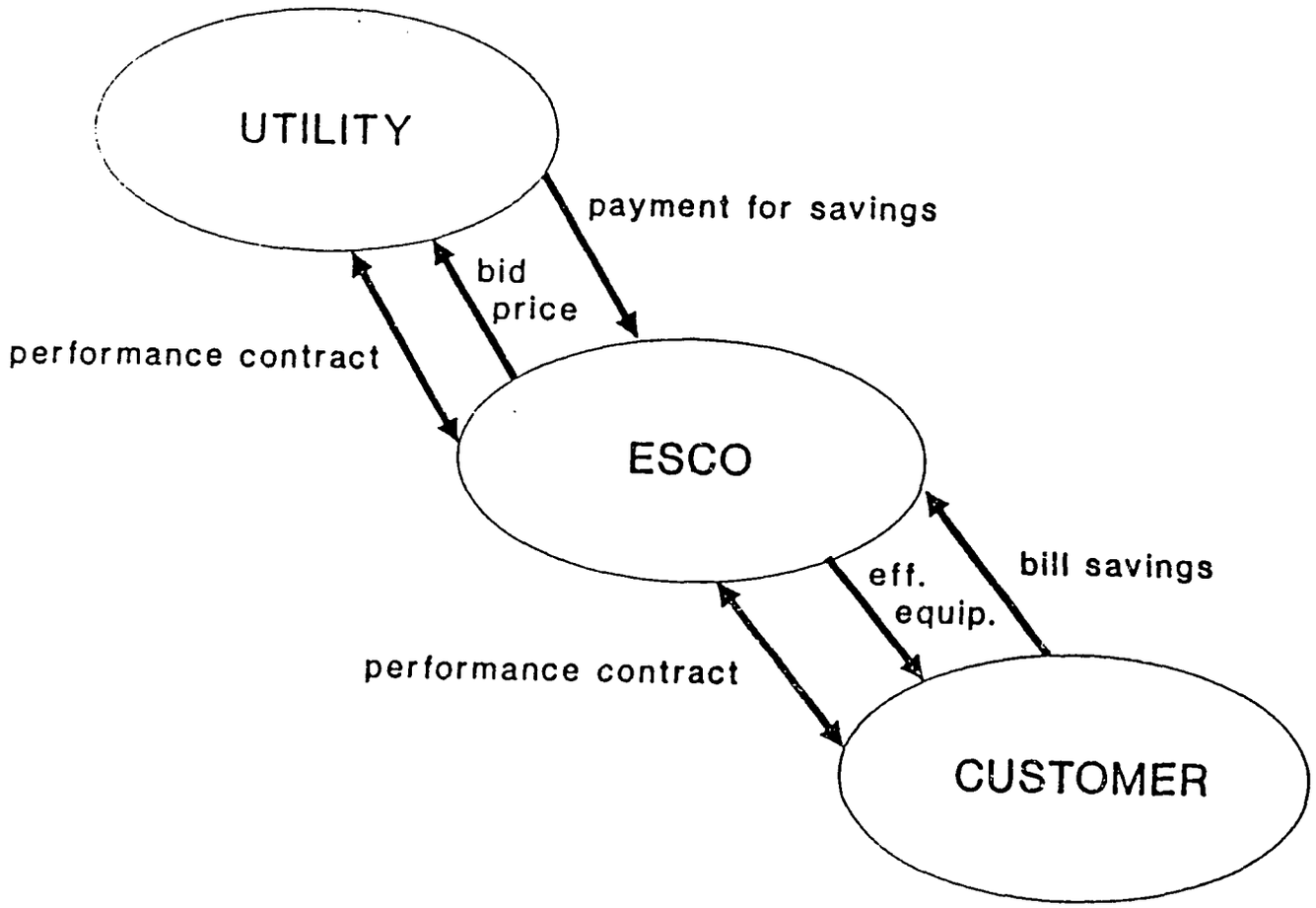
Figure. Analytic framework for the appliance standards analysis. (XBL 856-8918)

Table 1. Supply and DSM Resources in Utility Bidding Programs

Utility	RFP Issued	Amount Requested (MW)	Supply Projects		DSM Projects		C&LM Program Goal
			Proposed (MW)	Winning (MW)	Proposed (MW)	Winning (MW)	
Integrated Auctions							
CMP #1	12/87	100	666	0	36	17	≈65-105
CMP #2	5/89	150-300	2338	50	30	9	≈65-105
ORU	6/89	100-150	1395	181	29	18	≈76
PSE&G	8/89	200	654	210	47	47	≈360
JCP&L	8/89	270	712	235	56	26	≈200
Puget	6/89	100	1251	127	28	10	≈100
PSI Energy	12/88	550	1800	640	78	10	≈75
Niagara Mohawk	11/89	350	7115	405	162	36	≈350
Con Ed	2/90	200	2976	204	11.9	10.5	≈650
Separate Auctions							
LILCO	11/89	15-20	1750	132	23	10	≈350
Performance Contracts							
NEES - Supply	9/87	200	4279	204			
NEES - DSM					NP	13.6	≈326
BECO - Supply	5/88	200	2800	200			
BECO - DSM					NP	35	≈170

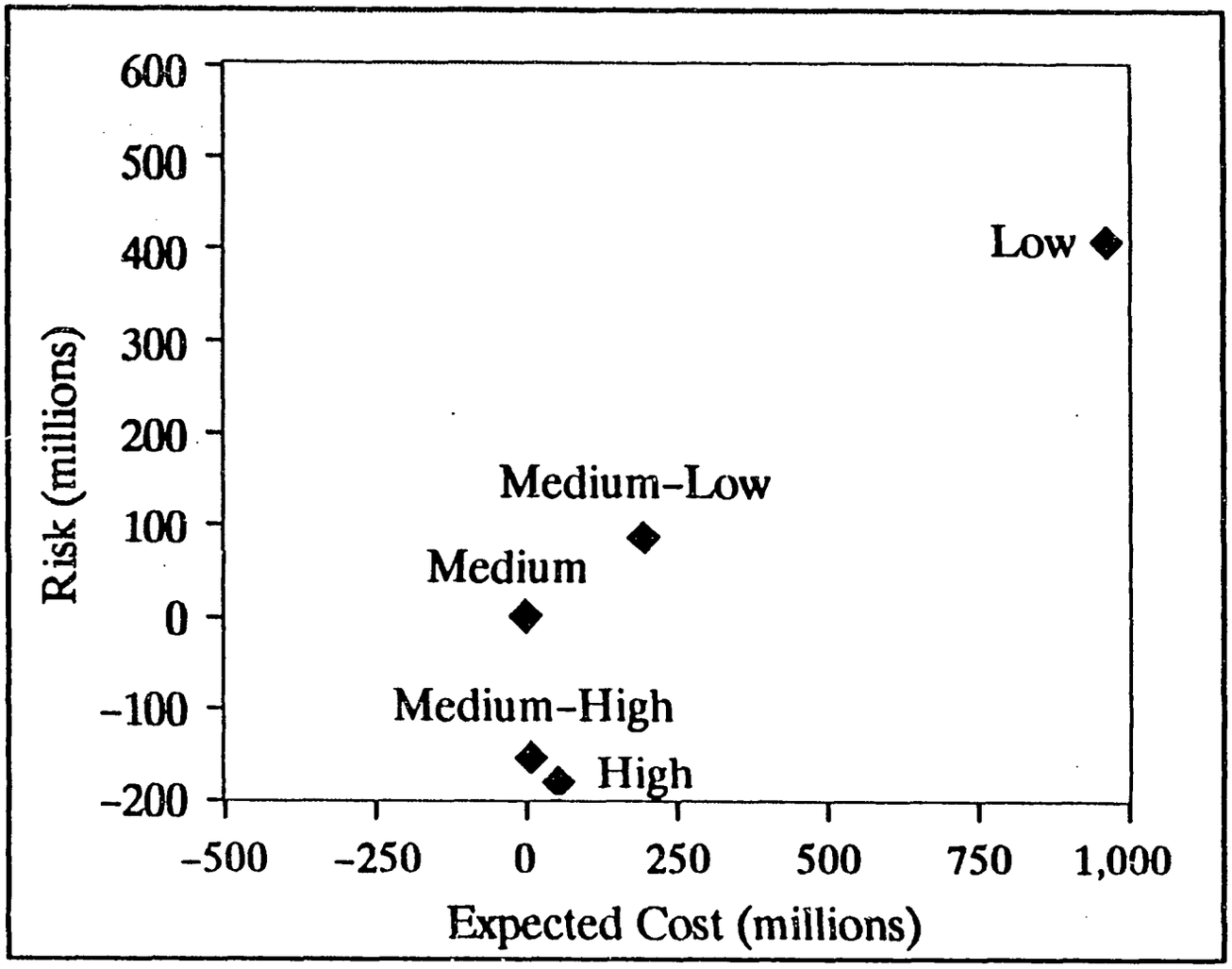
Notes: NP = Not Applicable

Figure 2. Arrangements between Utility, ESCO, and Customer



Conservation Target Risk Analysis

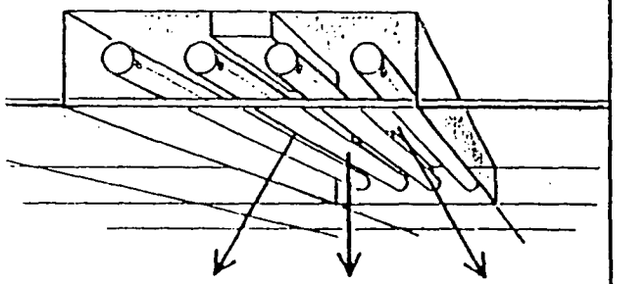
Figure 12
Trade–offs of Building to a Medium–High Load–Growth Level



CONVENTIONAL FIXTURE

INPUT: 175 WATTS

TWO BALLASTS DISSIPATE 27 WATTS

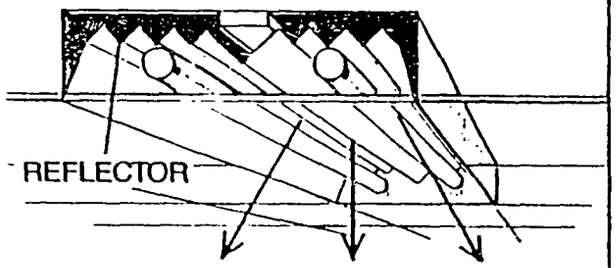


OUTPUT OF FOUR LAMPS: 11,000 LUMENS
FIXTURE EFFICIENCY: 65 PERCENT
FIXTURE OUTPUT: 7,000 LUMENS

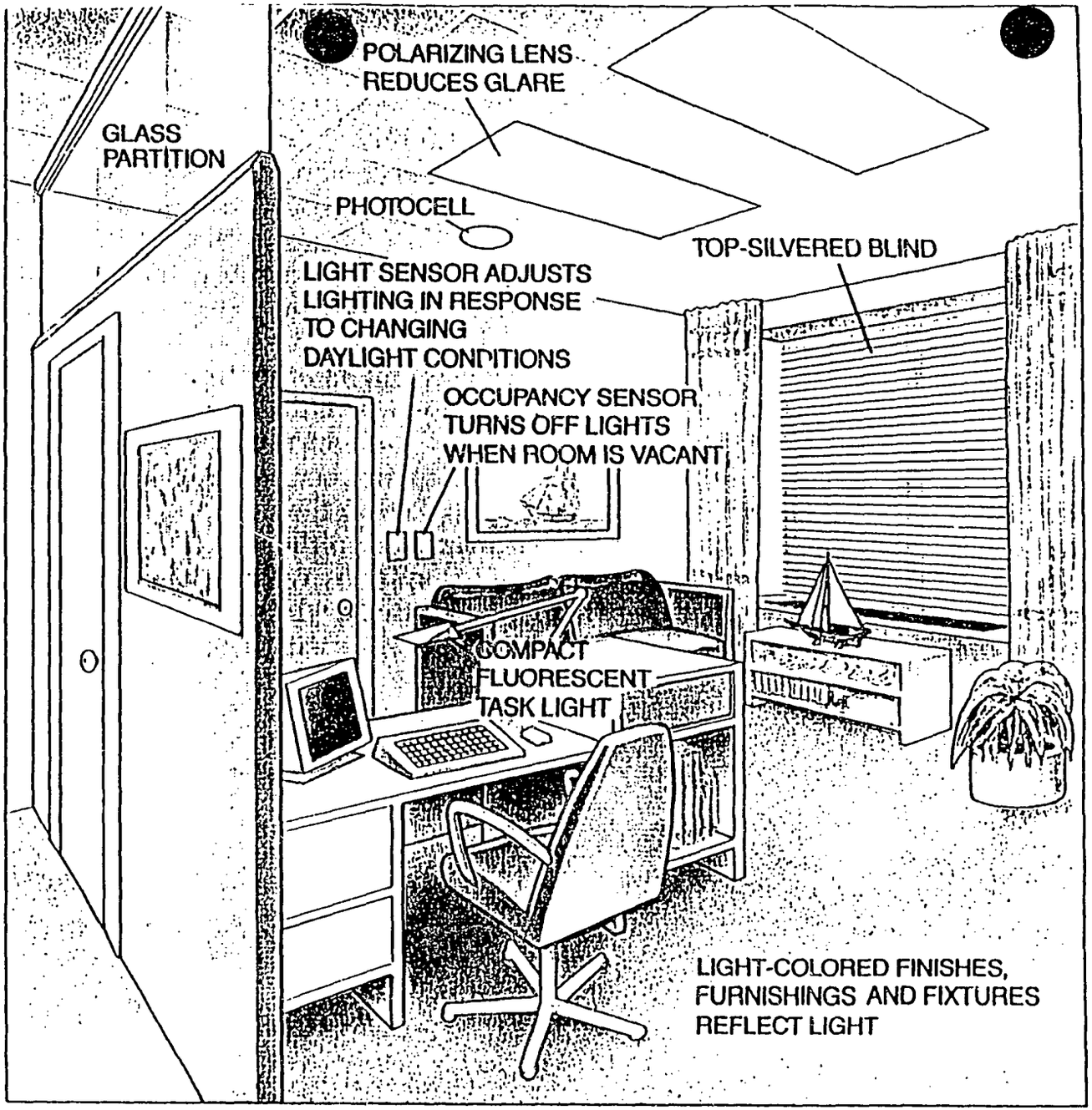
EFFICIENT RETROFIT

INPUT: 69 WATTS

ONE BALLAST DISSIPATES 2 WATTS

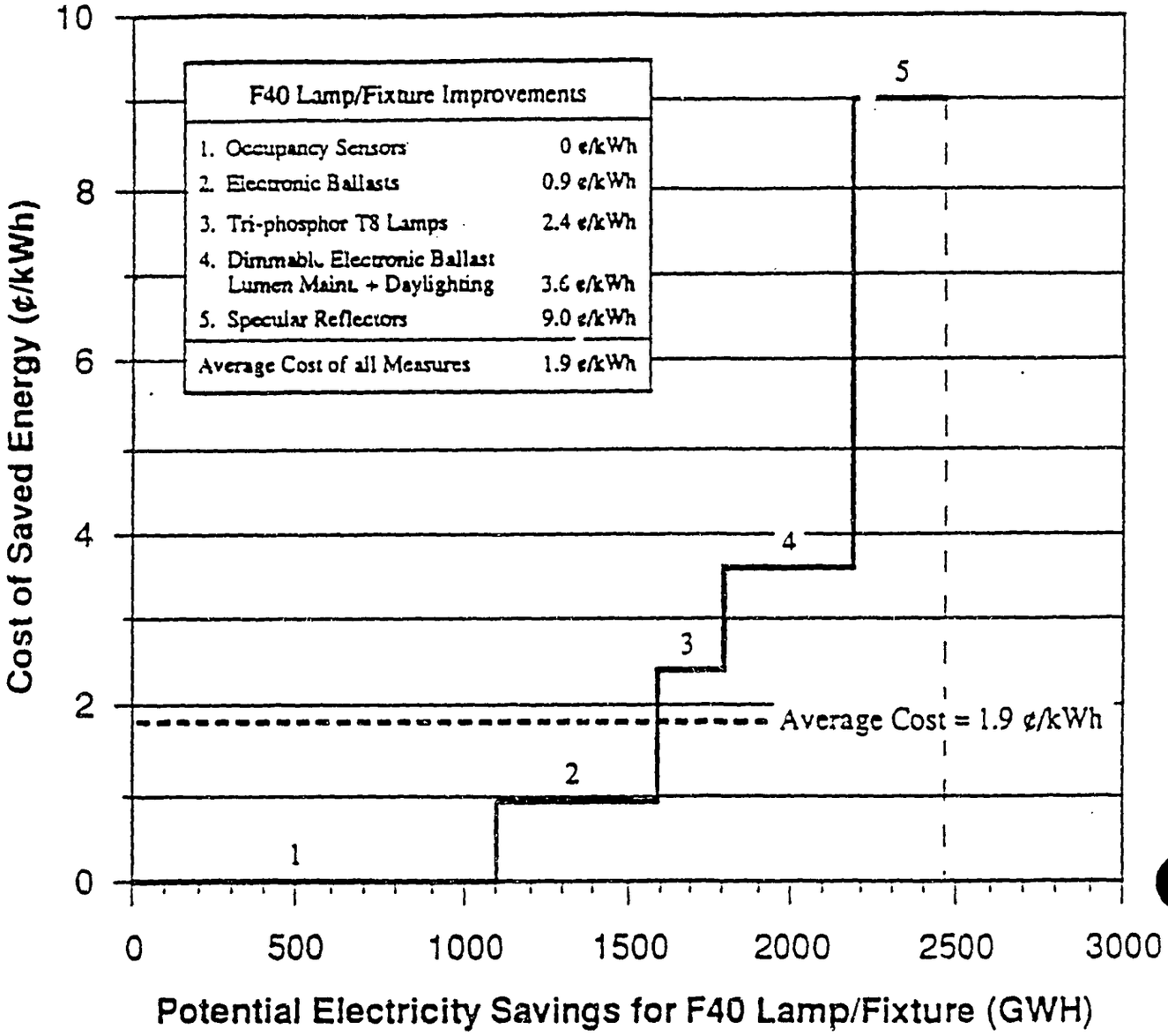


OUTPUT OF TWO LAMPS: 7,800 LUMENS
FIXTURE EFFICIENCY: 90 PERCENT
FIXTURE OUTPUT: 7,000 LUMENS

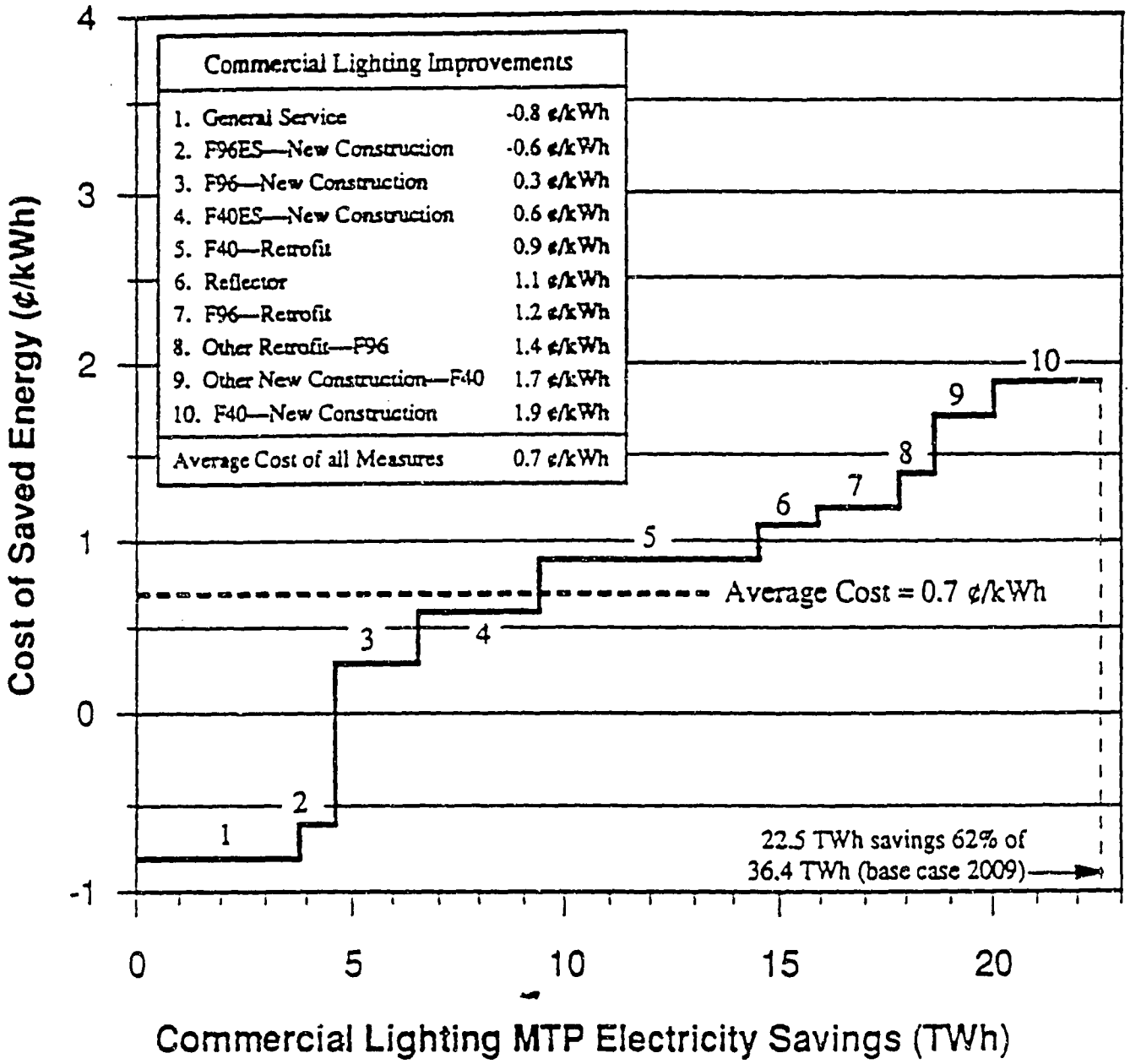


5 BILLION LIGHTING FIXTURES in U.S. buildings could use ›out 60 percent less electricity—typically from 70 to 90 ercent less when using dimming technologies available 1988. Lamp output is improved by phosphors, cooler fix-

The retrofit costs less than $130 per fixture, saves $50 in long-term maintenance costs and pays for itself in one or two years. It saves electricity at a net cost of about .6 cent per kilowatt-hour. The further options shown can save even more



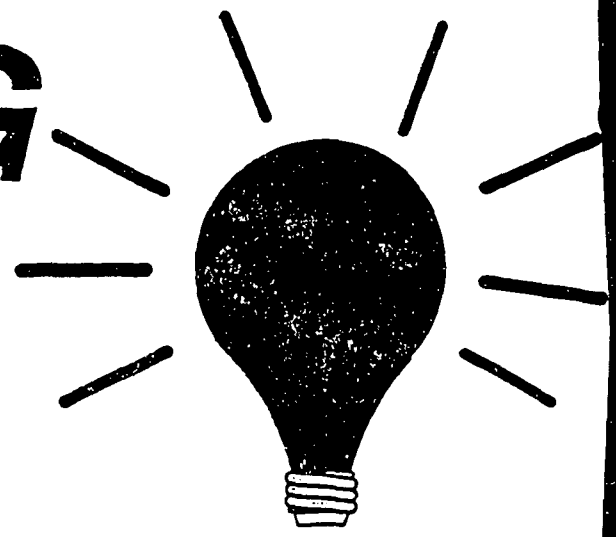
F40 Lamp/Fixture Electricity-Efficiency Supply Curve For California by the Year 2009. If California pursues higher efficiency levels for commercial buildings using F40 lamps, the potential savings could be almost 2,500 GWh in the year 2009 at an average cost of 1.9 ¢/kWh. For more detail see Section IV or Appendix C.



Commercial Lighting Electricity-Efficiency Supply Curve For California by the Year 2009. If California pursues higher efficiency levels for lighting in commercial buildings, the potential savings could be almost 22,500 GWh in the year 2009 at an average cost of 0.7 ¢/kWh (0.8 ¢/kWh assuming 20% program costs). These savings represent 62% of the 36,400 GWh total commercial interior lighting demand projected by the CEC in year 2009. Valued at today's price of 7.5 - 0.8 = 6.7 ¢/kWh, the annual savings in 2009 are worth $1.5 billion to California's commercial ratepayers. These savings are equivalent to the electricity generated by 4.5 baseload power plants (4.5 GW). The avoided construction costs alone are worth $5-7.5 billion.

Source: *Initiating Least-Cost Planning in California: Preliminary Methodology and Analysis*, D. Goldstein, R. Mowris, B. Davis, K. Dolan, NRDC and The Sierra Club, prepared for the California Energy Commission, Docket No. 88-ER-8, February, 1990.

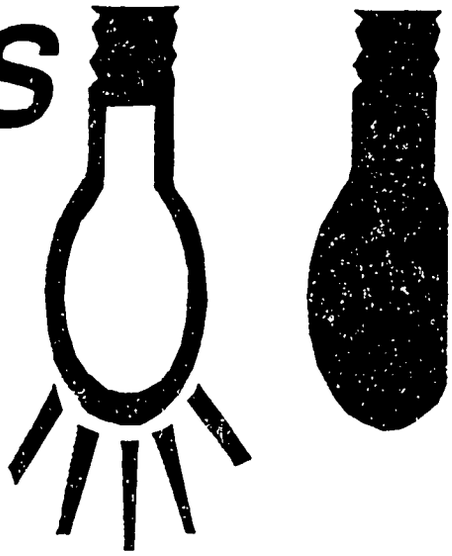
LIGHTING
(*in* the U.S.)



- Consumes 20 to 25% all electrcity
- Over 500 Billion kWh per year
- $32 billion per year expenses
- Over 100 million tons coal per year
- 45% incandescent (2.8 billion sockets)
- 50% fluorescent (1.4 billion fixtures)
- 5% High Intensity Discharge (HID) (20 million sockets)

SOURCE: RMI's Competitek Service

LIGHT SAVINGS (in the U.S.)



Applying Available Innovations Could Achieve:

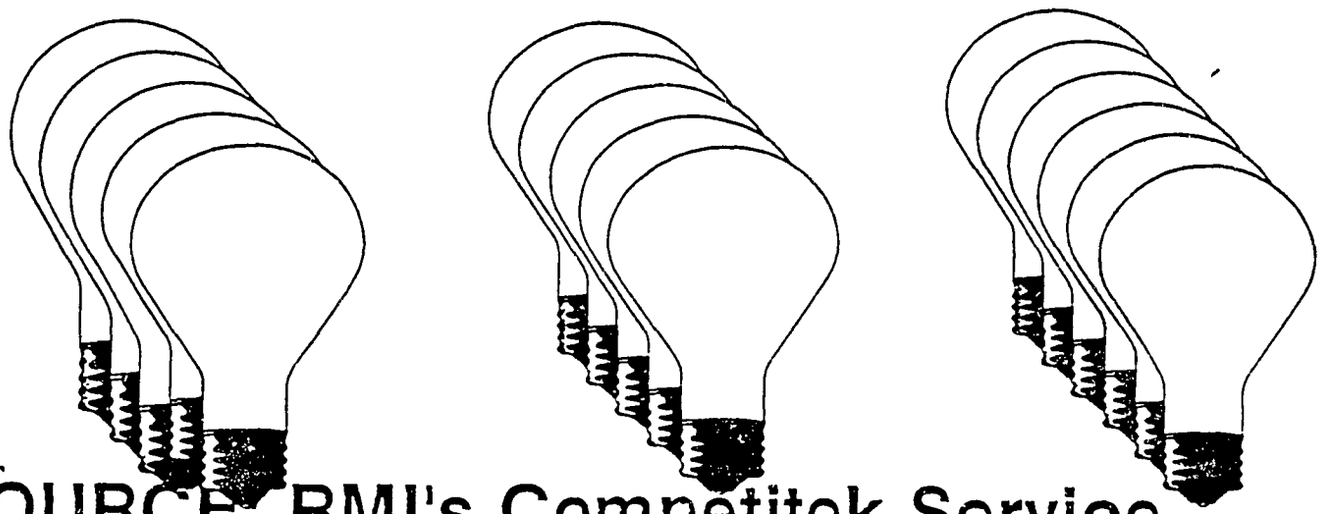
- √ 14–fold efficiency gain
- √ 80 to 92 percent savings
- √ $20 to $30 billion/yr savings
- √ Displace upwards of 120 Gigawatts
- √ Over 100 million tons of CO_2 reductions

SOURCE: RMI's Competitek Service

Replacing Incandescent w/ Advanced Innovation.

<u>Compact Fluorescent Lamp (CFL</u>
(in wattages from 5W to 32W)

- **consumes 75% less electricity**
- **lasts 10 to 13 times longer**
- **16W CFL vs 60W incandescent:**
  - -- **net savings over $30**
  - -- **saves 38 gallons oil**
  - -- **prevents 775 lbs CO_2**



SOURCE: RMI's Competitek Service

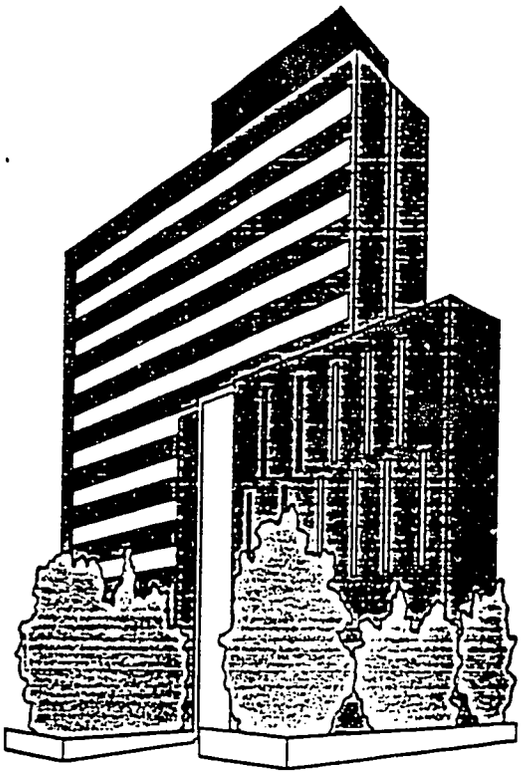
COST OF ELECTRICITY DIRECTLY SAVED BY A $15.50 SL*18 LAMP (1986 ¢/kW-h

DUTY FACTOR:	0.1	0.4	0.7	1.0
OPERATING H/D	2.4	9.6	16.8	24.0
OPERATING H/Y	868	3,506	6,136	8,766
Replacing $0.50 incandescent lamps (i.e., cheap wholesale lamps, no installation labor):				
	2.42	1.80	1.73	1.72
Replacing $1.00 incandescent lamps (i.e., retail lamps, no installation labor):				
	1.21	0.62	0.55	0.53
Replacing $1.50 incandescent lamps (i.e., cheap wholesale lamps + installation labor):				
	0.23	-0.36	-0.44	-0.48
Replacing $2.00 incandescent lamps (i.e., retail lamps + installation labor):				
	-0.98	-1.54	-1.63	-1.68

Thus the SL*18 at a competitive *retail* price ($15.50 in 1986 $) is very cost-effectiv to very low duty factors. In a commercial setting, *i.e.*, counting the standard $1.(cost of replacing a burned-out lamp and taking credit for very low ($0.50 wholesale incandescent-lamp prices, it typically saves electricity directly at a r cost. Clearly, even a modest further drop in the SL's price (each $1 decrease (cost of savings by ~0.1¢/kW-h) will make the levelized cost of saved electrici more likely to be less than zero. Even in the most restrictive case, with no inst

Compact Fluorescent Lamp Potential in Mexico

- At least 180 million incandescent sockets currently (based on similar estimates for Brazil)



- Growth potential over 1 billion sockets (based on U.S. saturation level)

- 55% turnover of current stock would:
  - save 47.8 billion kWh
  - save 3.8 billion gallons oil
  - prevent 39 million tons of CO_2
  - reap net savings of $3 billion

- Other Benefits
  - Increase employment
  - Open Export Market Opportunities

SOURCE: IIEC Policy Information Project

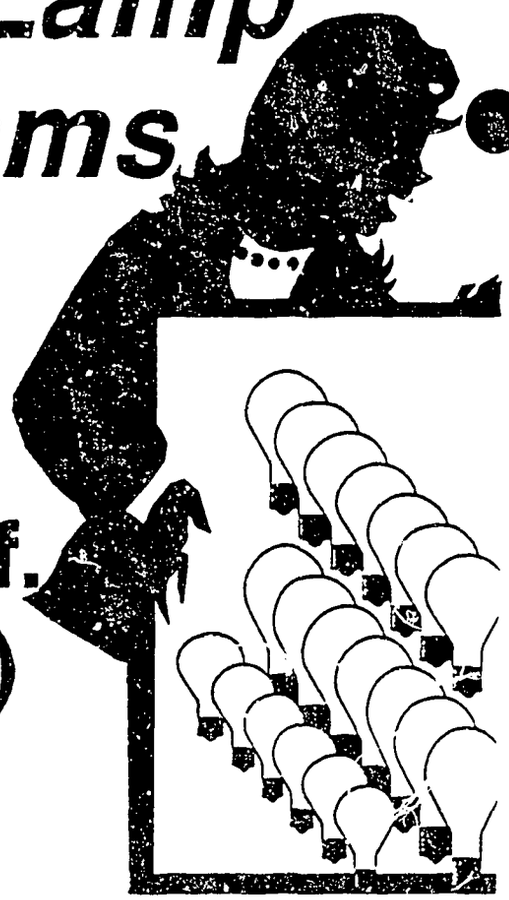
BARRIERS TO CFL USE

- <u>Payback Gap</u>
- High initial cost
- Very high consumer discount rate
- Lack of Incentives (based on utility investment perspective)
- Split Incentives (e.g., renters vs landlords, builders vs. owners)

- <u>Efficiency Gap</u>
- Lack of market availability & variety for all fixtures
- Lack of information on benefits

SOURCE: LBL Rpt 30389; RMI Competitek Service

Utility Compact Lamp Incentive Programs



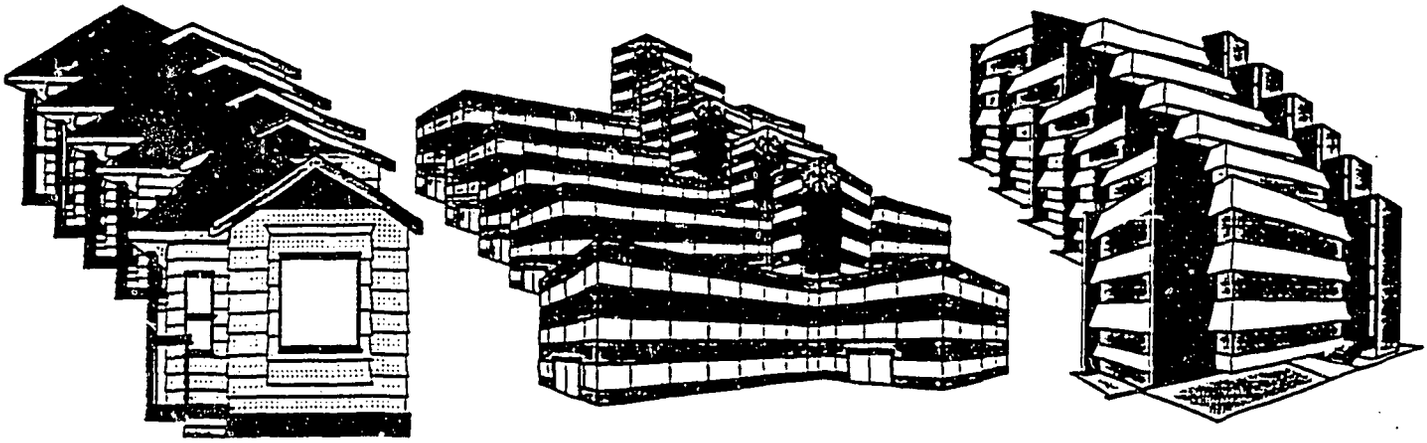
- <u>Give aways</u>
  (e.g., Southern Calif. Edison's 1.4 million)

- <u>Rebates</u>
  (some percentage less than 100% of total cost)

- <u>Lease</u>
  (to customer at no upfront capital; customer pays off on monthly utility bill)

SOURCE: IIEC Policy Information Project

•Utility CFL Lease Arrangement



- Utility large–scale purchase of CFLs from manufacturers (reducing market risk & spurring local production/availability)
- Able to negotiate wholesale prices
- Distribute to all customers at no out-of-pocket cost (using utility's cost of capital)
- Recoup costs plus profits via customers' monthly utility bills

SOURCE: Gadgil et al., LBL Rpt 30389

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Power to the utilities. Savings to the people.

Philips SL•18

Introducing the SMARTLIGHT Program. A new lease on light.

The SMARTLIGHT leasing program can shed a favorable light on your utility's image *and* bottom line – regardless of whether you are short on capacity or have power to spare.

This demand-side management program delivers an attractive return on investment while reducing customers' consumption. Your customers lease the highly efficient Philips SL•18 compact fluorescent lamp for pennies a month. You gain an attractive new source of revenue, while they save up to 75% of the energy they would use for incandescent lamps.

SMARTLIGHT programs are already generating good news – and awards – for utilities around the world. For example, the SMARTLIGHT Program instituted by the Taunton (Mass.) Municipal Lighting Plant has earned the company broad recognition, including coverage in *The Wall Street Journal* and the Energy Innovator Award from the U.S. Department of Energy and the American Public Power Association.

To find out more about the SMARTLIGHT Program and the incredible Philips SL•18 lamp, call your Philips Lighting representative at 1-800-631-1259. The sooner you put the power of the SMARTLIGHT Program to work for you, the more power to you.

It's time to change your bulb.™

Philips Lighting

PHILIPS

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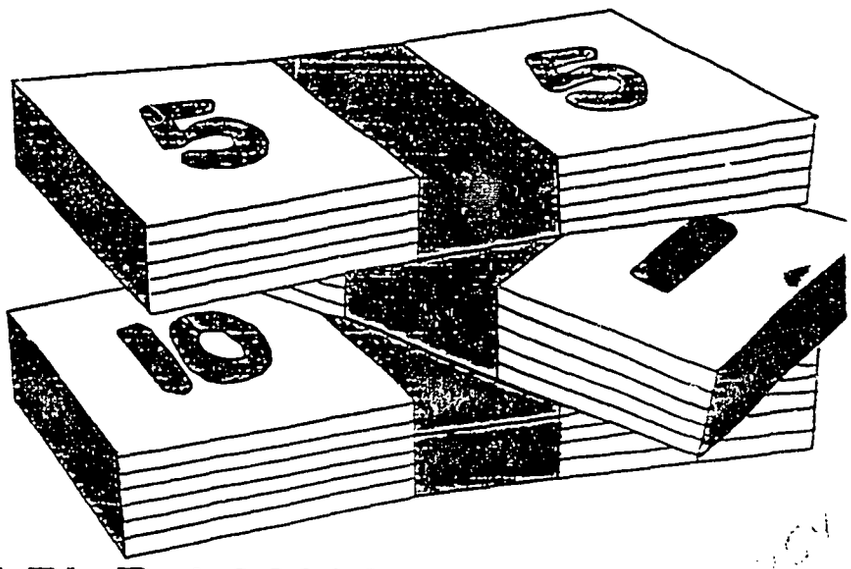
Benefits from a CFL Lease Arrangement

- Resolves <u>Payback Gap</u> by using utility investment perspective instead of consumer discount rate
- Resolves <u>Efficiency Gap</u> by including all customers in marketing design of lease program
- Maximizes market penetration, ensuring rapid and large savings
- Creates significant additional benefits



SOURCE: Gadgil et al., LBL Rpt 30389

Large-Scale Savings from CFL Lease Plan

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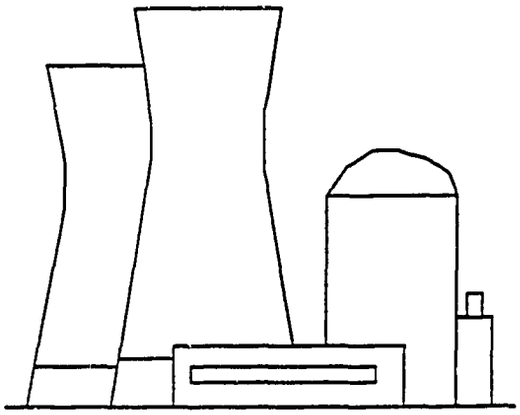


1 CFL Factory
6 mil CFL/yr
$7.5 million

700 MW Plan
$1 Billion

Capital Savings
133 times
Greater from CFL
Factory Investment

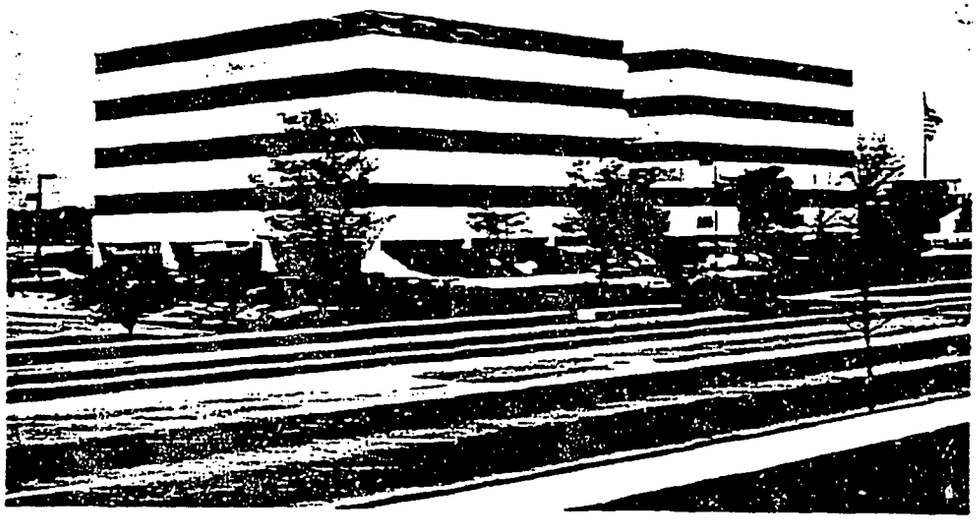
=

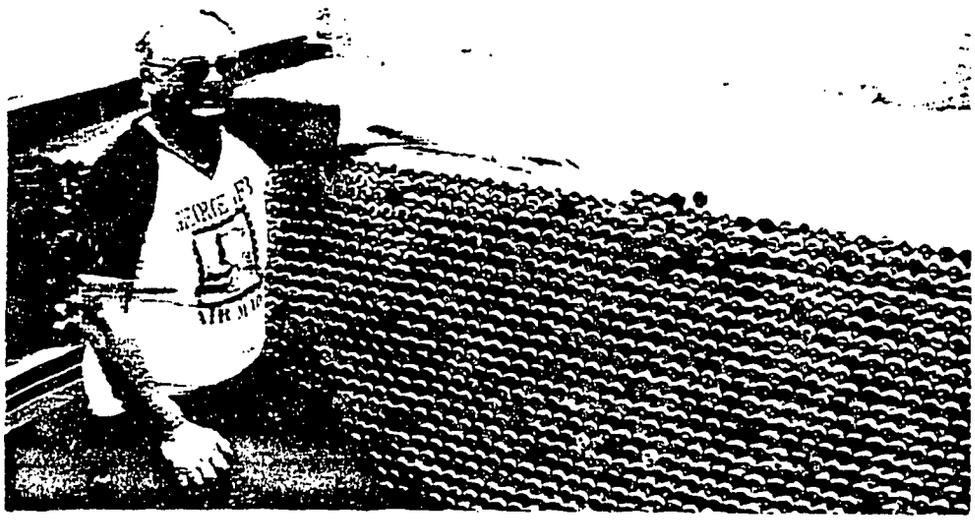
SOURCE: Gadgil et al., LBL Rpt. 30389.

nearer three than two times those of F40CWs today: possibly on the order of 230 lm/W[305]. So far these are laboratory curiosities, but if recent history is any guide, at least some of them may reach the market sooner than expected.

A reflector retrofit of this Illinois office building (top) removed half the lamps (bottom) while providing essentially unchanged illuminance. Each lamp represents a ~$25/y saving on electricity and maintenance.

Photo courtesy of Silverlight Corporation.





[305] S.M. Berman *et al.*, LBL Center for Building Science, *FY 1986 Annual Report*, LBL-24292, May 1987, at p. 4-23.

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INFORMATION SHEET NUMBER 4 (Edition No. 3, December 1989):

INTERNATIONAL DARK-SKY ASSOCIATION
3545 N. Stewart, Tucson AZ 85716 U.S.A.

OPERATING DATA AND THE ECONOMICS OF DIFFERENT LAMPS:

Assume the following, as realistic input information:
4100 hours of use per year (average nighttime hours, dusk-to-dawn).
0.08 as the current cost per KWH (Kilowatt-hour, the power rate).
The circuit wattage includes the ballast losses.
Lumens/Watt or the Annual Operating Cost measure the efficiency of the source.

*** LOW PRESSURE SODIUM ***

	180W	*135W*	90W	**55W**	35W	18W
Initial Lumens	33000	*22500*	13500	**8000**	4800	1800
Mean Lumens	33000	*22500*	13500	**8000**	4800	1800
Lamp Wattage	180	*135*	90	**55**	35	18
Circuit Wattage	220	*180*	125	**80**	60	30
Initial Lum/Watt	150	*125*	108	**100**	80	60
Mean Lum/Watt	150	*125*	108	**100**	80	60
Annual KWH Use	902	*738*	513	**328**	246	123
Annual Oper Cost	$72.16	*59.04*	41.00	**26.24**	19.68	9.84

*** HIGH PRESSURE SODIUM ***

	400W	*250W*	*200W*	150W	**100W**	50W
Initial Lumens	50000	*27500*	*22000*	16000	**9500**	3900
Mean Lumens	45000	*24750*	*19800*	14400	**8550**	3500
Lamp Wattage	400	*250*	*200*	150	**100**	50
Circuit Wattage	465	*294*	*246*	193	**130**	66
Initial Lum/Watt	108	*94*	*89*	83	**73**	59
Mean Lum/Watt	97	*84*	*80*	75	**66**	53
Annual KWH Use	1907	*1205*	*1009*	791	**533**	271
Annual Oper Cost	$152.52	*96.43*	*90.69*	63.30	**42.64**	21.65

*** MERCURY VAPOR ***

* INCAND *

	400W	250W	**175W**	100W	150W
Initial Lumens	*21500*	11500	**8150**	4000	2880
Mean Lumens	*17200*	9400	**7000**	3160	2600
Lamp Wattage	*400*	250	**175**	100	150
Circuit Wattage	*455*	295	**208**	120	150
Initial Lum/Watt	*47*	39	**39**	33	19
Mean Lum/Watt	*38*	32	**34**	26	17
Annual KWH Use	*1866*	1210	**853**	492	615
Annual Oper Cost	*$149.28*	96.76	**68.22**	39.36	$49.20

[Note: The columns in italics and in bold show the relative values for lamps of approximately the same light output, showing the potential savings resulting from using more efficient light sources.]

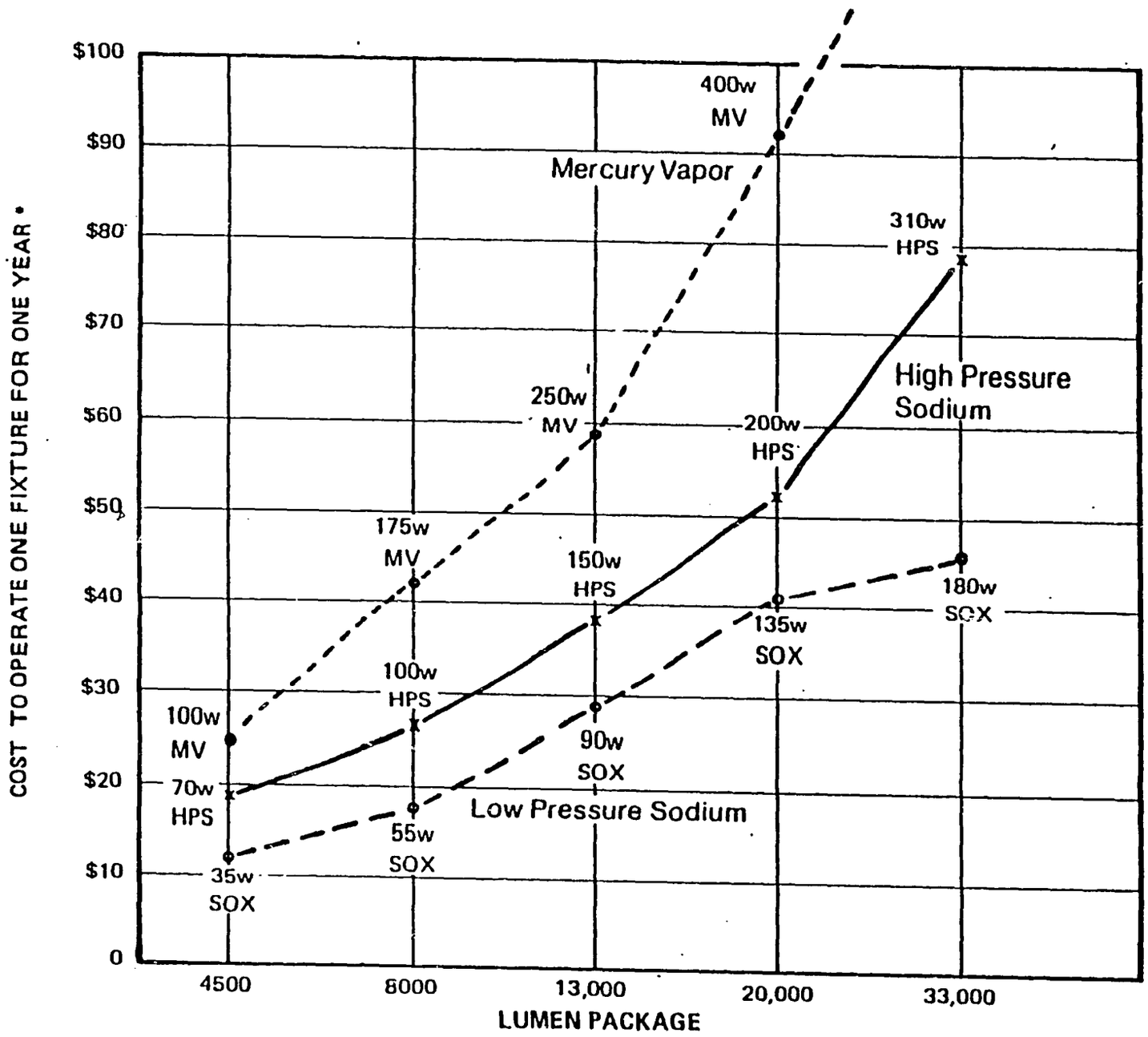
Watt (W) = unit of electric energy
Lumens = light output, candlepower

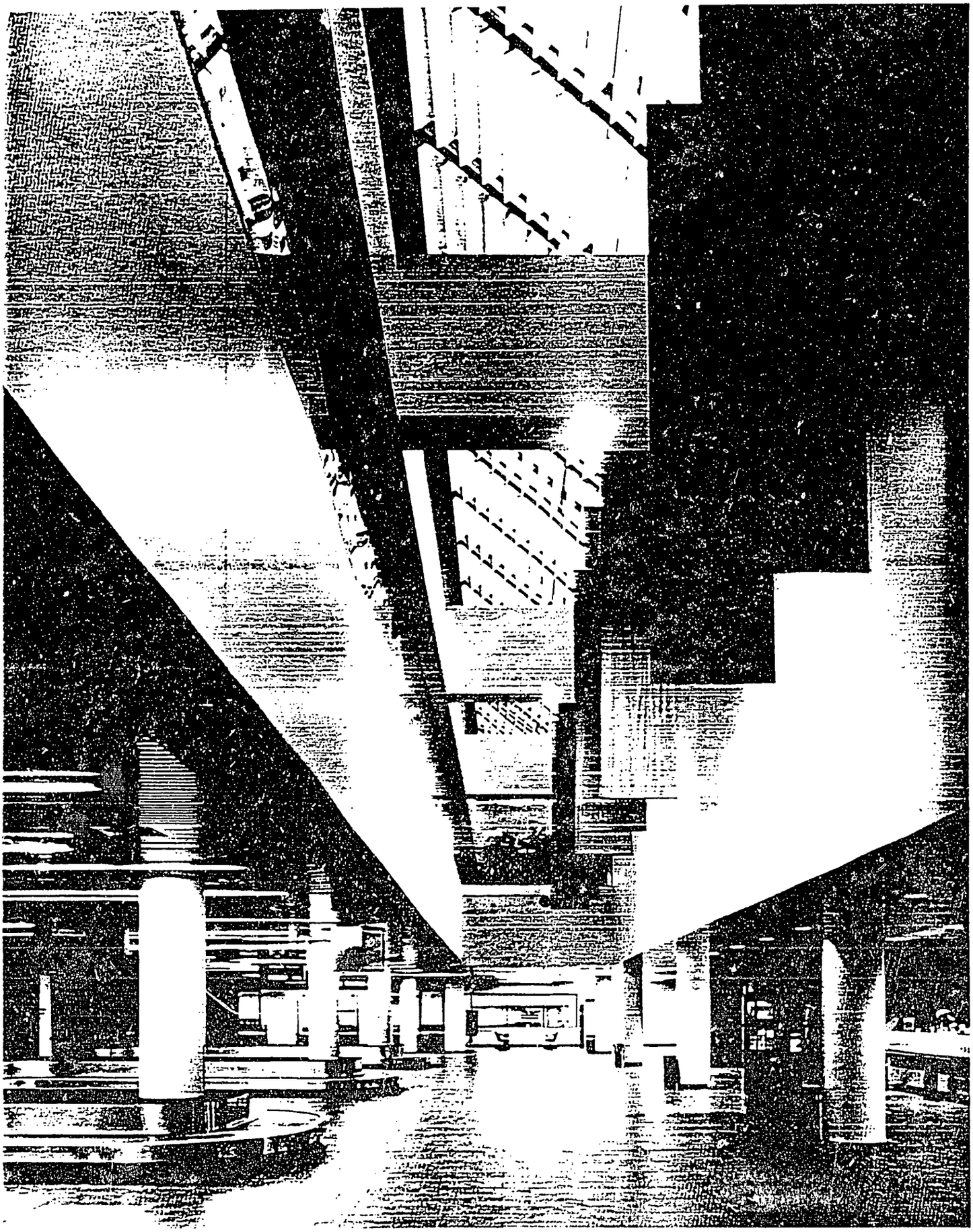
Design Options for Commercial Fluorescent Lighting—F40 Lamps and Fixtures.

	Adjusted Annual Energy Use *kWh/ft2*	Adjusted Annual Energy Savings Includes HVAC *kWh/ft2*	Total Levelized Cost Includes Relamp *$1990*	Marginal CSE *¢/kWh*	Average CSE *¢/kWh*	Incremental Annual Savings by 2009 *GWH*	Total Annual Savings by 2009 *GWH*
F40—New Construction or Remodeling							
0. Base case (F40CW 3-lamp fixture CU=0.7, magnetic ballast)	5.5	-	7.9	-	-	-	-
1. Occupancy Sensors	3.9	1.8	7.8	0.0	0.0	1102	1102
2. Electronic Ballasts	3.1	2.6	8.4	0.9	0.2	489	1591
3. Tri-phosphor T-8 Lamps	2.8	3.0	9.0	2.4	0.5	206	1797
4. Dimming Electronic Ballasts, Lumen Maintenance, Daylighting	2.3	3.6	10.8	3.6	1.0	375	2172
5. Specular Reflectors	1.8	4.1	14.2	9.0	1.9	284	2456
F40ES—New Construction or Remodeling							
0. Base case (F40CWES 3-lamp fixture CU=0.7, magnetic ballast)	5.6	-	8.3	-	-	-	-
1. Occupancy Sensors	3.9	1.9	8.1	-0.2	-0.2	1469	1469
5. Specular Reflectors, Tri-phosphor T-8 Lamps, Electronic ballasts	2.3	3.7	9.7	1.4	0.6	1433	2902
Other New Construction—F40 used for base case							
0. Base case (F40CW 3-lamp fixture CU=0.7, magnetic ballast)	5.5	-	12.2	-	-	-	-
1. Occupancy Sensors	4.4	1.2	9.5	0.3	0.3	543	543
2. Electronic Ballasts	3.6	2.1	8.7	0.7	0.5	413	956
3. Tri-Phosphor T-8 Lamps	3.2	2.5	8.2	2.6	0.8	174	1130
4. Specular Reflectors	2.6	3.2	7.9	5.0	1.7	299	1429
F40—Retrofitting Existing Buildings							
0. Base case (F40CW 4-lamp fixture CU=0.5, magnetic ballast)	8.6	-	2.4	-	-	-	-
1. Delamp	6.5	2.6	2.0	-0.3	-0.3	1683	1683
2. Occupancy Sensors	4.5	4.9	1.9	0.0	-0.2	1527	3210
3. Change to Energy-Saving F40ES Lamps	3.7	5.8	3.0	1.7	0.1	617	3827
4. Specular Reflectors	2.5	7.3	5.2	2.2	0.6	982	4809
5. Electronic Ballasts	2.1	7.8	7.2	6.6	0.9	280	5089

Note 1. For more detail see Tables C1 through C5 in Appendix C.

COST TO OPERATE ONE LIGHT POINT ONE YEAR



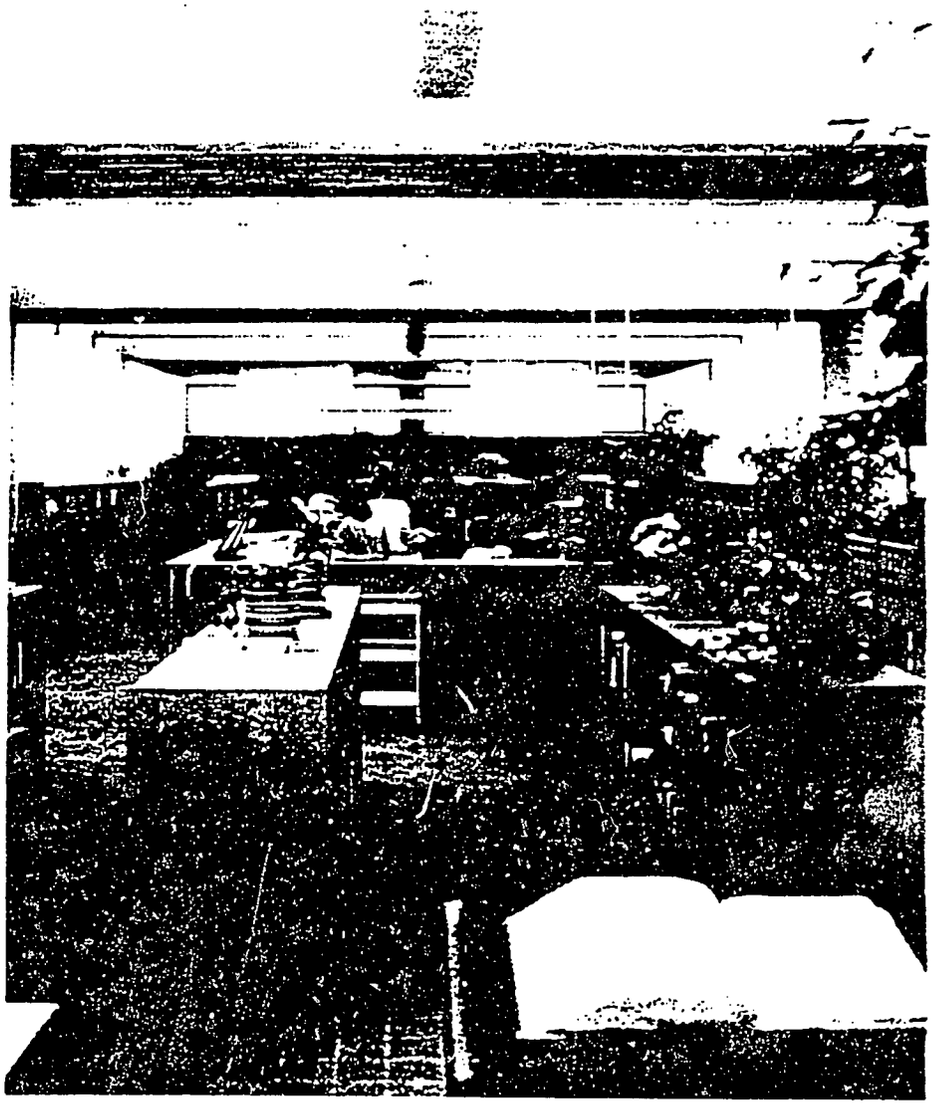


SKYLIT SOLAR COURT provides 40 percent of the lighting and 20 percent of the heating in the new passenger terminal at the Albany County Airport in Colonie, N.Y. A microcomputer, programmed with the solar altitude and azimuth angles until the year 2000, continuously gauges the indoor and outdoor environment and selects the most energy-efficient position for the louvers. The dark masonry wall supporting the skylight stores solar heat. The stone floor provides additional thermal mass. When daylight is available, photoelectric controls dim the artificial lighting supplied by efficient fluorescent and mercury-vapor lights. Linhorn Yaffee Prescott designed the terminal, and the energy consultant was W. S. Fleming & Associates, Inc.

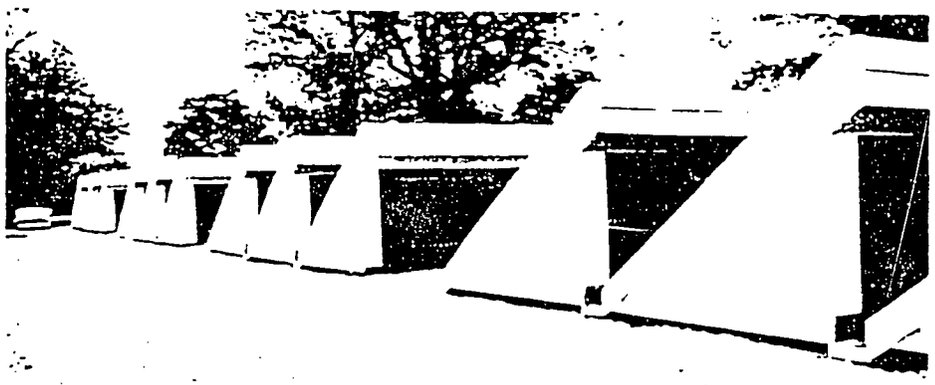
Although each building in the program is worth study, one can serve as a representative example. The Mt. Airy, North Carolina, public library is a beautiful 13,500-square-foot building with light shelves, clerestories, and other ingenious daylighting features. Its annual cost for electricity (the only purchased energy necessary for the building) is $6,119, or 45 cents per square foot. According to the Building Owners and Managers Association International, the cost of energy for a comparable non-solar building would be $1.49 per square foot — more than three times as much.

In 1979, the average commercial building was 20 years old and consumed energy at a rate that would cost $1.60 per square foot. Some buildings, equipped with floor-to-ceiling single-glazed windows that pour warmth outside in winter and pour unwanted heat inside in summer — are more likely to have annual energy bills of about $3.00 per square foot.

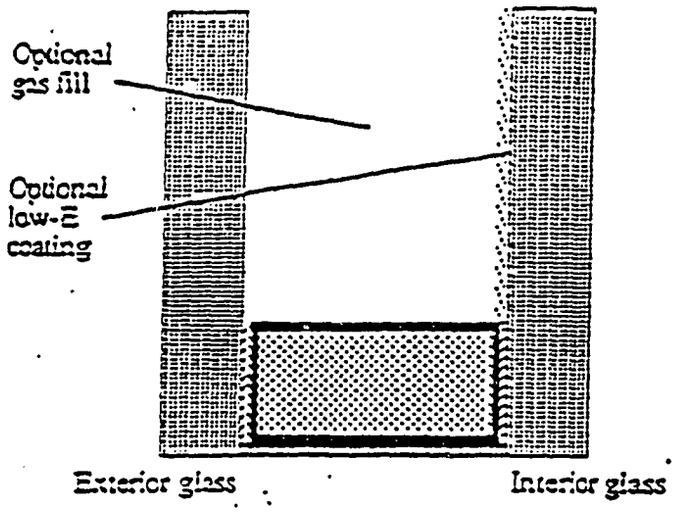
At this rate, over a building's 50-year life span *its energy bill would double or triple its construction cost.* This is a sobering prospect particularly since research and experience have made it possible to avoid these staggering costs, while improving the comfort and quality of the interior space for everyone who works or spends time in the building over that entire 50 years.



More than twice as many people as originally expected use the Mt. Airy Library each day.



The [illegible] the building [illegible]

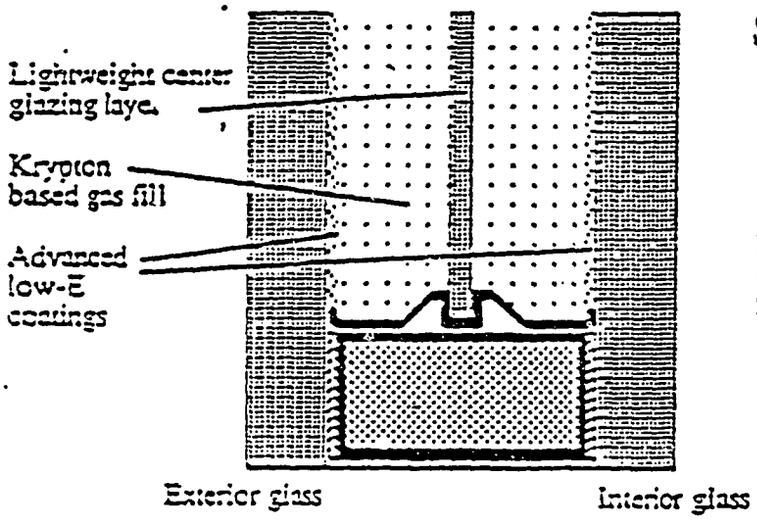


Current Window Design

R-2 Double Glazing

R-3 Double Glazing with low-E coating

R-4 Double Glazing with low-E coating and gas fill



Superwindow Design

R-6 to R-10 High-R Glazing

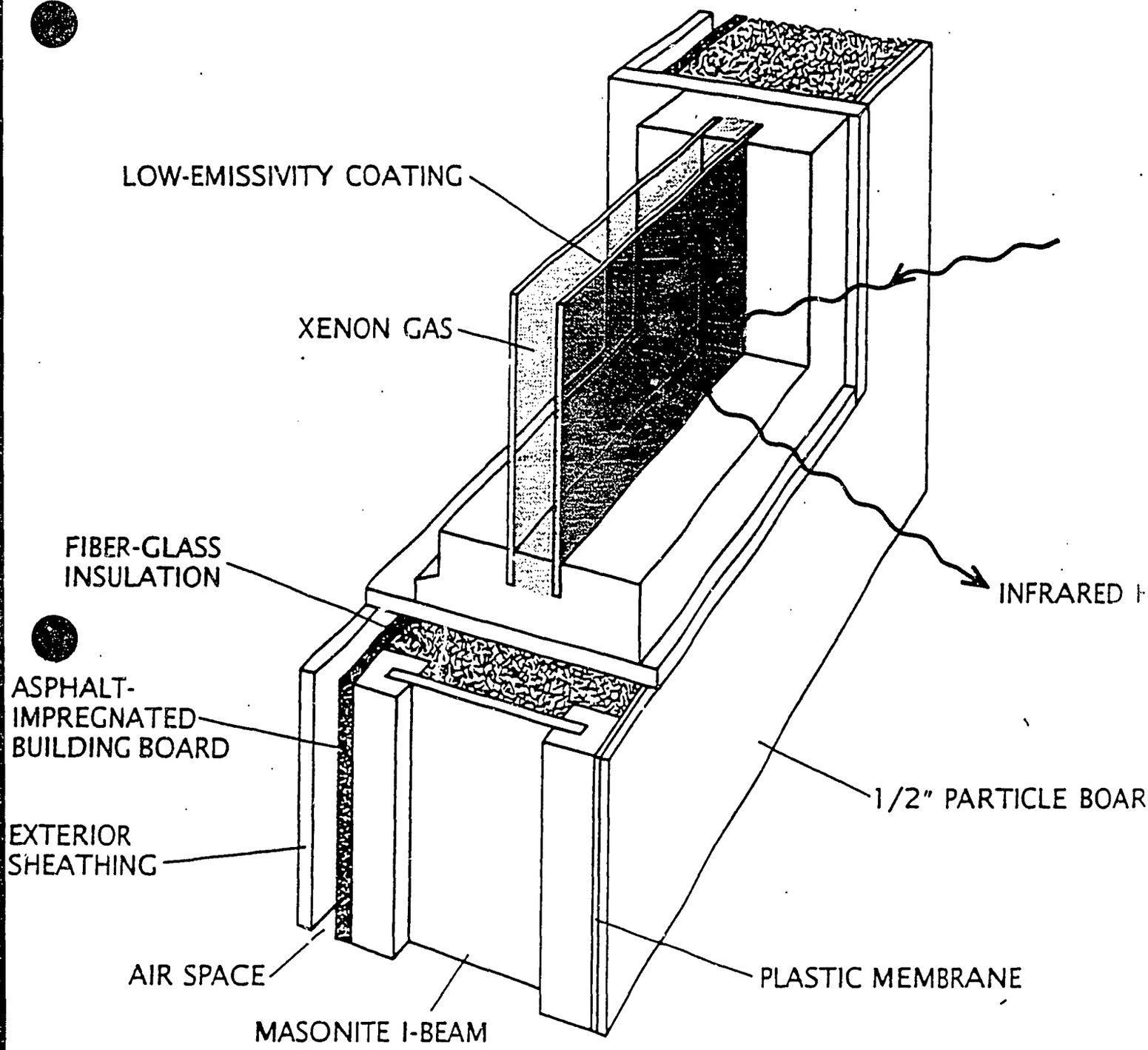
Example:

R-8 Insulating Glass (center) using two low-E coatings (E=.06) and 90% Krypton/10% Argon gases

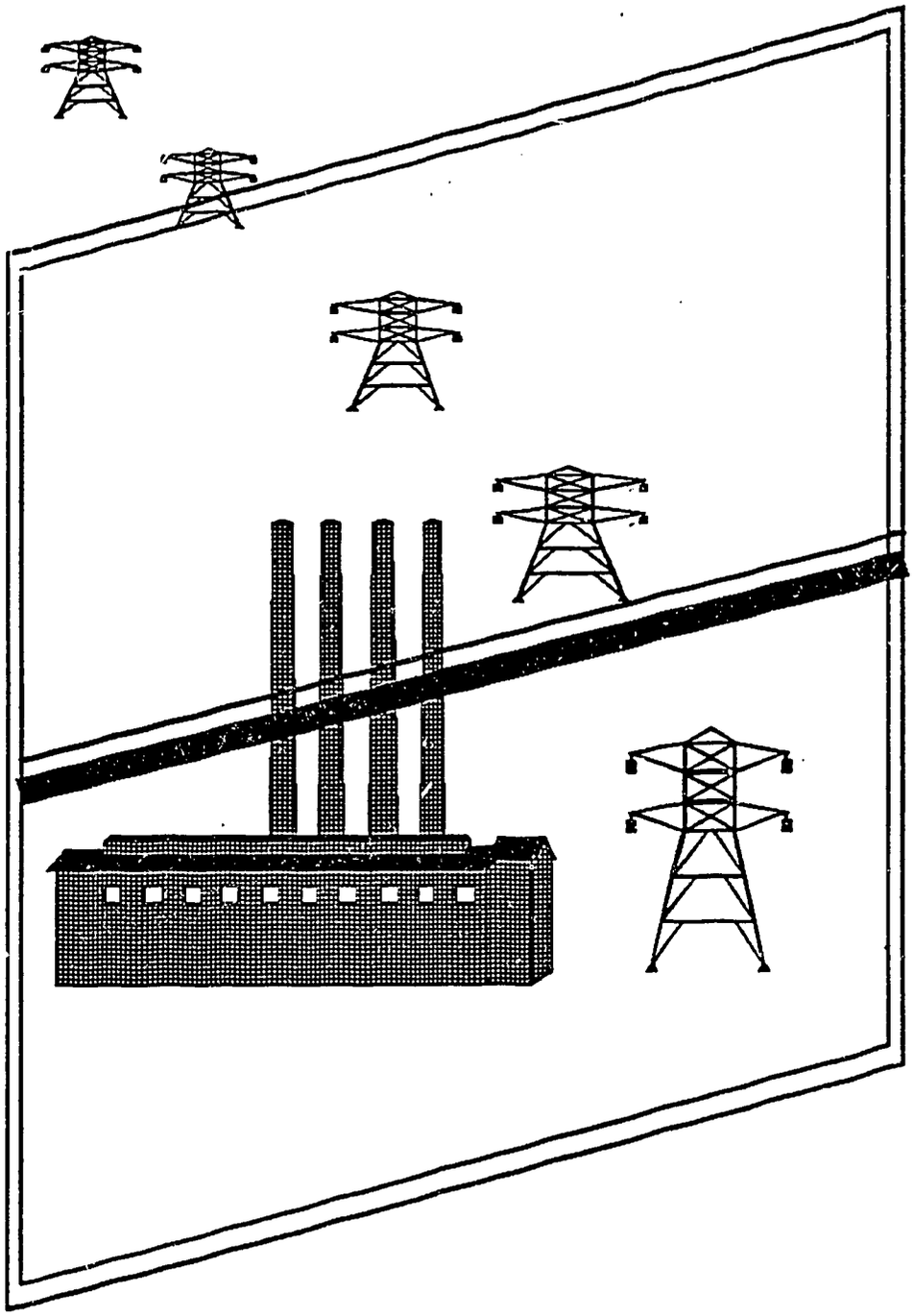
FIGURE 7. Superwindow Design Compared to Current Window Design. The upper figure shows current window design with double pane glass and R-values ranging from 2 to 4. The lower figure shows superwindow design with lightweight center glazing layer, krypton gas fill and dual low-e coatings. These advanced technologies are capable of producing R-values ranging from 6 to 10.

be improved to an R-3 rating by coating one of the inner surfaces with a thin film of a transparent low-emis-

major home electrical appliance
frigerators, freezers, water he
and air conditioners. They acc

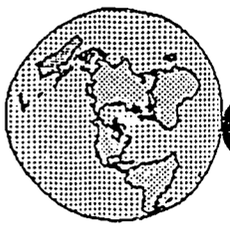


SUPERINSULATED walls and windows can reduce home heating needs by more t
75 percent compared with homes built before 1973. In ordinary insulated walls, l
seeps through wood studs between the inner wall and the outer wall. This Swedish
signed wall overcomes the problem by using I-beam studs consisting of a sheet of i
ati masonite held between two pine flanges. Heavily insulated walls must be sea
on the inside with a plastic membrane to prevent indoor moisture from condensing
he cold insulation in the wall. Heat loss through double-glazed windows can be cu
half by coating one of the inner surfaces with a low-emissivity material such as tin
de and filling the air space with argon or xenon gas. Even on their own, low-emissi



SPECTRALLY-SELECTIVE GLAZINGS
A CAPITAL-EFFICIENT ALTERNATIVE

$1.5 Billion Power Plant
$10 Million Coating Plant



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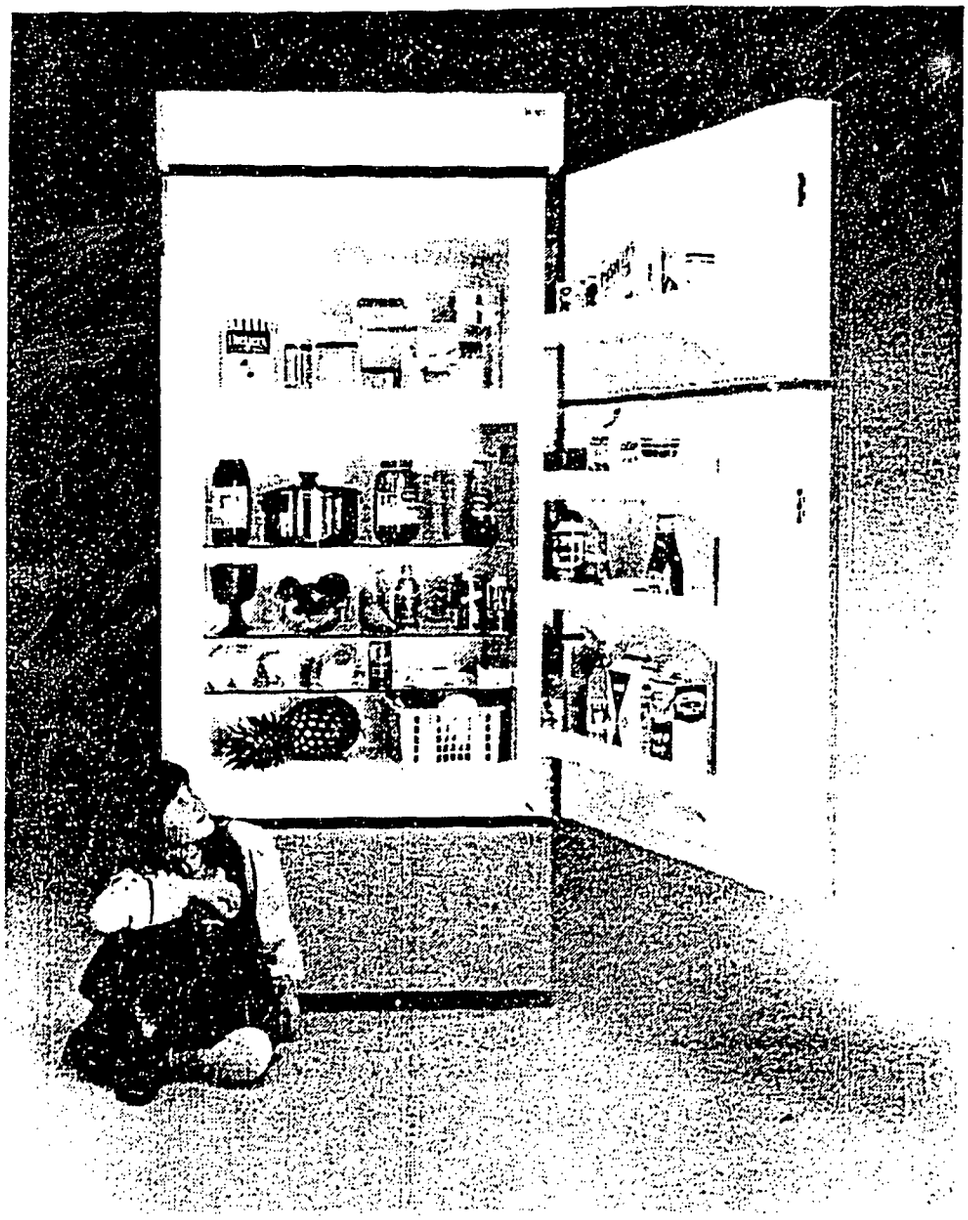
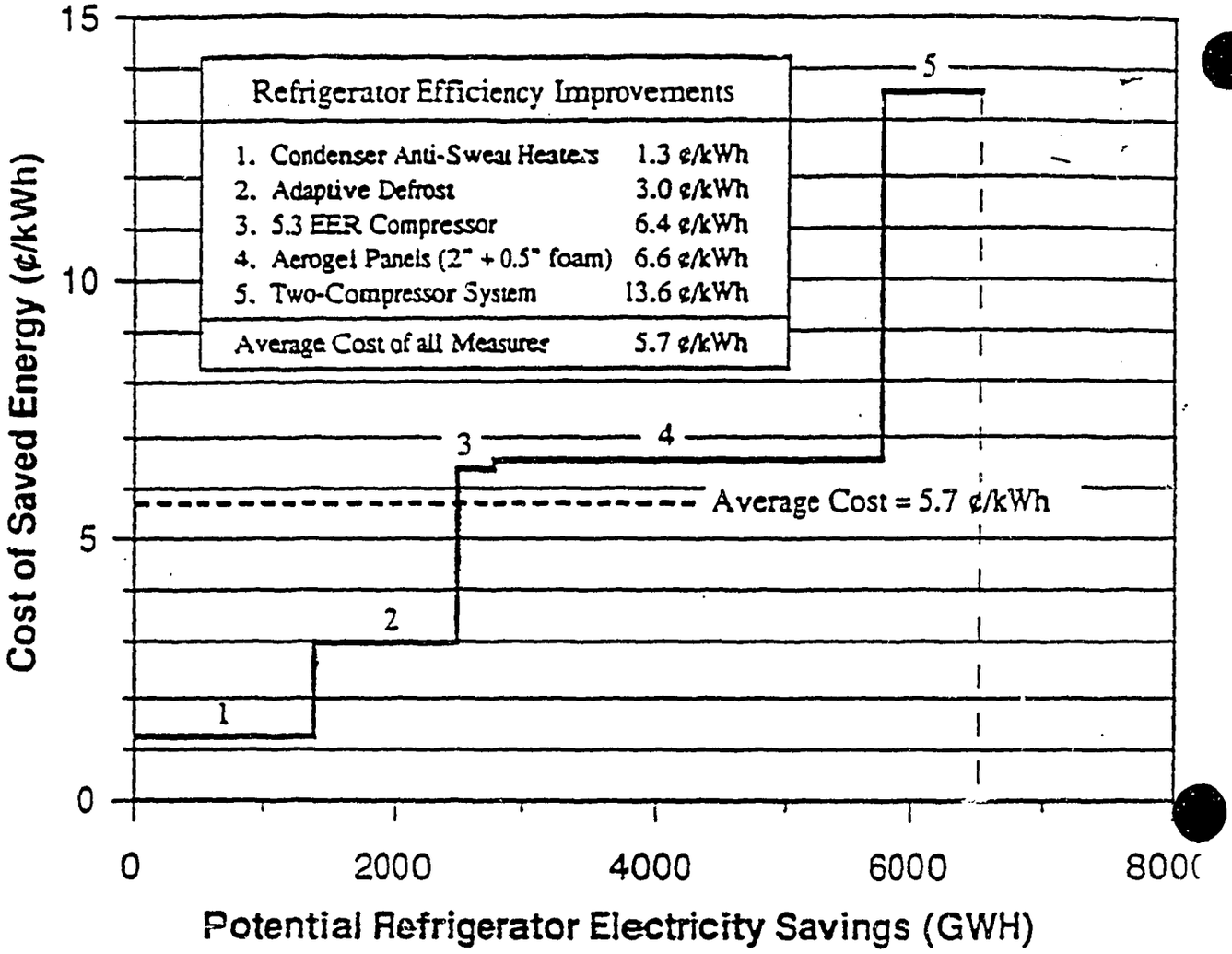


Figure 2.5B: SUN FROST'S 16-FT^3 REFRIGERATOR/FREEZER, WHICH USES ~240 KW-H/Y

The AC-powered 16-ft^3 (18.5-ft^3 AV) refrigerator/freezer uses about 240 kW-h/y. DC models use less energy because their compressors are more efficient. Sun Frost principal Dr. Larry Schlussler says that all his units could use 25-30% less energy if compressor manufacturers would put the same effort into improving the efficiency of the small ~60-W_{th} compressors he uses as they have into the larger ~200-250-W_{th} compressors used in mass-produced refrigerator/freezers. Tom Gulbrandsen and his colleagues at the Tech-

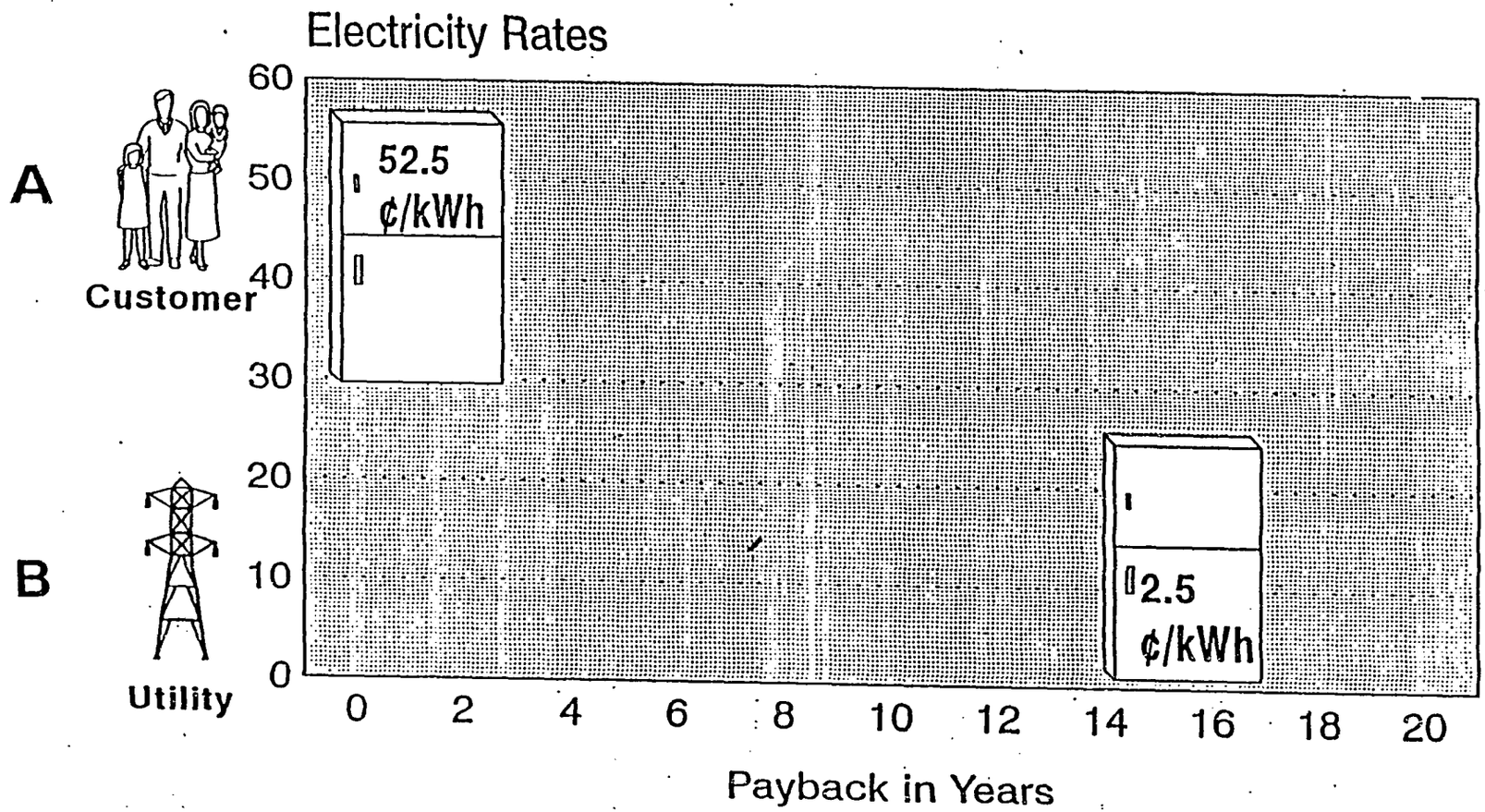


Refrigerator Electricity-Efficiency Supply Curve for California by the Ye 2009. If California pursues higher efficiency levels beyond the 1993 Federal Standards, t potential annual savings could be about 6,470 GWH in the year 2009 at an average cost about 5.7 ¢/kWh. These savings represent 45% of the 14,500 GWh total refrigerator electric demand projected by the CEC in year 2009. For more detail see Table 5 and Appendix D1.

The Payback Gap:

Utilities Long Term Investment Perspective vs. Customers Short Term Payback Demand

Investment in the same highly efficient refrigerator requires A) Price signals of 52.5 ¢/kWh for a consumer based on their rapid payback requirement of roughly a year vs. B) Only 2.5¢/kWh electricity rate with a 15 year payback based on a utility's long term investment perspective.



Assumptions: 20 Year Product Life.
Utility Real Discount Rate= 3%, Consumer Discount Rate= 64%.
Source: Krause and Eto, 1988

Progress for kWh for Refrigerators

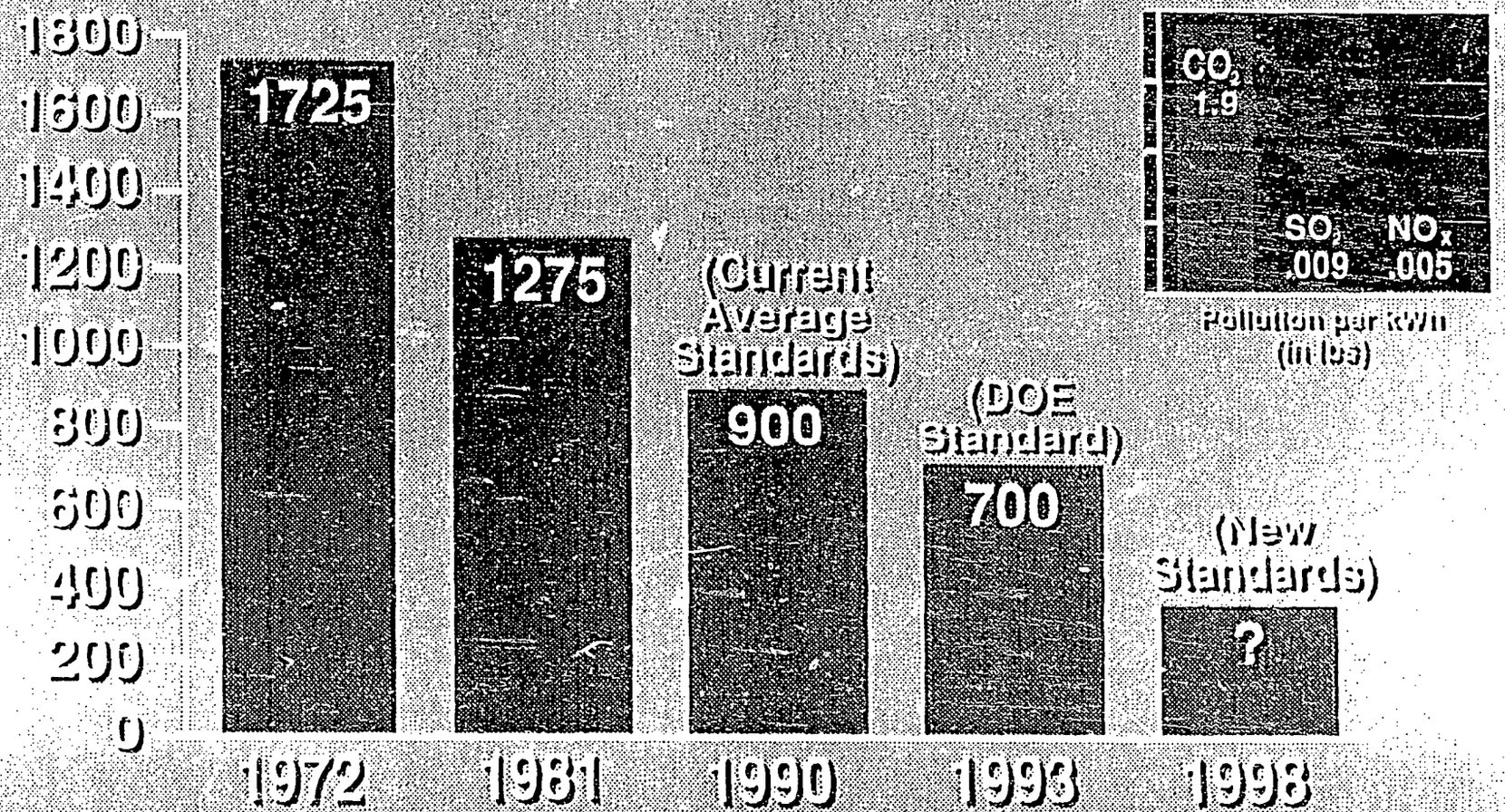


Table 2. PG&E Refrigerator Rebate Program

Year	Rebate Level $	Eligibility Guidelines
1979	*California Appliance Standards*	
1982	$50	10%
1983	$50 $100	20% 35%
1984	$50	20%
1985	$50 $75	20-35% 35%
1987	*California Standards Revised*	
	$50 $75	10% 15%
1988	$50 $75	10% 15%
1989	$50 $75	10% 15%
1990	*Federal Standards Enacted*	
	$50 $100	10% 15%
1991	$50 $75 $150	10% 15% 20%

ty guideline refers to minimum energy efficiency level that must be achieved for a qualifying reba
ıe applicable state or federal appliance efficiency standard.

Major Industrial Drivepower Savings

Motor choice
- Conventional high-efficiency induction motors
- New types (RE-Fe-B permanent-magnet, amorphous-Fe, high-speed homopolar, reluctance,...)
- Correcting past rewinds' core damage
- Correcting gross oversizing
- Improving synchronous & DC motors & MGs

Motor controls
- Variable-frequency electronic drives (several types)
- "Power-factor controllers" / soft-start devices
- Fast controllers (axial/centrifugal turbomachines)
- Switching, cycling, scheduling, & load management

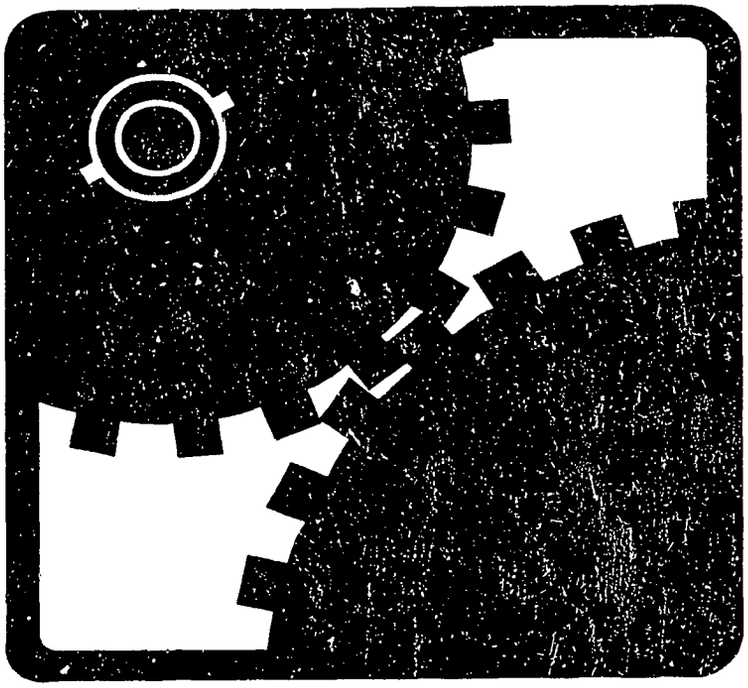
Electrical tuneups
- Phase balancing (under dynamic conditions)
- Correcting power factor near or at load terminals
- Improving local power quality & voltage stability
- Reducing in-plant distribution losses

Mechanical tuneups
- Drivetrain efficiency (belts, gears, bearings,...)
- Advanced lubricants, better lubrication techniques
- Cooling, cleaning, & maintenance practices

Management, acquisition, monitoring, recordkeeping

Total U.S. retrofit drivepower savings potential:
~44±16% (more recently, ~50% -- EPRI agrees)
@ average cost < 0.5±0.15¢/kW-h,
or ~80-190 (prob. ~160) GW + $25-50 billion/y,
with ~1¼-y average payback @ 5¢/kW-h
+ downstream process/control savings, hydraulics,....

HIGH-EFFICIENCY ELECTRIC MOTORS



- Market share only 10-15%
- Full use of best 1988 models could save 12–14 GW
- Higher savings because most motors operate at part–load
- 15–25% price premium, but savings recoup costs w/in year
- 100–hp standard (92%) @ $3000 vs. high–efficiency (95%) @ $4,000
- Run full–time $42,648 vs. $41,302 (@ $0.06/kWh), or 9 month payback

SYNERGISMS
Of High Efficiency Motors

- 50–100% longer–lived because run cooler, better insulation systems and bearings

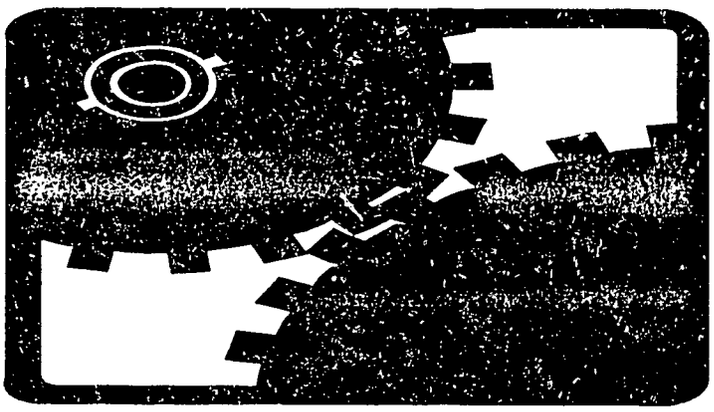
- 3/4ths of 1–200 hp motor failures caused by failed bearings
- Maximum–capacity bearings routinely supplied in hi–eff motors double motor's life
- Maintenance savings from tripled lubricant life of hi–eff bearings
- High–starting torque permits more accurate matching to peak load, avoiding oversizing, and reducing capital costs

Additional Benefits of Energy-Efficient Motors

- The ability to operate in higher ambient temperatures
- A service factor of 1.15
- Fewer failures under conditions of impaired ventilation
- Less sensitivity to abnormal operating conditions, such as under and over voltage or phase unbalance
- More tolerance to poorer voltage and current waveshapes
- A slightly higher power factor in the 100 hp and lower size range, which reduces distribution system losses

MOTOR RETROFIT VS. REWIND

- Whenever standard motor fails it is severalfold more attractive to replace with high–efficiency motor
- 100 hp is threshold below which one shouldn't even bother with rewind
- Group retrofitting of existing motors allows bulk–purchase discounts, deferring forced outages, & improved standarization of inventory.
- Stanford U. group retrofit 73 HVAC motors w/ duties of >2000 h/yr averaging 3 yr payback



MOTOR SIZING

- "Oversized motors may be industries' greatest energy waste"
- Waste arises because motors' eff depends on the torque load at which a motor is operating
- Efficiency should be evaluated over the <u>RANGE</u> of expected loads, NOT just at rated full speed (which motors seldom operate)
- 2– to 3–fold <u>oversizing</u> customary in both average– and peak–load sizing
- Shaving peak torque often cheaper by using piggyback booster motor, a clutched flywheel or torque converter
- Using efficient speed–changing gear systems can greatly reduce starting torque, motor size, & operating losses

Sizing...

- PG&E found 1/2 motors operating <60% and 1/3 <50% rated load
- 1/2 motors can be 1 size smaller & 1/3 can be 2 sizes smaller
- CEC study of 44 industrial motors avgd 32 hp and 0.61% load factor, leading analysts to recommend downsizing 59% of the motors
- One–size reduction typically reduces the marginal cost of the motor by a factor ranging from 2 to 10
- RMI study of DOE/BPA/PGE data indicates downsizing would reduce average marginal cost of hi–effic replacement motor to zero

MOTOR CONTROLS

- The marriage of microchips & high-speed/power, solid-state switching devices offer flexible, reliable, very efficient drivesystems

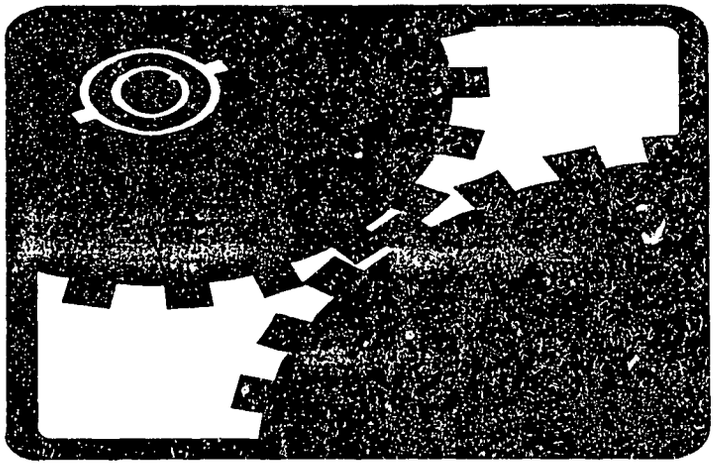
- Major savings can be achieved by adjusting output to meet instantaneous needs when torque loads vary in size or duration

- Electronic Adjustable Speed Drives, (or variable-frequency inverters)

- Power-factor controllers

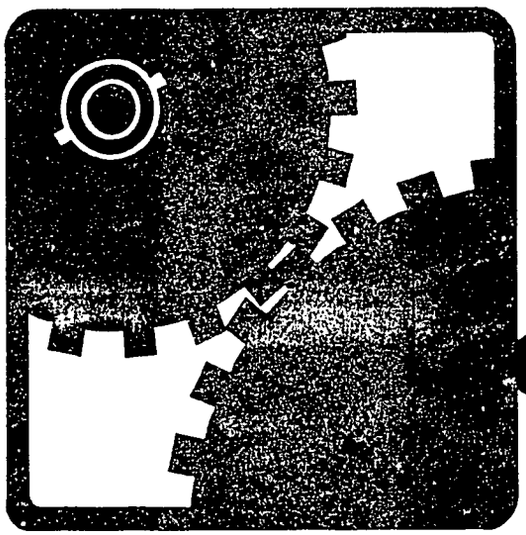
- Turbomachinery "fast controllers"

- Smart motors w/ integrated controls and sensors



ELECTRONIC ADJUSTABLE-SPEED DRIVES

- ASDs installed for speed control or to reduce losses in part–loaded motors and driven equipment
- By 1986, over 200,000 sold in U.S. ranging in size from 8 to 20,000 hp
- Sales increasing 25%/yr, yet only 10% of market tapped as of 1988
- Provide "soft–starting" which help prolong motor, drivetrain, switch gear, & reduce peak–demand charges and maintenance costs
- Lower–speed operation also extends life of motor & equipment



ASDs...

- ASDs instead of throttling valves and fan dampers extends pump, fan, and piping/valve life because equipment not fighting against backpressure and vibration

- Maintenance cost reductions on the order of 10–20%

- More precise control of cutting speeds in machining possible, improving tool life & productivity

- Continuous processes such as plastic extrusion or metal annealing can use ASDs to permit immediate changes in throughput speed to match the temperature of the heat zones during the changeover period

ASDs...

- Supermarket–freezer ASDs can improve temperature control, increasing food's shelf life and reducing frost buildup
- Commercial savings include chillers (16–30%), air–handling (65–80%), and refrigeration (20–25%)
- Industrial savings range 20–50% in pumps, fans, blowers, compressors, refrigeration, and machine tools
- Muncipal water & waste–treatment works can achieve 30–50% savings on boiler feedwater pumps & 20–25% on pumps serving less varying loads

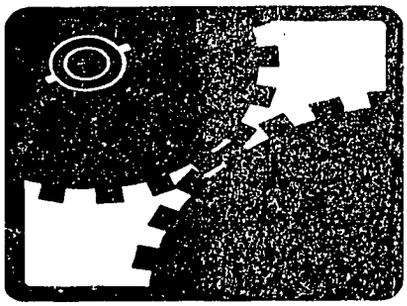
ASDs...

- ASDs can regenerate power and return it to the line, foregoing drag brakes in winding webs of paper or textiles: a hi–speed paper rewinder may require 600 hp, then waste virtually all of it in the brakes. An ASD can recover 80% of the lost power.

- ASDs isolate motors from the line, reducing motor stress & inefficiency caused by varying line voltage, phase imbalance & poor input wave form

- Compact, easy to retrofit, and can be located anywhere convenient

POWER-FACTOR (PF) CORRECTION



- PF is the ratio of watts to volt–amperes, and measures how much of the power drawn by the load is "real" – in phase with voltage – and thus able to do work.
- The greater the out–of–phase component, the lower the PF
- The magnetic fields induced by the coils in inductive motors inevitably result in a lagging, or lower, PF
- Lagging PF accounts for as much as 20% of all U.S. grid losses, equal to 1.5% of total national power generation worth $2 billion/yr

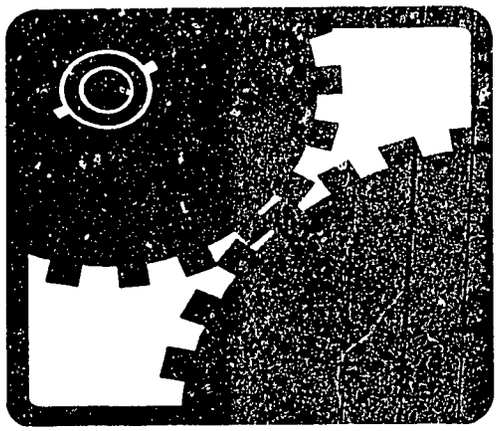
PF correction...

- Low PF costs utilities: oversizing transformers (& shortened lifespans), extra power & distribution costs, degraded system voltage regulation --all higher costs for consumers

- Raising PF in facilities increases motor life and efficiency, achieves up-stream in-plant distribution savings, and saves money

- Well chosen hi-eff motors may have 10-15 percentage point better PF than standard motors

POWER-FACTOR CONTROLLERS



- PFCs are variable–voltage motor controllers, which reduce surplus magnetizing current by adjusting the motor's input voltage to the minimum needed for operation

- Valuable in applications where the load varies over a wide range, or is low most of the time

- Includes escalators, conveyors, crushers, injection–molding and vacuum–forming equipment, lumber saws, sewing and weaving machines, many machine–tool spindle drives, single–stroke presses, washing machines

315

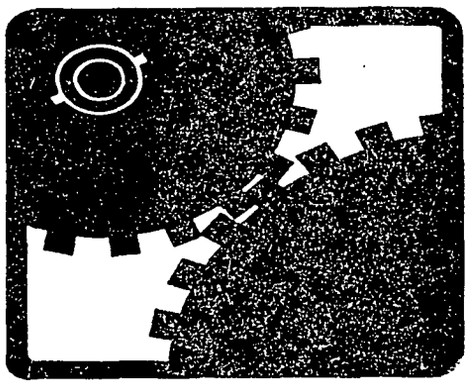
PF controllers...

- 59% power savings in two 20-hp reciprocating air compressors operating unloaded 40% of the time
- "typically" 67% in grinders, wire-cutting machines, and punch presses 50% in drill presses and lathes, 27% in belt sanders, 31% in milling machines, and 50% in industrial sewing machines
- PFCs also provide "soft-starting", a key to prolonging lives of motors, upstream distribution gear and down-stream drivetrains and equipment
- Reported paybacks typically under 2 years, and cost of saved energy under 1 cent per kWh

PF controllers...

- PFCs are installed like ASDs -- between the power supply & load
- Savings at, e.g., 40% of rated load are typically 25% for single- and 10% for 3-phase motors
- 3 Wash, DC Metro escalators (10 hp, 16 h/d duty) showed savings of 20% and 58% in up and 71% in a down escalator, and 11-28 month paybacks (25,000 escalators in U.S.)
- Grinders & granulators in plastics factories, run continuously, ready to accept feed at random times -- PF controllers averaged 50% savings, w/ costs of 1 cent per kWh saved, (300,000 such machines in U.S.)

OTHER OPPORTUNITIES



- Electrical tune–ups
  - –– phase balancing
  - –– power quality
  - –– facility voltage variations

- Mechanical efficiency
  - –– low/high–power geartrains
  - –– chains & belt couplings
  - –– bearings
  - –– lubricants/greases

- Maintenance,cleaning
  - –– electrical monitoring
  - –– thermal monitoring
  - –– relubrication
  - –– recordkeeping

Table 4

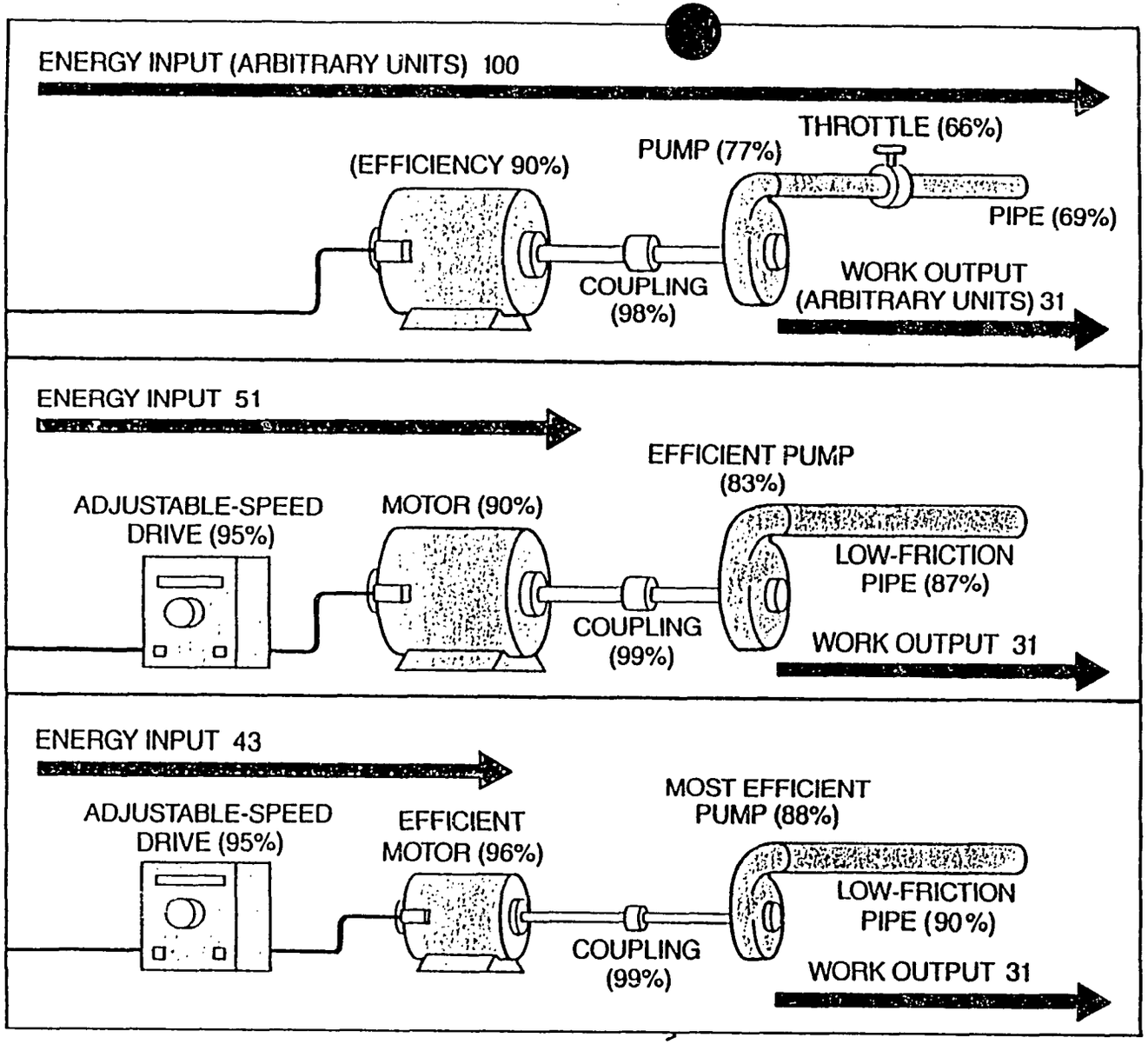
Washington State Energy Office
Electric Motor Report

20 HP/1800 RPM/TEFC

MANU	Model	Full Load Eff.	3/4 Load Eff.	1/2 Load Eff.	Full Load P.F.	3/4 Load P.F.	1/2 Load P.F.	S.F	Frame Size	List Price
US	Premium Efficiency	93.2	94.0	94.1	84.6	82.8	76.7	0.00	286T	1268
TO	E.Q.P./Premium Eff.	93.2	0.0	0.0	87.2	0.0	0.0	1.15	256T	1268
GE	Energy Saver	93.0	93.7	93.6	85.0	83.4	76.1	0.0	256T	1268
ST	Silver Line	93.0	91.7	88.2	89.4	83.3	74.5	1.15	256T	1146
MG	E-Plus III	93.0	94.3	93.1	86.5	82.5	76.3	1.15	256T	1884
TE	MAX-E1/HE	93.0	93.0	93.2	83.0	82.9	78.3	1.15	256T	558
BA	High Efficiency	93.0	0.0	0.0	85.0	0.0	0.0	1.15	256T	1266
RE	XE	92.4	0.0	0.0	86.1	0.0	0.0	1.15	256T	1268
SI	Premium Efficiency	92.4	93.4	93.6	89.2	87.5	81.5	1.15	256T	1535
ST	U Series/High Eff.	92.4	91.5	89.2	84.3	80.1	72.0	1.15	256T	0
TO	Standard Eff.	91.9	92.5	92.2	87.2	86.6	81.4	1.15	256T	1025
MA	Blue Chip XRI/HE	91.7	92.4	92.4	85.0	80.0	70.5	1.15	256T	1268
MG	E-Plus	91.7	0.0	0.0	85.4	0.0	0.0	1.15	256T	1559
LE	Standard Efficiency	91.2	0.0	0.0	0.0	0.0	0.0	1.15	256T	642
ST	K Series	91.0	90.0	88.5	85.0	81.5	72.0	1.15	256T	942
ST	J Series	91.0	91.0	90.0	85.0	82.3	75.2	1.15	256T	942
DY	Cast Iron	90.2	0.0	0.0	0.0	0.0	0.0	1.15	256T	767
TE	Standard Efficiency	90.2	90.4	90.7	90.5	90.5	87.1	1.15	256T	445
US	High Efficiency	89.8	90.6	89.8	85.3	82.7	75.5	1.15	286T	1025
DE	C.I.M./Energy Eff.	89.6	90.4	90.3	75.5	71.8	60.4	1.15	256T	1535
DY	Rugged Duty	89.5	0.0	0.0	0.0	0.0	0.0	1.15	256T	957
MA	Blue Chip	89.5	90.0	89.0	84.5	81.0	72.0	1.15	256T	1025
DE	T Line	88.61	88.9	88.0	78.9	74.3	64.0	1.15	256T	1025
ST	U Series	88.5	85.4	82.1	89.4	87.3	80.4	1.15	286U	1612
BA	Standard Efficiency	88.0	0.0	0.0	84.0	0.0	0.0	1.15	256T	1040
MG	Standard Efficiency	87.5	88.4	87.0	89.9	86.4	81.0	1.15	256T	1058
MG	Standard Efficiency	87.5	88.4	87.0	89.9	86.4	81.0	1.15	256T	1327
SI	Standard Efficiency	87.5	87.5	88.5	85.5	83.0	77.0	1.15	256T	1025
GE	Standard Efficiency	87.5	88.5	87.5	81.5	80.0	72.0	0.00	256T	1025
DY	Standard	86.5	0.0	0.0	0.0	0.0	0.0	0.00	256T	834
RE	Standard Efficiency	86.5	0.0	0.0	0.0	0.0	0.0	0.00	256T	1102
LI	Standard Efficiency	86.5	0.0	0.0	86.6	0.0	0.0	1.15	256T	672

Key: Motor manufacturers include:

(BA) Baldor
(DY) Dayton
(DE) Delco
(GE) General Electric
(LE) Leeson
(LI) Lincoln
(MG) Magnetek/Century
(MA) Marathon
(RE) Reliance
(SI) Siemens
(ST) Sterling
(TE) Teco
(TO) Toshiba
(US) US Motors



RETROFIT can raise the efficiency of a typical motor-pump system (*top*) from 31 to 72 percent and can pay for itself in two to three years (or less counting saved maintenance costs). An electronic drive (*middle*) affects the efficiency of the other components. Here the drive's net effect is a 21 percent savings, not counting lower pipe losses. A more efficient and properly sized motor and pump, as well as better pipes, saves even more (*bottom*), partly by fixing the damage caused by improper repairs to the old motor. Further refinements may cut energy use by 40 percent.

- Vattenfall
- Holmen Paper Company

--> Improve 16 pumps
- Initial use = 9000 MWh/year ~ 1800 Single-family homes

	Vattenfall	Holmen
Real Discount Rate	5%	20%
Required Discounted Payback Time	10 years	2 years
Savings Potential in One Plant	3500 MWh/y (38%)	600 MWh/y (7%)
Cost of Conserved Energy	1.4 cents/kWh	2.5 cents/kWh
Cost of New Supply	(~ 6 cents/kWh)	

Note: The Holmen method transforms a 5-year simple payback into a perceived payback of > 50 years!

Let us help you increase profits and productivity with our rebate on high-efficiency electric motors

Using electricity efficiently is one of the best ways you can increase profits and stay competitive. Higher efficiency lowers your power bill today and helps us keep the cost of power down in the future.
That's why your plant's next motor--new or replacement -- should be a high-efficiency motor. And it's why we'll help you pay the extra cost to trade up from a standard model.

Better productivity

High-efficiency motors can do more work with less energy because they reduce the losses incurred when electricity is converted to useful power. They cut your operating costs through

- improved power factor
- lower transformer loading
- cooler operation (less heat loss)
- longer life.

This improved performance does cost more, and often the payback falls just outside the strict financial guidelines most companies operate with in today's economy. That's where Hydro's rebate comes in.

How the rebate works

The rebate is a reward for being efficient. The more efficient the motor, the greater the rebate. We compare the efficiency of the model you choose to the industry standard. You get $400 for every kilowatt saved, up to a maximum of 25% of the cost of your motor. This will help offset the higher purchase price and give you a favourable payback.

Calculate your rebate using this formula:
Rebate = $400 x HP x .746 x(100/b - 100/e),
where b = base efficiency and e = qualifying motor efficiency.

Example: Buy a 100-horsepower motor. At 93.0% efficiency rating you earn the minimum rebate of $800 (see table). Choose an even more efficient model with a rating of, say, 93.8%, and your rebate grows by $287 to $1,087. And, of course, you start saving on energy costs right away.

B.C. Hydro High-Efficiency Electric Motor Rebate Percentage Efficiency Standards Table

HP	Base Efficiency for Electric Motors	Minimum Efficiency* to qualify for rebate** 1800 RPM	1200 RPM	Minimum Rebate***
	%	%	%	$
1	76.9	80.0	80.0	$15
1.5	77.4	80.5	82.0	$22
2	78.3	81.5	82.5	$30
3	79.7	83.0	84.0	$45
5	81.5	85.0	86.0	$75
7.5	83.4	87.0	87.0	$112
10	84.5	87.0	88.0	$120
15	86.0	88.5	89.0	$150
20	86.4	90.0	89.0	$200
25	87.8	91.0	90.5	$250
30	88.3	91.0	91.0	$300
40	88.8	91.5	91.5	$400
50	88.8	92.5	91.5	$500
60	89.2	92.5	92.0	$600
75	89.7	93.0	92.5	$750
100	90.7	93.0	93.0	$800
125	90.7	93.0	93.0	$1000
150	91.2	93.5	93.5	$1200
200	91.7	94.0	94.0	$1600
250	92.5	94.5	94.5	$1700
300	93.2	95.0	95.0	$1800
400	93.2	95.0	95.0	$2400
500	93.2	95.0	95.0	$3000

* As defined in CSA C390 or NEMA MG1 Standards.
** Motors not covered above will be considered on an individual basis.
*** The rebate may not exceed 25% of the cost of the high-efficiency motor (materials only).

Clip here

Value of 1 Percent Efficiency by HP
Annual Energy and Dollar Values

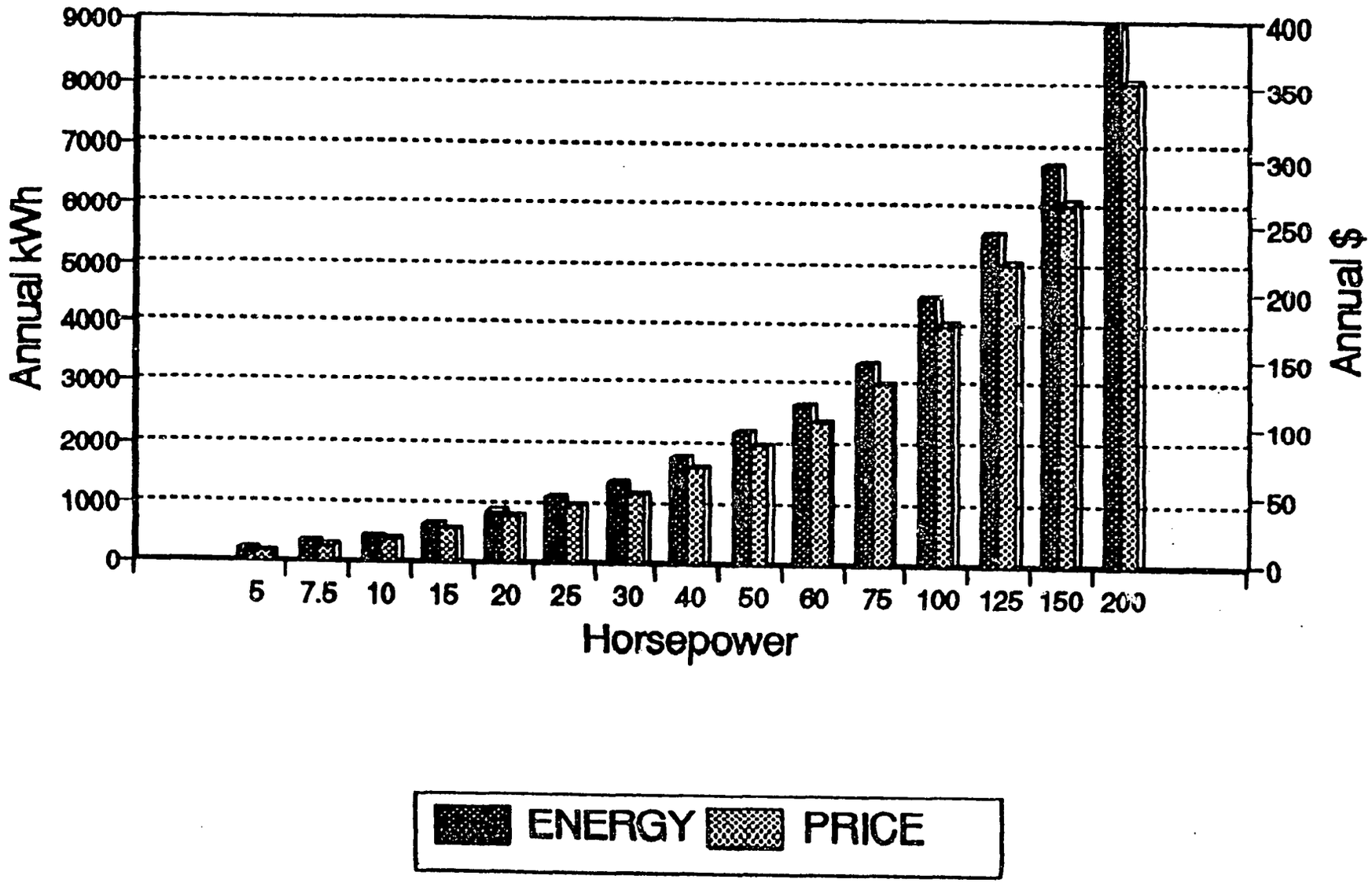


Figure 5

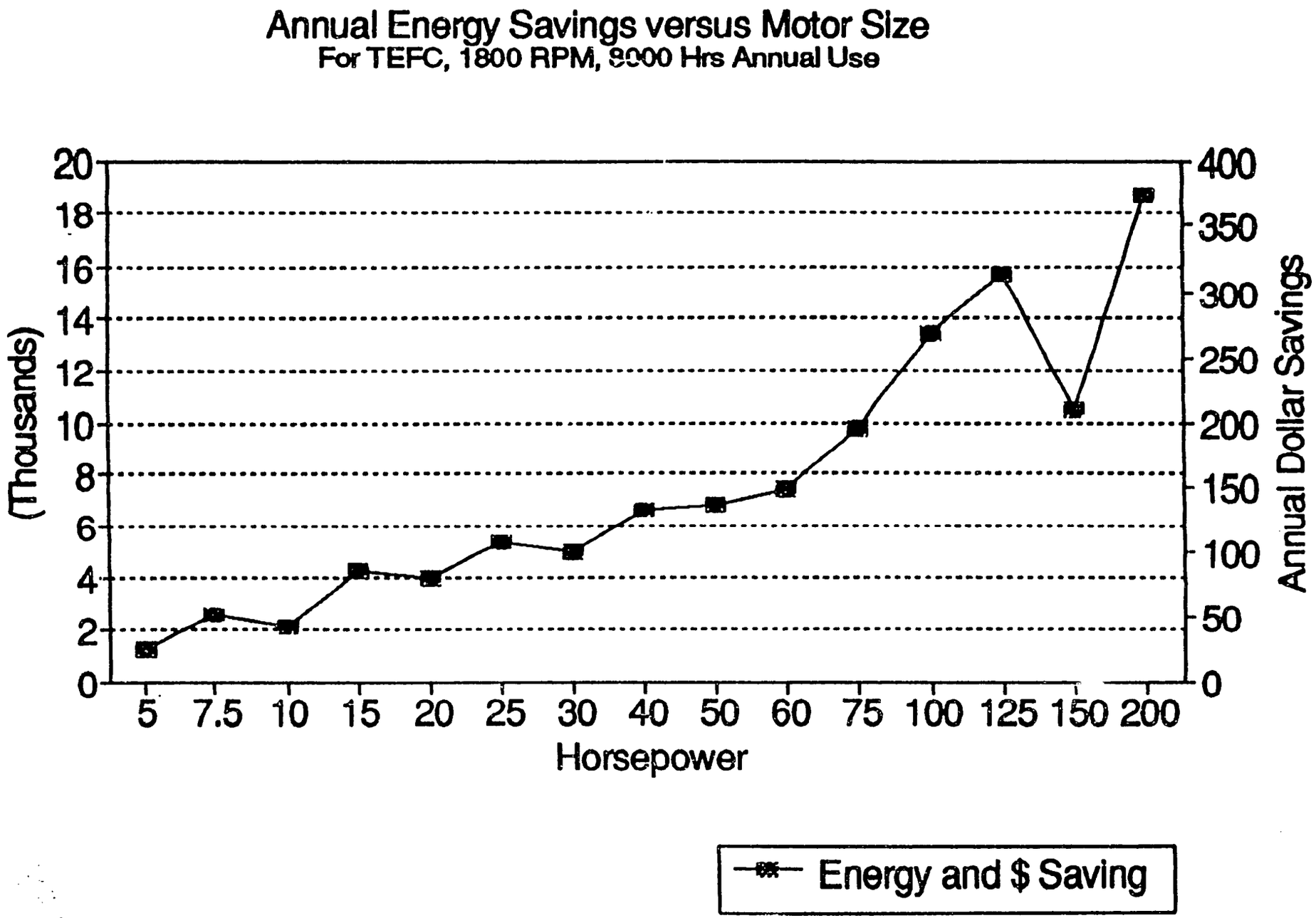

Annual Energy Savings versus Motor Size
For TEFC, 1800 RPM, 8000 Hrs Annual Use
(Thousands)
20
18
16
14
12
10
8
6
4
2
0
400
350
300
250
200
150
100
50
0
Annual Dollar Savings
5
7.5
10
15
20
25
30
40
50
60
75
100
125
150
200
Horsepower
Energy and $ Saving

Figure 6

List Price versus Efficiency for Standard and Energy-Efficient Motors

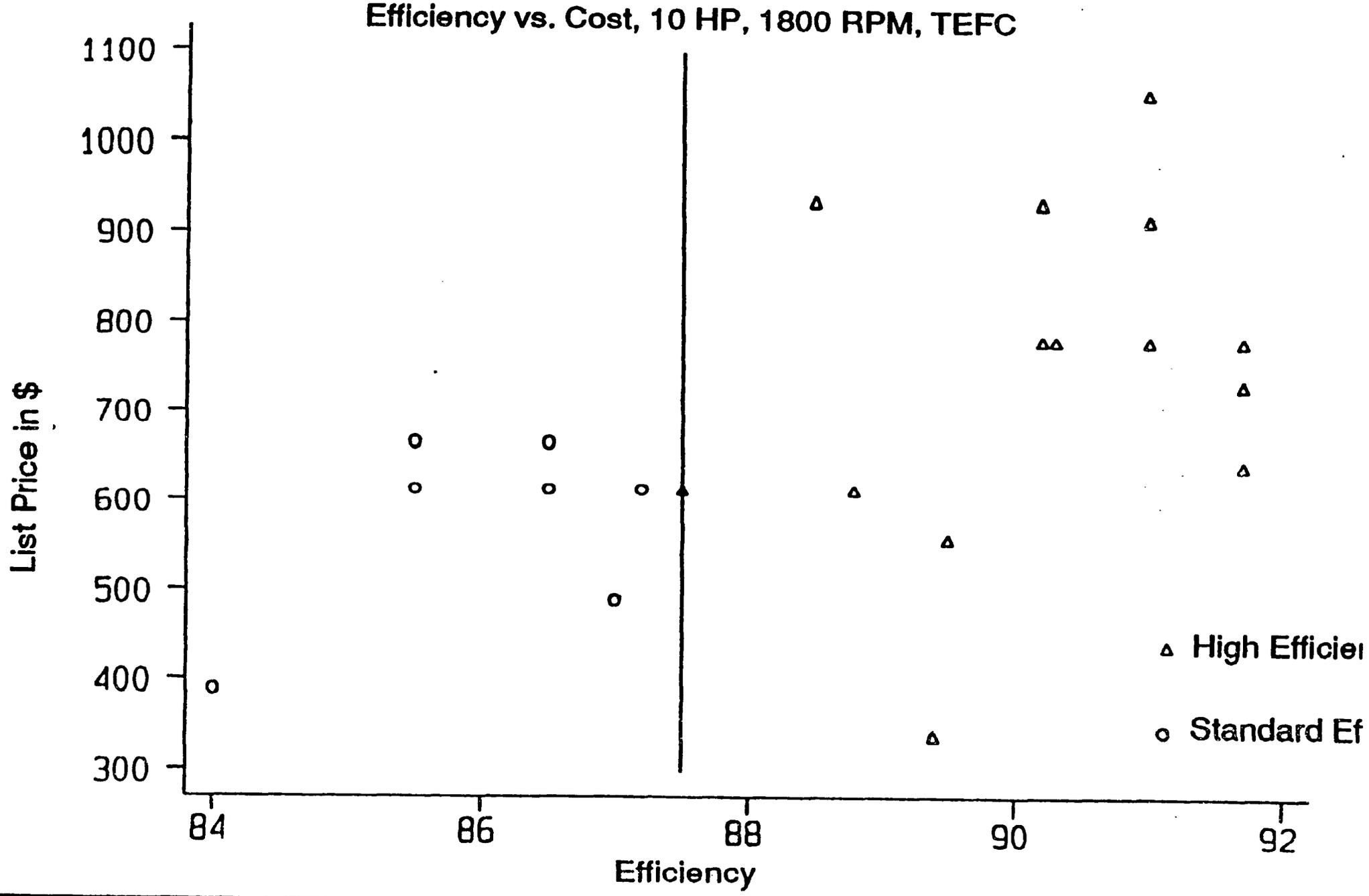


Figure 13
Oversized Motor Replacement Analysis

Unscheduled Motor Changeout Analysis

Company: HCC
Plant:
Date/Time: 1-9-89 0800
Building:
Dept.:
Application: Fan
Motor Shop Number: 1943
Phase and HZ: 3/60
Make: Louis Allis
Frame size: 505
Model/Type:
Insulation class:
Serial number:
Efficiency rating:
Service factor: 1.15
NEMA torque type: B
Enclosure type: ODP
Temperature rise: 40°C

A) Full load HP: 75
B) Volts: 440/220
C) Amperes: 91/182
D) Full load speed: 1,175
E) Sync. speed: 1,200
2 pole = 3,600, 4 pole = 1,800, 6 pole = 1,200)
F) Full load slip (E-D): 25

Measured Values

G) Average volts: 445
H) Average amperes: 75
J) Average kW: 40
K) Operating speed, RPM: 1,188
L) Full load operating hours: 8,000
M) Average electricity price ($/kWh): .03

Calculated Values

N) Running slip (E-K): 12
P) Per cent load (N/F)(100%): 48%
Q) HP output (A)(P)(100%): 36
R) kW output (Q)(0.746): 26.3
S) Eff. per cent (R/J)(100%): 67%
T) kVA input (G)(H)(1.732)/(1000): 57.8
U) Power factor (J)/(T)(100%): 69%
V) kW losses (J-R): 13.1
W) $/Year operation (J)(L)(M): $9,600
X) $/Year losses (V)(L)(M): $3,144
Y) [1]Annual energy savings due to changeout with a 40 h high-efficiency motor (R)(L)(M)(100/S - 100/EFF): $2,641
Z) [2]Replacement motor cost: 1521 + 500
Simple payback, years (Z)/(Y): 0.76

[1]EFF is the efficiency (%) of a replacement premium efficiency motor at the appropriate load factor.
[2]Cost is the total cost of purchasing and installing an optimally sized, high-efficiency motor

Appendix A
Induction Motor Test Data Sheet

Unscheduled Motor Changeout Analysis

Company _____ Plant _____ Date/Time _____

Building _____ Dept. _____ Application _____

Motor Shop Number _____ Phase and HZ _____

Make _____ Frame size _____

Model/Type _____ Insulation class _____

Serial number _____ Efficiency rating _____

Service factor _____ NEMA torque type _____

Enclosure type _____ Temperature rise _____

A) Full load HP _____

B) Volts _____

C) Amperes _____

D) Full load speed _____

E) Sync. speed _____
2 pole = 3,600, 4 pole = 1,800, 6 pole = 1,200)

F) Full load slip (E-D) _____

Measured Values

G) Average volts _____

H) Average amperes _____

J) Average kW _____

K) Operating speed, RPM _____

L) Full load operating hours _____

M) Average electricity price ($/kWh) _____

Calculated Values

N) Running slip (E-K) _____

P) Per cent load (N/F)(100%) _____

Q) HP output (A)(P)(100%) _____

R) kW output (Q)(0.746) _____

S) Eff. per cent (R/J)(100%) _____

T) kVA input (G)(H)(1.732)/(1000) _____

U) Power factor (J)/(T)(100%) _____

V) kW losses (J-R) _____

W) $/Year operation (J)(L)(M) _____

X) $/Year losses (V)(L)(M) _____

Y) [1]Annual energy savings due to changeout with a ____ high-efficiency motor (R)(L)(M)(100/S - 100/EFF) _____

Z) [2]Replacement motor cost _____

Simple payback, years (Z)/(Y) _____

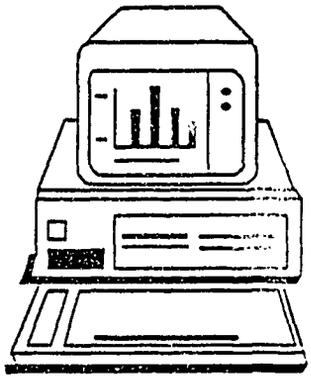
---

[1]EFF is the efficiency (%) of a replacement premium efficiency motor at the appropriate load factor.
[2]Cost is the total cost of purchasing and installing an optimally sized, high-efficiency motor

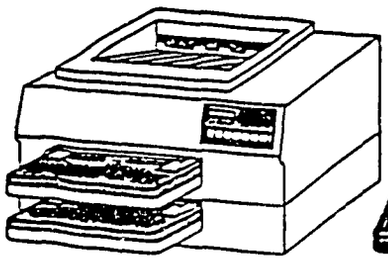
Computers & Peripherals

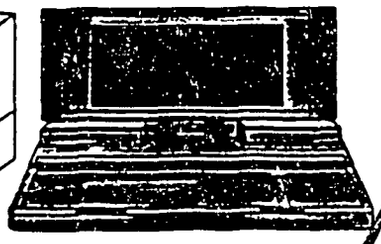
Electricity-saving Options

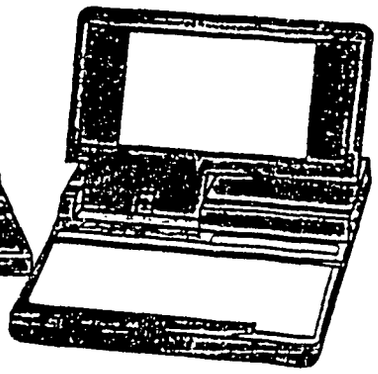
- Replace N–MOS w/ CMOS chips and use power-management methods
- Automatic switch–off devices during use, turn off nights/weekends
- Energy consumption labels

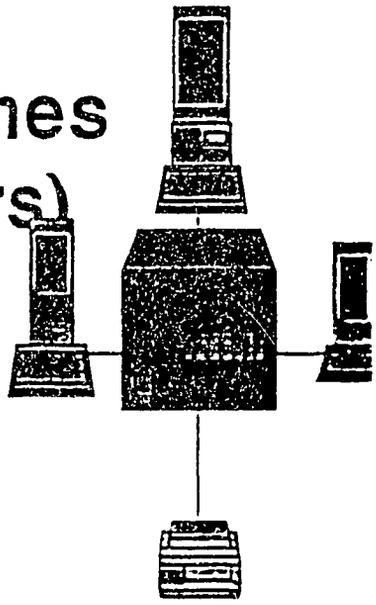


- High-speed, ion-deposition printers & copiers (2-4x less energy-intensive than standard xerographic equipment)
- Ink-jet printers & fax machines (97% less energy than lasers)



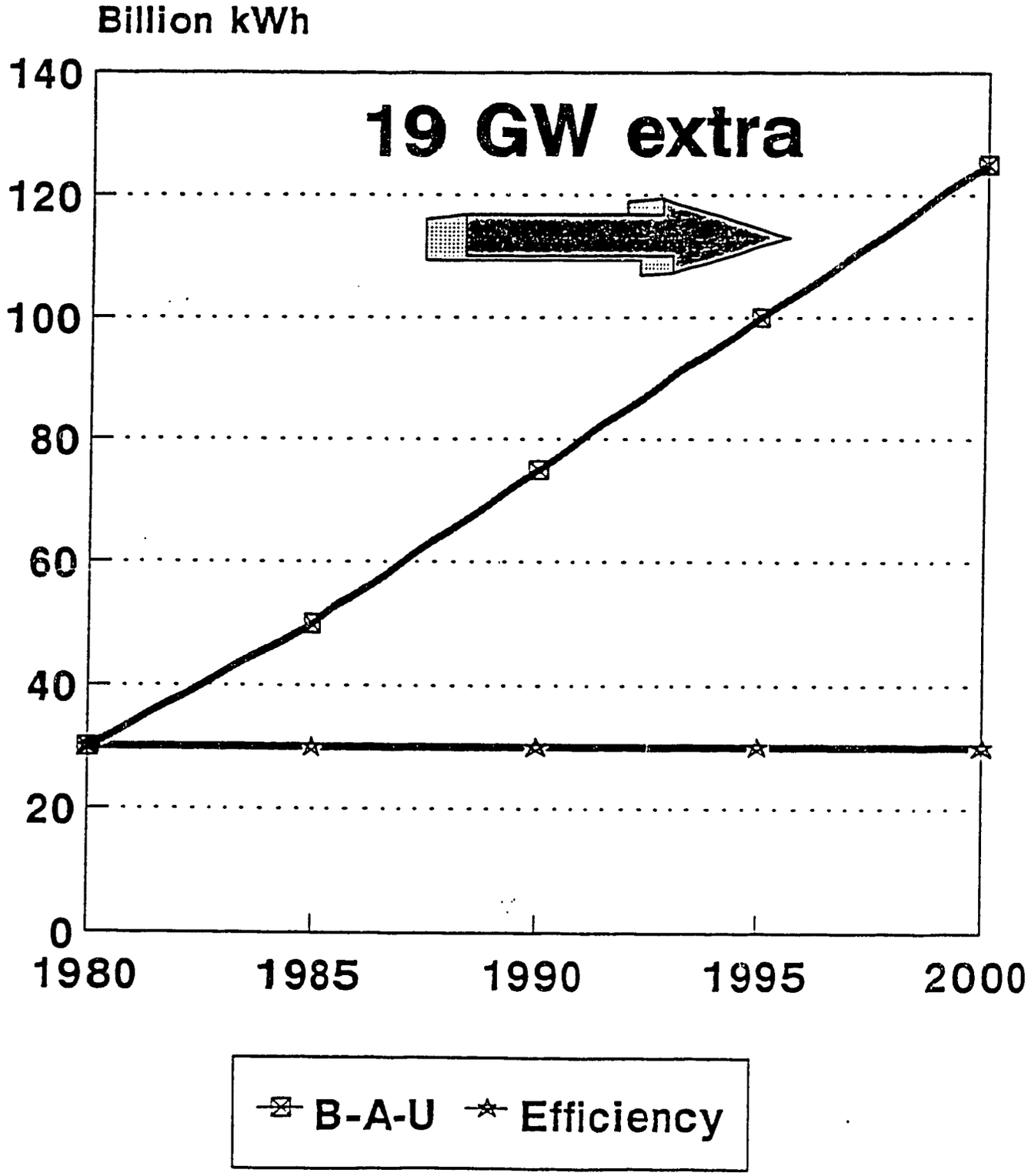






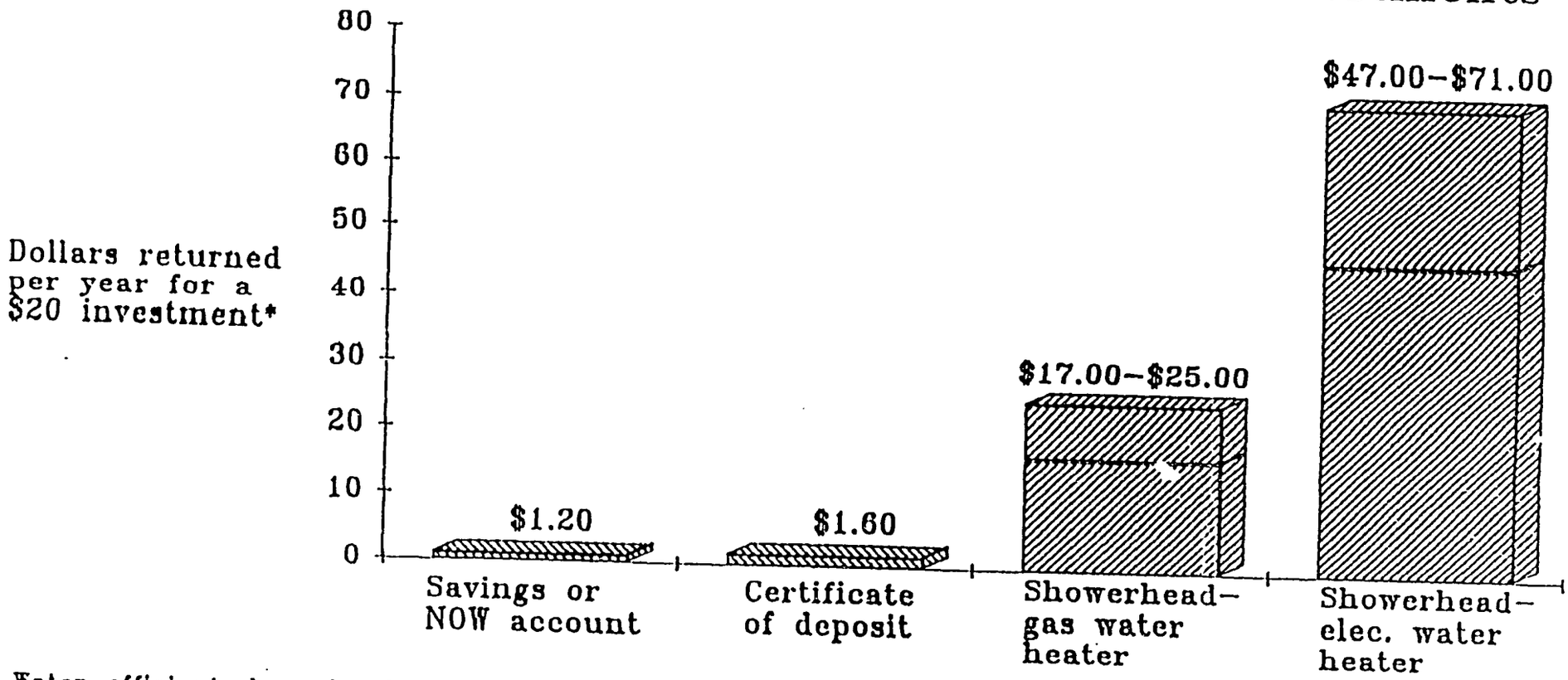
SOURCE: Rabl et al., 1989.

Computers & Peripherals
Electric Savings Potential



SOURCE: Rabl et al., 1989.

Water-efficient Showerhead vs Traditional Investments



Water-efficient showerheads upstage traditional investments: energy savings through reduced hot-water use provide a much higher rate of return than do savings accounts or certificates of deposit.

Your potential financial savings are substantial if you heat water with gas, tremendous if you heat water with electricity. It makes good economic sense to invest in a water-efficient showerhead.

*Assuming 3.0 people/household and Colorado retail rates of $0.075/kW-h for electricity and $0.53/therm for gas. Savings are calculated for a shift from 4.0 and 6.0 gpm (peak flow) showerheads to 2.0 gpm (peak flow) heads.

Savings reflect an additional 20 degree F heating requirement for water from low-flow showerheads. A fine, rapidly cooled spray from some low-flow heads may necessitate this additional heating.

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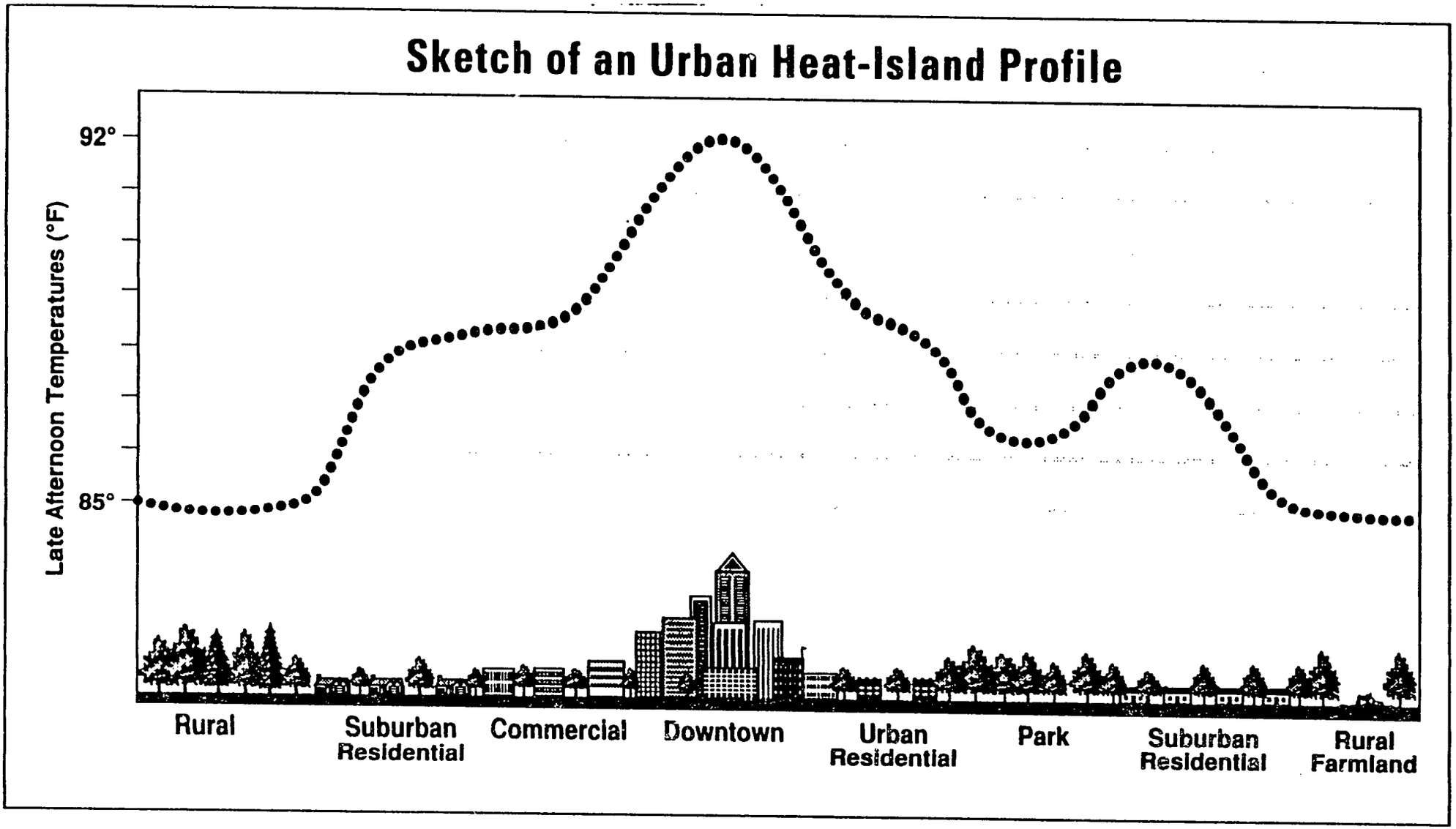

Source: Andrasko, Huang, 1990

F
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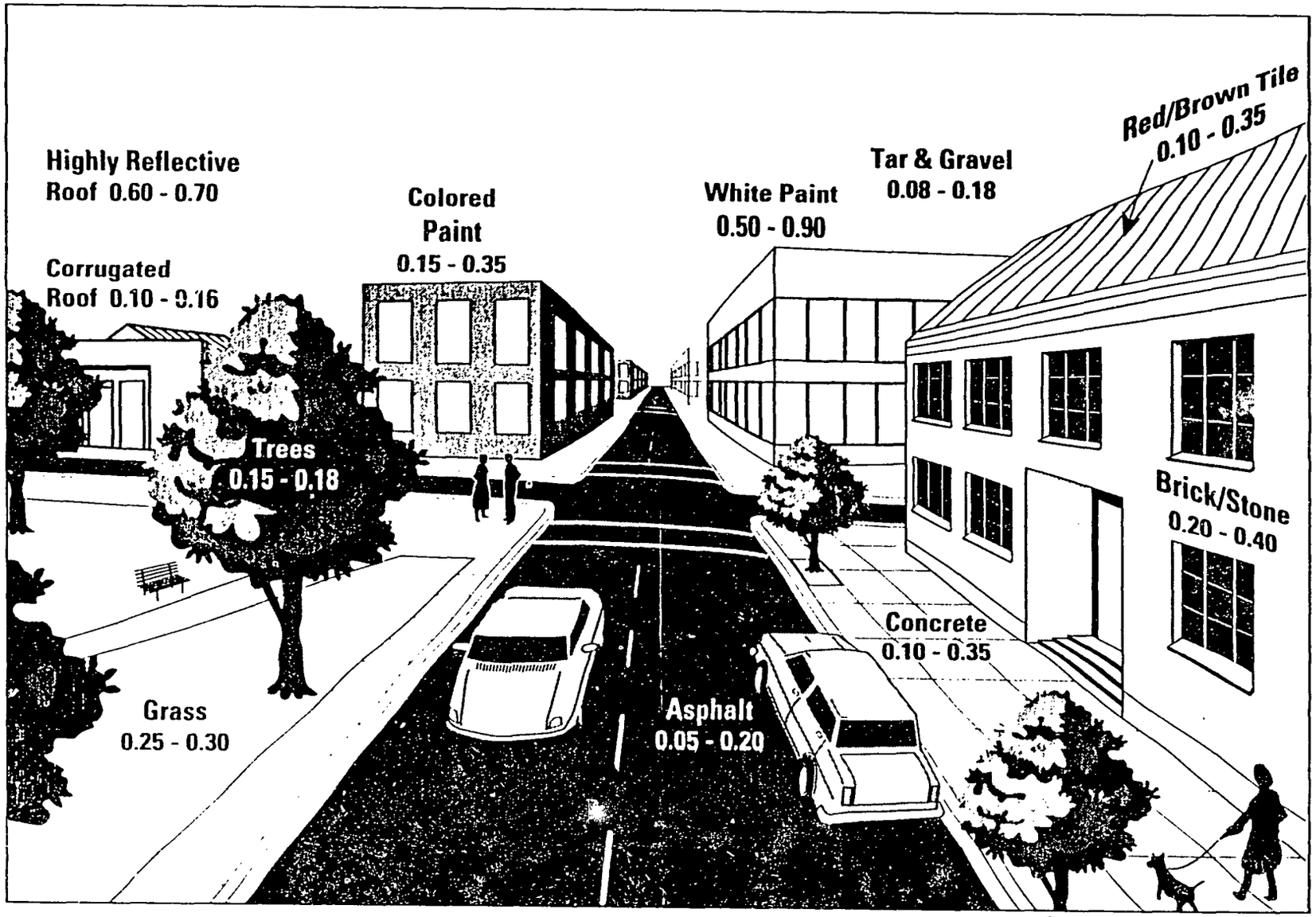
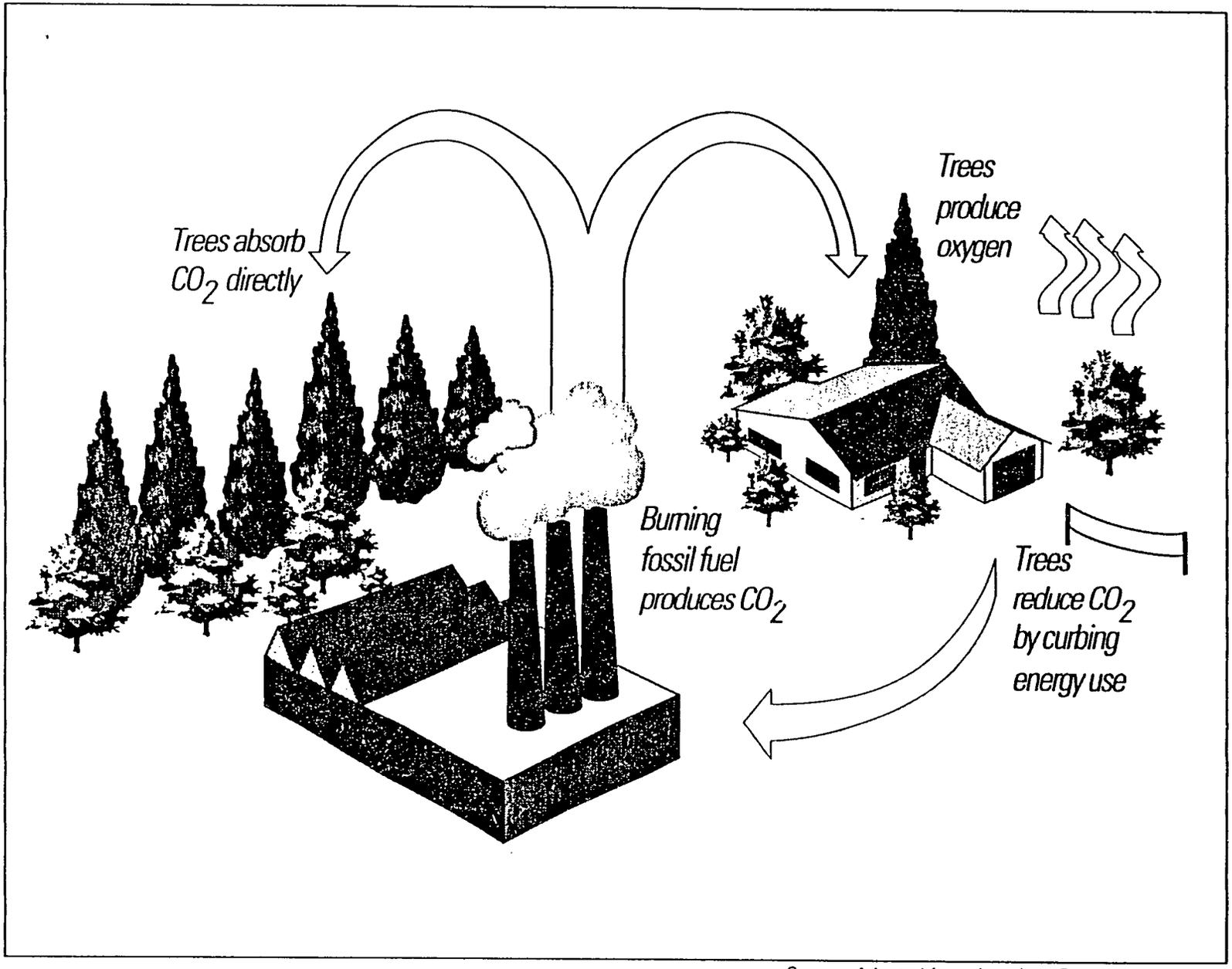
a
a



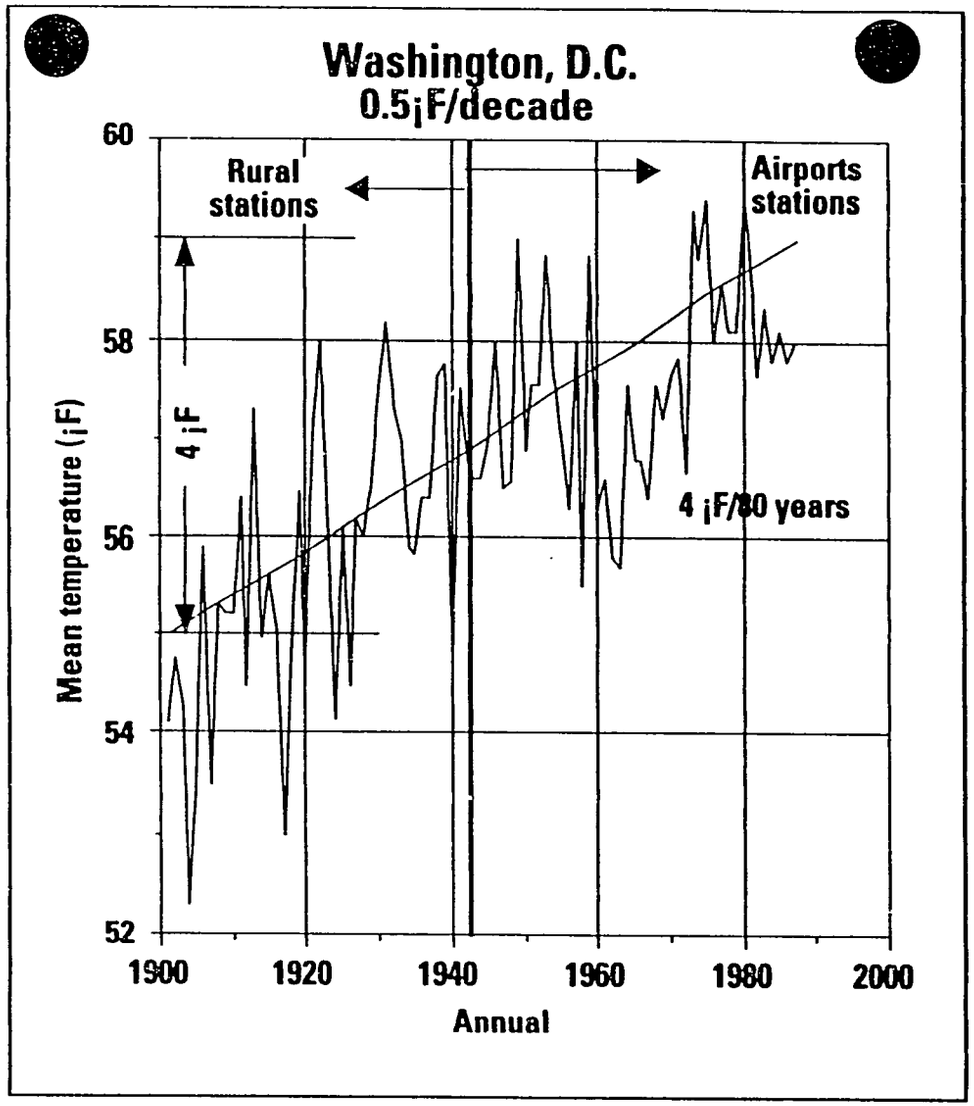
Source: Huang and Taha, 1990

Figure 3-3.
Surface albedo values: The more solar radiation a surface absorbs, the hotter it gets. The more radiation it reflects, the cooler it stays. Today's urban communities contain surfaces with many different albedo values. Surfaces with high albedo values reflect more solar radiation and are generally cooler.



Source: Adapted from American Forestry Association

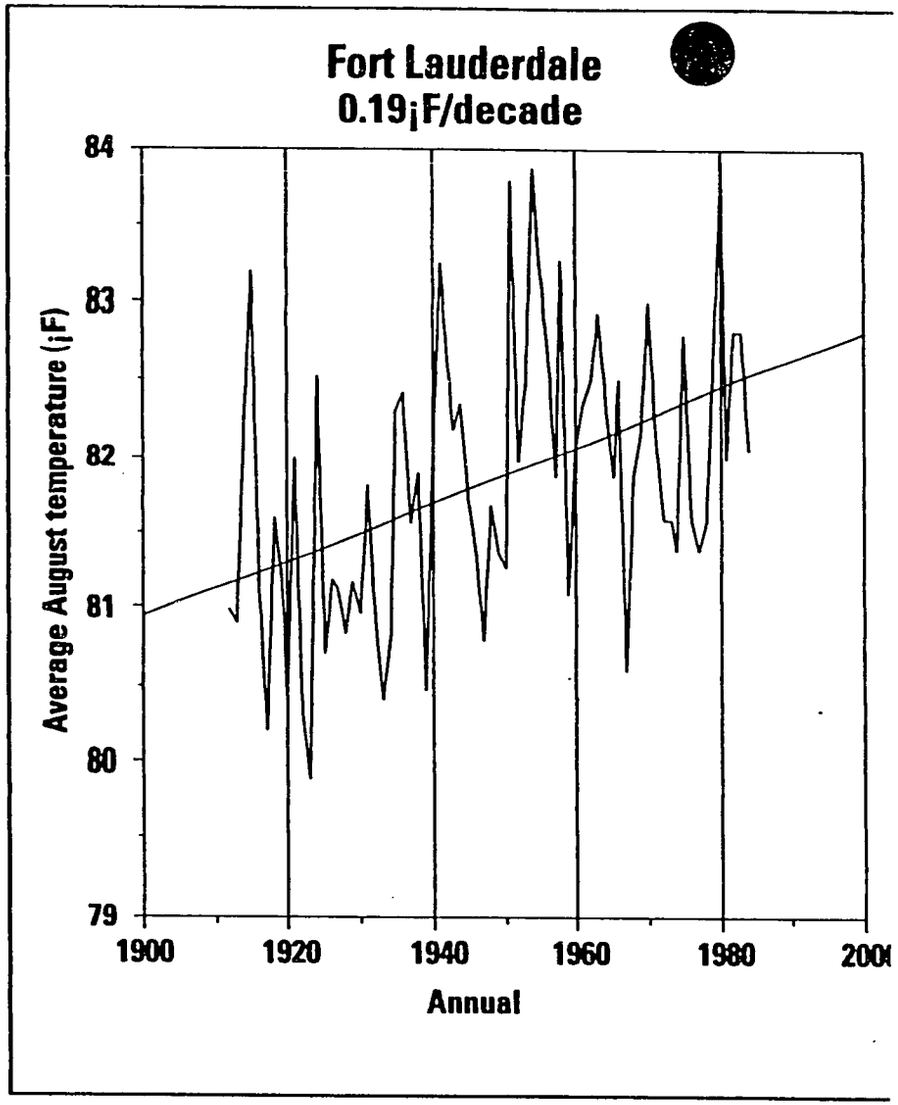
Figure 2-10.
Trees can help reduce the greenhouse effect in two ways. First, trees directly absorb CO_2—the primary greenhouse gas—from the atmosphere during photosynthesis. Second, shade from trees can reduce air-conditioning energy use, which reduces the amount of CO_2 emitted by power plants.



Source: Taha, 1991

Figure 1-11.

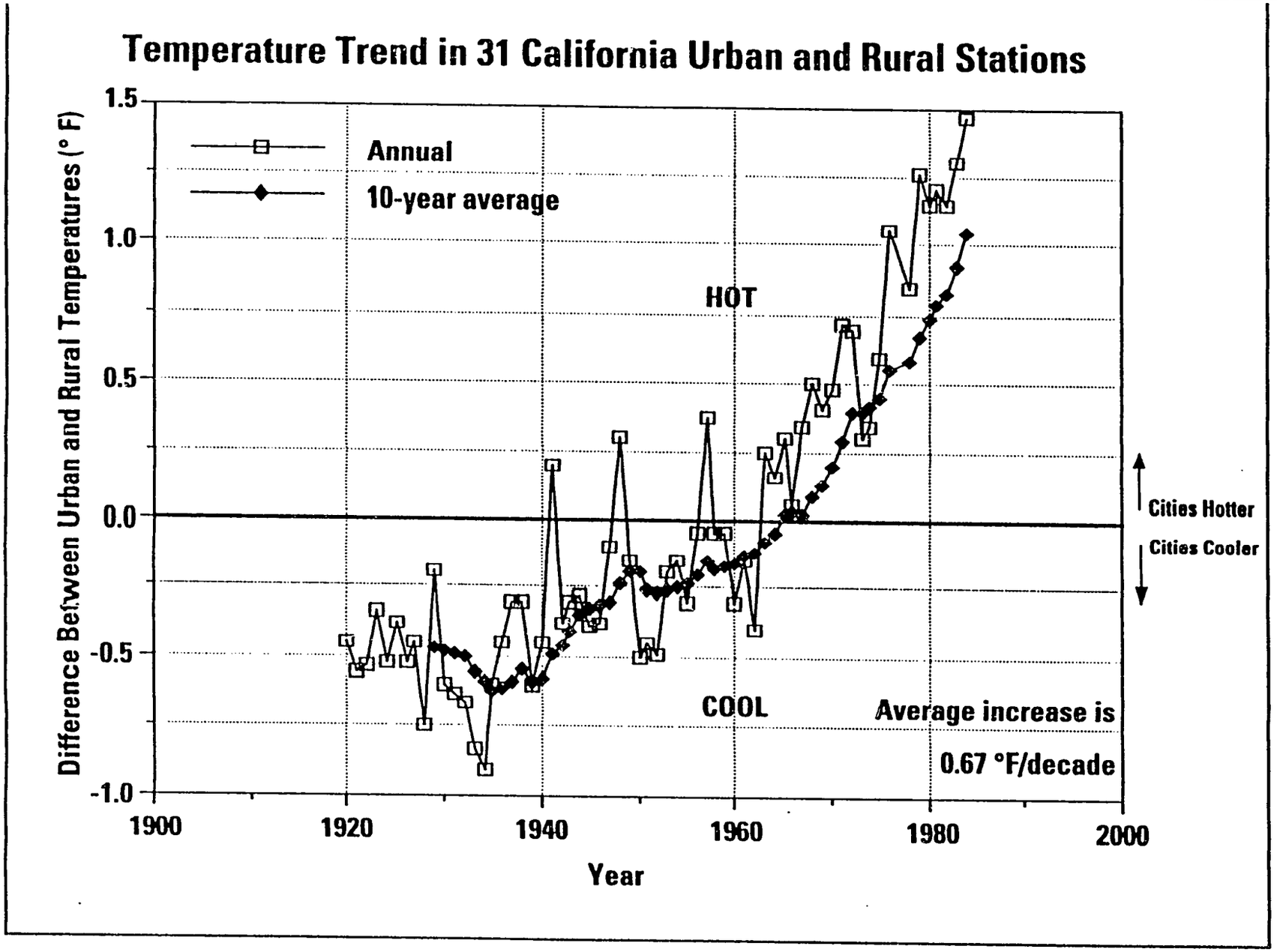
Washington, D.C. temperatures: Since 1900, annual mean temperatures in Washington, D.C. have risen by a steady 0.5°F per decade.



Source: Taha,

Figure 1-12.

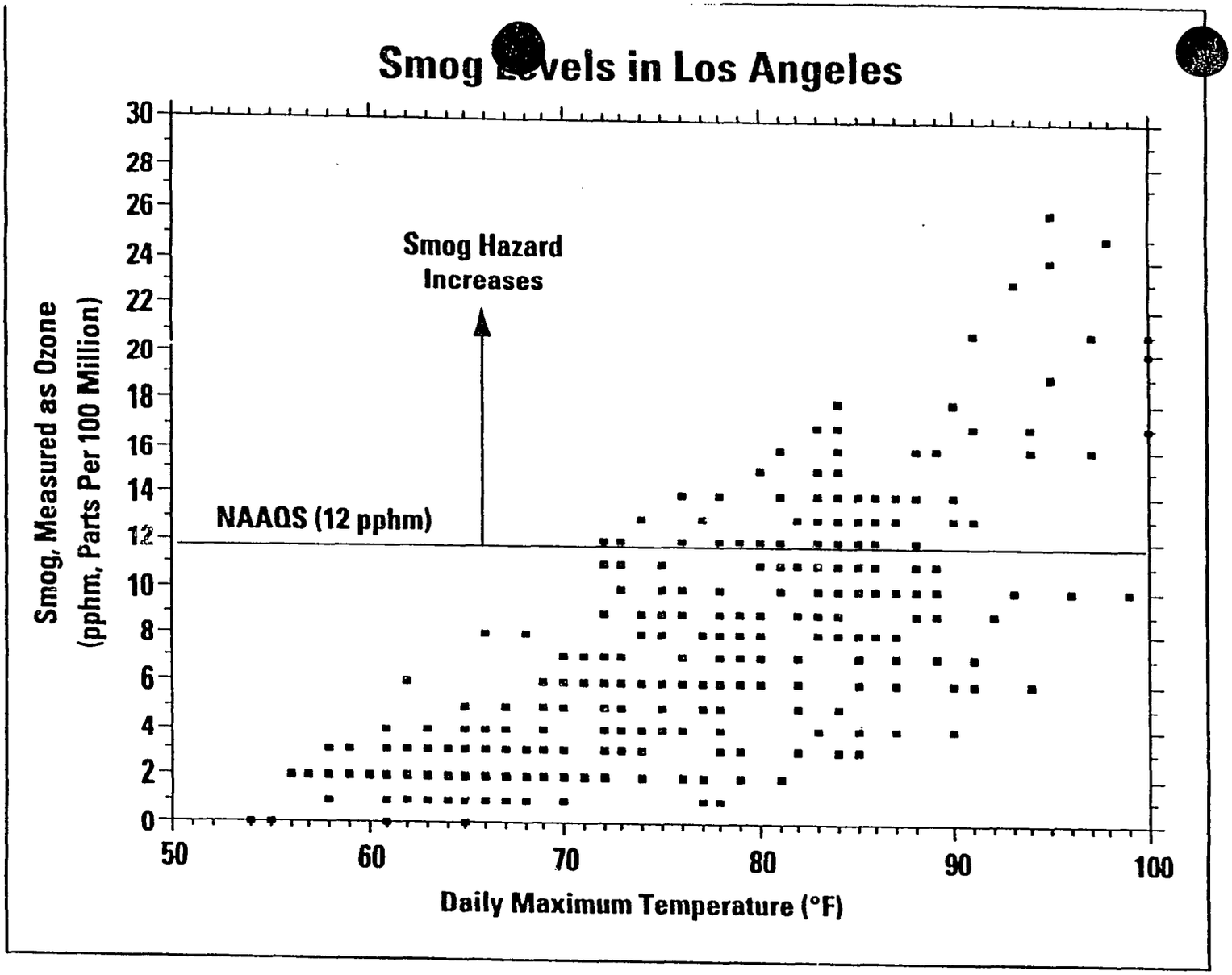
Fort Lauderdale (FL) temperatures: Average Au temperatures for Fort Lauderdale show a 0.2°F ris temperature per decade. The increase is lower in city because it is oceanside.



Source: Akbari et al., 1990, based on data from Goodrich, 1989

Figure ES-2.

Urban areas are getting warmer: Since 1940, the temperature difference between urban and rural stations has shown an increase of 0.67°F per decade. (Also appears as Figure 1-15.)

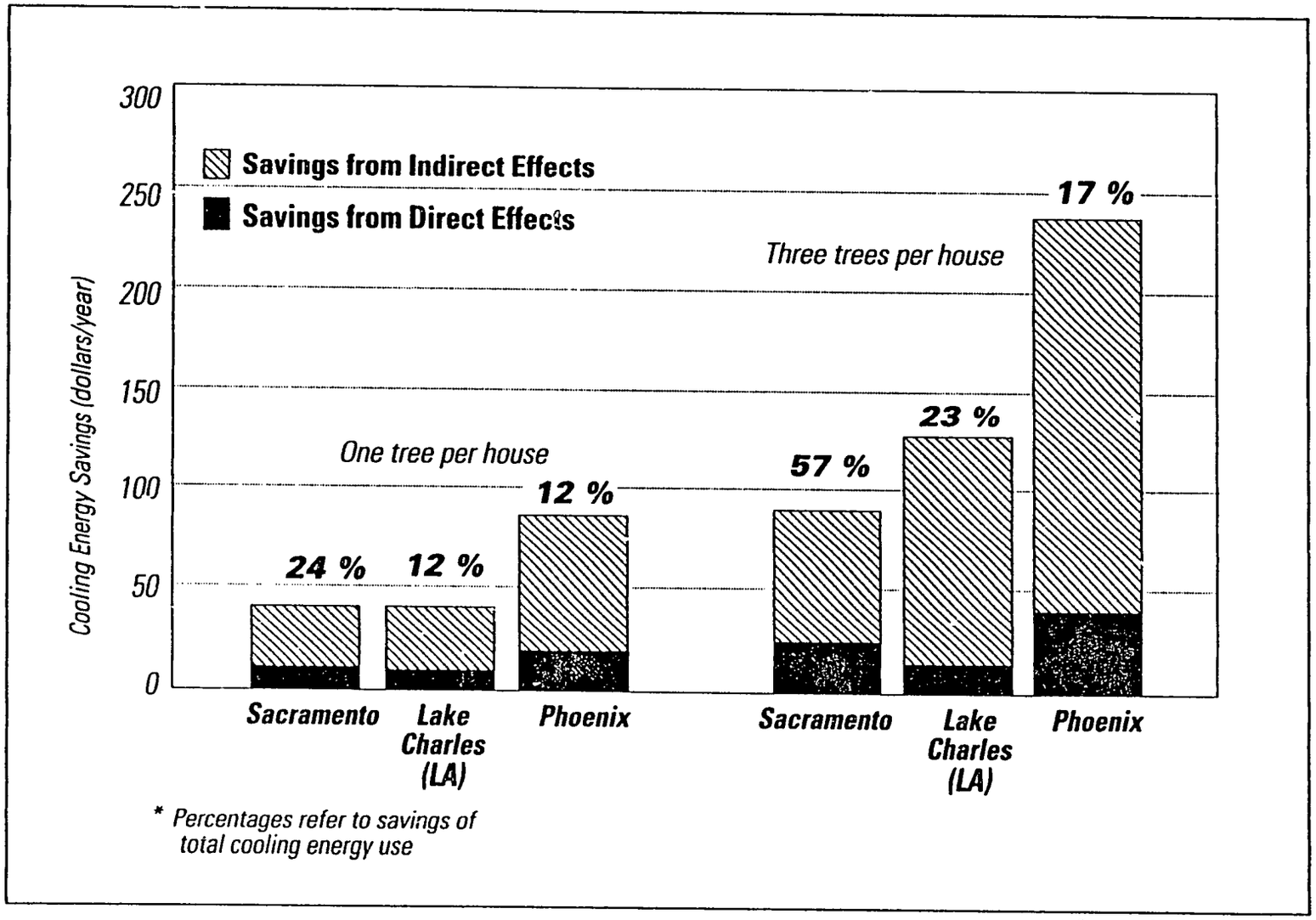


Source: Akbari et al., 1990

Figure ES-3.

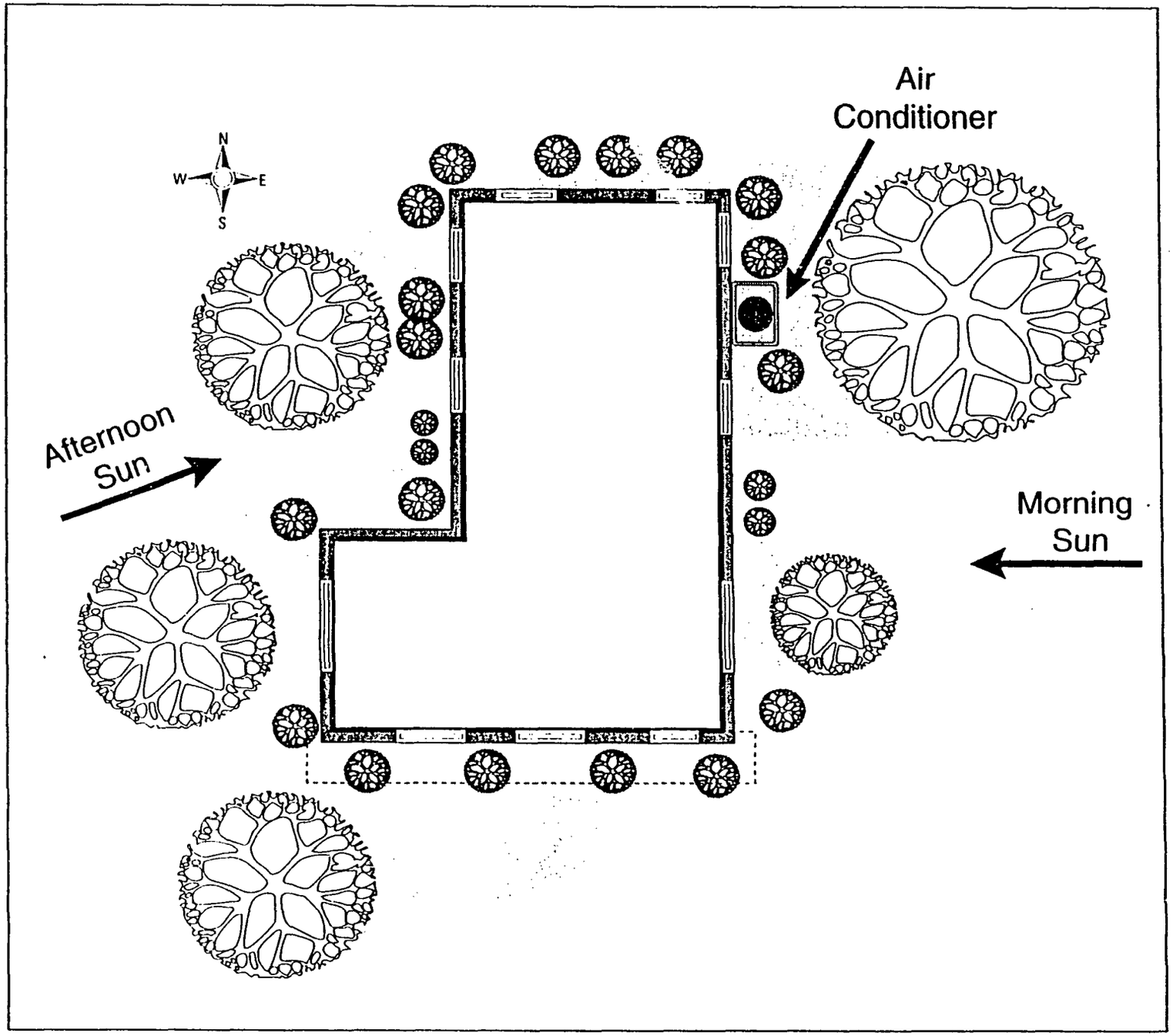
Rising temperatures and smog: This graph shows ozone concentrations compared to daily peak temperatures in Los Angeles, California. As temperatures rise above 74°F, ozone concentrations can more frequently exceed the National Ambient Air Quality Standard (NAAQS) which is currently 12 parts per hundred million. (Also appears as Figure 1-23.)

Figure 2-9.
Estimated Cooling Energy savings in a typical, well-insulated, new house from the combined direct and indirect effects of trees. Note that direct effects provide a relatively small percentage of the total energy savings for new housing stock.

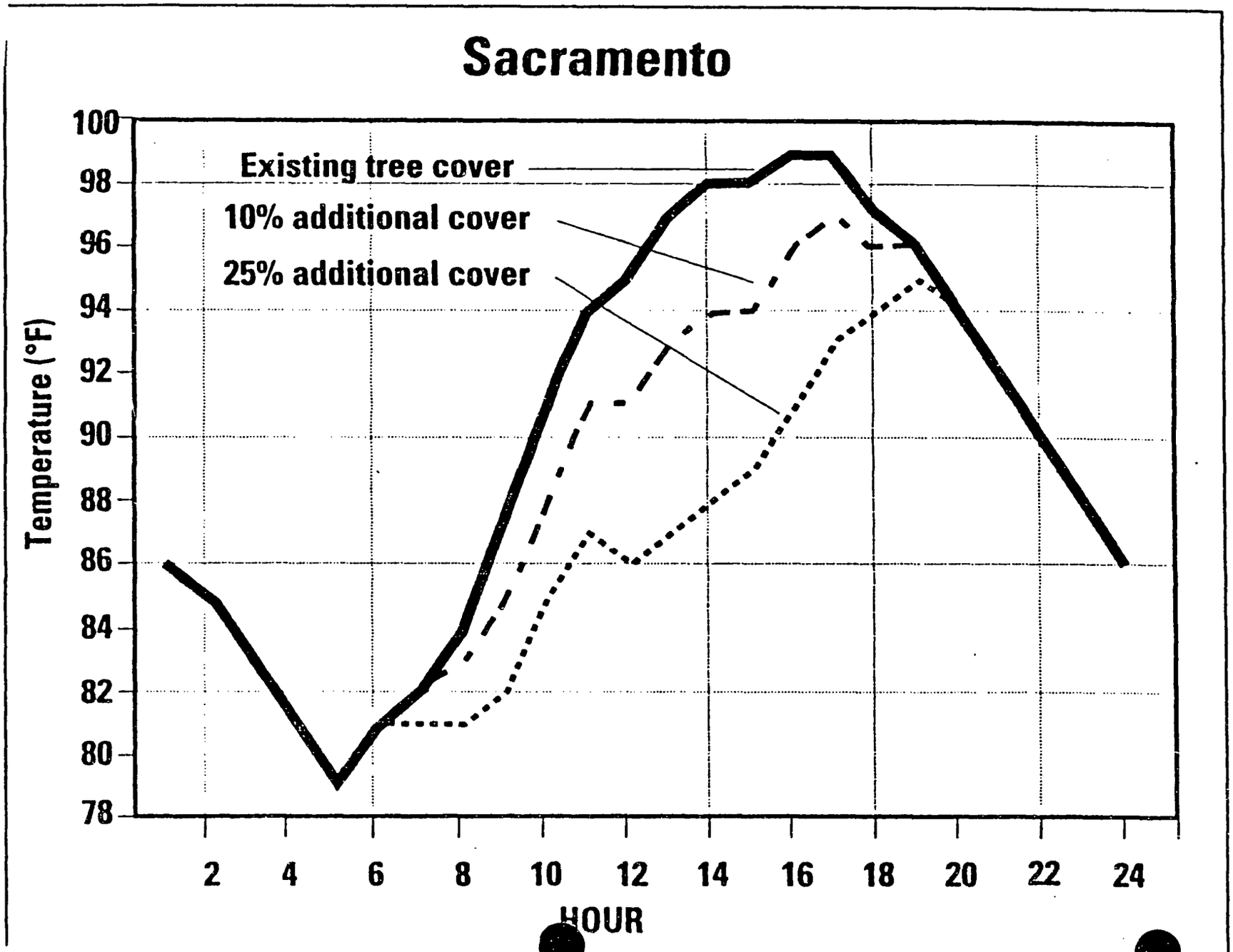


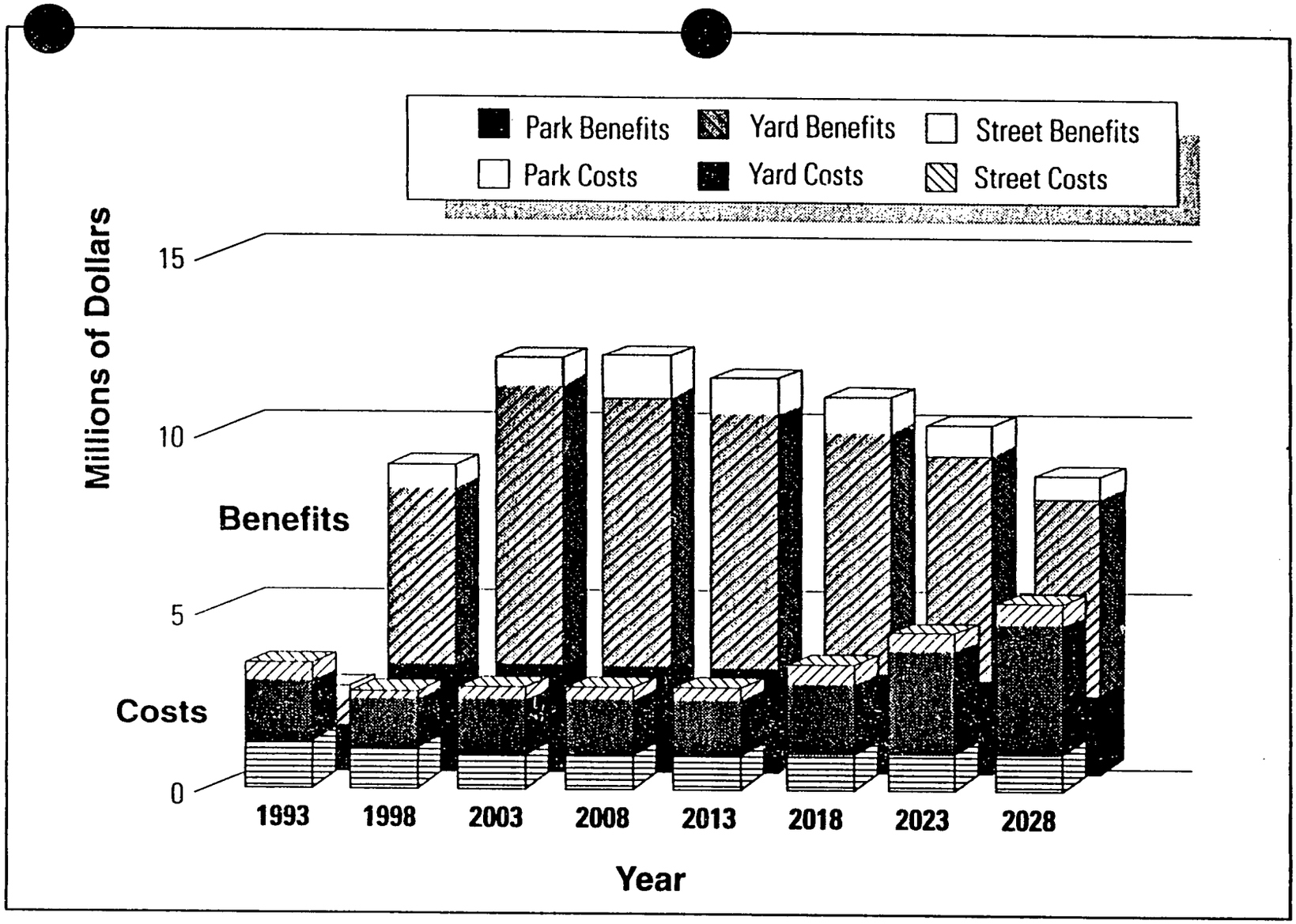
Source: Huang et al., 1987

Figure ES-4.
Sample residential landscape: A large tree is planted on the east side to shade the air conditioner, and on the west and south sides to cast maximum shadows on the house. Shrubs planted on all sides of the house help to reduce the temperatures of soil and walls. (Also appears as Figure 6-9.)



Source: Parker, 1982


Sacramento
Existing tree cover
10% additional cover
25% additional cover
Temperature (°F)
100
98
96
94
92
90
88
86
84
82
80
78
2
4
6
8
10
12
14
16
18
20
22
24
HOUR



Source: McPherson, 1991

Figure 2-13.
Projected annual costs and benefits of the Trees for Tucson/Global Releaf reforestation program.

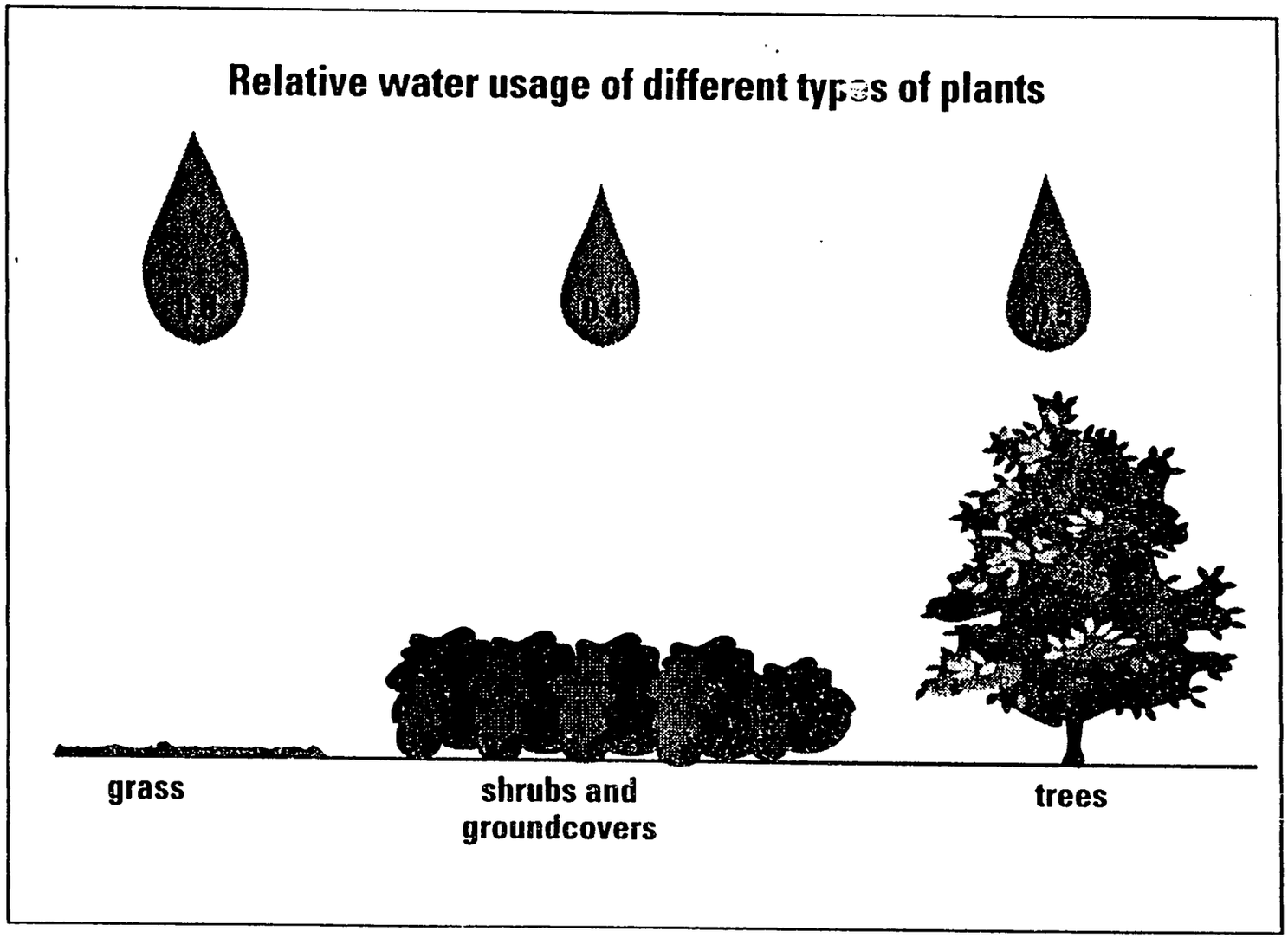
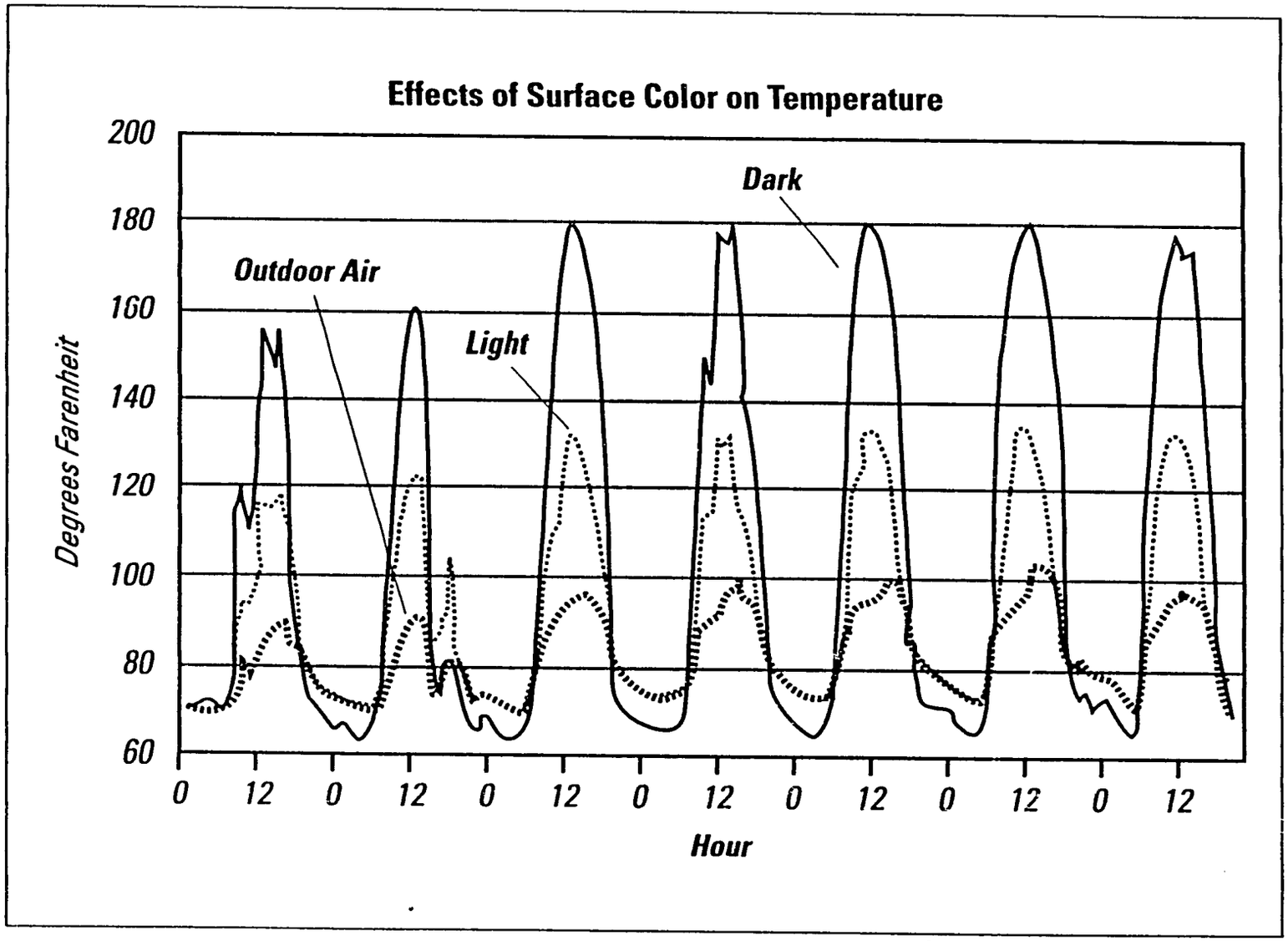
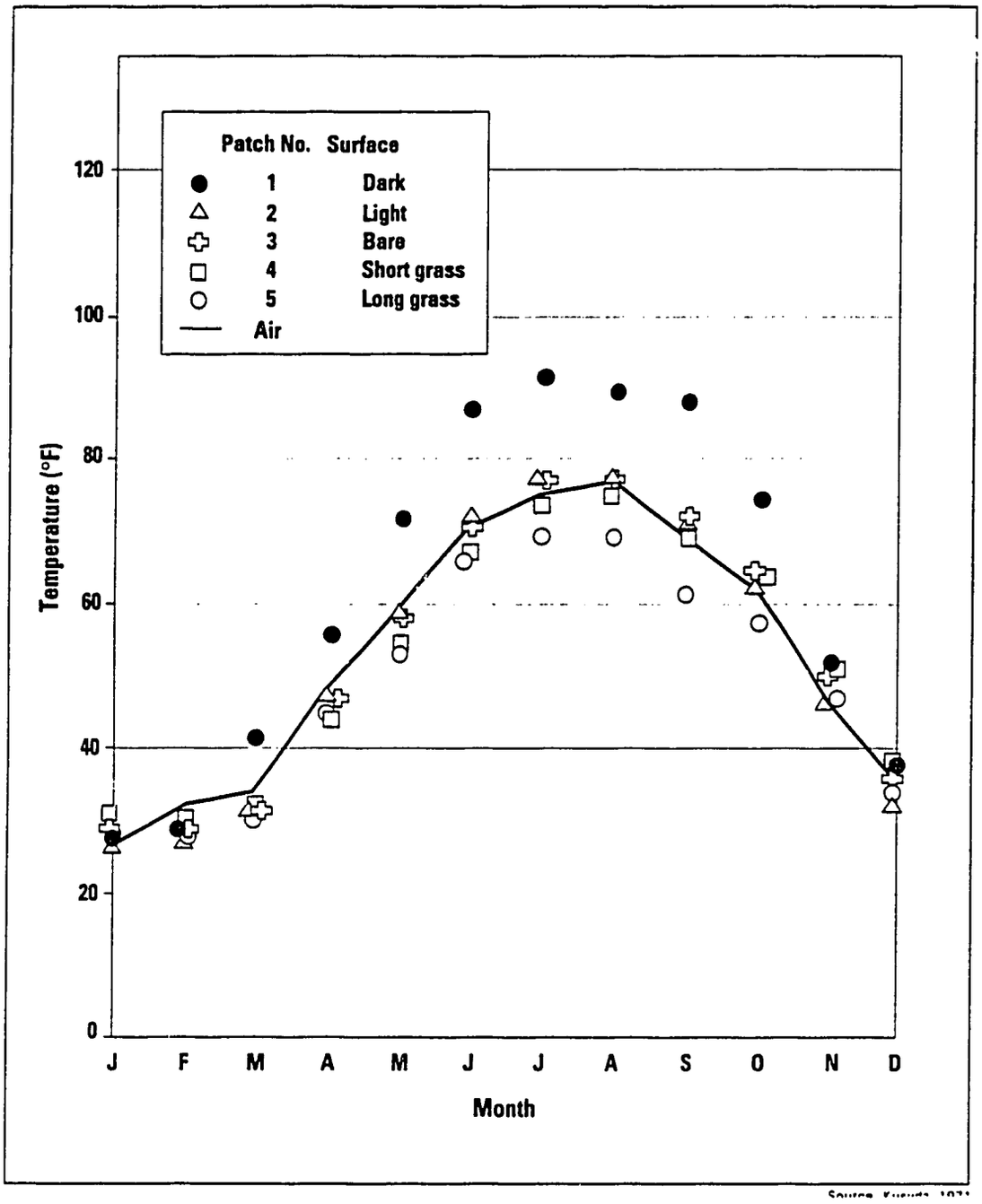


Figure 4-1.
Estimated typical water usage of varying plant types in relative amounts: The

Figure 3-4.
Daily surface temperature: Dark-colored roofs get much hotter throughout the day than do light-colored roofs.



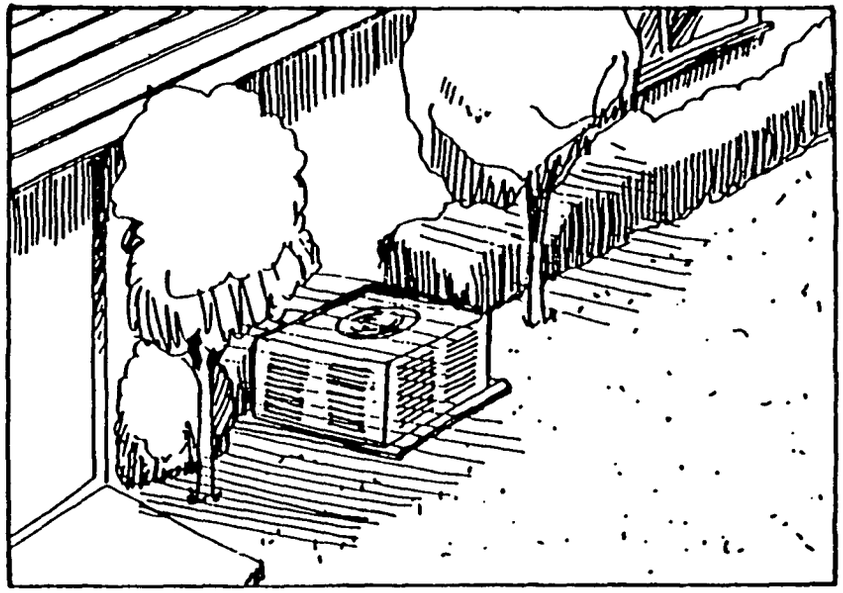
Source: Adapted from Griggs et al., 1989



Source: Kuehn, 1971

Figure 3-5.
Year-round ground surface temperatures: Dark-colored surfaces are also hotter throughout the year than light-colored surfaces or even ground vegetation.

SHADING AND MICROCLIMATE MODIFICATION NEAR THE AIR CONDITIONER

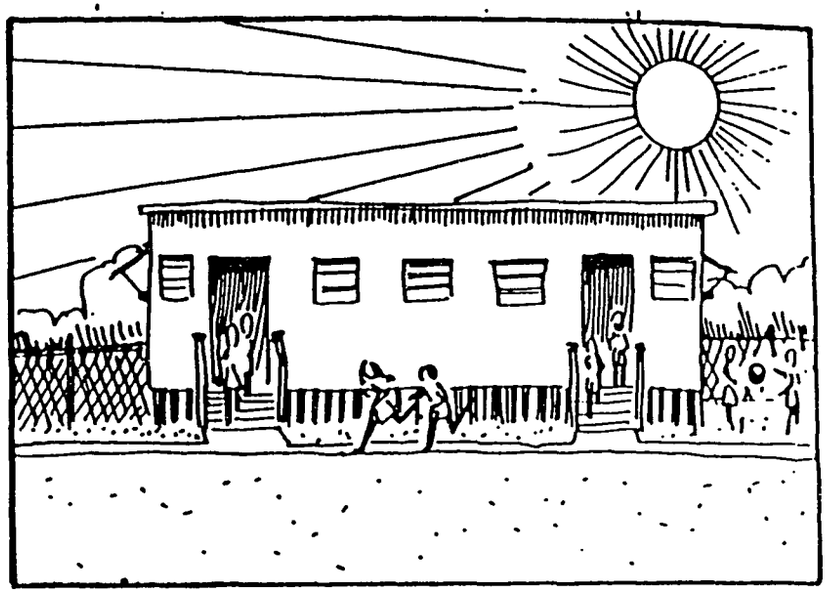


Completely shade the air conditioner, but do not block the exhaust.

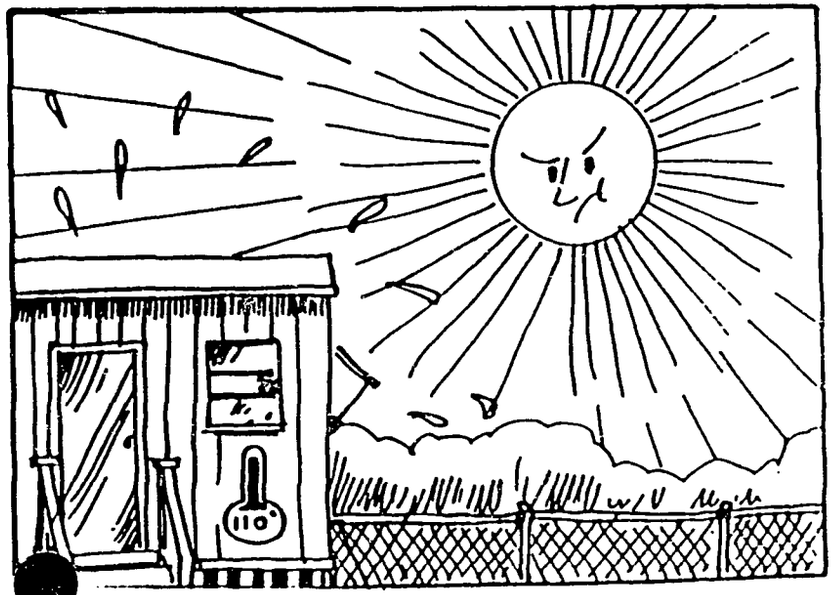
SHADING OVER AIR CONDITIONING UNIT AND SHADING OF SURROUNDING GROUND REDUCES AMBIENT OPERATING TEMPERATURE 6-7 DEGREES F., = 4-10% NET SAVINGS

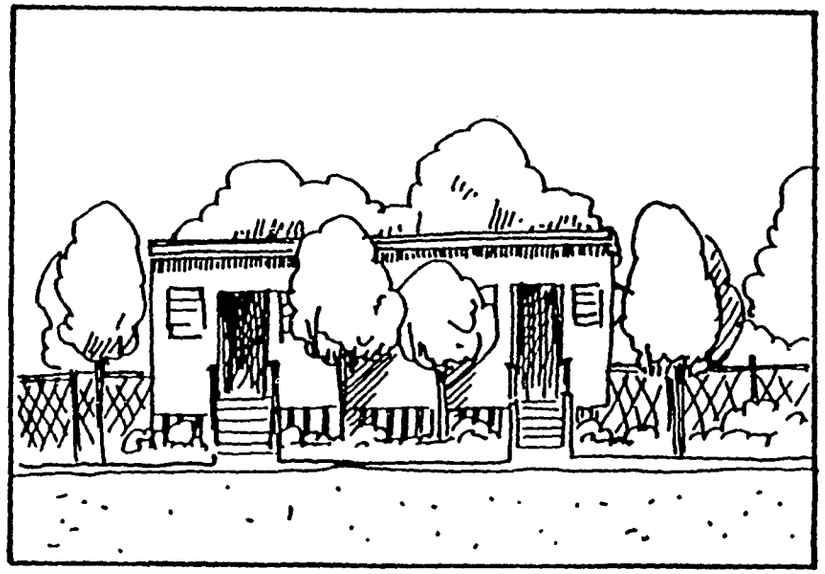
BEFORE:

CHILDCARE FACILITY
AT
FLORIDA INTERNAT'L
UNIVERSITY - MIAMI
(PARKER)



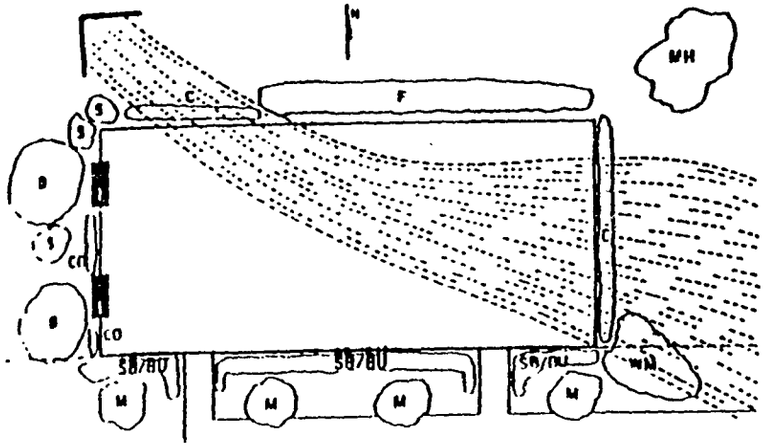
Children, running in and out, added to the load on the cooling system



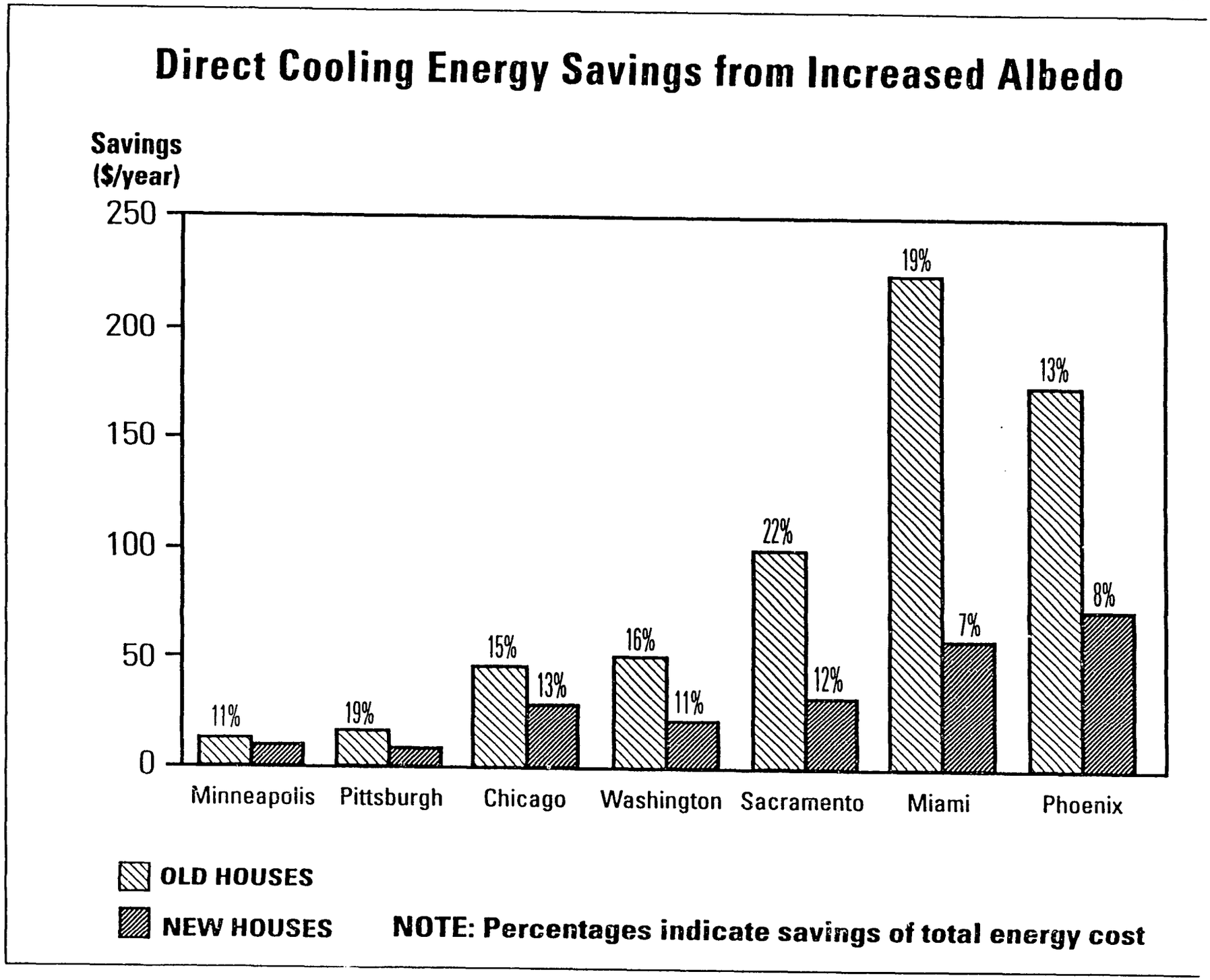


After landscaping, a 58% savings in energy use during peak load hours.

AFTER



'do.



6.
energy savings
direct effects of
l albedo: Com-
dels project sig-
energy savings
do increases in
cross the coun-
higher dollar
sunbelt cities.

Source: Ta

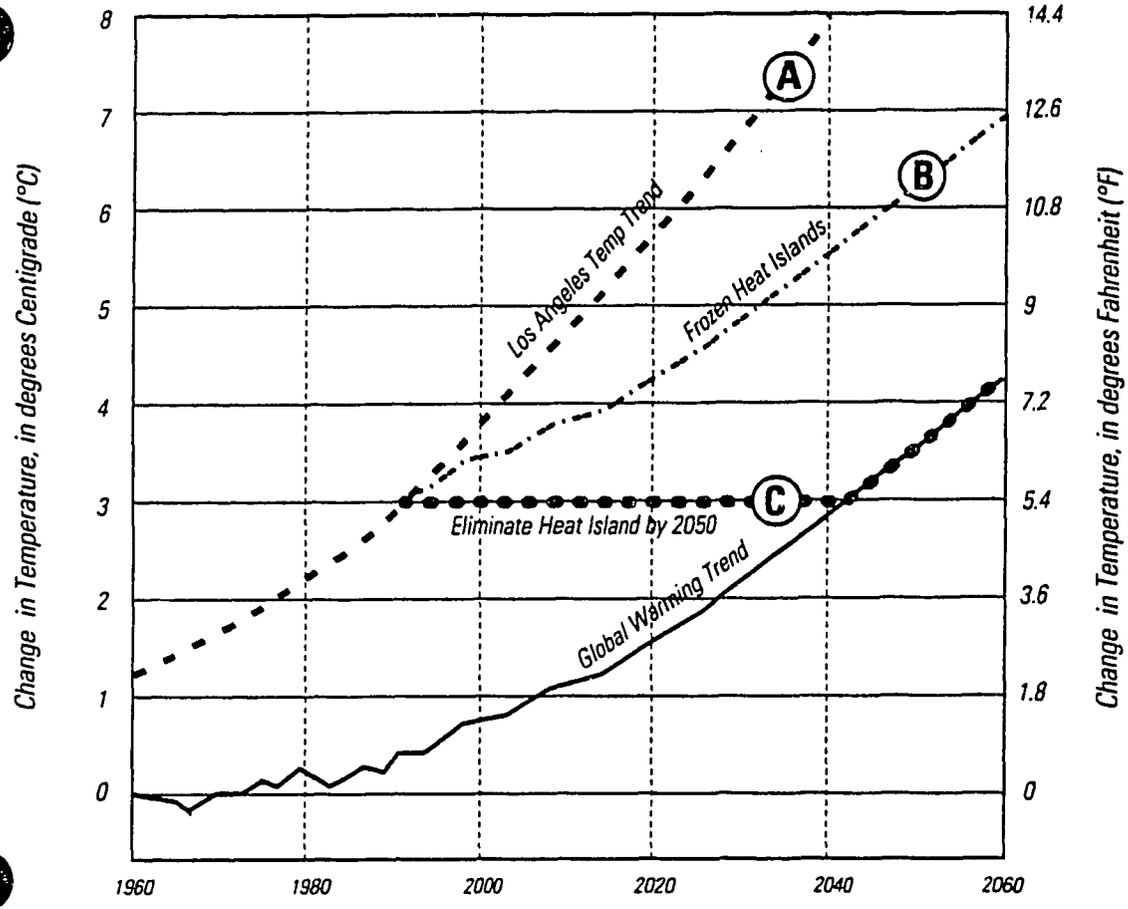


Figure 8-1.
Three scenarios of future Los Angeles temperatures, added to a forecast of global warming trend.

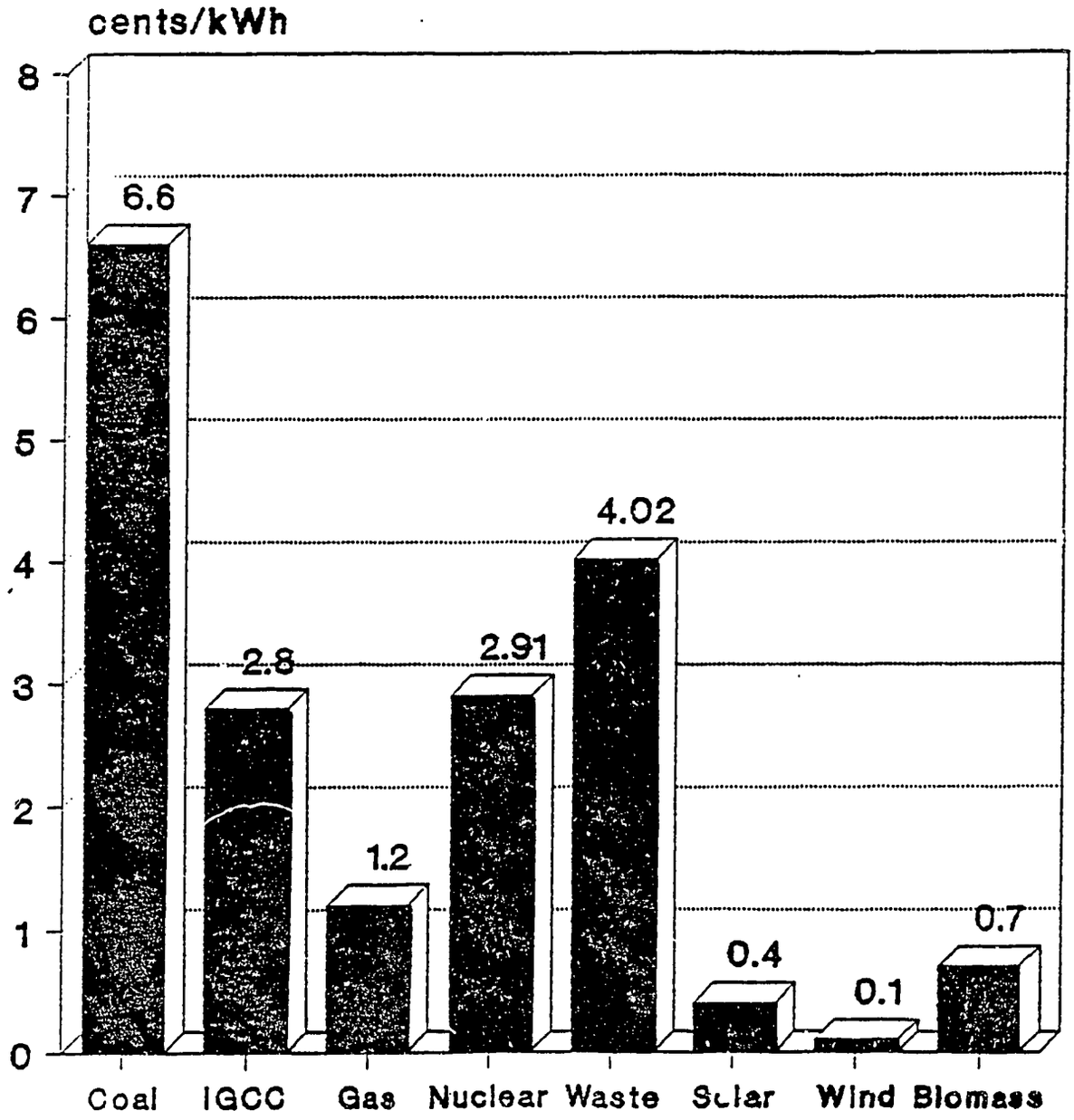
By 2050, under the business-as-usual "Los Angeles Temp Trend" (1° per decade growth in the heat island), downtown L.A. will be 18° hotter than it was in 1940 (A). With the L.A. heat island "Frozen" at its 1990 level, the city will still be 12° hotter (B). With a vigorous program of heat-island mitigation ("Eliminate Heat Island by 2050"), it's possible to entirely compensate for the effects of global warming in L.A. until somewhere around 2050 (C). Note: the global warming trend shown assumes an exponential greenhouse gas growth of 1.5 percent per year.

The $57,000 Tree
(over a 50-year lifetime)

- $75 per year
  air conditioning
- $75 per year
  stormwater control
  soil erosion prevention
- $50 per year air
  pollution control
- $75 per year
  wildlife shelter
- $27/square inch at dbh
- Between 7 and 27 percent of
  appraised value of property

SOURCES: MSU study; ISB formula; Gallup poll.

Externality Costs
Electric Power

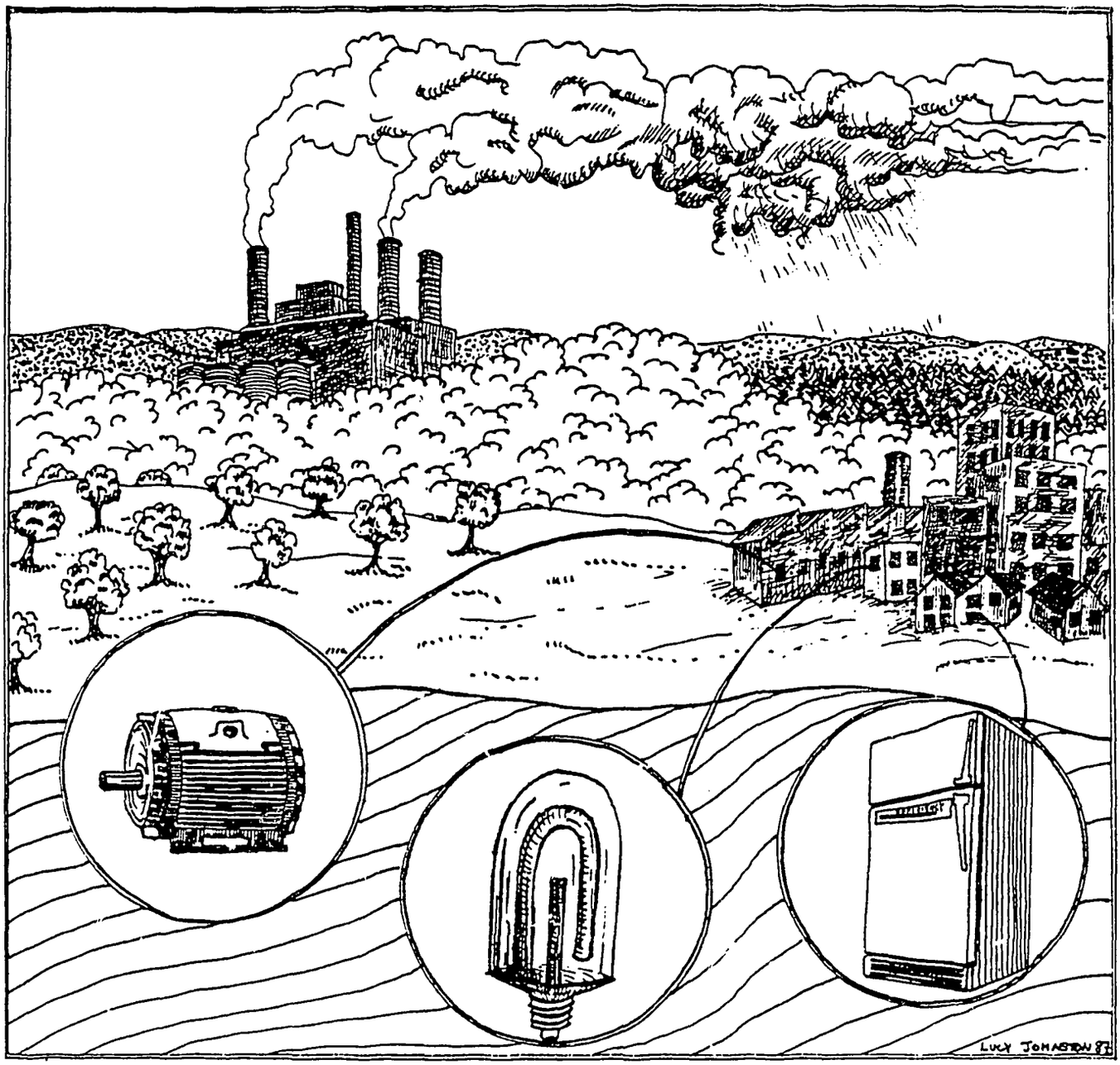


Ottinger et al, 1990

Acid Rain and Electricity Conservation

by the American Council for an Energy Efficient Economy

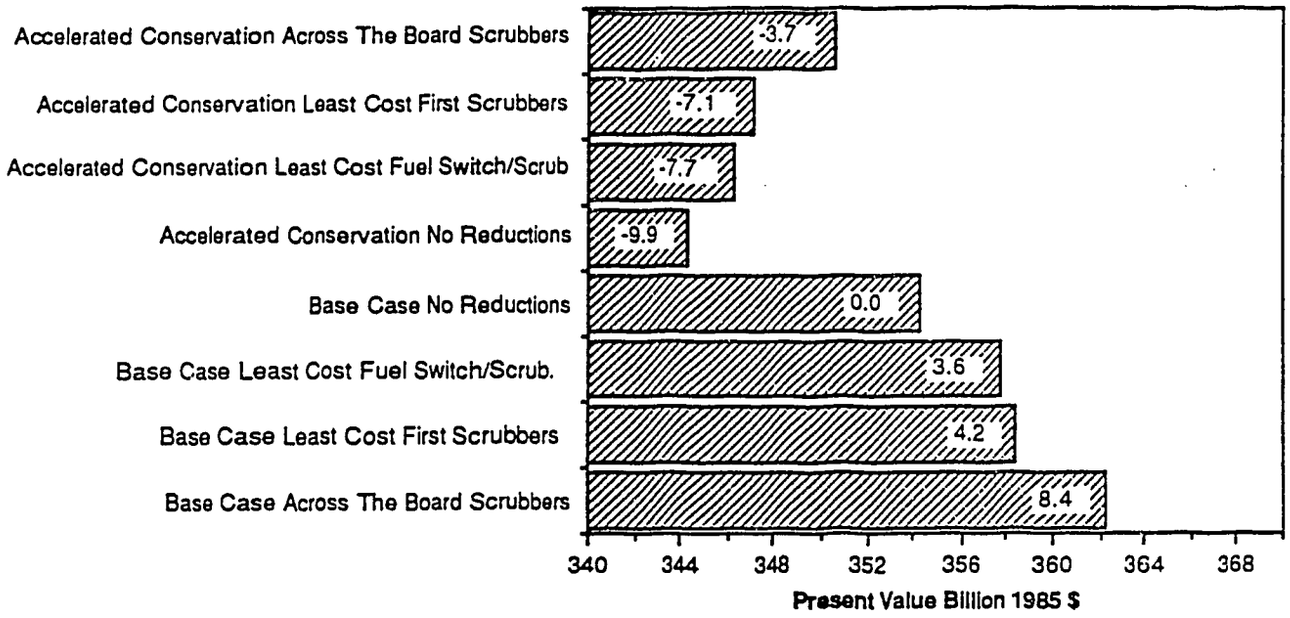
Howard S. Geller
Eric L. Miller
Marc R. Ledbetter
Peter M. Miller



Published by: The Energy Conservation Coalition
and the American Council for an Energy Efficient Economy

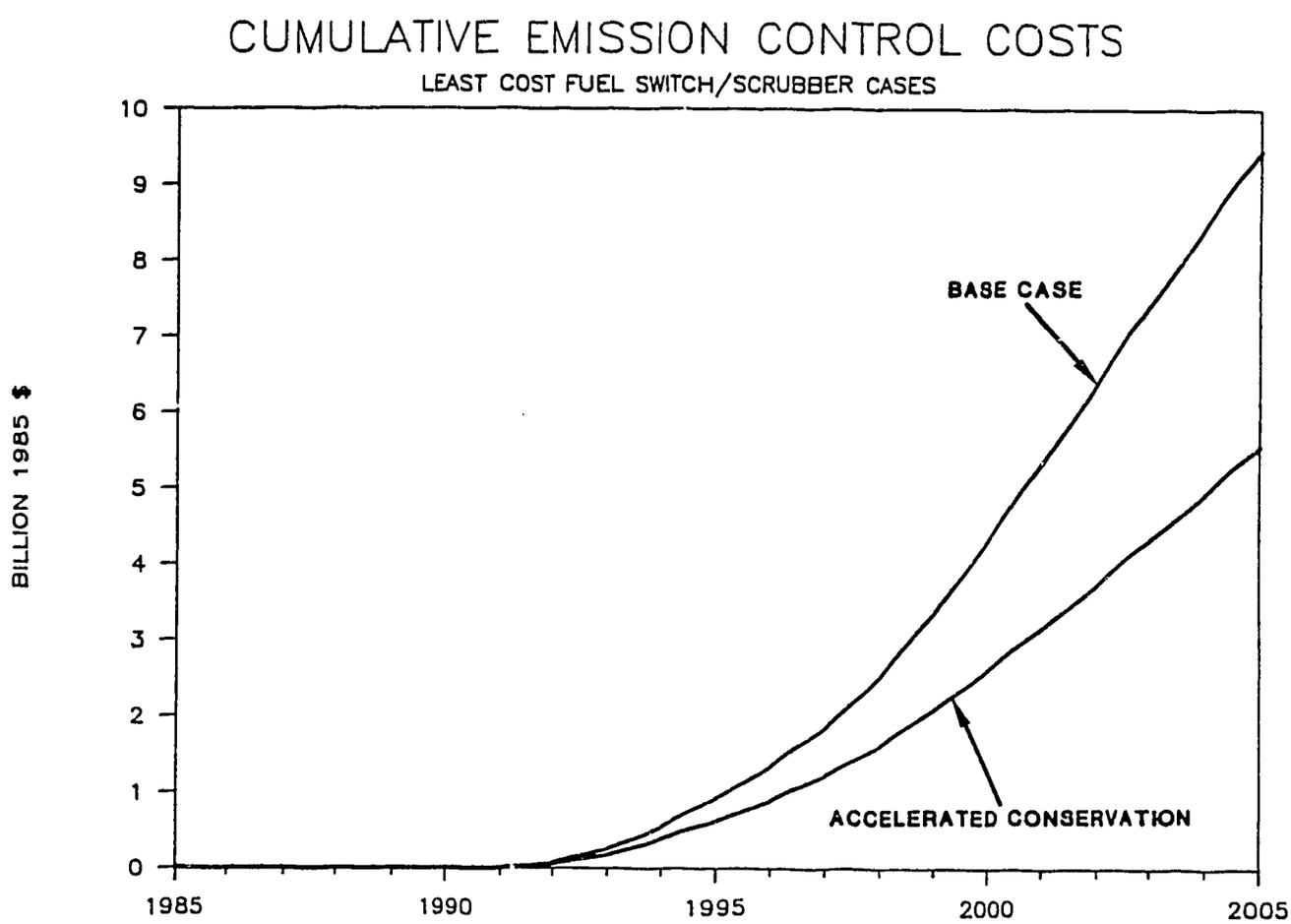
June 1987

Present Value of Energy Service Costs During 1985-2000



1) The length of each bar equals the total present value of the scenario.
2) The number within each bar equals the difference between the scenario and the base case with no emission reductions.

FIGURE S.4



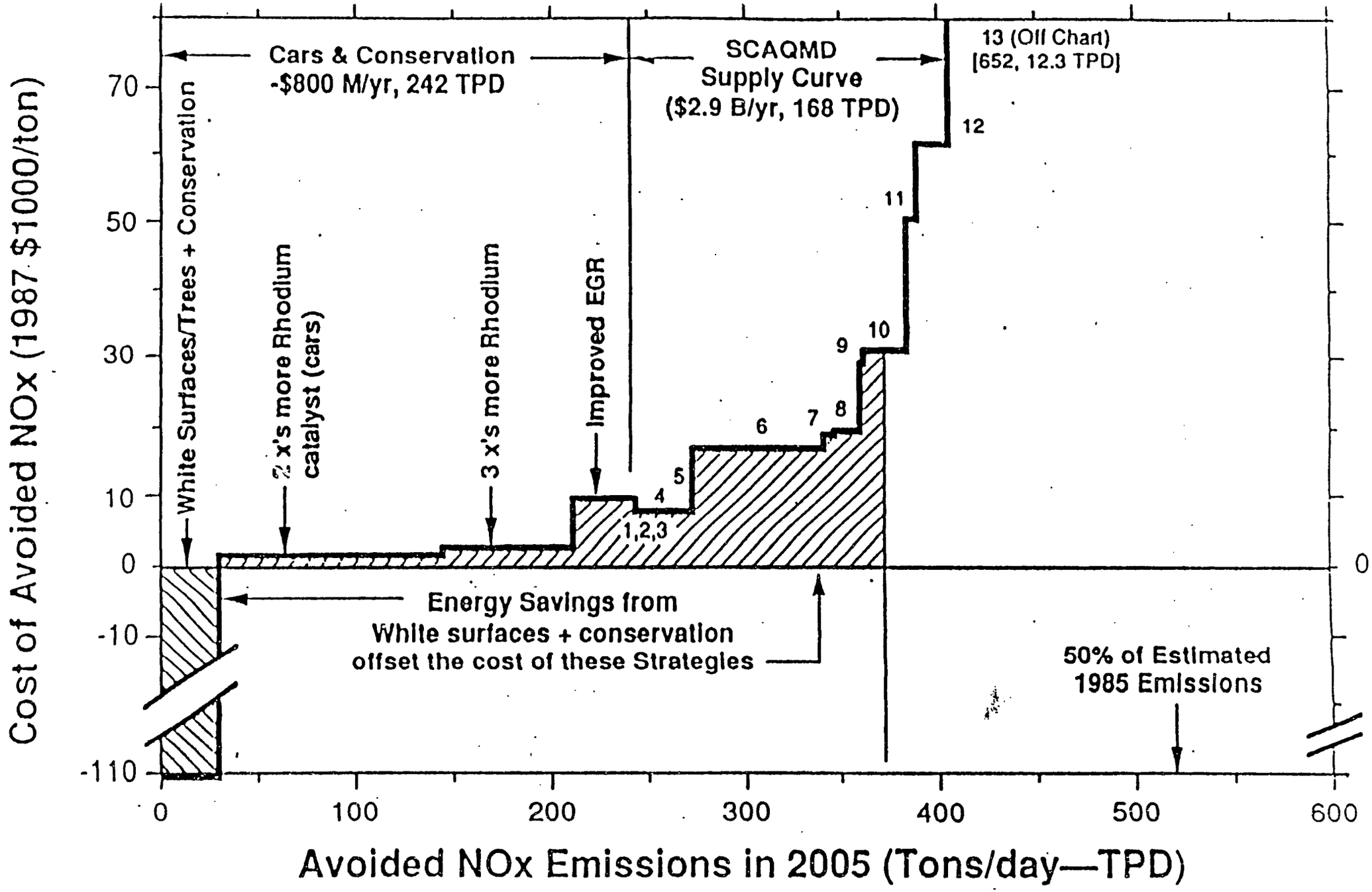

Cars & Conservation
-$800 M/yr, 242 TPD
SCAQMD
Supply Curve
($2.9 B/yr, 168 TPD)
13 (Off Chart)
[652, 12.3 TPD]
White Surfaces/Trees + Conservation
2 x's more Rhodium catalyst (cars)
3 x's more Rhodium
Improved EGR
1,2,3
4
5
6
7
8
9
10
11
12
Energy Savings from
White surfaces + conservation
offset the cost of these Strategies
50% of Estimated
1985 Emissions
Cost of Avoided NOx (1987 $1000/ton)
70
50
30
10
0
-10
-110
0
100
200
300
400
500
600
Avoided NOx Emissions in 2005 (Tons/day—TPD)

TABLE 7

STATUS OF STATE ACTIONS INCORPORATING ENVIRONMENTAL EXTERNALITY COSTS

Legend

O - Incorporation Ordered
P - Incorporation Order Pending
U - Under Consideration
N - No Action

STATE	O	P	U	N		STATE	O	P	U	N	
ALABAMA				X		NEBRASKA				X	
ALASKA	X				1	NEVADA	X				1
ARIZONA	X					NEW HAMPSHIRE				X	
ARKANSAS				X		NEW JERSEY	X				
CALIFORNIA	X				2	NEW MEXICO				X	
COLORADO	X					NEW YORK	X				
CONNECTICUT		X				NORTH CAROLINA			X		
DELAWARE				X		NORTH DAKOTA				X	
DISTRICT OF COLUMBIA			X			OHIO	X				
FLORIDA				X		OKLAHOMA				X	
GEORGIA				X		OREGON	X				
HAWAII			X			PENNSYLVANIA	X				
IDAHO	X					RHODE ISLAND			X		
ILLINOIS				X		SOUTH CAROLINA				X	
INDIANA				X		SOUTH DAKOTA				X	
IOWA		X				TENNESSEE				X	
KANSAS	X					TEXAS	X				
KENTUCKY				X		UTAH			X		
LOUISIANA				X		VERMONT	X				
MAINE			X			VIRGINIA	X				
MARYLAND			X			WASHINGTON				X	
MASSACHUSETTS	X				2	WEST VIRGINIA				X	
MICHIGAN	X				2	WISCONSIN	X				
MINNESOTA	X				2	WYOMING				X	
MISSISSIPPI				X							
MISSOURI				X	3	BPA	X				1
MONTANA			X			NWPPC	X				1

This table is derived from the references at the end of Chapter X.G.

(1) Established by legislation.

(2) Order issued to consider externalities; implementation pending.

(3) Commission has stated that it may consider externalities.

FIGURE 1

Schematic of Overall Methodology to Assess Air Pollution Externality Costs Associated with Electricity Generation

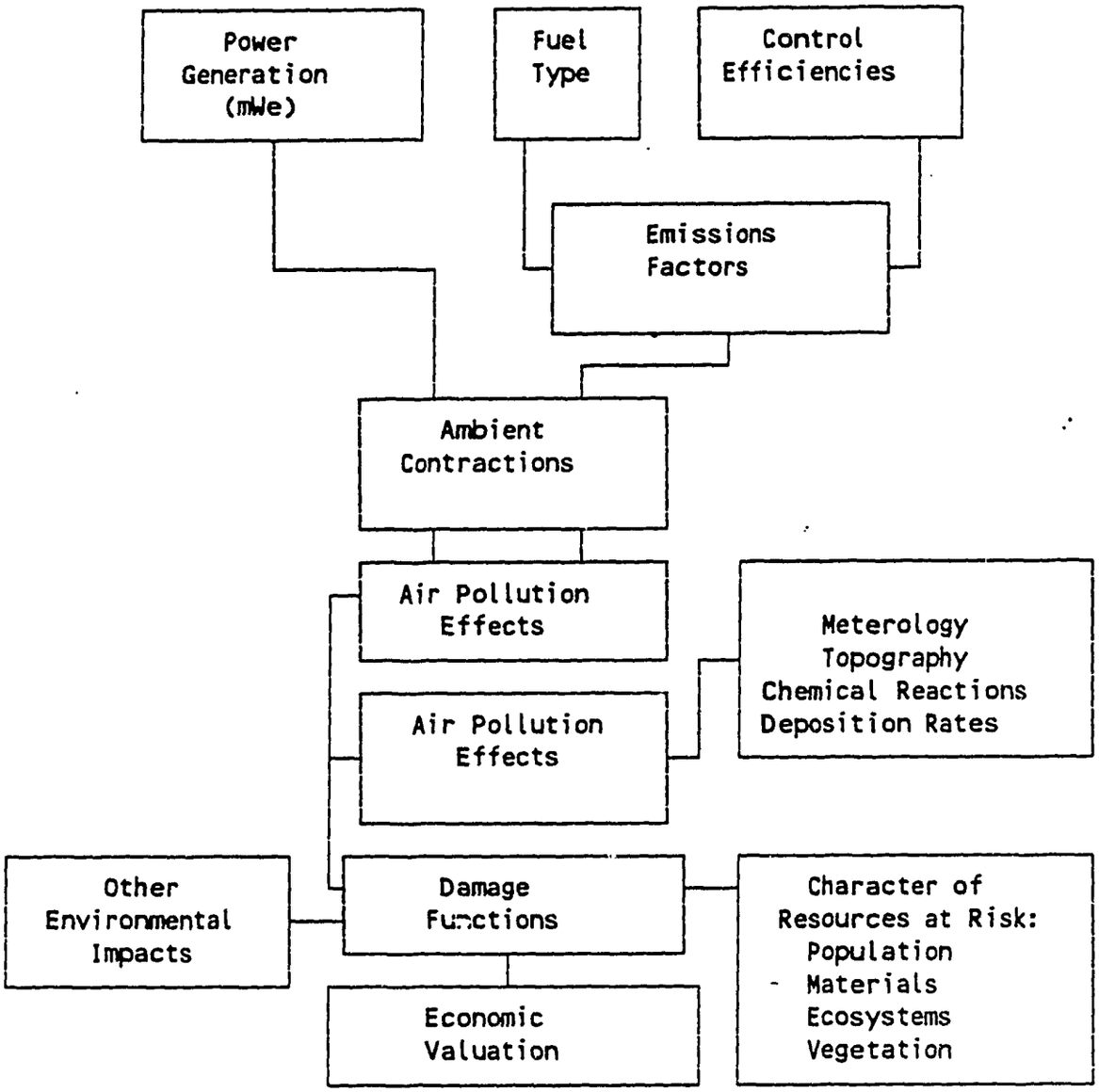


TABLE 2

EMISSIONS CHARACTERISTICS OF SOLID WASTE GENERIC FACILITY

	Emissions (Tons/Yr)	Tons/MWh	Increase in Morta/Morb Annual Linear dose-response
Particulates	61	9.8×10^{-4}	0.04
SO_2	220	33.5×10^{-4}	1.5
NO_2	290	44.1×10^{-4}	0
VOCs	9.6	1.46×10^{-4}	?
CO	168	25.6×10^{-4}	3.8
HCI	69	10.5×10^{-4}	0.055
H^2SO_4	5.6	0.85×10^{-4}	0.23
Lead	1.6	0.24×10^{-4}	?
Mercury	0.53	0.08×10^{-4}	0.00075
Flouride	4.8	0.73×10^{-4}	0
Dioxin	5.1×10^{-6}	0.76×10^{-10}	0.062
POM	1.8×10^{-3}	0.27×10^{-7}	0.008
Beryllium	8.8×10^{-6}	1.34×10^{-10}	0
PCB	0.01	1.52×10^{-7}	3×10^{-5}

Source: BPA/ECO, Five Resources, Technical Appendices, Appendix C, Table C1-1. Tons/mWh calculated based on average annual output of 65,700,000kWh. See BPA/ECO, Five Resources, Final Report at p. 4-4. The generic plant is equipped with scrubbers and particulate controls. Increases in morbidity/mortality are from Appendix C, Table C1-5, at C1-55 of the BPA/ECO Report.

The estimated externality costs vary from a high cost assessment of 484.199 mills per kilowatt hour to a low cost assessment of 1.854. The low cost assessment was based on an assumption that existing air pollution standards completely protect human health, a conclusion which the BPA authors considered unlikely.[29] The high cost estimate is based on a linear dose response curve with no safe threshold for exposure. The "expected" cost, 111.453 mills per kilowatt hour, was based on dose response data at projected ambient concentrations. The report notes that if larger populations are

Environmental Externalities Calculation: Hypothetical Gas Combined Cycle

	Emissions Coefficient	Value		Conversion Factor	Result
Major Air Emissions					
1. CO_2	953 lbs/mWh x	$22/ton	x	100¢/$ / (2000 lbs/ton)(1000 kWh/mWh)	= 1.05 ¢/kWh
2. SO_x	0 lbs/mWh x	$1500/ton	x	100¢/$ / (2000 lbs/ton)(1000 kWh/mWh)	= 0.00 ¢/kWh
3. NO_x	0.64 lbs/mWh x	$5000/ton	x	100¢/$ / (2000 lbs/ton)(1000 kWh/mWh)	= 0.16 ¢/kWh
4. Particulates	0.01 lbs/mWh x	$360/ton	x	100¢/$ / (2000 lbs/ton) (1000 kWh/mWh)	= 0.00 ¢/kWh
				Subtotal for Major Air Emissions	= 1.21 ¢/kWh
Other Environmental Externalities					
5. Land Use	minor major use of pristine land	0 0.18¢/kWh		Select one or interpolate	= 0.09 ¢/kWh
6. Solid Waste	0 lbs/mWh x	$35/ton	x	100¢/$ / (1000 kWh/mWh) (2000 lbs/ton)	= 0.00 ¢/kWh
7. Amount of Water Use	600 gallons /mWh x	0.16¢/ gallon	x	1 / 1000 kWh/mWh	= 0.10 ¢/kWh
8. Input Water Impacts	none major loss of habitat	0 .16 ¢/kWh		Select one or interpolate	= 0.08 ¢/kWh
9. Thermal Change	no change minor change major change	0 .06 ¢/kWh .12 ¢/kWh		Select one or interpolate	= 0.06 ¢/[illegible]
10. Chemical Change	no change minor change major change	0 .02 ¢/kWh .04 ¢/kWh		Select one or interpolate	= 0.02 ¢/kWh
11. Air Toxics	No fuel gas coal or oil	0 ¢/kWh .05 ¢/kWh .10 ¢/kWh		Select one or interpolate	= 0.05 ¢/kWh
12. Aesthetics	minor major	0 0.05 ¢/kWh		Select one or interpolate	= 0.03 ¢/kWh
13. Indoor Air Quality	no impact major impact	0 0.05 ¢/kWh		Select one or interpolate	= 0.00 ¢/kWh
14. Fuel Issues	none minor (natural gas) major (coal or oil)	0 0.05 ¢/kWh 0.10 ¢/kWh		Select one or interpolate	= 0.05 ¢/kWh
15. Tropospheric Ozone: VOCs	0.01 lbs/mWh x	$60,000/ton	x	100¢/$ / (2000 lbs/ton) (1000 kWh/mWh)	= 0.03 ¢/kWh
16. Stratospheric Ozone: CFCs	none some	0 0.04 ¢/kWh		Select one	= 0.00 ¢/kWh
				Subtotal for Other Environmental Externalities	= 0.51 ¢/kWh
				Total Environmental Score	= 1.56

Summary of Cost Estimates

All Costs are in 1989 Constant Dollars

		Northeast U.S		Southern California	
		$/ton	$/lb	$/ton	$/lb
1.	Nitrogen Oxides (NO_x)				
	Ambient Air Quality	$6,500	$3.50	$262,000	$131
	Greenhouse	$ 0	$0.00	$ 0	$ 0
	Total	$6,500	$3.50	$262,000	$131
2.	Sulfur Oxides (SO_x)	$1,500	$0.75	$ 75,000	$37.50
3.	Volatile Organics Gases				
	VOCs	$5,300	$2.65		
	ROGs			$ 29,000	$14.50
4.	Particulates*				
	TSP	$4,000	$2.00	$ 4,000	$ 2.00
	PM_{10}			$ 44,000	$22.00
5.	Carbon Monoxide (CO)				
	Ambient Air Quality	$ 820	$0.41	$ 820	$ 0.41
	Greenhouse	$ 50	$0.02	$ 50	$ 0.02
	Total	$ 870	$0.43	$ 870	$ 0.43
6.	Carbon Dioxide (CO_2)	$ 22	$0.011	$ 22	$ 0.011
7.	Methane (CH_4)	$ 220	$0.11	$ 220	$ 0.11
8.	Nitrous Oxide (N_2O)	$3,960	$1.98	$ 3,960	$ 1.98

* In southern California, the PM_{10} cost should be applied to emissions of PM_{10}, while the TSP cost should only be applied to additional particulate emissions that are *not* PM_{10}.

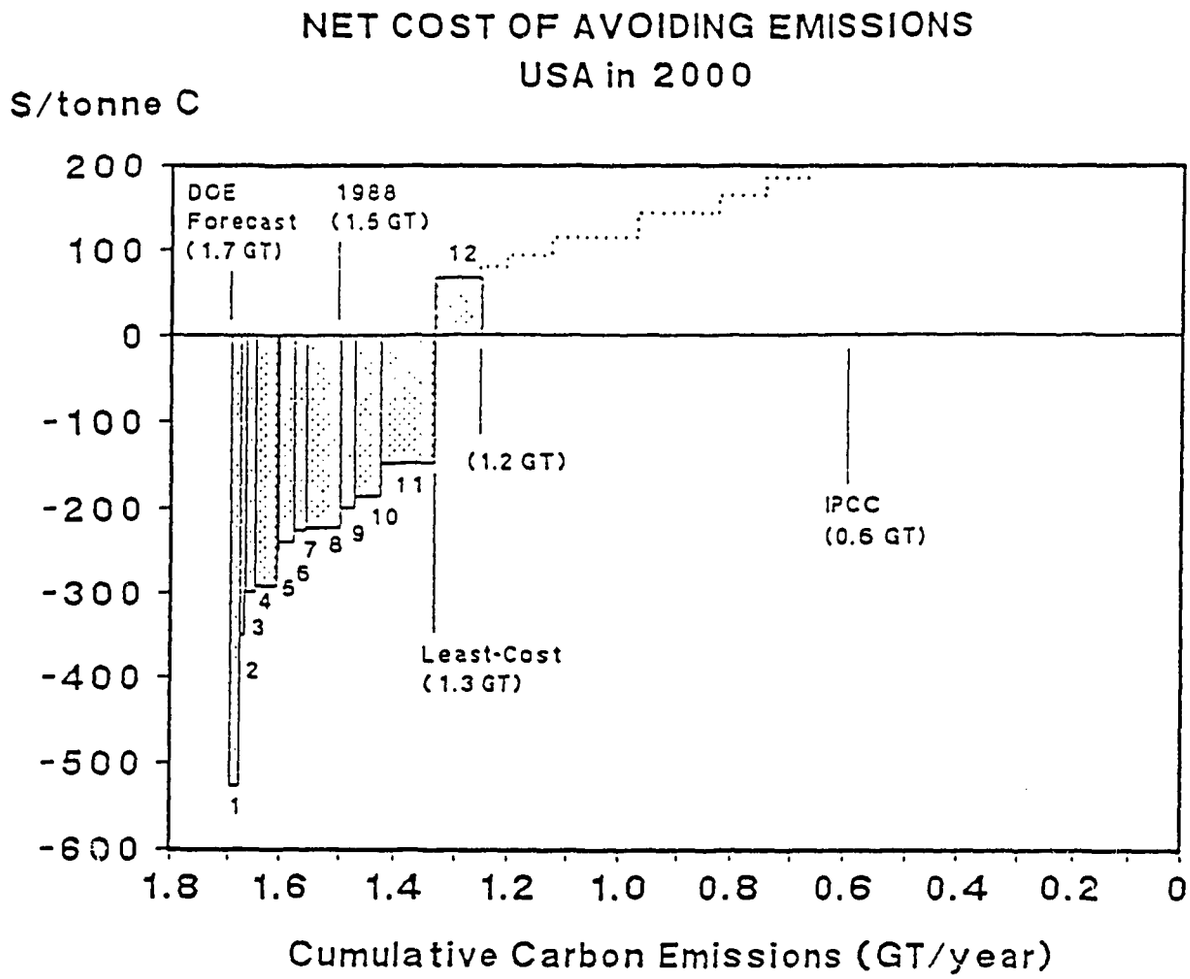


Figure 2. The x-axis shows total national carbon emissions at various levels of energy efficiency and assuming various fuel sources. The upper limit (1.7 GT) represents the current US DOE forecast for the year 2000. The "IPCC" label indicates the level of reductions necessary to stabilize atmospheric concentrations of greenhouse gases, according to the Intergovernmental Panel on Climate Change. The y-axis indicates the net cost of implementing each measure. Negative costs reflect a net economic benefit compared to the DOE forecast. The average net economic benefit of avoided emissions is $162/tonne.[55]

Legend

1. Raise the federal gasoline tax by 12 cents per liter within five years and spend part of the revenue on mass transit and energy-efficiency programs.
2. Use white surfaces and plant urban trees to reduce air conditioning loads associated with the summer "heat island" effect in cities.
3. Increase the efficiency of electricity supply through development, demonstration, and promotion of advanced generating technologies.
4. Raise car and light truck fuel-efficiency standards, expand the gas-guzzler tax, and establish gas-sipper rebates: new cars average 5.2 l/100km and new light trucks average 6.7 l/100km by 2000.
5. Reduce federal energy use through life-cycle cost-based purchasing.
6. Strengthen existing federal appliance efficiency standards.
7. Promote the adoption of building standards and retrofit programs to reduce energy use in residential and commercial buildings.
8. Reduce industrial energy use through research and demonstration programs, promotion of cogeneration, and further data collection.
9. Adopt new federal efficiency standards on lamps and plumbing fixtures.
10. Adopt acid rain legislation that encourages energy efficiency as a means for lowering emissions and reducing emissions control costs.
11. Reform federal utility regulation to foster investment in end-use energy efficiency and cogeneration.
12. Replace half of the passenger-car kilometers with kilometers from biomass-based methanol cars.

Table A-1. Examples of avoided emissions and their costs.

EFFICIENCY [a]	Measure Resource Cost ($/unit)	Avoided Emissions	Cost of Avoided Carbon-equivalent
	($/kWh)		
(Cost of avoided resource: $0.044/kWh [coal])		(g Carbon-eq/kWh)	($/tonne)
End-Use Efficiency [b]			
- Available Technologies			
o Lighting (incand. --> compact fluorescent)	-0.011	318	-171
o Lighting (efficient fluorescent tube)	-0.007	318	-159
o Lighting (lamps, ballasts, reflectors)	0.013	318	-96
o Refrigerator/freezer, no CFCs	0.018	318	-79
o Freezer, automatic defrost, no CFCs	0.022	318	-67
o Heat pump water heaters	0.034	318	-30
o Variable-speed motor drive	0.011	318	-102
o U.S. field data, multifamily, htg. retrofits	0.038	318	-19
o Retrofits in 450 US commercial buildings	0.026	318	-54
o No-cost or behavioral measures	0	318	-137
Electricity Production [c] [busbar costs]			
- Available Technologies			
o Biomass steam-electric (wood fuel)	0.041	318	-9

Electricity Production [c] [busbar costs]			
- Available Technologies			
o Biomass steam-electric (wood fuel)	0.041	318	-9
o STIG (gasified coal)	0.041	9	-313
o STIG (natural gas)	0.027	163	-103
o Wind (1988)	0.065	318	67
o Solar thermal electric (1988)	0.119	318	238
o Solar photovoltaics (1988)	0.232	318	592
o Nuclear--current U.S. conditions	0.057	318	41
- Emerging Technologies			
o ISTIG (gasified coal)	0.034	57	-176
o ISTIG (natural gas)	0.024	187	-106
o Chemically recuperated gas turbine (nat. gas)	0.029	204	-73
o Solar thermal electric			
(2000)	0.049	318	16
(2010)	0.042	318	-6
(2020)	0.034	318	-29
o Solar photovoltaics			
(2000)	0.073	318	91
(2010)	0.051	318	23
(2020)	0.037	318	-22
o Wind			
(2000)	0.036	318	-24
(2010)	0.030	318	-44
o Nuclear--Industry target for U.S.	0.040	318	-11
- Fuel Choice [STIG base case]			

TerraMedia™

Lighting System Efficiency

Utility Training Module

iiec

The International Institute for Energy Conservation

About TerraMedia

TerraMedia is a collaborative effort headed by the International Institute for Energy Conservation to produce an interactive, multimedia energy efficiency information workstation. TerraMedia is divided into modules, each addressing a single area of interest. Each module combines text, graphics, audio, video, interactive spreadsheets, and technical diagrams to convey information in the most effective manner. TerraMedia harvests the knowledge and experience of energy efficiency experts and organizations. The collaborative nature of TerraMedia insures that a wide variety of qualified sources can contribute to the final product.

For more information about TerraMedia or The International Institute for Energy Conservation, please contact Michael Totten, TerraMedia Director, or Christopher Gronbeck, TerraMedia Project Manager:

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International Institute for Energy Conservation
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E-Mail: cgj@nova.stanford.edu (Internet)

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- Lending Institutions
- Universities
- Regional Information Centers
- Government Agencies

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Purpose of Collaborative:

- Pool expertise of many institutions
- Consolidate financial resources
- Eliminate redundant distribution systems
- Strengthen institutional ties

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Characteristics of Workstation:

- Current, Accurate Information
- Interactive
- Multimedia Approach
- Advanced Navigational Techniques
- Integrated with Other Resources

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1. Information & Graphics
2. Module Development
3. Fundraising

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Moving Around TerraMedia

There are several ways of moving around in the TerraMedia training module:

- Click on left and right arrow icons on bottom of screen
- Click on recent topics icon to find a topic you recently viewed
- Click on map icon to see where you are, from there you may back up to the beginning of a topic or section
- Click on boldface text to see more information on the topic
- Click on the main menu icon to go there
- Use custom buttons in certain entries to go to specific topics

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REFERENCES PRINT

Trade Associations

Illuminating Engineering Society of North America (IESNA)
345 East 47th Street
New York, NY 10017 USA
Phone: 212-705-7926

International Association of Lighting Designers (IALD)
18 East 16th Street, Suite 208
New York, NY 10003 USA
Phone: 212-206-1281

National Lighting Bureau (NLB)
2101 L Street, NW, Suite 300

INDEX ← → HELP

TerraMedia

A Project of the International Institute for Energy Conservation
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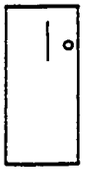
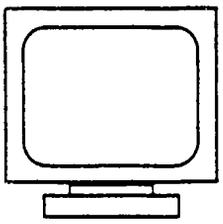
Proposed Equipment Configuration

Development System


Apple Quadra

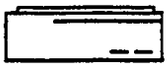

16" Color Monitor

2GB Fixed Drive

Magneto-Optical Drive

CD-ROM Drive

Color Laser Printer


Color Scanner

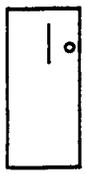
Modem

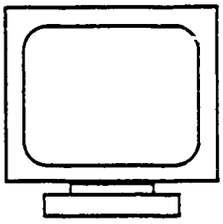
VCR

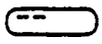
Video Digitizer Card

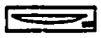
Audio Digitizing Device

User System


Apple Quadra


16" Color Monitor

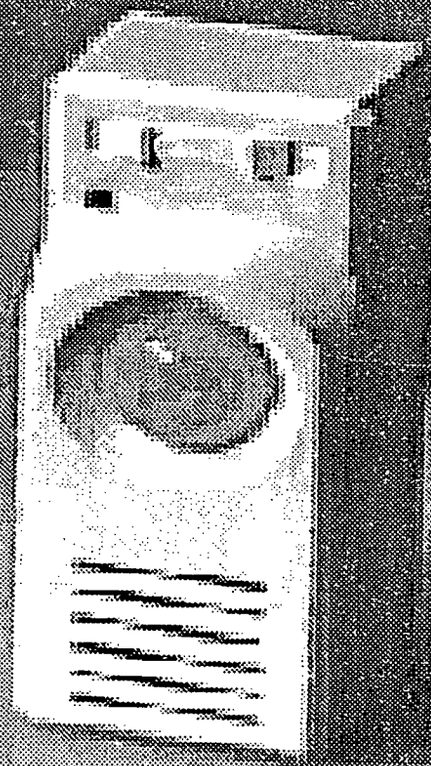

2GB Fixed Drive


CD-ROM Drive

Laser Printer

Lighting Controls

Lighting controls are used to reduce energy consumption, to achieve an aesthetic effect, to reduce glare, to reduce power to new lamps which are oversized to compensate for output depreciation with age, and to match illumination levels with specific tasks. Lighting controls are projected to be a billion dollar industry by the end of the century (Newman 1987).



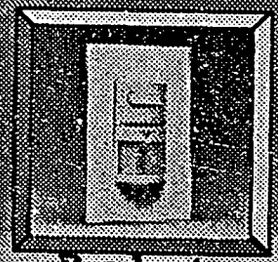
Switches

Dimmers

Schedulers

Photocells

Occupancy Sensors



Product Database

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Lighting Electric

Lighting Controls Product Database

CRESTRON

Honeywell

LEVITON

LUTRON

ECD Corporation

INTERMATIC

Robertshaw

LOA

MyTech

sensorswitch

Tek-Tron

NOVITAS™

TORK

TheWatt Stopper

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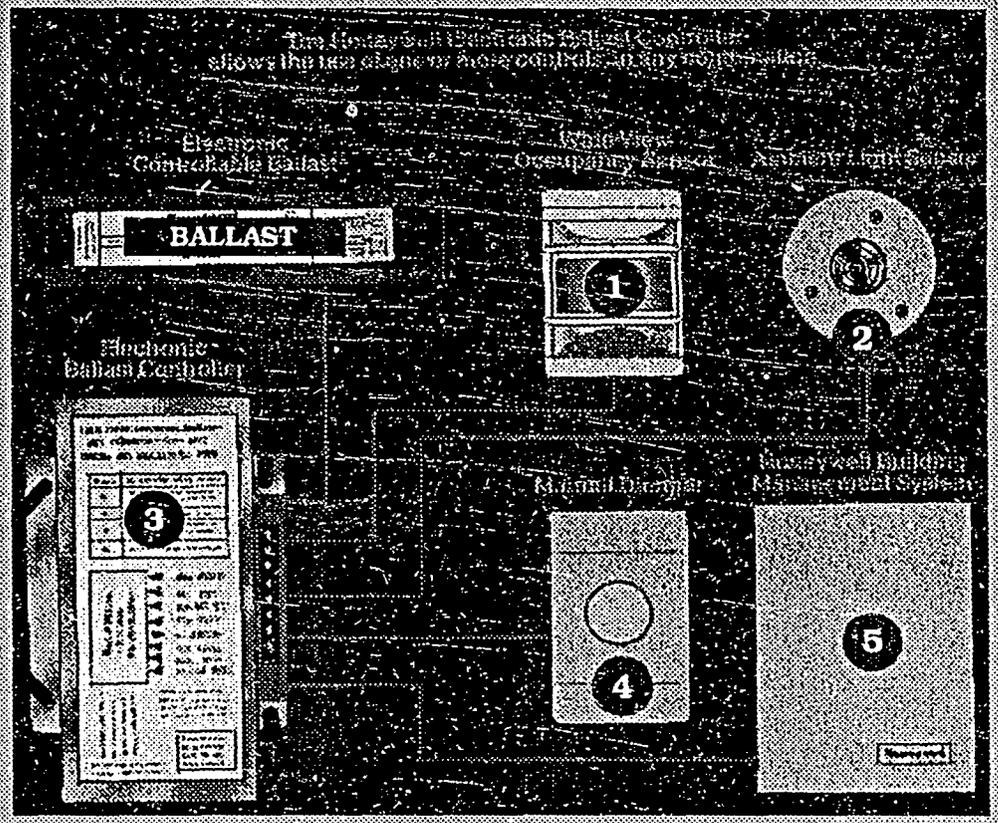
TERRA MEDIA

Lighting Enterprises

Honeywell Controls

Honeywell

Components in representative Honeywell fluorescent light control system: occupancy sensor [1], ambient light sensor [2], electronic ballast controller [3], manual dimmer [4], and bulding management system [5]. Click on a numbered component for more information.



For More Information:

Honeywell Residential and Building Controls
Honeywell Plaza
Minneapolis, MN 55408
USA
Attn: Customer Assistance
1-800-345-6770, x7153

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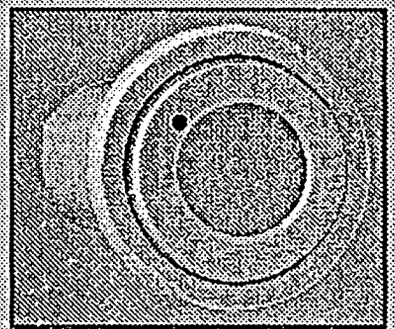
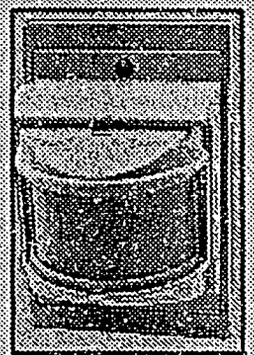
Play Honeywell Video (inactive)

Honeywell Controls

OCCUPANCY SENSORS



Model EL7628



Model EL7680

Ceiling mount (EL7628) or wide view (EL7680) sensors used with EL7305 controller turn off or dim lights when you leave the room

Print This Information

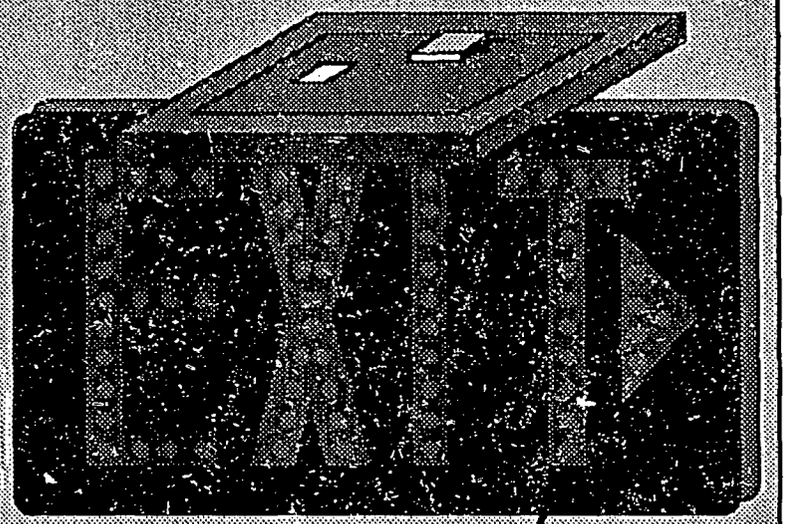
Return to Honeywell Controls

LED Exit Signs

Light-emitting diodes (LEDs) are small **semiconducting devices** that emit **visible light.** They consume an extremely small amount of power, and are useful for applications that require light to convey information and not to illuminate space.

In an exit sign, around 100 LEDs 5mm in diameter are used to form the letters on the sign. A typical LED consumes 20 **milliwatts** of power. An exit sign consisting of 100 such LEDs would draw only 2 Watts of power, compared to 40 Watts or more for conventional incandescent-based units.

Because so many exit signs exist in commercial and industrial facilities, and because they draw power 24 hours per day, there is a great potential for energy and financial saving by installing LED exit signs in new facilities and retrofitting existing exit signs.



Light-emitting diode

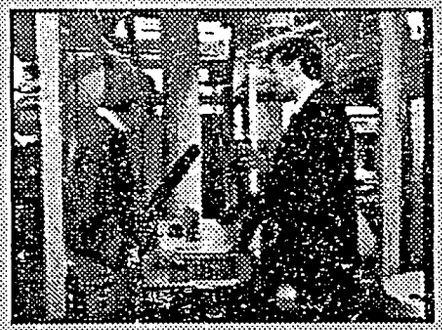
Energy-Saving Potential

How LEDs Work

Product Database

Daylighting Design Laboratories

The Center has three laboratories dedicated to designing and testing daylighting schemes. The Daylighting Lab lets architects and design professionals simulate the effects of daylight on a variety of spaces. The Daylighting Model Shop lets them build and test prototypes for projects. The Heliodon Station combines an adjustable table, representing the earth, with a ceiling-mounted light source, representing the sun. This simulation can test the effect of sunlight on any building at any location at any time. Existing models or those created in the Daylighting Model Shop may be used. These laboratories will let simple or complex designs be tested before building plans are finalized. Simulations can be useful in energy conservation or aesthetic design techniques.



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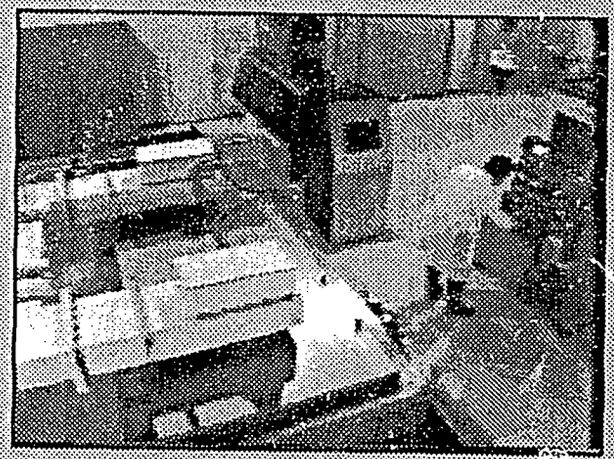
Customer Technology Application Center

Industrial Technology Center

CTAC's Industrial Technology Center examines new electricity-based technologies that improve productivity and decrease air pollution. Showcased technologies include ultraviolet curing, infrared heating, and dielectric heating and drying. These technologies are applicable to industries such as petrochemical, aerospace, paper, metals, printing, construction materials, wood products, and textiles.



Click in this box to view a 30-second video about the Industrial Technology Center's coating and lighting demonstrations.

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The International Institute
for Energy Conservation
750 First Street, NE, Suite 940
Washington, DC 20002 USA
Phone: 202-842-3388
Fax: 202-842-1565

TerraMedia™

Utility Lighting Efficiency Training Module

Information Sheet

Subject: Compact Fluorescent Ballasts, Page 1 of 2

Advance Transformer Co.
10275 West Higgins Road
Rosemont, IL 60018 USA
Phone: 708-390-5094
Fax: 708-390-5109

American Power Products, Inc.
12650 Colony Street
Chino, CA 91170 USA
Phone: 714-590-2626
Fax: 714-591-6778

Lights of America, Inc.
611 Reyes Drive
Walnut, CA 91789 USA
Phone: 714-594-7883
Fax: 714-598-5931

MagneTek
200 Robin Road
Paramus, NJ 07652 USA
Phone: 201-967-7600
Fax: 201-967-0904

Matsushita Electric Works, Ltd.
1048 Kadoma
Kadoma-Shi
Osaka 571 Japan
Phone: 6-909-1375
Fax: 6-906-7586

OSRAM Corporation
110 Bracken Road
Montgomery, NY 12549 USA

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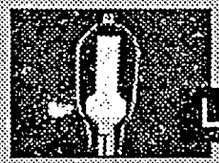
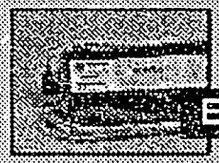


Light Sources

Outdoor Lighting



Ballasts

Luminaires

Components

MANUFACTURERS

PRINT

Compact Fluorescent Ballasts

Advance Transformer Co.
10275 West Higgins Road
Rosemont, IL 60018 USA
Phone: 708-390-5094
Fax: 708-390-5109

American Power Products, Inc.
12650 Colony Street

REFERENCES

Seria

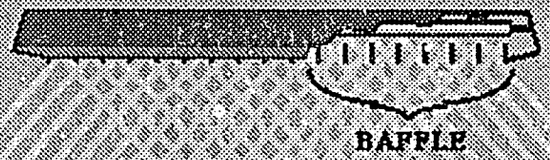
Energy User News
Fairchild Publications
7 East 12th Street
New York, NY 10003 USA
Phone: 800-247-8080
Monthly. Articles, product g

Home Energy

GLOSSARY

Baffle

An opaque or translucent element that shields a source from direct view at certain angles or that absorbs unwanted light.



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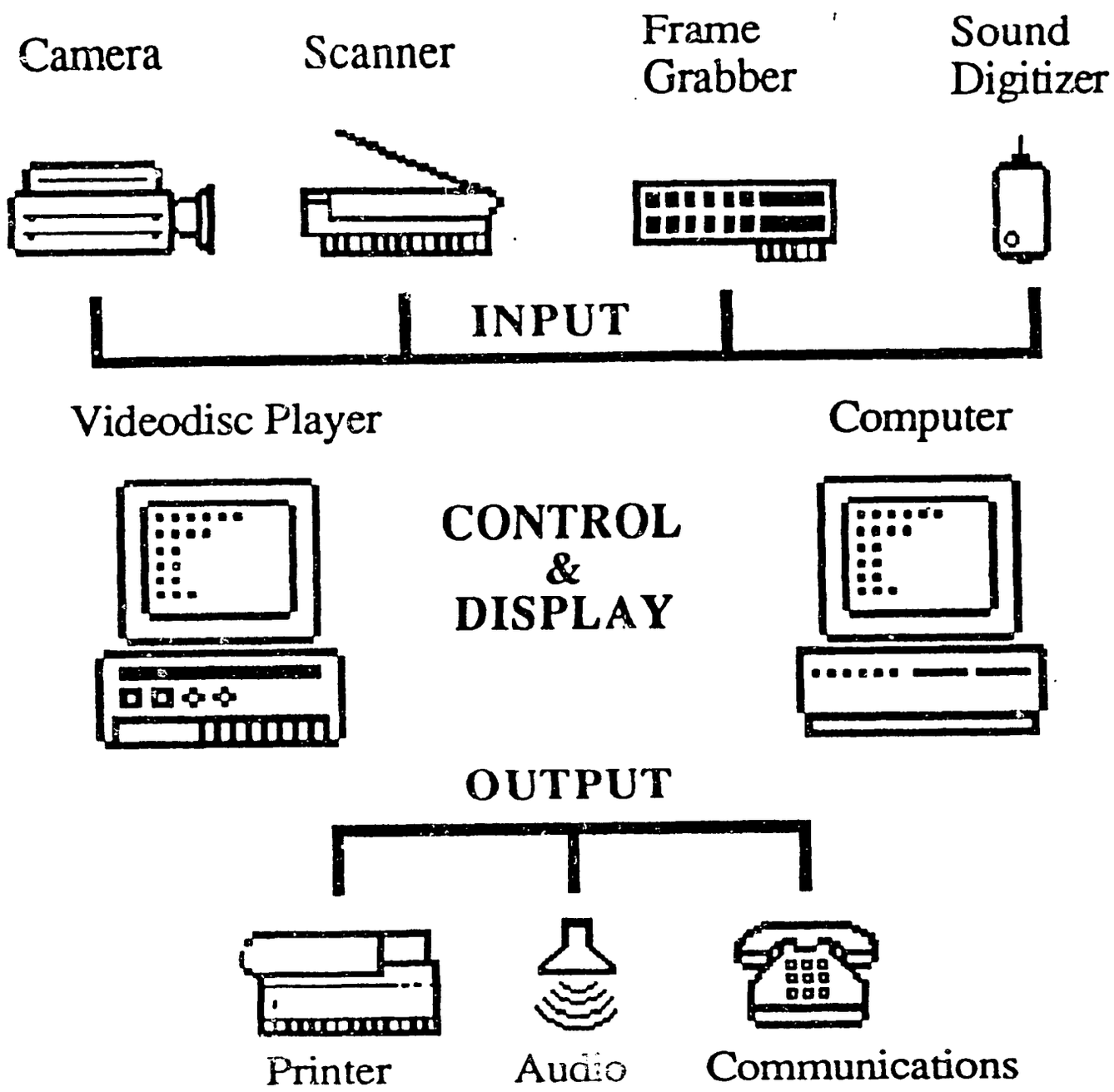
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Scanner
Frame Grabber
Sound Digitizer
INPUT
Videodisc Player
Computer
CONTROL & DISPLAY
OUTPUT
Printer
Audio
Communications

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- End Use
- Demand Side Management
- Rate Structure
- Load Management
- Energy Conservation
- Demand Forecasting

INCENTIVES

- Design for Excellence
- New Construction Rebates
- Jointly-Funded Feasibility Studies

ISSUES

Commercial Buildings

- Daylighting
- Electric Heat Pumps
- Outdoor Lighting

Residential Buildings

- Windows
- Electric Heat Pumps & Heat Pump Water Heaters

Fig. 3. Information structure of the kiosk.

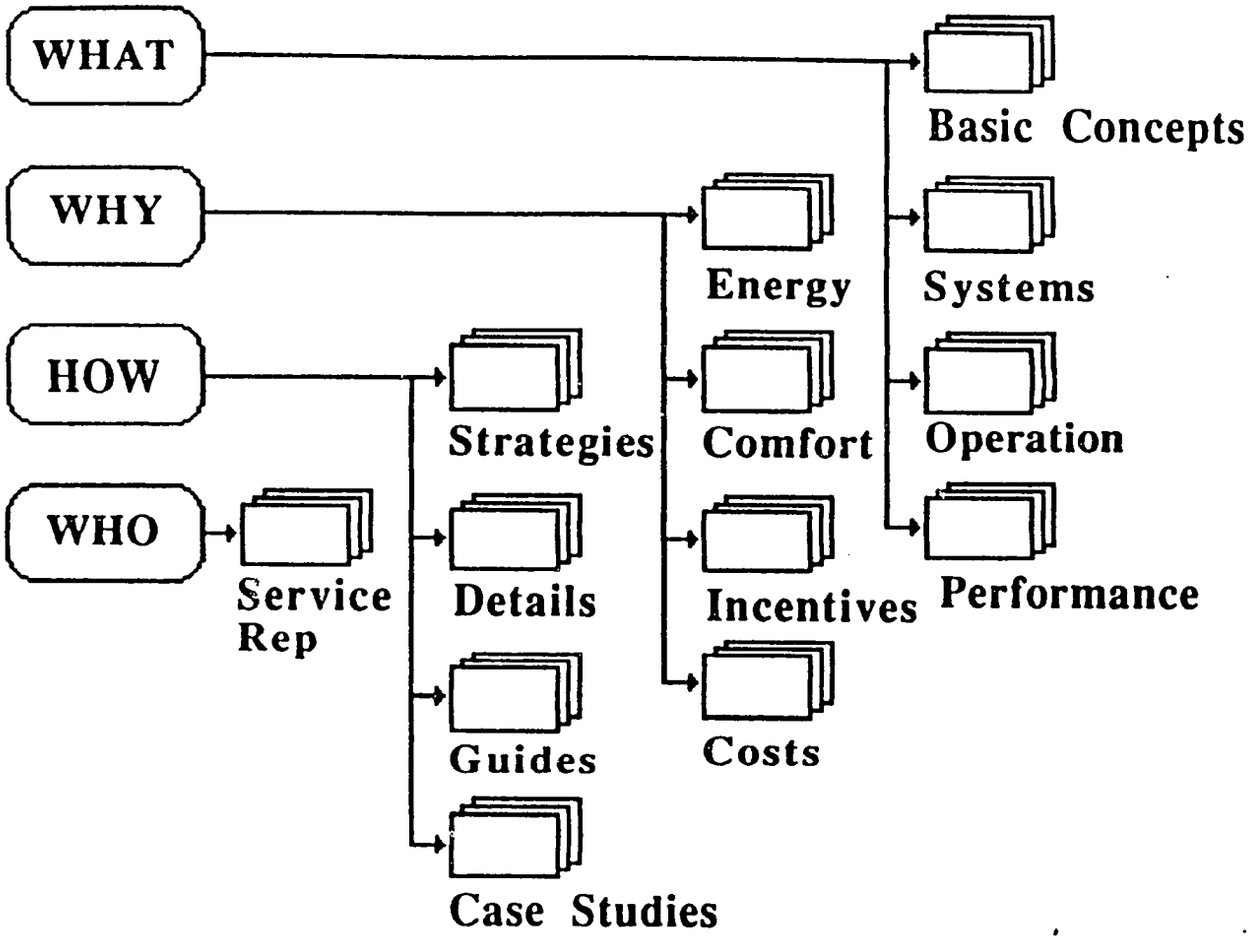


Fig. 4. Structure of the ISSUES portion of the kiosk.

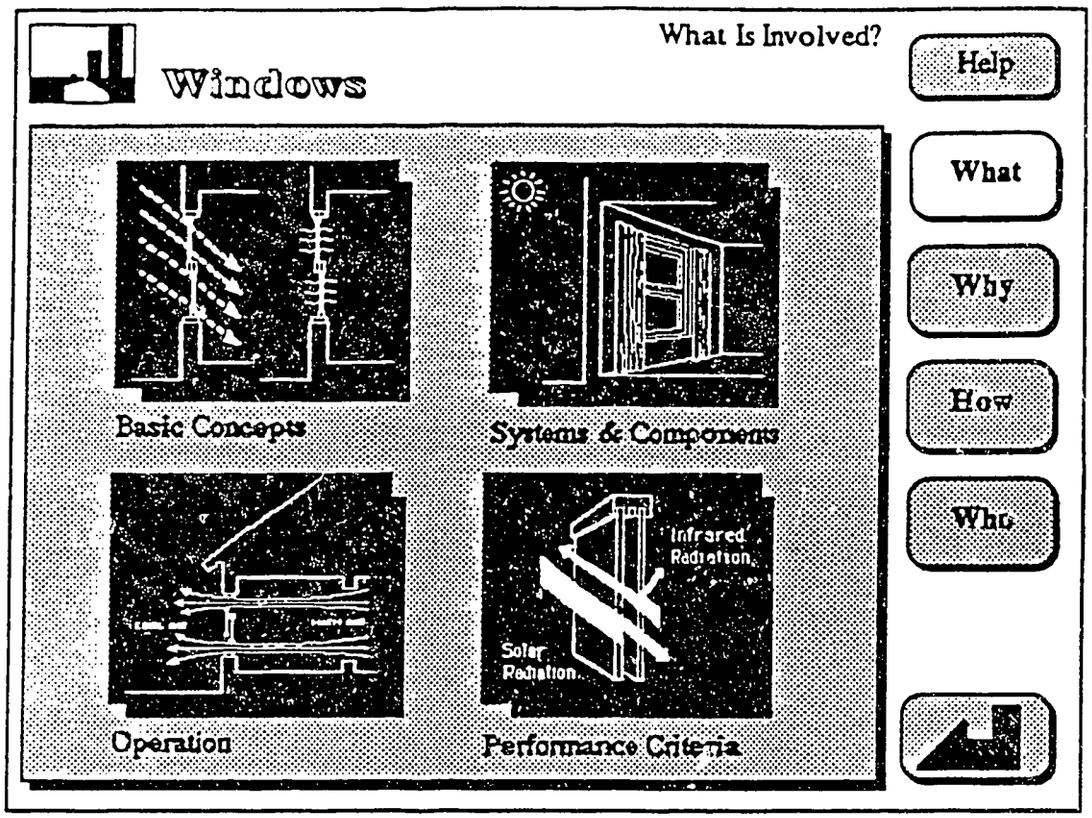


Fig. 5. "WHAT" menu for the residential windows portion of the kiosk.

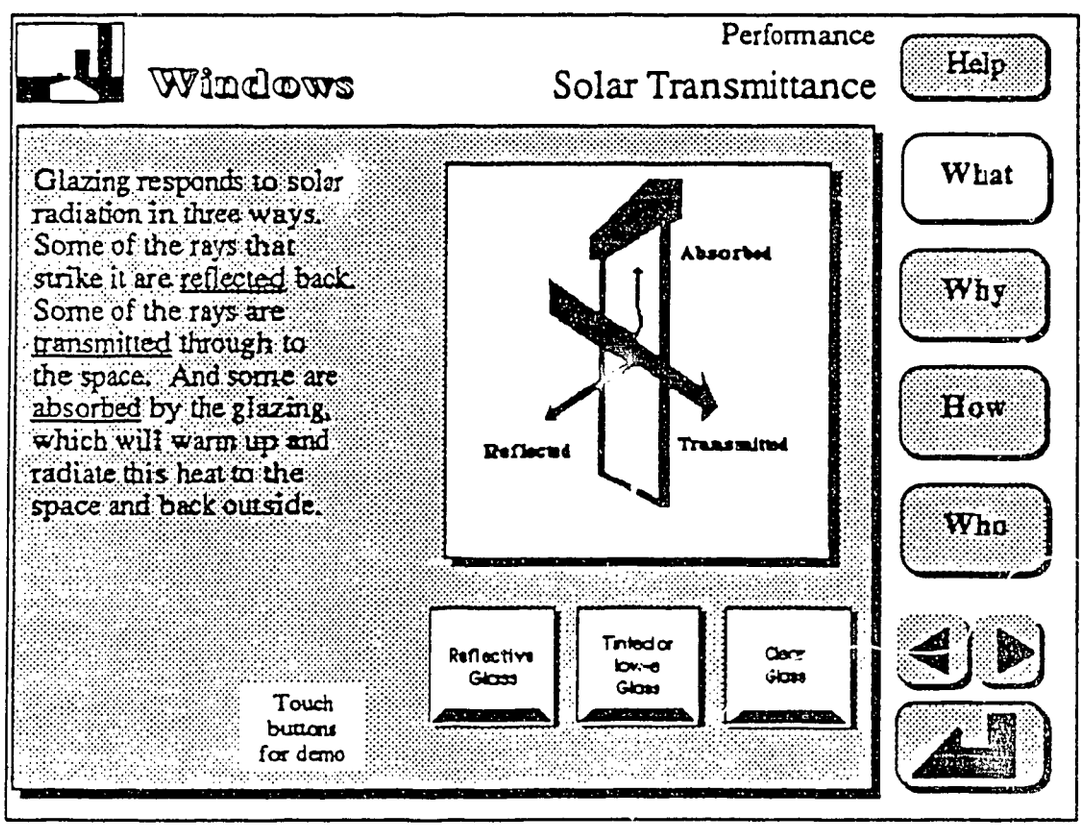


Fig. 6. Sample Screen from the residential windows portion of the kiosk.

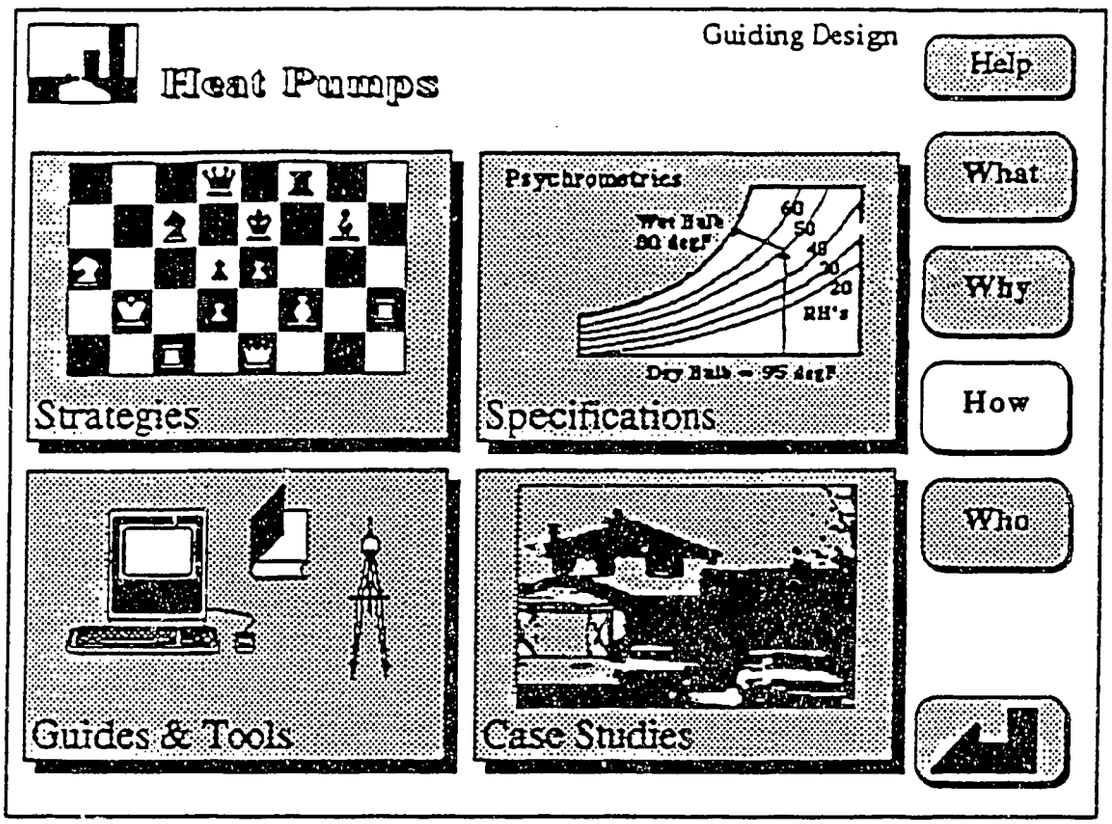


Fig. 7. "HOW" menu for the residential heat pump portion of the kiosk.

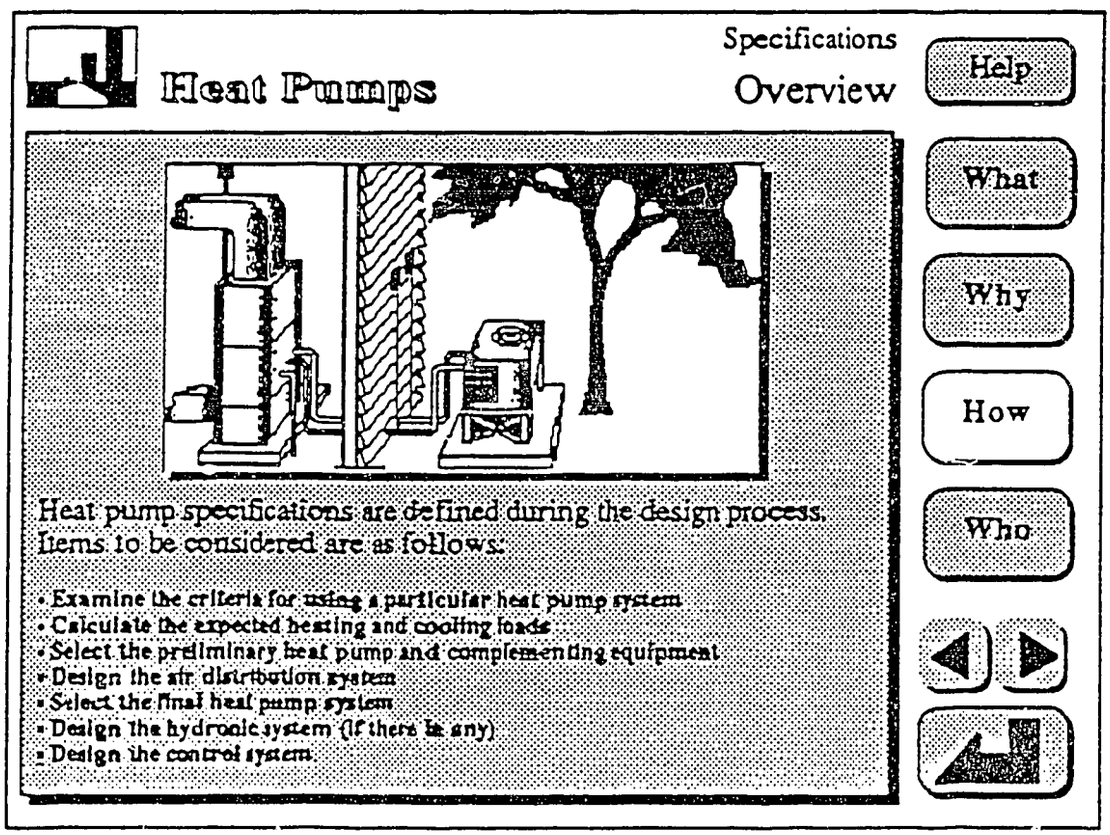


Fig. 8. Sample screen from the residential heat pump portion of the kiosk.

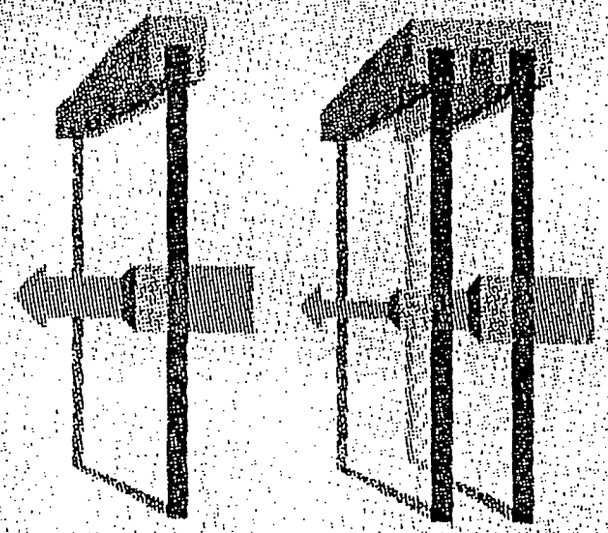
Exterior Tour

Help

Building Envelope

The ECDC uses double-pane insulating glass to reduce heating loads during the winter. In addition, awnings are on the south-facing windows to help reduce summer cooling loads.

The Center also has a double-door "air lock" at the main entrance to reduce the loss of conditioned air to the outside during times of heavy traffic.



Single Glazing
U=1.1 Btu/hr-sqft-degF
R=0.9 hr-sqft-degF/Btu

Double Glazing
U=0.5 Btu/hr-sqft-degF
R=2.0 hr-sqft-degF/Btu

Building Info

Building Tour

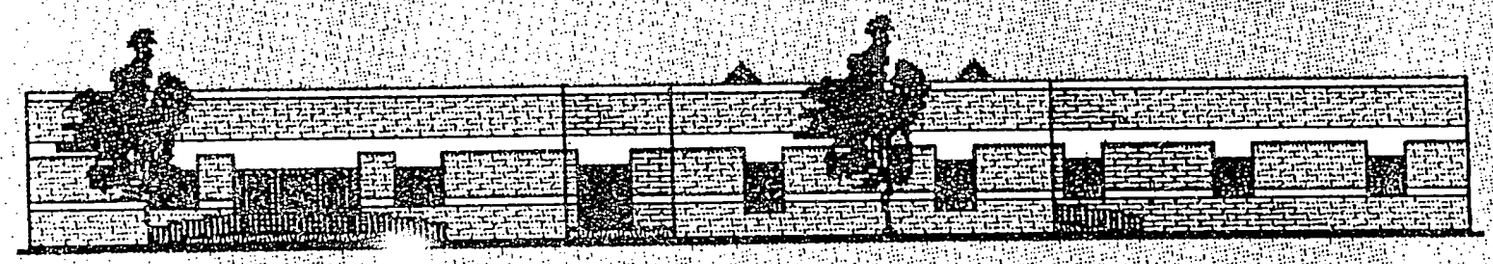
Energy Features

Previous Screen

Exterior Tour

Energy Child Development Center

The ECDC is an 8088 square foot facility located at the Forrestal Building in Washington D.C. The Center is intended to provide child care and an educational program that fosters the total development of each child in an on-site facility yielding safe quality care. In addition, the facility will utilize some of the solar and energy efficiency technologies the U.S. DOE employees have helped bring to marketplace.



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Building Info

Building Tour

Energy Features

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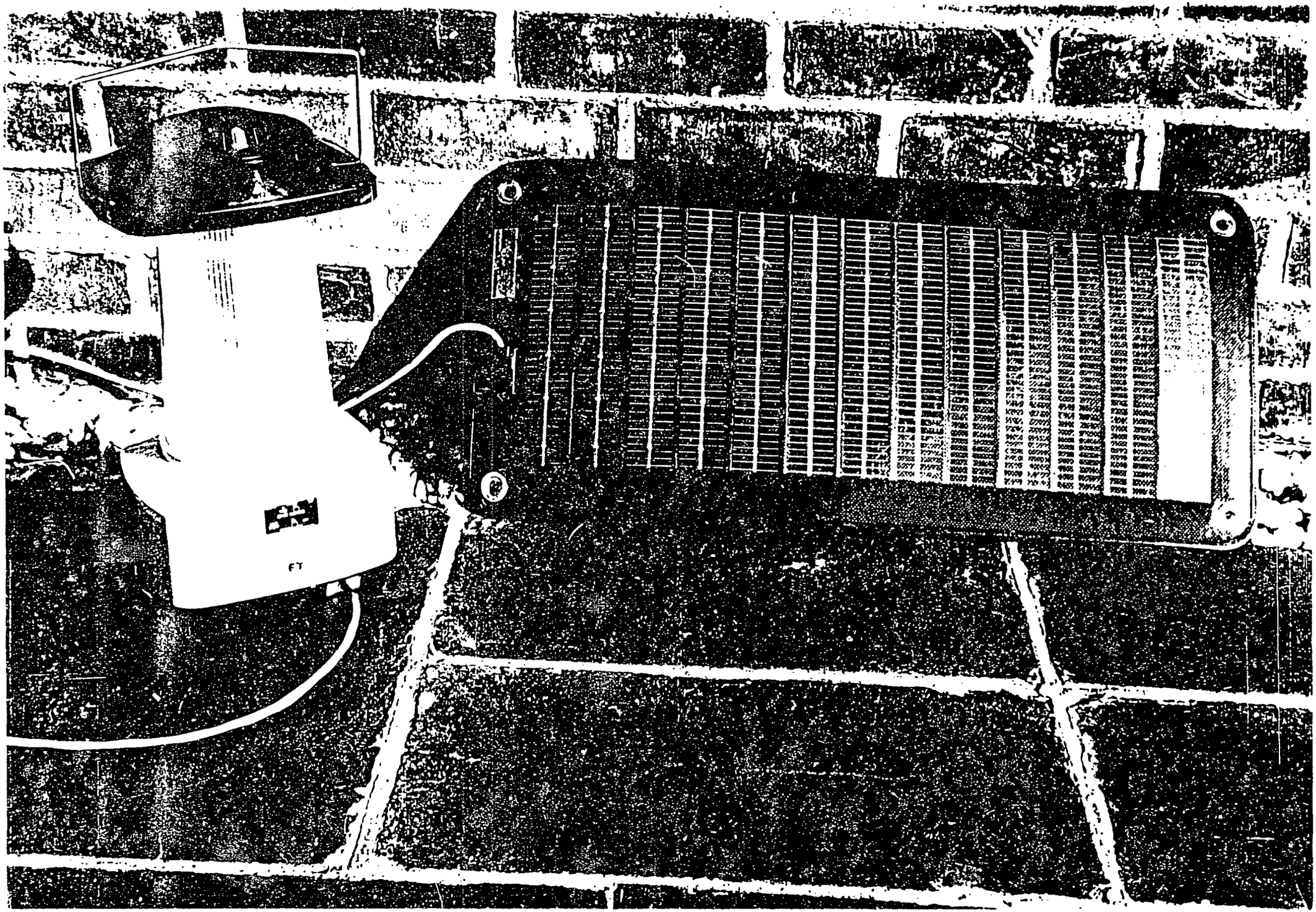
FT

Feasibility Study
ILUMEX
Proyecto de Uso Racional de Iluminación en Mexico

December 1992

prepared for
Comisión Federal de Electricidad
by

The International Institute for Energy Conservation (IIEC)
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Feasibility Study funded by the
U.S. Agency for International Development
for a World Bank Global Environmental Facility Project

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1. Executive Summary

Overview

In August of 1991, the World Bank Global Environmental Facility (GEF) initiated discussions with the Mexican utility, Comisión Federal de Electricidad (CFE), to prepare a demonstration project proposal for World Bank GEF funding. The proposed project focuses on demonstrating the technical and financial feasibility of reducing greenhouse gases through the widespread installation and use of energy efficient compact fluorescent lamps (CFL) as a utility demand side management (DSM) option.

Highly efficient lighting components like CFLs can be used to replace incandescent bulbs, providing similar quality of lighting while consuming 75 percent less electricity and lasting 10 to 13 times longer. Over one CFL's 10,000 hour rated lifetime the consumer will accrue net savings of several tens of dollars, and the utility will defer over one hundred dollars of investment in generation, transmission and distribution expansion. By investing in this technology, utilities can reduce electricity consumption among subsidized user classes who are currently subsidized under the existing tariff structure. (CFE's tariff structure can be found in Section 6) In the short term, implementation of this energy efficient lighting strategy in Mexico can thus help reduce the subsidies paid to certain residential ratepayers. In the long-term, as CFE implements marginal cost pricing for all user classes, investment in demand side resources, such as CFLs, (which target the user groups that are currently subsidized), will mitigate rate shock for these users as rate increases are offset by reduced usage.

Demand side utility investments represent an alternative means of providing energy services to users at a fraction the cost of expanding these services through traditional investments in generating capacity, fuel, and transmission and distribution infrastructure. Societal benefits include the prevention of over one thousand pounds of the greenhouse gas carbon-dioxide (CO_2), as well as over eleven pounds of sulfur-dioxide per lamp installed.

The proposed project -- called the ***Proyecto de Uso Racional de Iluminación en Mexico (Ilumex)*** -- is intended to demonstrate how utility investments in lighting efficiency can provide expanded energy services at reduced cost while reducing global greenhouse gases at no extra cost. The economic analysis included in this study demonstrates the net positive benefits that accrue individually to CFE, CFE customers, and to society as a result of the Ilumex project.

CFE proposes to undertake a $20 million CFL DSM project. The (Ilumex) project involves the installation of one and one-half million CFLs over a two year period in two cities (Monterrey and Guadalajara). CFE would contribute $10 million of the $20 million project costs from its own resources. The other $10 million would be a GEF grant. This study describes the proposed project and provides an economic analysis of the costs and benefits associated with it. The analysis indicates clear net benefits for users, CFE, and the nation of Mexico.

The Ilumex project is structured to ensure that the original $20 million investment will be replenished by project revenues to enable expansion of the Ilumex project throughout the residential sector of the country. The project, as conceived, will thus

ensure the sustainability of the original demonstration project. In the longer term, the project can be modified and adapted for the non-residential sectors. The World Bank's GEF technical review committee met in December 1991, and provided initial approval for funding the project.

Background

In the Summer of 1992, in consultation with the World Bank, the U.S. Agency for International Development (AID) provided $200,000 to fund a team of consultants to provide assistance to CFE in designing the project, developing CFL product technical specifications, and preparing this Feasibility Study for implementing a CFL DSM program. A fundamental component of this effort was the integration of training into the program design process. The team of consultants, including project managers from DSM programs at two major North American utilities, and a variety of DSM program consultants, evaluation experts, and CFL technology experts, worked with representatives of CFE's Distribution Division, CFE's local offices in Monterrey and Guadalajara, and their colleagues from the Mexican government, to develop the Ilumex project in response to the objectives of CFE. This group worked together as the "Ilumex team."

Since 1991, CFE has been actively involved in the design and implementation of seven pilot residential relamping projects throughout various communities within Mexico. These projects were designed to test various delivery mechanisms, assess consumer acceptance of compact fluorescents, and establish an administrative capacity in marketing energy efficient devices to the residential sector.

In addition to these pilot projects, the Ilumex project team undertook a market survey in July 1992 in Guadalajara and Monterrey to determine household lighting characteristics, market saturation/acceptance of compact fluorescents, energy conservation potential, and purchasing preferences of consumers. In general, the findings of the above pilots and survey indicated a limited penetration of CFLs, strong consumer desire to purchase CFLs if the bulbs were more affordable, and an adequate number of incandescent retrofit opportunities in these markets (that are both physically and economically feasible applications for CFL technology) to reasonably assure the success of the Ilumex project.

Purpose

CFE identified its objectives in designing the Ilumex project in terms of the project's multiple value as an institutional capacity-building mechanism, a demonstration of a promising demand side technology and a cost-effective energy resource with significant environmental benefits. CFE's primary objective lies in using Ilumex to establish within the utility the capacity to deliver demand side management resources for the long term. Additionally, CFE is mindful of the value of Ilumex in providing a means to eliminate subsidized electricity rates among low-use residential rate classes. *(Please see the CFE tariff schedule at the end of Section 6 of this report.)* In reducing consumption within this tariff class, Ilumex would reduce the amount of subsidies currently paid to CFE customers, while mitigating the rate shock that will face these users as the utility moves towards long-range marginal pricing for all rate classes.

CFE hopes to use the Ilumex program to collaborate with the Global Environmental Facility in testing the CFL technology in the Mexican context. Indeed, the Ilumex team

worked to establish technical specifications and product testing methods that will allow this project to push the existing technology to assure reliable performance under the difficult conditions typical of the Mexican market. The Ilumex team developed data on the ambient weather conditions, monitored electricity quality conditions in the cities of Monterrey and Guadalajara, and undertook an extensive (1,000 home) marketing study in these cities to identify the technical requirements for the CFLs. The team also heard presentations from more than fifteen manufacturers of CFLs regarding technical potential, and reviewed the CFL performance experience of North American utilities, in addition to reviewing the performance testing capability of the lighting test laboratory available to CFE for this project.

In addition to establishing an institutional expertise in the delivery of demand side resources at CFE, the utility hopes to use the Ilumex demonstration project in Monterrey and Guadalajara as the initial step in undertaking a nationwide CFL residential retrofit program. The Ilumex project is therefore conceived to establish a revolving pool of funds, using the $20 million budgeted only to seed a financially self-sustaining program. The CFL price will be set to cover the equipment and administrative costs of the program. The funds will thus be regenerated from CFL sales over the course of the Ilumex project. These funds will then be applied in expanding the program throughout Mexico.

With the program expanded to a nationwide program, the Ilumex benefits of energy savings -- including environmental benefits and resource conservation, and reduced demand growth --will be multiplied.

Description

For a variety of reasons, CFE decided to focus the Ilumex project exclusively on the residential sector. While the utility intends to expand its DSM program in the future into non-residential sectors, CFE chose initially to limit the demonstration to the residential sector because:

1) Other key Mexican government energy agencies (including FIDE, PAESE, and CONAE) are focusing on non-residential sectors;

2) The present CFE tariff structure maintains heavily subsidized electricity rates in the low-use residential tariff categories, where rates range as low as 1.5 cents per kWh (see rate schedule above); Reducing usage among these customers will reduce subsidy payments in the short term, and provide a rate-shock mitigation tool to enable the utility to implement long-range marginal cost rates in the medium term.

3) CFE has demonstrated a long-standing interest in helping low-income households;

4) CFE is concerned about its poor public image; a DSM program with direct benefits for residential users would boost consumer confidence in CFE. The Ilumex project will serve a similar role in educating the market about the benefits of the relatively new CFL technology, thus serving to provide a demand boost for CFLs in the long term; and,

5) CFE has undertaken a number of small-scale pilot CFL programs in the residential sector and thought it prudent to build upon this base of experience. The failure of CFE to measure results from these previous pilots drove the Ilumex team to include a strong evaluation component in the design of the Ilumex project. This evaluation rigor will

allow CFE to maximize its value as a replicable demonstration project from which lessons can be derived for application to future projects.

In designing the project, a great deal of effort was given to keeping administrative costs low to reduce CFE's risk and to keep product costs low for program participants. In view of this objective, CFE will utilize the existing network of local CFE administrative offices within the cities of Guadalajara and Monterrey to implement the project. Guadalajara has 14 such offices, while Monterrey has 9 local offices. Local offices are familiar to customers since the majority pay their electric bills in person at these locations. They are thus designed to deal with walk-in business and offer a support network of staff and equipment.

The Ilumex project is structured to utilize the lowest cost method of CFL distribution that can still achieve project objectives. Regular project impact evaluation exercises will monitor the number and type of lamps being distributed by site and customer classification. This will provide data for inventory control, as well as a constant measure of project effectiveness relative to program objectives. The project design includes a series of delivery method adjustments that can be activated incrementally to effectively improve penetration for a given sector of the market, as such need is indicated in the monitoring process. These include adjustments in the payment terms of the lease arrangement, use of a mobile sales office to sell directly in a targeted neighborhood, and mobilization of a direct sales and installation force. Each incremental change involves a slightly higher implementation cost. These adjustments will be made, as needed, to fine-tune project impact while maintaining the lowest possible administrative costs. A flow chart describing the incremental project implementation plan is provided in Section 3 of this study.

Under the program guidelines, residential customers will be eligible to purchase up to six compact fluorescent lamps at the utility's mass purchase cost plus an 8 to 10 percent administrative cost. Customers may purchase the CFLs outright by paying cash at the local CFE offices or they may choose to finance their purchase over a two year period for an additional 12 percent financing fee -- equal to CFE's cost of money. Customers choosing to finance the CFL purchase over time will be required to pay an initial 5,000 pesos per bulb and will be billed for the balance in conjunction with their bi-monthly utility bill.

Procurement Guidelines

CFE will follow World Bank procurement procedures for international bids. In determining the best bid responses, a number of technical and non-technical selection criteria will be used in a weighting system to evaluate which CFLs CFE will purchase. A minimum standard will be employed and specific performance criteria will then be scored to select the winning bids. An extensive description of the technical requirement to be employed in the procurement process follows in Section 4 of this study.

Technical Selection Criteria

Recognizing the economic and technological trade-offs involved in balancing sometimes competing technical performance and cost criteria, an explicit weighting system will be employed to compare the bids of various vendors. It is expected that several products will be selected for demonstration in this program to cover a range of residential applications. It is also anticipated that the best performing CFLs in this demonstration will be used in future CFE programs, as well as elsewhere in the developing world as World Bank and global utility interest in the technology grows.

The products selected for use in the Ilumex project will be subject to the following performance criteria for each category of light output to be required:

CFL Product Performance Criteria

- **The CFLs will require large voltage fluctuation tolerances. A minimum standard of 10 percent will be *required*, but CFLs exhibiting wider voltage fluctuation tolerances will receive higher values in the weighting system. In addition, because a variety of standard voltages are employed in different quadrants of the CFE system within the cities of Monterrey and Guadalajara, (ranging from 110 to 120 volts), two different voltages will be specified for each lamp style and size to be acquired.**
- **The CFLs must demonstrate longevity under low power-up conditions. The manufacturers will be required to provide product warrantees bids. The prototypes provided during the bidding process will undergo performance tests over the anticipated voltage range for the Monterrey and Guadalajara service areas.**
- **The CFLs must demonstrate constant light output under variable power quality conditions.**
- **The CFLs will be judged on their ambient temperature tolerances under conditions typical of Monterrey and Guadalajara.**
- **To the extent that magnetic ballasts will be included in the procurement (which will include electronic ballasts, as well), power factor-corrected capacitors may be required -- subject to a cost-effectiveness test.**
- **All ballasts would be subject to electrical transients tolerance testing; Ilumex will employ existing international standards as a criterion.**

Non-technical Selection Criteria

Each bidder will provide their own product guarantee for a specified period. The terms of this guarantee, and the manufacturer's track record will play a large role in the manufacturers selected.

Given the importance of lamp life as indicated in the economic analysis of the project (see Section 7), and the emphasis on performance, the bid process will probably favor non-integral (modular) ballast/lamp packages in order to maximize the operating life of the ballast investment. However, an integral CFL package that responds favorably to the technical criteria and price considerations explicit in the bid package will be considered.

The manufacturers will need to prove their ability to deliver the products in a timely manner, reliably, with consistent quality assurance.

Two separate specifications will be used to reflect variations between system conditions in Monterrey and Guadalajara. In addition, three different categories of lumen

output will be procured to provide CFLs that will replace 40-60 watt, 75 watt, and 100 watt incandescents. These lumen packages reflect the requirements of the Guadalajara and Monterrey residential markets as indicated in the Ilumex team's market survey for these two cities.

This feasibility study also details the recommended procedures to be incorporated in testing to be undertaken by CFE to confirm the claimed performance characteristics of sample products submitted by the manufacturers. It is essential that CFE undertake this testing -- at the very least for finalists -before any contracts are let and the winning bidders selected. There are no internationally-recognized laboratory certification procedures and no available means for assuring uniformity in testing procedures between laboratories. Further, reliance on test results from testing labs who have been paid by the manufacturers are of limited value. CFE's access to the Mexico municipal testing laboratory -- an award-winning facility with the highest caliber equipment (which the Ilumex team toured) -is a tremendous resource. Bidding manufacturers will be required to pay the cost of testing their lamps at this facility.

A series of simplified scoring sheets are provided as Appendices of this study by the Ilumex technical consultants. They reflect the performance criteria detailed in this study that will be used to judge the winning bids.

Implementation Plan

An organizational chart and detailed description of the project implementation team follows in Section 3 of this study.

One of the primary program criteria embraced by the Ilumex team in designing the project implementation plan was to minimize the need for CFE staff additions in implementing the project. It is CFE policy not to increase staff, where it can be avoided. The Ilumex project reflects this concern.

An important dynamic in the implementation of electricity sector efficiency initiatives in Mexico is the working relationship that exists between CFE, the Programma De Ahorro De Energia Del Sector Eléctrico (PAESE) -- the efficiency arm of CFE, and the Fideicomiso De Apoyo Programa de Ahorro de Energía del Sector Eléctrico (FIDE) -- the national fund for electrical sector efficiency that houses PAESE. CFE has worked with FIDE and PAESE in the development of both the Ilumex project and the previous CFL/efficiency pilot projects. The project design is thus a product of the same multi-organizational team that will implement and administer the project.

In addition to the objective of using existing CFE staff in the administration of the project, Ilumex was designed to minimize delivery costs while achieving the program goal of disseminating 1.5 million CFLs in Monterrey and Guadalajara, primarily to residential customers in the low-use tariff classifications. Ilumex thus employs an incremental delivery approach, with each succeeding modification in the delivery mechanism triggered, as need is determined by an on-going evaluation process that will be operationalized as a functional component of the project. The program, described in detail in Section 3, will work as follows:

1) CFL lamp sales stations will be established in each CFE office in Monterrey and Guadalajara. These district offices represent an excellent contact point with the

customers, as most CFE customers (and the vast majority of low-use tariff customers, in particular), pay their electricity bills in person at these offices.

2) The customers will have the option of purchasing the lamps with cash, or paying over time, at a rate that is established to create a net positive cash flow to the customer (since electricity savings will exceed the amortization cost established by CFE). The payment over time option will be transacted as an itemized addition to the regular CFE electricity bill.

3) The name and customer number will be noted for each transaction. CFE will evaluate, at regular intervals, the market penetration of the lamps, by purchase option and customer type. If project goals are not being met under this lowest-cost sales method, including number of lamp sales and customer-type distribution, the project will be adjusted.

4) The project adjustment options include:

• Reducing the CFL lamp cost -- the projected price of $11.64 per lamp reflects a 100 percent recovery of the estimated lamp purchase costs plus administrative and project evaluation costs (see Section 3). CFE is highly confident, given their limited (and largely undocumented) experience with small-scale pilot projects for CFLs, that there will be no difficulty in reaching project sales goals for the targeted sector if the lamps are sold at the full-recovery price. However, if the discount rate for the primarily low-income customers targeted by Ilumex prove to be higher than CFE estimates, CFE will have to subsidize the cost of the lamps to induce the desired level of sales. The economic analysis (Section 7) shows that the effect of variable lamp costs (and delivery costs) on Ilumex economics for both CFE and customers. The indication is that Ilumex can function economically for all parties with such subsidies.

• Reducing interest rates on the payment-on-electric-bill option, or extending payment period terms. These two adjustments will provide customers with added benefits by improving the net monthly cash flow to them resulting from purchase (over time) of the CFLs.

• Invoke the "Neighborhood Sales" plan. This plan, described with itemized cost projections in Section 3, allows for targeting of specific types of users, by neighborhood. The option represents an increased level of delivery costs (see Section 3, cost table) from an estimated $1.55 per lamp (for the CFE office sales method) to $2.02 per lamp -- including an estimated $.50 per lamp project evaluation cost. The Neighborhood approach includes two components -- a mobile sales van that can bring the CFL sales kiosk out of the CFE offices and into any neighborhood or gathering, and a mobile sales force undertaking a door-to-door direct sales approach. *(As noted in the attached Project Menu, this direct sales method, while more costly, is the preferred delivery mechanism of many North American DSM experts. Direct sales provide the utility with greater control over who uses the CFLs and how they are used. The customer education benefit, the persistence of savings, and the ability to measure savings accurately, are all positive attributes of direct installation. However, CFE's interest in minimizing delivery costs while not subsidizing CFL sales dictated a limited and reserved role for the direct installation method in Ilumex.)*

The project cost estimates for Ilumex (Section 3) assumes that a mix of project types will eventually be invoked in a proportion that allows Ilumex to meet its objectives

and goals. The projection is that 1.2 million lamps will be sold via the direct sales mechanism at the CFE offices (Ventas de Agencia), and .3 million additional lamps will be sold through the Neighborhood delivery mechanism.

PAESE staff currently operate energy savings programs out of CFE offices in Monterrey and Guadalajara. For the implementation of the Ilumex project, CFE offices will be used as distribution sites for CFL sales. FIDE personnel, under the direction and management of the CFE/FIDE project managers in each city, will staff the centers and any community outreach efforts, including mobile sales initiatives, that evolve as the program develops. PAESE personnel in Monterrey and Guadalajara will coordinate the projects in each city, under the direction of a CFE manager with marketing experience. These PAESE coordinators have been a vital part of the Ilumex team in designing the project to date. As part of this effort, they have undergone program evaluation training.

In addition, one project manager with relevant retail management experience in areas such as sales and inventory management, will be hired by CFE to manage each city's operations. These two individuals are expected to be the only two additional hires required to operate the project. The operations associated with the Ilumex project are significantly different from the existing CFE experience. It will be essential to the success of the Ilumex project that the city operations are managed by business people with relevant retail experience, thus reflecting the characteristics of the Ilumex project, including inventory control, retail staff management, and marketing. These managers, working in conjunction with the professional staffs employed by CFE, PAESE, and FIDE who have worked as part of the Ilumex team in developing this project, will form an adequate team for implementing Ilumex.

Evaluation

In researching other large-scale utility relamping programs, and observing the general lack of evaluation data available to assess the previous CFE pilot projects, the Ilumex team recognized the importance of developing a complete and automated monitoring/tracking system for the Ilumex project. Such a system is of particular importance for a demonstration project of this type. The project should identify the relative successes and failures of its various components and approaches. Ilumex will serve as a model for a larger, nationwide residential lighting retrofit effort by CFE, as well as for future DSM initiatives at the World Bank. As such, it is imperative that program impact be measured on an on-going basis.

A sophisticated data collection process patterned on those developed by U.S. utilities with extensive experience with similar programs, will be developed to track inventory, sales, and customer class (in terms of kWh usage), on a daily basis. This data will be used to restock, track penetration rates, and trigger additional advertising and/or neighborhood outreach efforts. Each office will be responsible for conducting weekly inventory checks and will be liable for any missing inventory beyond two percent loss. CFE will conduct an independent inventory check on a monthly basis.

Details of the evaluation process that is built into the program design are provided in Section 8 of this study. This evaluation and monitoring system will be rigorously applied to indicate program inputs and will allow for incremental adjustments in program design to better meet program objectives. The evaluation plan also allows for a comprehensive accounting of program costs and benefits at regular intervals during project implementation. Final project evaluation will provide a comparison against project

projections. The evaluation will provide data that will be applicable in expanding the program throughout Mexico.

While the Ilumex team consultants worked with the Mexican team members to develop a strong evaluation component within the Ilumex project, and provided several days of evaluation training for the Mexicans, follow-up evaluation support should be provided by outside experts at several points during and following the project implementation process. This support will prove essential to the long-term effectiveness of the project and will provide the discipline necessary to assure that the project objectives are sustained in the implementation phase.

Timeline Schedule

The following chart provides a projected program initiation schedule.

Ilumex Project Timeline

ACTIVITY	*DATE*
Preliminary CFL specifications made public to manufacturers	Dec. 1992
CFE Feasibility Study complete and submitted to World Bank	Dec. 1992
World Bank approval	April 1993
CFL Request for Proposal issued	May. 1993
Manufacturer bid proposals due	July 1993
Laboratory testing of CFL complete	Aug. 1993
Select and issue contracts to successful mfgs.	Sept. 1993
Hire and train Ilumex staff	Sept. 1993
Kick-off Ilumex project	Nov. 1993
Initial Retail Market Study	Nov. 1993
Initial Program Monitoring Report	Feb. 1994
Program Evaluation Process	(See Section 8 For Detailed Schedule)

The Ilumex project will be implemented over a two year period in its initial phase. CFE intends to tap the revolving fund to expand the DSM lighting initiative throughout Mexico. An evaluation implementation schedule is provided in Section 8 of this study.

Project Cost

CFE designed an administratively-lean approach in developing the projected budget for the Ilumex project. The overall goal was to keep administrative costs under 10 percent and develop a continuous sales presence, while allowing for an increasingly

intensive sales effort within target communities, as determined by project monitoring results. The $10 per lamp projected cost for acquiring the CFLs via international bidding represents a conservative average cost estimate factoring in the multiple requirements to be placed on the manufacturers. The consultants' recommendations for manufacturer requirements are intended to minimize CFE's risk by transferring a portion of variable costs to the manufacturer, by requiring manufacturer responsibility for lamp performance. Even so, the estimated $10 per lamp cost to CFE is probably higher than the actual cost will be, given the experience of North American utilities in lamp procurement.

The administrative cost estimates of $1.17 per lamp are described above in greater detail ("Implementation Plan"), and in Section 3 of this study. This includes all costs to operate the program, except the $700,000 budgeted for program evaluation costs. These estimates provide an additional $2.55 million (15 percent) for contingencies, including potential subsidies for the price of each CFL, or the provision of favorable finance terms for the purchase-over-time delivery option.

Ilumex Project Costs

(in million U.S. dollars over a period of two years:)		
CFLs: 1,500,000 units @ $10/CFL	**=**	**$15.00**
Administrative costs -- ($1.17/lamp)	**=**	**1.75**
Monitoring & Evaluation costs (full implementation)	**=**	**0.70**
Total		**$17.45**
(contingency -- including CFL price subsidies, if needed)		**$2.55**

Project Benefits

The cumulative experience of CFL DSM programs in Europe and North America provides evidence that a win-win-win outcome accrues for customers, the utility, and society. The Ilumex project has been designed to capture significant net benefits from each of these perspectives within the Mexican context. The economic analysis for the Ilumex project, as well as for an expansion of the project throughout Mexico, follows in Section 7 of this study. The primary benefits are summarized below.

End-users

The benefits to customers include:

1) a comparable or improved quality of light delivered at reduced cost-- market surveys in Guadalajara and Monterrey indicate a consumer preference for the CFL technology over incandescents; this also corresponds with CFE's experience with small-scale CFL demonstrations where a strong consumer preference for the modern CFL technology has been evident;

2) avoided incandescent light bulb purchases -- the CFLs are rated to last 9,000 hours each, versus the 750 hour expected life of an incandescent lamp;

3) savings on electric utility bills;

4) a lease arrangement option, provided at a favorable rate can enable users to purchase the CFLs without up front capital; the lease term can be set to eliminate all out-of-pocket payments by the users, instead allowing lease payments to be made on a monthly basis at a rate that is less than the savings resulting from the use of the CFLs.

Utility

CFE accrues multiple financial, environmental, and public relations benefits. These are described at length in Sections 6 and 8 of this study. CFE's primary benefits from the Ilumex project include:

1) Net economic benefits from the investment, yielding returns that are significantly greater than alternative investments in traditional supply-side capital expansion projects. (See Section 7)

2) The development of an institutional capability to identify, develop and deliver the demand side resource in the future. This resource can be used to bring on-line expanded energy services in either small or large increments with very short lead-times and relatively small capital resources per unit of services delivered. The attached Ilumex program menu, developed by the consultants to the Ilumex project, was used in designing the Ilumex project. It is intended as a resource guide for developing other forms of the DSM resource at CFE in the future.

3) CFL-replacable incandescent lamp use in the residential sector corresponds directly with CFE's peak power demand period. As such, CFL installation yields peak power demand reductions for Monterrey, Guadalajara, as well as the CFE system, which, for purposes of system planning, is fully interconnected. As a result, CFE can defer new system power supply as well as transmission and distribution plants.

4) The Ilumex project targets the low-use tariff customers in the residential sector, for whom electricity rates are heavily subsidized under current tariff structures. Reduced usage among this group results in savings to CFE through lowered subsidy payments. The Ilumex project also provides CFE a tool for implementing a marginal cost pricing structure throughout the CFE system. By reducing usage among low-tariff users while simultaneously raising rates to reflect true CFE costs in delivering services to this user group, the impact of rate increases on individual customers is blunted. Even as rates increase and lighting services (the primary use for electricity among these users) are preserved at current or greater levels, the user's costs can remain steady. CFE's demand profile is thus shifted to the non-lighting loads, where usage is at a lower system peak coincidence, and existing electricity rates meet or exceed average system costs.

5) CFE values highly the Ilumex project's appeal to its customers and the positive public image that the project would appear to generate, given the data available from the Ilumex market study (Section 6) and CFE's limited pilot project experience. Public perception that CFE is interested in customer satisfaction and the delivery of cost-

effective energy services is important if CFE is to successfully implement tariff reform and grow to meet the demands of the expanding Mexican economy.

Society

Society-at-large, or "the nation", as referred to in this study, also accrues multiple benefits from the project. According to the economic analysis, each CFL, on weighted average, will displace the need for 50 watts of generating capacity and the capital required to construct and operate that capacity. Overall, the installation of 1.5 million CFLs through the Ilumex project will defer over 80 MW of peak capacity, avoid annual generation of over 140 million kWh, and provide a net societal benefit of more than 130 billion pesos.

In addition, the Ilumex project will accrue environmental benefits to the cities of Monterrey and Guadalajara, as well as to Mexico and the global environment, as a result of a reduction in several pollutants. Because specific data on emissions from Mexican oil-fired power plants was not made available to the consultants, we include in the feasibility study for illustrative purposes the estimates for emissions for an oil-fired Steam Plant using #6 oil.

Emissions from an Oil-fired Steam Plant using #6 Oil (column 4 is estimated annual emissions reductions from the Ilumex project based on installation of 1.5 million CFLs)**

		Per kWh Savings	Ilumex Project Savings
Heat Rate	BTU/kWh	9,840	n.a.
Oil-Sulfur Content	%S	2%	n.a.
Sulfur*	kg S/kWh	5.63×10^{-3}	760×10^{3}
SO_2	kg SO_2/kWh	1.15×10^{-2}	15.5×10^{5}
NO_x	kg NO_x/kWh	1.33×10^{-3}	180×10^{3}
Carbon	kg C/kWh	.204	27.5×10^{6}
CO_2	kg CO_2/kWh	.75	101×10^{6}
Methane*	kg CH_4/kWh	1.61×10^{-3}	217×10^{3}
Hydrocarbon	kg HC/kWh	3.06×10^{-5}	4.1×10^{3}
Carbon Monoxide	kg CO/kWh	1.53×10^{-5}	2.1×10^{3}
Particulates	kg TSP/kWh	1.27×10^{-3}	171×10^{3}
Solid Waste	kg /kWh	.05	6.8×10^{6}

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Source: U.S. Department of Energy, Energy Technology Characterization Handbook: Environmental Pollution and Control Factors, (DOE/EP-0093, March 1983).

Notes:

a: *Estimates from P. Chernick and E. Caverhill, The Valuation of Externalities from Energy Production, PLC, Inc., Boston, MA, 1989.

b. **Based on 9,000 hour lifetimes per CFL, and a weighted average savings of 50.4 watts per CFL (67.2 W incandescent replaced with a 16.8W CFL). In actuality, there will be three high-lumen per wattage size CFLs available through the program ranging between 13 and 22 Watts.

World Bank Demonstration Value

The Ilumex project will provide the World Bank with a model for replication in other newly-industrializing countries. It will demonstrate investment in end-use energy efficiency as a least-cost means of expanding energy services without generating greenhouse gases and a range of other environmental pollutants. The demonstration is also of value in gaining insights and experience on the following:

Technology and Market Innovation

- Performance of efficient technologies like compact fluorescent lamps under power quality and ambient conditions typical in developing countries;
- Development of markets for efficient technologies; Retail markets in the U.S. have experienced a two to 10 fold increase in CFL sales as a result of utility CFL DSM programs; (This result is referred to as the "free driver effect "of DSM programs.)
- Development of private sector activity (e.g., manufacturers and suppliers of CFL ballasts, lamps, and fixtures).

Utility Least-Cost Service Expansion

- Ilumex will allow CFE to develop the capacity to deliver DSM resources as a least-cost utility expansion option. Each of the necessary DSM project components, including design, implementation, and evaluation, require distinct institutional capabilities. The Ilumex project provides a vehicle for CFE to institutionalize this capacity. The Ilumex team, including the North American utility representatives and the DSM program consultants involved in the development and operation of a variety of DSM utility programs throughout North America, have worked with CFE staff to develop this capability in the Mexican utility for the Ilumex project.

Rationale for GEF Support

GEF support for the project is justified for several key reasons. First, market barriers and imperfections inhibit or prevent consumers from investing in CFL technology. A lack of information on the emerging efficiency technologies, such as CFLs, and the economics and quality of their performance hinders the market. Also, consumers' high discount rates -- estimated to be 18 percent, with sensitivities provided at 12 percent and 24 percent in the economic analysis of this study (Section 7) -- lead to undervaluing of the energy savings benefit of CFLs relative to other consumer and

societal investment decisions.[2] As a result, the CO_2, SO_x, and NO_x reduction benefits of reduced electricity generation are lost, and higher cost energy service options with poorer economics are pursued by the society as these investments are deferred exclusively to the utility. By providing the seed money necessary to newly establish a utility DSM initiative, the utility can bring its long-term investment perspective and bulk purchasing power to bear in proliferating the CFL technology.

Second, GEF support for the Mexican program would help establish a clear model for additional CFE DSM investments, as well as similar initiatives in other developing countries. This can clear the way for the adoption of similar demand side investment strategies to expand electricity services while displacing fossil fuels and minimizing debt and capital requirements.

Third, Ilumex provides the inducement necessary to move the market for energy efficient CFLs to develop a cost-effective, widely available technology that is responsive to the specific requirements of Mexico and other developing country economies. Because of the sizable procurement of CFLs that the Ilumex project will require, the project can facilitate the development and marketing of an advanced CFL technology that will boost the global market for this new technology throughout the developing world. The CFL technical specifications, developed for the Ilumex project, require a high performance, reliable technology that is "utility friendly" (meeting the power quality impact concerns -- including high power factor and low total harmonic distortion -- of electric utilities), and that is designed to function as specified under the difficult power quality conditions characteristic of newly-industrializing countries.

Future Expansion of the Program to other Regions and Sectors

CFE Expansion Opportunity in Residential and Non-residential Lighting

It is CFE's stated intention to expand a CFL DSM program throughout Mexico. Specifically, CFE will use the Ilumex fund pool to extend the residential lighting initiative beyond Guadalajara and Monterrey to encompass the entire nation. According to residential sector lighting use data developed by the Ilumex team for this study, there are approximately 50 million residential sector incandescent bulbs currently in use in Mexico that meet the requirements for a cost-effective and technically feasible CFL retrofit. That number is likely to increase substantially as the economy grows (in the US, for example, there are 10 bulbs per capita -- nearly 3 billion Edison light bulb sockets). A large number of additional bulbs are also located in non-residential buildings. According to Electric Power Research Institute data for the U.S., for example, non-residential/non-street incandescent lighting accounted for more than twice as much electricity usage as residential incandescents (180 TWH versus 82 TWH in the residential sector).

Thus, Ilumex holds great value as a model to be expanded to a nation-wide program. Applying the lessons learned through the Ilumex project and marshaling the

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[2] The CFE experience with small-scale CFL pilot programs indicates a relatively low consumer discount rate (not quantified by CFE). Within the Mexican market products perceived by consumers to be "high tech", with advanced technological design are valued very highly beyond their energy savings value. The 18 percent corresponds to the real consumer discount rate, as derived from credit card interest rates, factoring out inflation.

capacity developed in implementing Ilumex, CFE can invest in cost-effective replacements of incandescents with CFLs in existing sockets as well as in new construction in both residential and non-residential buildings. The advantages to be gained from expanding the Ilumex experience to CFL DSM programs in both the residential and non-residential sectors are discussed in Section 9 of this report, as well as in Appendix C.

Programs to promote lighting efficiency have been the most common efficiency program undertaken by North American utilities. Most of their focus has been on commercial and industrial (C&I) customers, although increasing attention is now being directed to residential customers.

A review of C&I lighting programs through early 1991 found nearly 200 programs offered by 93 utilities serving 43 states.[3] CFLs typically represent just one among a range of lighting upgrade options. Lighting upgrades are now being packaged into whole-building assessments involving other advanced efficient end-use equipment (including HVAC, advanced window glazings, water heating, water-conserving devices).

Utilities are discovering that a DSM "portfolio" approach, which looks at all cost-effective efficiency opportunities in a building or facility, helps reduce the administrative, program and delivery costs per kWh saved. While it is prudent to accumulate experience demonstrating a single DSM measure like CFLs, it is important to recognize that the DSM resource is much larger and more diverse than this single technology. However, the experience that is gained through a single technology project such as Ilumex provides the vehicle for expanding to a DSM portfolio approach. The Ilumex project provides the initial capacity-building step necessary to open this range of demand side resource opportunities to CFE. This will allow the utility to integrate into its resource portfolio the least-cost, environmentally superior demand side development options that can fuel economical energy service growth in Mexico. Ilumex can also serve to facilitate CFE's move towards marginal cost pricing by expanding energy services while reducing electricity consumption.

(The "Ilumex Menu" was compiled by the Ilumex team to serve as a background document in the development of the Ilumex project. The Menu provides assessments of the range of program options available to the team in developing this program. The assessments are derived from the extensive experience of utilities internationally in operating residential lighting projects. This Menu is provided as an attachment and supplement to this feasibility study. In it, many of the issues related to the development, operation, and evaluation of residential sector lighting programs are developed and explored in greater detail).

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[3]Barakat & Chamberlin, Inc., **Green Lights Utility Program Database, Version 0.5**, 1991, prepared for the U.S. Environmental Protection Agency, Office of Air and Radiation, Global Change Division, Washington, DC.

2. Background on Origins of Ilumex Project

The World Bank's initial Executive Project Summary (IEPS) for Ilumex focused on a demonstration pilot project in Mexico known as the "High Efficiency Lighting Pilot Project." The project was conceived to promote the use of high-efficiency compact fluorescent lamps (CFL) as a means of delivering electricity services while achieving reductions in greenhouse gases and other environmental pollutants.

The IEPS described the benefits to be gained from a GEF-sponsored project in a developing country like Mexico. The paper pointed out that lighting is a common electricity service that consumes a significant percentage of total electricity consumption. Lighting usage in the residential sector is highly coincident with the system-wide peak demand in Mexico. Highly efficient lighting components like compact fluorescent lamps (CFLs) can be used to replace incandescent bulbs, providing similar quality of lighting while consuming 75 percent less electricity and lasting 10 to 13 times longer. Over the CFL's 10,000 hours rated lifetime the consumer will accrue a significant net savings, and the utility will defer over one hundred dollars of investment in generation, transmission and distribution expansion. Societal benefits include the prevention of over one thousand pounds of the greenhouse gas, carbon-dioxide (CO2), as well as significant amounts of sulfur-dioxide.

The project concept paper noted that increased use of CFLs would allow Mexico to meet part of its electricity service needs with reduced capital and operating expenditures relative to the more costly current practice of building and operating fossil-fuel fired power plants to operate less efficient incandescent light bulbs. Fossil-fired (public) electrical production in Mexico in 1988 represented 76.5 TeraWatt-hours (TWh) out of a total of 102 TWh generated in the country, consuming 795,000 Terajoules of oil (75 percent), naptha (13 percent), coal (10 percent), and natural gas (1 percent).

Implementation of this energy efficient lighting strategy, in addition to saving capital and reducing the subsidies paid to certain residential ratepayers, would also reduce CO2 emissions in Mexico. Each 16-Watt CFL displacing a 60-W incandescent saves electricity equivalent to 450 pounds of coal (1,600 pounds CO2). The project would demonstrate lighting efficiency's excellent value in reducing global greenhouse gases at no extra cost.

There are at least 180 million incandescent bulbs currently in use in Mexico (assuming similar levels as Brazil, where there are roughly 2 bulbs per capita). A majority of these bulbs are candidates for CFL replacement. That number is likely to increase substantially (in the United States, for example, there are 10 bulbs per capita -- nearly 3 billion Edison light bulb sockets). The CFLs can be especially valuable in displacing peak power needs. Lighting can account for over one-fourth of residential peak period electricity use.

GEF Activity Description

The IEPS described a potential GEF-funded Mexico utility program with the following components: (1) design of a CFL implementation program; (2) purchase and installation of two million CFLs (specifically designed to perform under Mexican operating conditions) as replacements for existing incandescent bulbs; (3) the monitoring, testing,

measuring, and evaluation of the project to ensure projected results are achieved. Evaluation permits feedback on ways to improve project delivery, and identifies lessons that could be applied in replicating the project elsewhere in Mexico and other developing countries; and (4) preparation and studies that identify additional lighting and other capital-saving, pollution preventing, electricity and energy efficiency investment opportunities. The project could be designed, if desired, to recoup revenues to cover the full costs of the project.

Rationale for GEF Funding

The IEPS pointed out that a successful demonstration of investment in energy efficiency as a means of expanding energy services without generating greenhouse gases will provide a model for replication in other developing countries. Mexico is favorably situated to implement such a project, given:

(1) Rapidly increasing electricity demand; electricity growth in the 1980s rose at a rate of six percent per annum, doubling capacity needs every 12 years);

2) A vigorous and progressive private sector (including a domestic CFL industry), and a public utility system with stated interest in investment in end-use efficiency improvements as a capital-minimizing and pollution prevention strategy;

(3) A heavy dependence on hydrocarbon-based electricity generation; roughly 800,000 Terajoules of hydrocarbons annually fuel Mexican power plants. Hydrocarbon-fueled power plants are projected to remain a major part of Mexico's future electricity generation; and,

(4) Low-use residential electricity rates are heavily subsidized under the existing CFE tariff structure; the utility has a means, through low-cost efficiency improvements, of reducing subsidies to ratepayers while also damping rate shock effects as the utility implements rate increases in a move toward marginal cost pricing at each tariff level.

Finally, the IEPS noted that GEF support is required for implementing this project. Absent the GEF funding and technical support, the Ilumex project benefits, including the CO_2, SO_x, and NO_x savings and other benefits of reduced electricity generation would not be realized. Specifically, GEF will address several barriers to project implementation and the widespread use of CFLs in Mexico:

- Market imperfections prevent consumers from investing in CFL technology. The GEF program can help overcome the most serious barriers to taking advantage of cost-effective energy efficiency investments: consumers' extraordinarily high discount rates and a lack of information about the technology and its economics. By providing the seed money necessary to establish a utility initiative, the utility can bring its long-term investment perspective and bulk purchasing power to bear in proliferating the CFL technology. Such utility programs in North America have displayed a strong market stimulus impact, even beyond the immediate impact of CFL sales resulting directly from the utility project.

- GEF support for the Mexican project would help establish a clear model for other DSM initiatives by CFE and throughout the developing world. This can clear the way

for the adoption of similar demand side investment strategies to expand electricity services while displacing fossil fuels and minimizing debt and capital requirements.

- GEF initiative and GEF funding are necessary to induce CFE to explore the DSM resource in a serious manner. It was the promise of GEF participation that moved CFE to establish its initial institutional effort to develop a DSM capability within the utility's Distribution Division. The GEF initiative is essential for building a capacity within CFE to continue to identify and develop the demand side resource as a cost-effective investment opportunity.

- Despite the overwhelming promise of the DSM resource, as indicated by the $2 billion investment in DSM by United States utilities in 1991[4] and the economic and environmental benefits of the Ilumex project (described in Section 7), no comparable project has yet been undertaken with World Bank funding to date. The GEF's role as a facilitator of projects which, while economically attractive with significant environmental benefits, would not otherwise proceed, is perfect for the Ilumex project. Such investments are not yet mainstreamed in the normal lending channels at the bank. GEF represents the facility for introducing such projects into the traditional power sector loan process.

World Bank GEF Technical Review

Documentation necessary for initiating a technical review of a CFL program was completed by CFE and submitted to the World Bank in the Fall of 1991. The World Bank's GEF technical review committee met in December 1991, and favorably recommended pursuing the project. The reviewers did emphasize the point that non-residential DSM programs can provide grater net economic benefits than residential programs. CFE maintains its preference for limiting the program initially to the residential sector. The program will be structured to ensure that program seed funds be replenished by program revenues to enable expansion of the program throughout the residential sector of the country, to then be followed by the non-residential sector.

Ilumex Project (Proyecto de Uso Racional de Iluminacion en Mexico)

In the Summer of 1992, the U.S. Agency for International Development (AID) offered the services of two AID contractors to assist CFE in the preparation of this feasibility study for implementing a CFL DSM program. Named the Ilumex project, the project team included CFE's Distribution Division, as well as representatives of CFE's offices who will manage the project implementation in the selected field sites, and representatives from the Fideicomiso De Apoyo programa de ahorro de energía del sector eléctrico (FIDE) and the Programa de Ahorro de Energia del Sector Eléctrico (PAESE). AID has contributed $200,000 to support the services of the U.S. team that includes: the International Institute for Energy Conservation (IIEC) serving as project manager, Lawrence Berkeley Laboratory (managing a market study for the demonstration cities of Guadalajara and Monterrey, as well as preparation of the benefit/cost economic analysis of the project); DSM program managers from Southern California Edison and the Los

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[4] "Conservation Power", Business Week, (September 16, 1991), P. 86.

Angeles Department of Water and Power; a DSM program evaluation expert; and a CFL design engineer (serving as technical performance expert).

In working with CFE to develop the program, the U.S. team prepared a 13 module MENU that covered all aspects of designing and implementing a CFL program. The MENU includes a review of utility CFL DSM practices in the U.S., Canada and Europe. A copy of the MENU is attached to this Feasibility Study. The MENU was delivered to CFE during the week of meetings held in September 1991.

A fundamental part of the AID-funded U.S. consultants' collaboration with CFE in designing the Ilumex program was a training effort. The Mexican team joined the U.S. consultants in California in July to review DSM implementation efforts at Southern California Edison and the Los Angeles Department of Water and Power. The team toured CFL factories, testing laboratories, program accounting facilities, and joined U.S. utility contractors in surveying customers and installing CFLs. Presentations were made to the group by 15 CFL manufacturers.

In September, the U.S. team conducted a four day training seminar on program evaluation at CFE offices in Mexico City. The U.S. consultants have stressed the importance of a strong program evaluation component for the Ilumex project, in order to assure the project's value as a demonstration and a replicable model for other CFE and developing country DSM projects in the future. The design of the Ilumex project, as well as the emphasis during the project development stage on evaluation training for the participating CFE, FIDE, and PAESE personnel who will administer the program, reflect the determination that evaluation will be a priority in the administration of Ilumex.

Two City Demonstration: Monterrey and Guadalajara

The Ilumex project will employ compact fluorescent lamps (CFLs) to replace incandescent lighting within the residential sector of two cities in Mexico -- Monterrey and Guadalajara. These cities were chosen by CFE to reflect the variety of service territories represented throughout the CFE distribution system.

A fundamental part of the Ilumex project was a market survey undertaken during the summer of 1992 on behalf of the Ilumex team by a Mexican market research firm in Monterrey and Guadalajara. The data from the survey was used to determine the most effective delivery mechanism for each city, as well as to assist projections of the energy savings potential of the project. The performance, size, and lighting quality characteristics of lamps required by these markets was also indicated from the survey data. Additionally, CFE assembled a power quality profile of the distribution systems in both cities. This data helped determine the performance requirements for the lamps to be acquired through the bid process.

Following World Bank lending policies, an international open bidding process will be employed in procuring the lamps for the project. The conditions in the Mexican (and other developing country) markets are significantly different from those found in the Western European and North American markets, where the technology is fairly well established. The operating environment, including the climatic conditions, the power quality, and the type of lamp use, present a different set of technological challenges than are reflected in the existing technology. In developing a lamp for the Ilumex project, manufacturers will be advancing a technology for use throughout more of the developing world.

As such, the development of a technology specifically designed for these conditions is considered essential to the success of the Mexican project, as well as to the future widespread use of CFLs in the global market. The bid specifications will also reflect CFE's concern about the potential effect of the widespread use of the new lighting appliances on their distribution system, as measured by power factor and total harmonic distortion. Finally, the long-term performance of the lamps and ballasts will be key to assuring persistence of savings and the economics and success of the project, and will thus be a factor in the technology selected.

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3. Description of Ilumex Project, Execution and Cost

Background

The Comisión Federal de Electricidad (CFE) is faced with a challenge to provide energy services at the lowest cost possible to fuel Mexico's expanding economy, and reduce subsidies to low-use tariff customers in the residential sector as the utility moves to marginal cost pricing. Due, in part, to the interest of the World Bank and GEF, CFE has embarked on an effort to demonstrate the value of utility investment in end-use efficiency equipment as a least-cost means to expand energy services in Mexico. These demand-side management (DSM) options offer cost-effective ways to manage peak demand and delay the construction of more costly power plants.

CFE has chosen to use the technology of compact fluorescent lighting (CFL) to demonstrate the value of utility investments in energy efficient equipment. Since 1991, CFE has been actively involved in the design and implementation of seven small-scale pilot residential relamping projects throughout various communities within Mexico. These projects were designed to test various delivery mechanisms, assess consumer acceptance of compact fluorescents, and gain an administrative capacity to market energy efficient devices to the residential sector.

The experience of CFE, working with FIDE (Fideicomiso de Apoyo Programa de Ahorro de Enérgia del Sector Eléctrico) and PAESE (Programma De Ahorro de Energia del Sector Eléctrico) in implementing these projects has caused the utility to view residential CFL programs as a demand-side management (DSM) resource of considerable promise in Mexico. CFE's vision for the Ilumex project is to achieve high residential sector penetration rates of the CFL market in two large cities representing different climates and economic profiles. With the experience gained in developing and implementing the Ilumex project, CFE intends to expand to a nationwide project.

The CFE experience from the seven small-scale pilot programs yielded little in the way of precise data to guide the design of the Ilumex project. Much of the knowledge gained was anecdotal or general in nature. There has been no evaluation process incorporated into their implementation. In order to develop an effective project for Ilumex which reflects true market conditions in Monterrey and Guadalajara, the Ilumex team consultants undertook a survey of 500 homes in each of the two cities to determine household lighting characteristics, market saturation/acceptance of compact fluorescents, energy conservation potential, and purchasing preferences of consumers. CFE contributed estimates of sales volume and market response based on their pilot project experiences and their knowledge of the capability of the CFE-FIDE-PAESE team that will be responsible for project implementation.

In general, the findings of the seven small-scale pilot projects and the market survey undertaken by the Ilumex team indicate very minimal penetration of the market by the CFL technology to date, strong consumer desire to purchase CFLs if the bulbs were more affordable and if better information were available about their performance and capability, and a willingness to use energy-saving devices, particularly where the technology is perceived as advanced and innovative. In addition, approximately 2 million

CFL retrofit opportunities were identified for the two cities. These "opportunities" are defined as existing incandescents that are physically replaceable by CFLs and that operate at least four hours per day (and thus represent cost-effective retrofit opportunities for CFE, their customers, and the nation -- see Section 7.) Close to 4 million such opportunities exist when the pool of retrofit opportunities is expanded to include all replaceable incandescents that operate for at least two hours per day. At this level of usage, the economic benefits actually improve, from the perspective of CFE and the nation. However, the high consumer discount rate requires that CFE subsidize the purchase price of CFLs that only operate for two hours per day in order to maintain attractive economics from the consumer perspective. (See Section 7.) By expanding the pool of retrofittable lamps to include all lamps that operate for two or more hours per day, less than a 40 percent penetration will be required in the two cities in order to meet the Ilumex project goal of 1.5 million CFLs installed.

Goals and Objectives

Based on a desire to provide efficient and effective service to its customers, CFE has spent the past several years researching and reviewing a variety of utility programs, including plant operations, rate, and demand-side management options. Prior to developing the Ilumex project, CFE established several goals and objectives to meet the utility's requirements, and to incorporate the best elements of various demand-side management approaches. The following chart includes the goals and objectives of the Ilumex project in descending order of CFE's priority. The last several objectives were deemed by CFE to be relatively unimportant for this demonstration project.

Primary Objectives of the Ilumex Project

- **Develop the capability within CFE to design, implement, and evaluate DSM programs;**
- **Provide project benefits primarily to the low use tariff customers;**
- **Reduce CFE payments for subsidies by lowering electricity consumption within the highly subsidized low-use tariff classes (less than 200 kWh per month);**
- **Provide a mechanism for implementing a long-range marginal cost pricing structure for all users by establishing a DSM initiative that mitigates rate shock for customers currently being subsidized by reducing usage among these users as rates increase;**
- **Reduce electricity consumption and lower electricity demand during CFE system peak periods;**
- **Maximize total energy savings;**
- **Establish a revolving fund for the continued operation and expansion of the DSM project by establishing a self-sustaining project that produces revenues to offset project costs;**
- **Maintain a high level of customer satisfaction with the project services and products;**

- **Stimulate the market for compact fluorescent lamps by increasing customer awareness of their commercial availability and performance;**
- **Demonstrate the viability and economic benefits of utility DSM initiatives for Mexico; and,**
- **Spur the development of CFL technology that meets CFE criteria for power quality, reliability, and performance in the context of the Mexican market and the Mexican power distribution system.**

Project Design

In designing the Ilumex project. a great deal of emphasis was placed on keeping administrative costs as low as possible while meeting market penetration and project objectives and goals. A strong effort was made to restrict the addition of new CFE personnel employed to implement the project, excluding the essential position a manager with retail and inventory control experience for each city . In view of this, CFE will utilize the existing network of local CFE offices within the cities of Guadalajara and Monterrey in implementing the project. Guadalajara has 14 such offices, while Monterrey has 9 local offices. Local offices are familiar to customers, are designed to deal with walk-in business, and offer a support network of staff and equipment. Extensive use will be made of FIDE personnel for administering the project. The PAESE-CFE managers already in Monterrey and Guadalajara, who were instrumental in the design process for developing the Ilumex project and who have participated in the evaluation training process with the Ilumex team, will manage and oversee local project administration.

The project is structured to utilize the lowest cost method of CFL distribution for as long as possible in meeting the project objectives and goals. Thus, the initial sales effort will be limited to the "*Ventas de Agencia*", the direct sales (and sales over time via utility bill) initiated at the existing CFE offices. Regular project monitoring and impact evaluation exercises will account for the number and type of lamps being distributed by site and customer classification. This will provide data for inventory control, as well as a constant measure of project effectiveness relative to objectives.

The project design includes a series of delivery method adjustments that can be activated incrementally to effectively improve penetration for a given sector of the market, should the monitoring and evaluation process point to shortfalls relative to the project goals. These modifications include:

- adjustments in the payment terms of the lease arrangement;
- adjustments to the price at which each lamp is sold;
- use of a mobile sales office to sell directly in targeted neighborhoods;
- mobilization of a direct sales and installation force (or door-to-door/direct sales).

Each incremental change in the method of delivery would involve a slightly higher implementation cost. These adjustments will be used, if found necessary, to fine-tune

project impact while maintaining the lowest possible administrative costs. The progressive path of incremental project adjustments are represented in the figure at the end of this section of the study. The estimated implementation costs for the Ilumex project, assuming a variety of distribution methods are employed, are also detailed later in this section.

Under the project guidelines, residential customers will be eligible to purchase up to six compact fluorescent lamps at a price to reflect the utility's purchase cost plus an administrative cost estimated at roughly 10 percent. The baseline estimate is $1.17 per lamp, not including a project evaluation cost budgeted at roughly $.47 per lamp. As conceived, the cost per lamp will reflect all of CFE's costs, thus resulting in a revolving fund wherein all Ilumex project costs are recovered, to be applied in an expanded project nationwide. However, if CFE subsidies are required in order to meet sales objectives, then the economics remain attractive to CFE, (see Section 7) and the contingency for the Ilumex project could be tapped.

The customers may purchase the CFLs outright by paying cash at the local CFE offices or they may choose to finance their purchase over a two year period for an additional 12 percent financing fee -- equivalent to CFE's cost of capital. Customers choosing to finance CFLs will be required to pay an initial 5,000 pesos per bulb and will be billed for the balance in conjunction with their bi-monthly utility bill.

As stated above, one of CFE's key objectives is to target project benefits to customers in the low kWh usage tariff groups (see tariff structure in Executive Summary of this study). To assure saturation of this portion of the market, CFE has designated that a mobile neighborhood outreach office will be activated if target customers are under-represented as project participants in sales of CFLs at local offices, or if CFL sales lag behind expectations. The neighborhood outreach office will be a converted trailer, fully equipped to finance customers' purchases of CFLs, to distribute, and/or to install CFLs on a door to door basis. The neighborhood outreach office will also operate as an extension to local office operations should demand at local offices exceed capacity or should customers need installation assistance. These mobile offices can either serve as auxiliary sales kiosks, or as operations centers for door-to-door sales efforts -- the most intensive (and highest cost) distribution method available under the iterative distribution scheme.

Procurement

In past CFL pilot projects, and in the market survey undertaken by the Ilumex team, customers articulated a concern about the price of the CFLs. In the experience of utility companies throughout North America, the bulk purchase of CFLs has reduced retail prices by as much as 40 to 50 percent. A similar savings is expected under the CFE Ilumex project. CFE will purchase 1.5 million CFLs in a range of size and lumen outputs over the course of the two year project. Therefore, CFE will be able to negotiate not just a favorable price, but also assure product quality and availability. CFE took this into consideration in the design of the Ilumex project by establishing a single purchaser for the CFL products -- CFE. Through this effort, CFE believes the project will jump-start the CFL industry in Mexico until the economy of scale created by volume sales help to provide a cost-competitive product throughout the Mexican market, as well as improved

customer acceptance, as well.[5] CFE plans to issue an international bid directly to manufacturers to bulk purchase a mix of CFLs corresponding to the residential sector requirements identified in the market survey Section 6. Details of this procurement are provided in Section 4 of this study.

Marketing Project

Because of the novelty, benefits, and practical usage of CFLs, CFE has developed an extensive educational and marketing component within the Ilumex project. Such a project is essential because CFE has chosen not to do a direct installation project initially, instead opting for the lowest up-front cost delivery method identified. The public information campaign will help assure that the lamps that are sold are properly installed to maximize project benefits. The marketing effort will also help ease the longer term transition to retail sales of CFLs without the benefits of CFE participation.

A professionally designed advertising campaign will be implemented using news and electronic media. The thrust of the campaign will be to market energy savings, conservation of natural resources, and the environmental benefits of CFLs; aspects that surveys indicate have high consumer interest. A media blitz will commence 30 days prior to the project start up and will continue in various degrees throughout the first quarter. An integral part of the media strategy will include specialized marketing efforts tailored to reach customers with low kWh usage.

In addition to the above, paid advertising, a multi-faceted outreach project utilizing traditional (no-cost) public service opportunities will be implemented. CFE will make a concerted effort to schedule TV and radio interviews, issue press releases, schedule speaking engagements at local service clubs, trade organizations, conferences, and major public events. CFE will also include a bill-stuffer advertising project in the company's regular customer bills. To kick off the Ilumex project, CFE will host a major press conference inviting local and state dignitaries, celebrities, and officials as well as representatives of the partner utilities in the Ilumex project, Southern California Edison (SCE) and Los Angeles Department of Water and Power (LADWP).

A grass-roots promotion will also be developed to bolster CFL sales. Several events are planned, including incentives to customers and employees for submitting referrals, and distribution of fliers and posters. A special phone solicitation project is also planned to continue the sales momentum and target specific neighborhoods pending project monitoring results.

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[5] The "free driver" effect, where utility CFL programs appear to spawn retail purchase of CFLs by non-participants, has been observed in a number of European countries. Evan Mills notes, "the Swedish lamp manufacturers' trade organization estimates that the 75,000 rebate checks redeemed in the Stockholm Energi program 'leveraged' 41,000 additional lamp sales. According to the Dutch utilities, the GEB program [Den Haag City generating company] resulted in 25,000 direct sales versus 50,000 indirect sales. The corresponding numbers for the Freisland utility were 60,000 and 40,000 CFLs. In Switzerland, 7,000 CFLs were sold because of the programme and 'normal' sales increased by 70,000." Evan Mills, "Using Financial Incentives to Promote Compact Fluorescent Lamps in Europe, Cost Effectiveness and Consumer Response in 10 Countries," in Right Light, Bright Light, ed., Evan Mills, 1992.

Lastly, in an effort to create and maintain a CFL market, a special cooperative advertising campaign will be developed in conjunction with CFL manufacturers and retailers to stimulate CFL sales through the traditional retail distribution chain.

This marketing effort will help to leverage the benefits of Ilumex as a demonstration of advanced, energy efficient, environmentally-beneficial technology. The public information campaign will have spin-off effects in terms of the education of the population regarding environmental conservation. Likewise, the high-profile nature of the Ilumex project will serve to capture the attention of CFE management beyond those directly involved in the development and implementation of Ilumex, thus providing an avenue for introducing DSM resources to the long-term planning processes at CFE. A high profile for CFE in a project with considerable public relations and positive image benefits (part of the reason for CFE's focus on the residential sector for Ilumex) can be an important motivator for an institution that might otherwise be slow to accept change.

Monitoring/Tracking and Quality Assurance

In researching other large-scale utility relamping programs, the Ilumex team recognized the importance of a well-developed and automated monitoring/tracking system. Evaluation is a key component of any DSM project. Such a system is of particular importance for a demonstration project of this type, where a significant portion of the project value lies in the lessons provided for future endeavors modeled on the demonstration. These projects should identify the relative successes and failures of their various components and approaches.

The Ilumex project relies on regular and accurate monitoring processes as a means of controlling costs and identifying the lowest cost mechanism possible for meeting project goals. Since Ilumex will serve as a model for a larger, nationwide residential lighting retrofit effort by CFE, as well as for future DSM initiatives at the World Bank, it is imperative that project impact be measured on an on-going basis.

The Ilumex team was careful to build an evaluation process into the project design, as well as to establish a knowledge and appreciation for evaluation and monitoring within the Mexican members of the Ilumex team. Although CFE has undertaken several small-scale CFL pilot projects to date, none have included an adequate evaluation component. As a result, the data derived from these efforts is largely anecdotal and general in nature, with only limited value to future CFE DSM efforts. The value of these projects is thus diminished as the lessons learned are limited to the few participants in their implementation.

In order to establish an evaluation capacity within CFE for Ilumex, and for future DSM efforts, the Ilumex consultants undertook a four day evaluation training for CFE-FIDE-PAESE staff in September. It is essential that this component of the Ilumex project plan be carefully administered during the implementation phase, with follow-up assistance provided from outside CFE by an experienced DSM evaluation expert.

A sophisticated data collection process will be developed to track inventory, sales, customer class (in terms of kWh usage), etc. on a daily basis. This data will be used to restock, track penetration rates, and trigger additional advertising and/or neighborhood outreach efforts. Each office will be responsible for conducting weekly inventory checks

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and will be liable for any missing inventory beyond two percent loss. CFE will conduct an independent inventory check on a monthly basis.

Details of the evaluation process that is built into the project design are provided in Section 8 of this study. This evaluation and monitoring system will be rigorously applied to indicate project inputs and allow for adjustments to be made in project design incrementally to better meet project objectives. The evaluation plan also allows for a comprehensive accounting of project costs and benefits at regular intervals during project implementation. Final project evaluation will provide a comparison against project projections. This will be a key resource for CFE's future plans to expand Ilumex on a nationwide basis.

In addition to the processes described above, each participating customer will be sent a follow-up survey to reflect where the CFLs were installed, wattage replaced, hours of use, and overall product satisfaction. The questionnaire will also solicit suggestions for improving the Ilumex project and will allow the customer to refer other potential CFL customers. CFE will use this as part of the project monitoring and evaluation process. CFE will also develop an information exchange network with CFL manufacturers and retailers to track retail CFL sales on the open market. This information will be used to gauge inputs in the retail market. It will also help guide efforts to strengthen the retail market for a transition once CFE sales of lamps are terminated and the retail market takes over completely.

The evaluation plan developed by the Ilumex team for this project is described in greater depth in Section 8 of this study.

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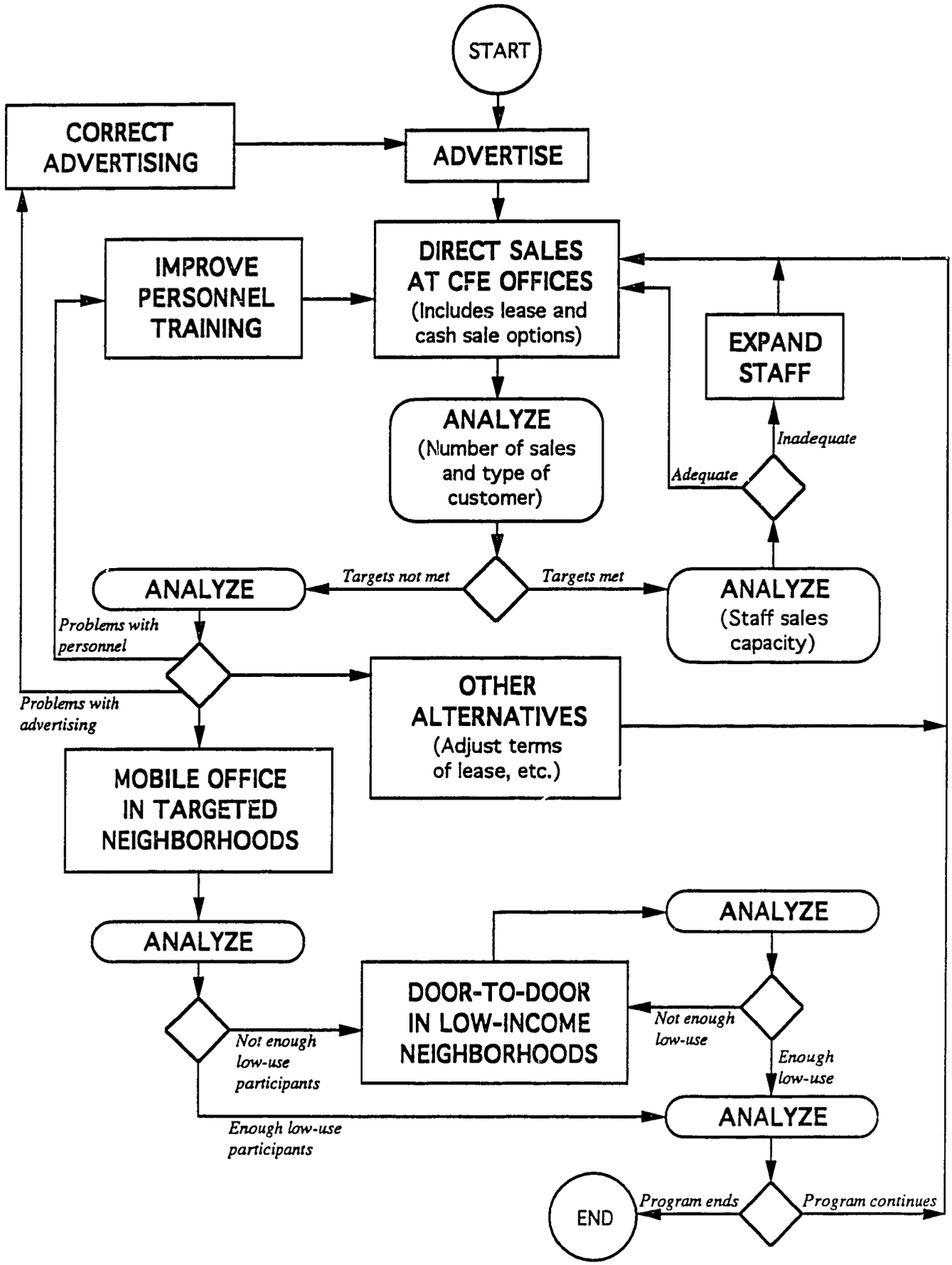
Ilumex Compact Fluorescent Lamp Delivery System Design Flowchart



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Staff Requirements For Project Implementation

The Ilumex team was able to satisfy the project design criterion of minimizing CFE staff additions in implementing the project by taking advantage of the working relationship that exists between CFE, PAESE (the efficiency arm of CFE), and FIDE (the national fund for electricity sector efficiency that houses PAESE). This relationship is central to the implementation of electric sector efficiency initiatives in Mexico. CFE has worked with both FIDE and PAESE in the development of seven previous efficiency pilot projects, in addition to the proposed Ilumex project.

For the implementation of the Ilumex project, CFE offices will be used as distribution sites for CFL sales. FIDE personnel will staff the centers and any community outreach efforts, including mobile sales initiatives. PAESE personnel in Monterrey and Guadalajara (who have been a vital part of the Ilumex team in designing the project to date and have undergone evaluation training) will coordinate the projects in each city. In addition, project managers with relevant retail management experience in areas such as sales and inventory management will be hired to manage each city's operations. The operations associated with the Ilumex project are significantly different from the existing CFE experience. It will be essential to the success of the Ilumex project that the city operations are managed by business people with relevant retail experience, thus reflecting the characteristics of the Ilumex project. The Ilumex budget thus reflects the need to hire a retail operations manager for each city.

General Implementation Policies Guiding the Operation of Ilumex

The following organizational chart illustrates the working relationships and responsibilities that will characterize the implementation of Ilumex. It graphically represents the following policies and operational relationships:

(1) An operating agreement will be contractually established between CFE and FIDE for the execution of Ilumex.

(2) FIDE will establish a separate division for the administration of Ilumex.

(3) FIDE will establish within NAFINSA a special account for the management of Ilumex project funds.

(4) The project costs will be organized by three accounting areas:

- Capital goods acquisition;
- Lamp acquisition costs;
- Operational costs;

(5) Project accounting and control will proceed on a monthly basis, with regular fiscal and financial reports given to CFE.

(6) All necessary acquisitions for the project, undertaken by FIDE, will be subject to agreements entered into between World Bank and CFE.

(7) The point of sales for the CFL's will be in kiosks established at the CFE offices in each city where they will be operated by FIDE according to the project guidelines.

(8) Hiring of personnel for the project and all labor relations will be FIDE's sole responsibility.

(9) The reimbursement of expenses that have been incurred by FIDE must be justified according to the project guidelines. The documentation will remain in FIDE's files where it will be available at all times to CFE.

(10) FIDE will establish operating offices for the project in the cities of Monterrey and Guadalajara, appointing a project manager in each city.

(11) FIDE will be responsible for the all sales interactions with CFL customers. For the payment-over-time purchase option, which involves customer installment payments on their CFE utility bills, CFE will support the accounting effort, transferring on a regular basis the funds received, and providing records on receipts to FIDE on a monthly basis.

(12) In each city a Technical Committee for Evaluation and Control will be established, presided over by the Division Manager with the participation of the Commercial Submanager and the PAESE officer for the Division. The Committee will meet monthly in order to supervise progress and to solve operating problems that arise.

(13) Likewise, a Central Committee will be established, formed by the Subdirector of Distribution, the officer from PAESE at the national level, and the Managers in the areas of commercialization and distribution, who will be familiar with and decide the progress and plans presented by the Committees of Evaluation and Control.

(14) The sales and marketing efforts for this project will be the direct responsibility of FIDE.

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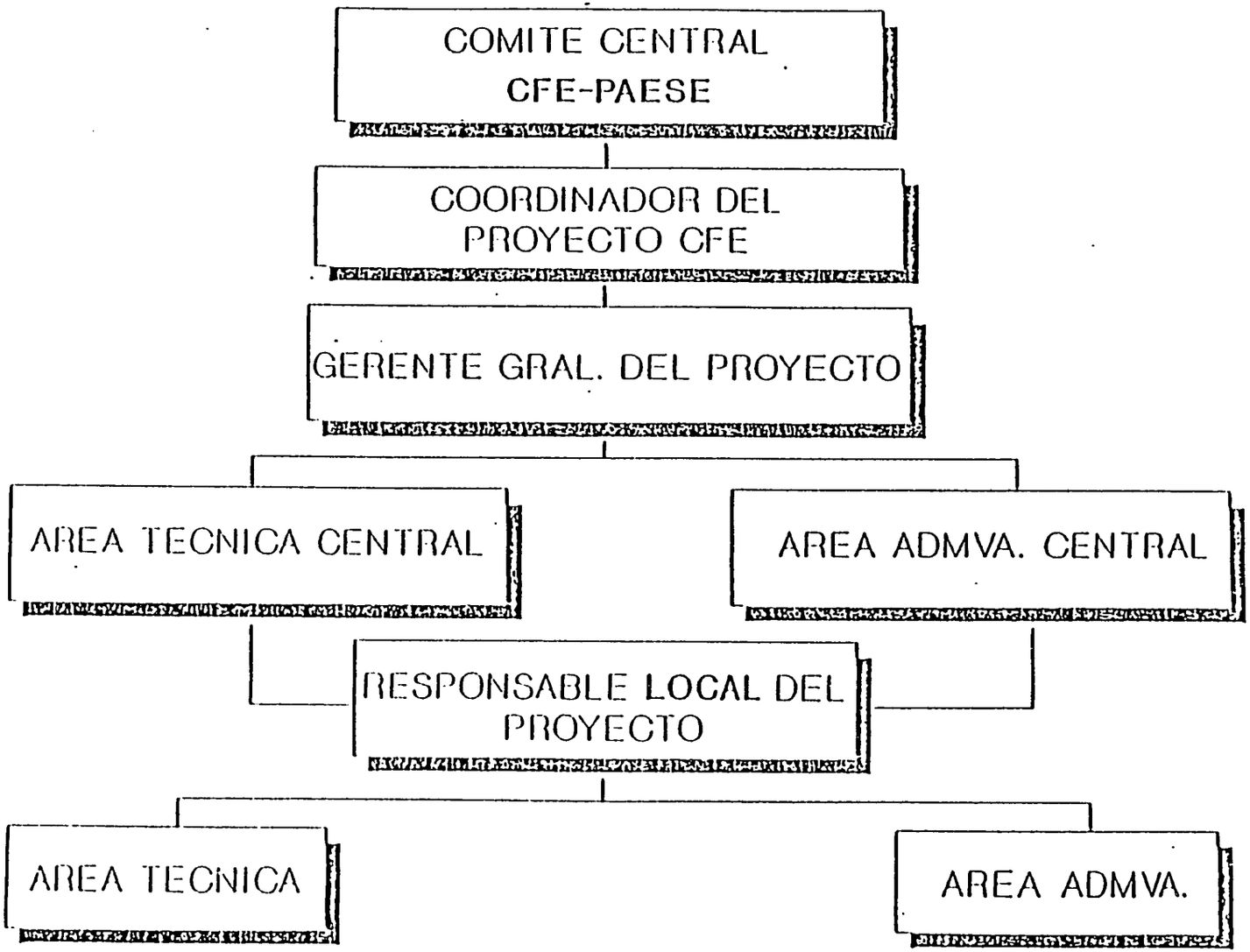
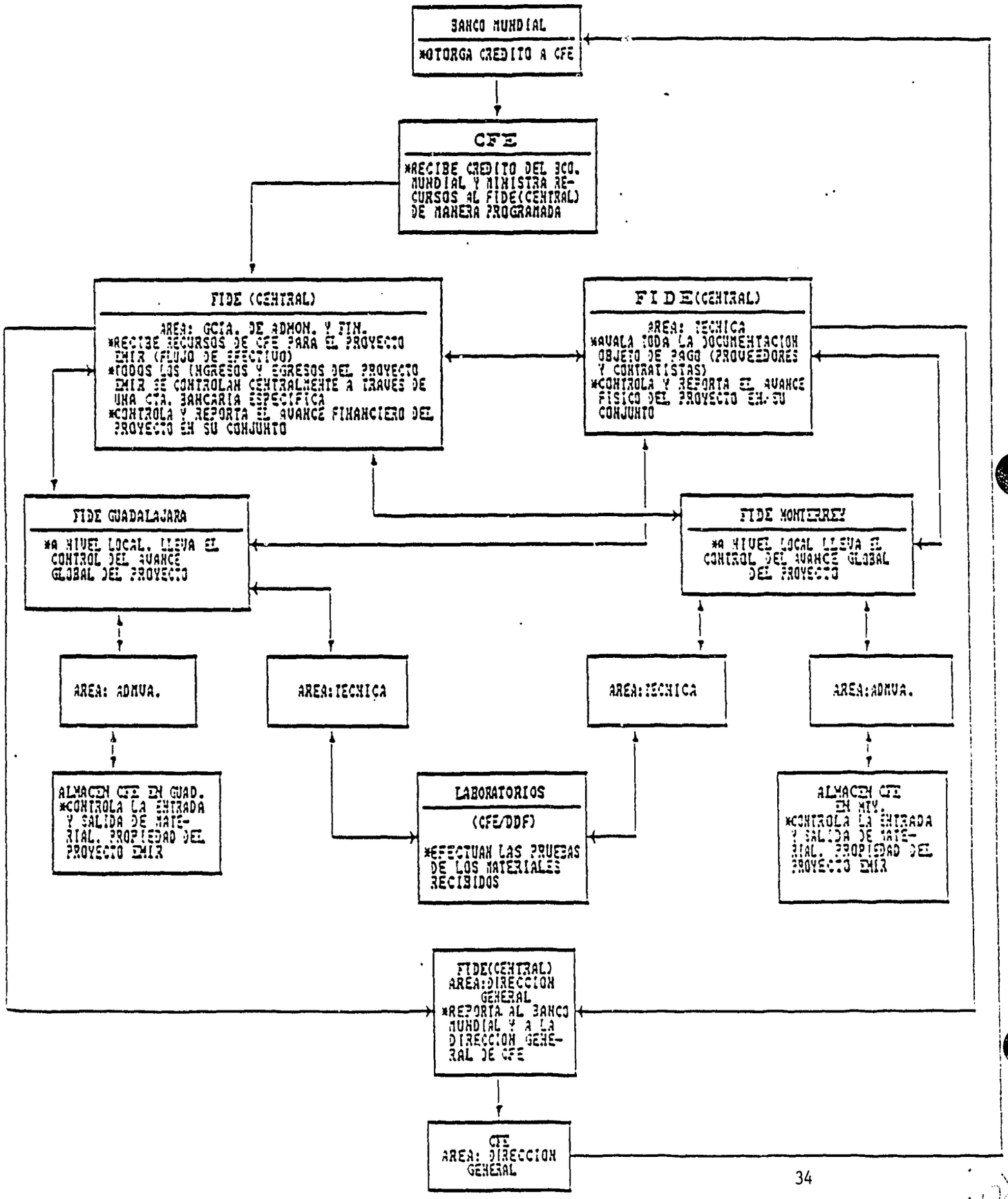
ESTRUCTURA FUNCIONAL DEL PROYECTO ILUMEX



MECANICA OPERATIVA RELACIONADA CON EL PROYECTO ILUMEX DEL BANCO MUNDIAL CIUDADES PILOTO: GUADALAJARA Y MONTERREY



Cost of Ilumex Project

The Ilumex project would be funded from the following resources:

Ilumex Project Funding Sources	
World Bank Global Environmental Facility	$10 million grant
Comisión Federal de Electricidad (CFE)	$10 million power loan
US Agency for International Development	$250,000 feasibility study, project development, and training
Total Ilumex project funding	$20.25 million

Project Budget

CFE designed an administratively-lean approach in developing the projected budget for the Ilumex project. The overall goal was to keep administrative costs under 10 percent and develop a continuous sales presence in the CFE offices, while allowing for an increasingly intensive expanded sales effort within target communities, should such need be indicated by project monitoring results.

Ilumex Project Costs (in million U.S. dollars over a period of two years:)*		
CFLs: 1,500,000 units @ $10/CFL	=	$15.00
Administrative costs -- $1.17/lamp	=	$1.75
Monitoring & Evaluation costs (full implementation)	=	$0.70
Total		$17.45
(Contingency)		($2.55)

Lamp acquisition costs are conservatively estimated at $10 per unit for the purposes of budget planning. The experiences of North American utilities, and the utility manager members of the Ilumex team indicate that the CFLs will probably be available at closer to $7 per lamp on average (several different lamp types will be acquired in the procurement). Since there is some uncertainty regarding the cost of the CFLs that meet the relatively rigorous requirements of the Ilumex specifications, and the ability of manufacturers to deliver the lamps, in the volume required, the Ilumex team chose to adopt the more conservative $10 per unit estimate.

The project implementation costs associated with Ilumex administration, capital costs, and overhead are detailed in the following spreadsheet. The *$1.17 per CFL* estimate assumes a scenario in which 1.2 million lamps are sold via the "Ventas de Agencia" method (direct sales and time purchases initiated at the CFE office CFL sales kiosks), and 300,000 lamps are sold through the "Neighborhood" process (including a combination of mobile kiosk/van sales, office, and a door-to-door direct sales effort). A "worst case" scenario in which all 1.5 million lamps must be sold through the Neighborhood approach -- at a cost of *$1.55 per CFL* -- is explored as a sensitivity in the economic analysis (Section 7). In the "best case" scenario, all 1.5 million lamps will be sold via the Ventas de Agencia method, at an estimated cost of *$1.08 per CFL.*

The costs associated with financing the purchase of the lamps over time, via the customers' utility bill are not accounted for as an expense here. CFE's cost of capital will be entirely recaptured in the interest rate charged to the customers that purchase using this option. It does, however, remain a program option to reduce the finance charges, in effect subsidizing the purchase of the lamps over time. CFE would still enjoy significant economic benefits with these subsidies (see Section 7).

Regardless of the mix of delivery mechanisms employed, the monitoring and evaluation budget has been calculated at $700,000 for the project, based on the evaluation plan built into the Ilumex project design. This amounts to an added implementation cost of *$.47 per CFL*, assuming the target of 1.5 million CFLs is installed. A detailed project evaluation budget is provided in Section 8 of this study, along with the Ilumex evaluation plan.

ILUMEX PROJECT ADMINISTRATIVE COSTS

VENTAS DE AGENCIA – (ASSUME: 600,000 - 750,000 LAMPS TO BE SOLD PER CITY)

(All Figures in Millions of Pesos)

Category	Sub-Category	2 yr. unit cost	Amortized Unit cost/m	Labor, O&M Cost/mo	TOTAL-Mthly Cost/Unit	Monterrey # of Units	Guadalajara # of Units	Total Monthly Cost-Monter.	Total Monthly Cost-Guadala.	Total Project Cost - 24 mo. MONTERREY	Total Project Cost - 24 mo. GUADALAJARA	Total Project Cost - 24 mo. BOTH CITIES
	Sales Booth	4.00	0.17	0.00	0.17	9.00	14.00	1.53	2.38	36.72	57.12	93.84
Transport	VW sedan	25.00	0.42	0.25	0.67	1.00	1.00	0.67	0.67	16.08	16.08	32.16
	Van	60.00	1.00	0.60	1.60	1.00	1.00	1.60	1.60	38.40	38.40	76.80
	Mobile office	120.00	2.00	1.20	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Office Equip	Computer	6.00	0.10	0.20	0.30	9.00	14.00	2.70	4.20	64.80	100.80	165.60
	Phone	5.00	0.08	1.50	1.58	1.00	1.00	1.58	1.58	37.92	37.92	75.84
	Fax	3.00	0.05	1.50	1.55	1.00	1.00	1.55	1.55	37.20	37.20	74.40
Labor	Secretary	0.00	0.00	1.00	1.40	1.00	1.00	1.40	1.40	33.60	33.60	67.20
	Salesperson	0.00	0.00	1.00	1.40	18.00	28.00	25.20	39.20	604.80	940.80	1545.60
	Driver	0.00	0.00	1.50	2.10	1.00	1.00	2.10	2.10	50.40	50.40	100.80
	Driver Super.	0.00	0.00	2.10	2.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Supervisor	0.00	0.00	2.10	2.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Proj. Manager	0.00	0.00	2.80	3.92	1.00	1.00	3.92	3.92	94.08	94.08	188.16
Advertising										$450.00	$450.00	$900.00
SUBTOTAL										$1,464.00	$1,856.40	$3,320.40
Overhead (@.17)										$248.88	$315.59	$564.47
TOTAL- Ventas de Agencia										$1,712.88	$2,171.99	$3,884.87

NEIGHBORHOOD SALES – (ASSUME: 150,000 - 250,000 LAMPS TO BE SOLD PER CITY)

Category	Sub-Category	Cost/Unit/Mo.	# of Units	Cost/Month	EACH CITY Cost/24 Mo.s	BOTH CITIES Cost/24 Mo.s
Space	Vehicle Garage	10	1	10	240	480
	Sales Booth	0.17	0	0	0	0
Transport Equip	VW	0.67	0	0	0	0
	Van	1.6	0	0	0	0
	Mobile Office	3.2	1	3.2	76.8	153.6
Office Equip.	Computer	0.3	1	0.3	7.2	14.4
	Phone	1.58	0	0	0	0
	Fax	1.55	0	0	0	0
Labor	Secretary	1.4	0	0	0	0
	Salesperson	1.4	6	8.4	201.6	403.2
	Driver	2.1	0	0	0	0
	Driver Super.	2.94	1	2.94	70.56	141.12
	Supervisor	2.94	0	0	0	0
	Proj. Manager	3.92	0	0	0	0
Advertising					0	0
Sub-Total					$596	$1,192
Overhead (@.17)					$101	$203
TOTAL - Neighborhood Sales					$698	$1,395

COMBINED PROGRAM ADMINISTRATIVE COSTS – (1.5 MILLION LAMPS)		$5,280
ADMINISTRATIVE COSTS PER LAMP	(IN PESOS)	$3,520
ADMINISTRATIVE COSTS PER LAMP	(IN DOLLARS)	$1.17

Timeline Schedule

The project will require approximately nine months to become operational, once funding is approved. This includes the time required to solicit lamp procurement bids, contract the testing laboratory, select winning bidders, test the lamps, negotiate lamp purchase contracts, establish the funding accounts and operating agreements between CFE/PAESE and FIDE, train staff, and hire the local project managers.

The project is initially projected to last only two years. However, Ilumex is designed to be self-sustaining. Therefore, just as funds are regenerated to finance program expansion throughout Mexico, so also can the funds be applied to extend the Ilumex project in Monterrey and Guadalajara. This serves to provide a more extensive penetration of the technically feasible market identified in the Ilumex market survey and to provide replacement lamps for the lamps already retrofit in the first stage of the program. Likewise, the project length could easily be extended to meet the initial 1.5 million lamp retrofit goal, if necessary with only minimal impacts on project economics.

The Project Timeline chart for Ilumex can be found in Section 1, the Executive Summary of this study.

4. Technical Specifications, Test Procedures, and Procurement

Introduction

A central focus of the Ilumex project is to advance the market for CFLs in Mexico both technologically, and in terms of the price and availability of the advanced technology. A large part of the Ilumex project's value, from both the Mexican and the international perspectives, lies in the ability of CFE to drive the market for CFLs under developing country conditions with the large procurement package that the project requires. Using its leverage as a large customer, CFE can use Ilumex to push the development of a superior CFL product that meets CFE objectives of superior efficacy, a high level of reliability, resiliency under poor power conditions and extreme ambient weather conditions, adequate product availability, and "utility friendly" performance (high power factor and low total harmonic distortion). The long-term benefits of such an impact on the Mexican (and global market) are immeasurable. The technical experts on the Ilumex team are confident of the technical feasibility of such success in driving innovation in the market with the Ilumex project.

The process of CFL procurement for Ilumex has already commenced. The Ilumex team met with nineteen Mexican and international manufacturers in both Mexico City and Los Angeles during June and July 1992. Ilumex team consultants made presentations to the manufacturers regarding the procurement process and the technical requirements of the project. The manufacturers provided displays and samples of their products, and each made a formal presentation on their products and capabilities. The team received advice from several U.S. utility managers on procurement based on the U.S. utility experience. In addition, the Ilumex team visited lighting test laboratories in Los Angeles and in Mexico City, as well as CFL manufacturing facilities. CFE is scheduled to advertise the upcoming bid process in international trade press in December 1992.

CFE International Bid Package Considerations

The market possibilities of the Ilumex project provide a significant opportunity for CFL manufacturers. Not only will CFL manufacturers have an opportunity to bid on delivering up to $20 million worth of products, but CFE intends to use the revenues generated by the project to expand the program throughout the country. In addition, the manufacturers who develop and produce the products specified for this project will establish a stronghold in the emerging developing country market globally.

In view of the attractiveness of the project to CFL manufacturers, CFE is in a unique position to leverage additional considerations within the bid package from CFL manufacturers.

It should be noted that each additional requirement placed on the manufacturers will directly increase the cost of the lamps. Often these costs will be greater than if CFE had simply handled the requested service through program staff. However, in some cases, the manufacturer's resources and capabilities indicate a preferred role for them. In addition, requiring additional manufacturer participation can provide a risk-sharing function between

CFE and the manufacturer, who will benefit from the market expansion input of Ilumex in the longer term. Adding these program costs to the lamp price also reduces risk to CFE by protecting the utility against certain fixed program costs in which Ilumex yields fewer sales than were projected for the program.

The negotiating considerations recommended to CFE, based on U.S. utility experiences are listed below:

Bid Package Considerations

- **Cooperative advertising**
- **Warehousing within 30-60 miles from program sites**
- **Guaranteed unscheduled delivery clause (e.g., x quantity within 30 day upon request)**
- **12-month product replacement warranty/guarantee**
- **Product training and promotional material**
- **Payment term discounts for early reimbursement by CFE**
- **No minimum purchase requirements**
- **Include a provision to purchase in excess of purchase order at existing prices**
- **Special packaging with CFE or FIDE logo including statement that CFLs are not for resale or perhaps a city-specific label (since voltage specification will differ for the two cities)**
- **Instructions (in Spanish) on use, warranty, and toll-free telephone number to return defective bulbs**
- **24 samples of each type bulb submitted in bid proposal**
- **Manufacturers to pay for bulb testing at designated testing laboratory in Mexico**

Recommended Specifications:

Given the intent of the overall project to replace incandescent light sources with the economically feasible alternative of compact fluorescent lamps, the following supplement is designed to provide technical specifications and test procedures for these compact fluorescent lamps. This information is to be outlined in four different specifications:

Specification for Purchase

The technical specification for purchase specifies the minimum performance characteristics of products that will be considered for this program. The intent of writing this specification is to identify those criteria which are critical to meet the needs of both the end user and the utility. The Specification for Purchase defines the criteria to be used

in determining which product will be accepted. These criteria emphasize the attributes of the compact fluorescent lamp of high efficiency, long life, power quality impacts on the utility distribution system, and adequate light quality.

Specification for Measurement by CFE

This specification defines the measurement which will be made by CFE (or subcontractor) to determine the performance characteristics of compact fluorescent lamps being considered for inclusion in this program. This specification defines what will be tested. The following specification will define how the test will be performed. Sample test forms that reflect each technical performance area to be measured by CFE under laboratory conditions are attached in the Appendices.

Specification for Procedure for Measurements

This specification defines the procedures which will be used in measuring the properties previously specified in Specification for Measurement by CFE.

Specification of Equipment

This specification will identify the equipment critical to making the measurements defined in the previous specifications. In general most lamp measurement equipment is sufficiently characterized by ANSI and IEC standards. Emphasis in this specification will be placed on that equipment that is atypical to the normal test procedures. The Mexico City municipal lighting laboratory has the equipment necessary for conducting the required tests.

Operating Assumptions

The product to be procured is a compact fluorescent lamp. The construction of this lamp can be either a one-piece lamp in which the light source and ballast are integrated into a single unit or a two-piece lamp in which the ballast and light source are separable. In the event that a two-piece product is procured, the manufacturer will be responsible for supplying both pieces and specifying performance on the basis of this combination. As a consequence of this assumption, no purchase specification have been developed on the separate ballast and light source performance. It is an economic and not a technical consideration as to the advantages of a two-piece lamp versus a one-piece lamp and is outside the scope of the technical specifications. The relative economic benefits are discussed in Section 7 of this study.

Technical Specifications for Purchase

Voltage		
Nominal Operating Voltage	120 V	127 V
Minimum Operating and Starting Voltage	108 V	116 V
Maximum Operating and Starting Voltage	132 V	140 V
Lamp Efficacy (minimum)	47 lumens per watt (lm/w)	
Lumens (minimum, 25 C operated base up)		

Category 1	750 lm
Category 2	1000 lm
Category 3	1400 lm
Lumen Maintenance at (1,000 hrs)	90% or greater
Color	
Type 1	4100 K
Type 2	2700 K
Color Rendering Index (CRI)	> 80
Rated life of lamp	10,000 hrs (3 hrs per start)
Noise	Residential Class Rating
Power Factor	>.90
Harmonic Distortion (not greater than)	
3rd Harmonic	30%
5th Harmonic	10%
7th Harmonic	7%
9th Harmonic	5%
Higher Harmonics	3%
Total Harmonic Distortion	33%
Electro-Magnetic Interference	Meets FCC limits (or Mexico National Standards)
Frequency of Operation of Lamp (if electronic)	Greater than 20 kHz less than 50 kHz
Construction of Lamp	
Base of Lamp	E26 (ANSI Standard)
Base of Fluorescent Tube (two-piece lamps)	Meets IEC standards
Physical Dimensions (diameter, height)	Determined by survey not to be applicable
Weight Limitation	Determined by survey not to be applicable
Safety	Meet UL equivalency
Packaging Operating Instructions	Clear and legible/Spanish language
Caution Notices	if required

Comments on Specifications for Purchase

Voltage

There are two nominal voltages within Mexico 120V (variance 108-132V) and 127V (variance 116-140V). The ideal lamp would operate over the entire voltage range, 108-140, without a significant change in performance. Both nominal voltages of 120V

and 127V were selected to provide the opportunity for magnetically ballasted products to be used in both sites. As the voltage decreases below the nominal voltage, it generally becomes more difficult for lamps to start. Conversely, as the voltage increases above the nominal voltage, power to the lamp generally increases which may cause overheating of the ballast and a subsequent shorter life. By choosing the two nominal voltages of 120V and 127V (+/-10 percent) we felt that we covered the broadest range of voltage for operation.

Lamp Efficacy

Given the nominal voltage for the compact fluorescent lamp, it is not necessary to specify the lamp current or lamp power, but rather to specify a minimum efficacy standard. A value of 47 lumens per watt was selected as an achievable standard for both electronic and magnetic ballasts as represented by the information supplied by Southern California Edison on their extensive testing results of CFLs currently available on the market. It is necessary, however, to measure the lamp current, voltage, and power, in accordance with ANSI C78.375-1991, to determine the efficacy.

Lumens

Three categories were specified based on the luminous output. The three categories provide an opportunity to specify minimum requirements for specific applications such as kitchen and work areas versus living spaces. Establishment of the lower limit of 750 lumens prohibits the use of 9 watt lamps which were found unacceptable in a previous CFE survey. Lamp measurements are made in the base up operation at 25°C in accordance with ANSI C78.375-1991.

Lumen Maintenance

The value specified is consistent with lamp manufacturer's specifications when using high quality discharge tubes.

Color

Two colors were identified for specification from a previous CFE survey, in which the high color temperature (4100 K) was desired in working spaces such as laundry and kitchen, and a lower color temperature (2700 - 3000 K) was desired in the living spaces.

Color Rendering Index

Color rendering index of 80 or greater was specified to insure the highest quality phosphors were used in the discharge source to provide a product which has the greatest acceptance by the end user.

Rated Life of Lamp

The rated lamp life is based on an operating cycle of 3 hours on and 20 minutes off and represents the mean life of the lamp where the failure rate should not exceed 50 percent by 10,000 hours, per IES LM-40-1987. For two-piece lamps, the rated life will insure that the ballast is properly matched to the lamp without requiring specification of ballast or lamp properties.

Noise

It is required that lamps meet minimum noise standards to ensure end-user satisfaction. In the apparent absence of Mexican standards to cite for this specification, the US standard will be adopted.

Power Factor

A cost of operating low power factor ballasts had been identified by CFE. This cost is more than compensated by power factor correcting the individual lamps when an electromagnetic ballast is used. It is less clear whether the power factor of electronically ballasted lamps can be increased to the minimum standard at minimal cost. This program will certainly provide the manufacturers the incentive to achieve this goal. Consequently, a power factor of greater than .9 was adopted for the standard.

Harmonic Distortion

The fluorescent lamp electromagnetic ballast system typically generates a current wave form which has a total harmonic distortion of between 20-30 percent. This system is used throughout the world with no noticeable adverse affect. Consequently, the specification adopts the IEC standard which is being accepted for electronic ballasts of fluorescent lamps. The international standard was selected on the basis of its relevance to the international bid process.

Electromagnetic Interference (EMI)

Mexico has not generated an EMI standard for light sources and has in general adopted the US standards established by the FCC as appropriate to its electronic industry. The FCC limits are known and recognized by manufacturers throughout the world.

Frequency of Operation of Lamp

If the lamp is operated by an electronic ballast, to minimize the potential of interference with other electrical appliances in the home, the frequency of operation has been specified to be greater than 20 KHz and less than 50 KHz.

Construction of Lamp

Base of Lamp

E26 Medium Screw Base - The base is specified to ensure that purchased lamps fit the Edison socket and meet the standards which ensure that good contact is made within the socket.

Base of Fluorescent Tube in Two-Piece Lamp

Applicable for two-piece lamps, the light source must have an IEC approved lamp base to ensure that replacements can be obtained from more than one source.

Weight

Restrictions on weight will be dependent upon the application as defined by the market survey. Generally there will be no unusual weight restrictions placed on the bidders. However, lighter CFLs will be favored marginally.

Dimensions

The overall length and diameter of the lamp will not be limited according to the results of the survey. However, more compact CFLs will be favored marginally.

Safety

It was decided not to specify UL approval since that is a private US testing company but rather to specify their standards for safety as tested by UL or an equivalent testing facility. This specification is critical to ensure safety of the end user.

Packaging

We feel it is critical that clear concise instructions be developed to assist the end user in identifying the appropriate application for the compact fluorescent lamp. Application notes would suggest uses which may encounter possible dimensional fit problems or cause instability in the luminaire being retrofitted. They would also suggest expected reduction in lumen output at extreme temperatures. The packaging should also provide any caution notices which may limit the use of the lamp such as wall dimmers, or restricted use in wet applications. All labeling and printed matter must be in clearly understood Spanish.

Preliminary Bid Specification Technical Requirements

Recognizing the economic and technological trade-offs involved in balancing sometimes competing criteria, an explicit weighting system will be employed to compare the bids of various vendors. It is expected that several products will be selected for demonstration in this program. It is also anticipated that the best performing CFLs in this demonstration will be used in future CFE programs, as well as elsewhere in the developing world, as World Bank and global utility interest in the technology grows.

The products selected for use in the Ilumex project will be subject to the following performance criteria:

(1) The CFLs will require voltage fluctuation tolerances, on the order of ±10 percent, but

(2) CFLs exhibiting wider voltage fluctuation tolerances will receive higher values in the weighting system.

(3) The CFLs must demonstrate longevity under low power-up conditions. The prototypes provided during the bidding process will undergo life tests over the anticipated voltage range for the Monterrey and Guadalajara service areas.

(4) The CFLs must demonstrate constant light output under variable power quality conditions.

(5) The CFLs will be judged on their ambient temperature tolerances under conditions typical of Monterrey and Guadalajara.

(6) To the extent that magnetic ballasts will be included in the procurement (which will include electronic ballasts, as well), power factor-corrected capacitors may be required-- subject to a cost-effectiveness test.

(7) All ballasts will be subject to electrical transients tolerance testing; Ilumex will employ existing international standards as a criterion.

Non-Technical Selection Criteria

(1) Contract will be awarded to the lowest evaluated bid.

(2) Each bidder will provide their own product guarantee for a specified period of time determined by CFE and conditionality to be determined individually. The terms of this guarantee, and the manufacturer's track record will play a large role in the manufacturers selected.

(3) Given the emphasis on performance, the bid process will probably favor non-integral ballast/lamp packages in order to maximize the operating life of the ballast investment. However, an integral CFL package that responds favorably to the technical criteria and price considerations explicit in the bid package will be considered.

(4) The manufacturers will need to prove their ability to deliver the products in a timely manner, reliably, with consistent quality assurance.

Laboratory Testing Measurement Procedures

The following specifications will guide CFE in conducting laboratory tests on the CFLs submitted by manufacturers as a part of their bids. CFE should test sample products of bid finalists before awarding contracts. The following procedures will guide CFE technicians in measuring the performance of the sample CFLs to corroborate manufacturer claims. CFL life testing cannot be completed within the time constraints of the Ilumex project. Manufacturer warranties will be used to assure performance claims in this area.

Sample test schedules providing standardized forms that CFE technicians can use in performing product performance tests are attached as Appendix A at the end of this study.

Measurements of the Operating Lamp-System: Initial Operating Performance

Initial performance of Lamp-System measured base-up at 25°C following a 100 hour burn-in. Measurements will be taken at the Nominal Input Voltage and at the Minimum and Maximum Operating/Starting Voltages: 120V, 108V, and 132V or 127V, 116V, and 140V. In the event the lamp is rated over both nominal voltages, measurements will be taken at 108V, 120V, 127V, and 140V.

The following measurements, therefore, will be made at the appropriate voltages following the specification of measurements prescribed by ANSI C78 and ANSI C82 in conjunction with IES LM-41-1985. Color Rendering measurements will be made in accordance with CIE Publication 13.2 And measurements of the Harmonic Distortion will follow in accordance with Annex A of IEC Specification 929 :

1) Input Voltage, True RMS
2) Input Current, True RMS
3) Input Current, Peak Value

4) Input Current, Crest Factor
5) Watts, RMS
6) Volt-Amps, RMS (#1 X #2)
7) Power Factor (#5/#6)
8) Lumen Output
9) Lamp Efficacy (#8/#5)
10) Color Temperature
11) Color Rendering Index
12) Percent Harmonic Distortion
    3rd
    5th
    7th
    9th
    Higher Harmonics
    Total Harmonic Distortion

Measurements of the Operating Lamp-System: Starting Test

Time-to-Start Test:

Measurements of "Time-to-Start" will be made at minimum, nominal, and maximum operating voltages at the minimum starting temperature as specified by the manufacturer and at 25°C.

	Minimum Voltage	Nominal Voltage	Maximum Voltage
Time-to-Start, (sec)			
(minimum starting temp - °C)			
(specified by manufacturer)			
Time-to-Start at 25°C, (sec)			

Measurement of the Components of the Operating Lamp-System: Initial Operating Performance

The following measurements will be made at the Input Voltage of 120V for the Lamp Measurements and the Nominal Rated Voltage of the Ballast for Ballast Measurements, following the specification of measurements prescribed by ANSI C78 and ANSI C82 in conjunction with IES LM-41-1985 and IES LM-66-1991. Color Rendering measurements will be made in accordance with CIE Publication 13.2. These measurements will only be applicable to Lamp-Systems where the ballast and compact fluorescent lamp are separable.

Component-Ballast Measurements:
1) Voltage to Lamp, RMS
2) Current to Lamp, RMS
3) Current to Lamp, Peak Value
4) Current to Lamp, Current Crest Factor
5) Current to Lamp, Amplitude Modulation (%)
6) Power to Lamp, RMS
7) Power to Ballast, RMS
8) Frequency of Operation

9) Ballast Factor

Component-Lamp Measurements (using a Reference Ballast):
10) Voltage to Lamp, RMS
11) Current to Lamp, RMS
12) Power to Lamp, RMS
13) Lumens
14) Lamp Efficacy
15) Color Temperature
16) Color Rendering Index

Measurements of Components of Lamp-Systems

Starting Tests

Component - Ballast measurement:

1) Starting Method for Light Source: ( ) Rapid Start ( ) Preheat ( ) Modified Rapid Start ( ) Instant Start
2) Time to Initiate Discharge
For rapid start, modified rapid start, and instant start ballasts, the time required until initiation of the discharge will be measured.
For systems applying current to cathodes prior to starting, the following test will be completed.
3) Filament Current During Starting Operation

This measurement will be made for preheat lamps using a dummy load, using a resistive value representative of the filaments. For rapid start and modified rapid start ballasting, current will be measured through filaments prior to the initiation of the discharge.

Life Test Measurements of Operating Lamp-Systems:

Life test measurements made by manufacturers are generally done in accordance with IES Specification LM-41-1985 which operates the lamp at the rated nominal voltage in a 25°C ambiance. It is recommended that this life test method be repeated independent of the manufacturers' results and to be expanded over the operating voltage range and at an elevated temperature of 60°C at nominal voltage. The operating cycle for all life test measurements will be 3 hours on 20 minutes off. Lamps would be operated at a series of voltages from the lowest to the highest rated voltage, hence the test schedule would be the following:

	-10% Nominal Voltage	-5% Nominal Voltage	+5% Nominal Voltage	+10% Nominal Voltage
1) Life Test: 25°C, Base-up Mean time to failure (hrs)				

Nominal
Voltage

2) Life Test: 60°C, Base-up,
Mean time to failure (hrs)

3)Rapid Cycle Test:

Lamps will be cycled on and off until failure. Lamps will be operated base down at 25°C and at the rated nominal line voltage. Lamps will be turned on for 10 seconds then turned off for 20 seconds. The number of cycles until failure will be noted.

Nominal
Voltage

3) Rapid Cycle Test:
Mean time to failure (# cycles)

Lamp Failure Tests of Operating Lamp-System:

Light source failure measurements will be made on two-piece lamps systems to determine the impact on the ballast component in the event the lamp fails.

1) Preheat Lamp-Systems:

For ballast components using two-pin lamps an electrical short will be placed between the two pin connectors used to connect the ballast to the lamp. This simulates a closed starter. The ballast will be operated at nominal voltage for 100 hours with the two pins shorted to determine if ballast characteristics have been altered. After 100 hours of testing, the Component - Ballast Measurements, Tests 1 to 9, will be repeated.

2) Electronic Lamp-Systems:

For four-pin lamps, the two respective pins for each filament will be shorted with a representative filament load to simulate a breakdown in the discharge which could result in filaments being continuously heated without the discharge being initiated. Operation of these ballast components will proceed at nominal voltage for 100 hours. After 100 hours of testing, the Component - Ballast Measurements, Tests 1 to 9, will be repeated.

3) Lamp Removal:

Ballast components will be tested without the presence of the light source for 100 hours to determine if the performance of this component has been altered. It would simulate the occurrence of lamp removal at end of light source life. After 100 hours of testing, the Component - Ballast Measurements, Tests 1 to 9, will be repeated.

5. Project Benefits

The cumulative experience of CFL DSM programs in Europe and North America leads many practitioners to conclude that a win-win-win outcome accrues for customers, the utility, and society. The Ilumex project has been designed to capture these benefits from each of these perspectives within the Mexican context.

End-Users:

The benefits to customers result from a combination of: 1) a comparable or improved quality of light; 2) savings on their utility bills; and 3) a lease arrangement option that enables them to purchase the CFLs without up front capital at a rate that allows for payments out of savings resulting from the use of the CFLs.

Utility:

CFE accrues multiple financial, environmental and public relations benefits. These are highlighted in the accompanying box.

Ilumex Benefits for CFE

- **CFL installation in residential households provides the utility a least-cost electricity resource opportunity based on the total resource cost-effectiveness test, saving CFE generation, transmission, distribution and fuel costs; The key to these savings is that residential lighting use corresponds directly with CFE's peak power demand period. The replacement of incandescent light bulbs with high efficiency CFLs will directly reduce the system peak. The market study conducted by the Ilumex team in Monterrey and Guadalajara bears this out; close to two million of the lamps in the two cities that operate for more than four hours per day are physically replaceable with CFLs (3.7 million operate over two hours per day). These lamps have an extremely high peak coincidence factor (see market study summary in Section 6) and the users are very amenable to CFL technology, once they are educated about the benefits.**
- **Each unit of electricity saved in the low-use tariff group of the residential sector directly lowers the subsidy outlays of CFE under the existing tariff structure, providing another unit of electricity to be sold to high-tariff large users;**
- **The project is a highly cost-effective way for the utility to establish a positive image with its customers, helping them to use advanced technologies that save them money on their utility bills and establishing a service identity for CFE; This is an important resource for CFE, which faces significant public image problems and has even experienced terrorist attacks on its physical plants in recent years.**

- **The project provides a mechanism for mitigating rate shock among heavily-subsidized low-use tariff customers as CFE institutes marginal cost pricing; Reducing usage among these users -- for whom lighting represents the primary form of electricity use -- allows CFE to raise rates with little or no net cost to this user group. The move to marginal cost pricing across all user classes is an important long-term development strategy for CFE. Ilumex provides an important tool for facilitating this pricing policy reform in a politically-charged environment.**
- **While non-residential CFL installations are more cost-effective than residential CFL installations, inclusion of the residential sector is politic for gaining widespread support for the non-residential CFL DSM programs (i.e., discontent could arise if the project was limited to non-residential customers).**

Society:

Society-at-large also accrues multiple benefits from the project. According to the Ilumex economic analysis, each CFL, on weighted average, will displace the need for 50 watts of generating capacity and the capital required to construct and operate that capacity. Overall, the installation of nearly two million CFLs through the Ilumex project will defer over 80 MW of peak capacity, avoid annual generation of over 140 million kWh, and provide a net societal benefit of more than 130 billion pesos (actual savings are difficult to project because three wattages of CFLs will be marketed, and the hours of operation will vary for each lamp).

In addition, the Ilumex project will accrue environmental benefits to the cities of Monterrey and Guadalajara, as well as Mexico and the global environment, as a result of a reduction in several pollutants. Because specific data on emissions from Mexican oil-fired power plants was unavailable, we include in the feasibility study for illustrative purposes the estimates for emissions for an oil-fired Steam Plant using #6 oil .

Emissions from an Oil-fired Steam Plant using #6 Oil

(column 4 is estimated annual emissions reductions from the Ilumex project based on installation of 1.5 million CFLs)**

		Savings per kWh	Ilumex Project Savings**	
Heat Rate	BTU/kWh	9,840	n.a.	
Oil-Sulfur Content	%S	2 %	n.a.	
S	kg S/kWh	*5.63 $x10^{-3}$	760-1013	$x10^3$kg
SO_2	kg SO_2/kWh	1.15 $x10^{-2}$	15.5-20.7	$x10^5$kg
NO_x	kg NO_x/kWh	1.33 $x10^{-3}$	180-239	$x10^3$kg
C	kg C/kWh	.204	27.5-37	$x10^6$kg
CO_2	kg CO_2/kWh	.75	101-135	$x10^6$kg
Methane	kg CH_4/kWh	*1.61 $x10^{-3}$	217-290	$x10^3$kg
Hydrocarbon	kg HC/kWh	3.06 $x10^{-5}$	4.1-5.5	$x10^3$kg

Carbon Monoxide	kg CO/kWh	1.53 $x10^{-5}$	2.1-2.8	$x10^3$kg
Particulates	kg TSP/kWh	1.27 $x10^{-3}$	171-229	$x10^3$kg
Solid Waste	kg /kWh	.05	6.8-9	$x10^6$kg

SOURCE: U.S. Department of Energy, Energy Technology Characterization Handbook: Environmental Pollution and Control Factors, (DOE/EP-0093, March 1983).

Notes:

a. * Estimates from P. Chernick and E. Caverhill, The Valuation of Externalities from Energy Production, PLC, Inc., Boston, MA, 1989.

b. ** Based on 9,000 hour lifetimes per CFL, and a weighted average savings of 50.4 watts per CFL (67.2 incandescent replaced with a 16.8W CFL). In actuality, there will be three high-lumen per wattage size CFLs available through the project ranging between 13 and 22 wattages.

6. Market Analysis: Monterrey and Guadalajara

Introduction

When designing a DSM program it is necessary know how, when, and how much electricity is used by the customer group that is being targeted. For this project the first two questions were answered through a survey done in Guadalajara and Monterrey, the two cities where the project will be implemented. Also important is the tariff information, which determines the amount of money the customer would save from installing CFLs, and the extent to which CFE would lose revenue. The CFE tariff schedule is attached at the end of this section.

Guadalajara and Monterrey

Guadalajara and Monterrey are the two largest cities served by CFE.[6] They also represent two different types of residential tariffs, one for temperate climate localities and the other for hot climate localities. Guadalajara's electrical customers are served under Rate 1, which is the tariff for temperate climate localities. Monterrey's residential customers are served under Rate 1-B which is one of the four tariffs for residential customers living in locations with average summer temperatures above 28°C.

Guadalajara is the capital city of the state of Jalisco and is located about 400 miles northwest of Mexico City. Its climate is temperate with low relative humidity. Guadalajara's metropolitan area population is estimated at 3.6 million.

There are an estimated[7] 590,000 residential customers in the metropolitan area of Guadalajara. Their average consumption is 125 kWh/month with a median of 75 kWh/month (Fig. 1). This average consumption does not change much with seasons because Guadalajara's residential customers don't use significant amounts of electricity for space heating or cooling.

Monterrey is the capitol city of the state of Nuevo Leon and is located about 500 miles north of Mexico City. Its climate is hot in the summer and temperate in the winter. Monterrey's metropolitan area population is estimated at 3.1 million.

There are an estimated 600,000 residential customers in the metropolitan area of Monterrey. Their average consumption is 200 kWh/month (65 percent more than Guadalajara's), with a median of 125 kWh/month (Fig. 1). Electricity consumption changes through the year with the highest consumption occurring during the summer months when air-conditioning is used.

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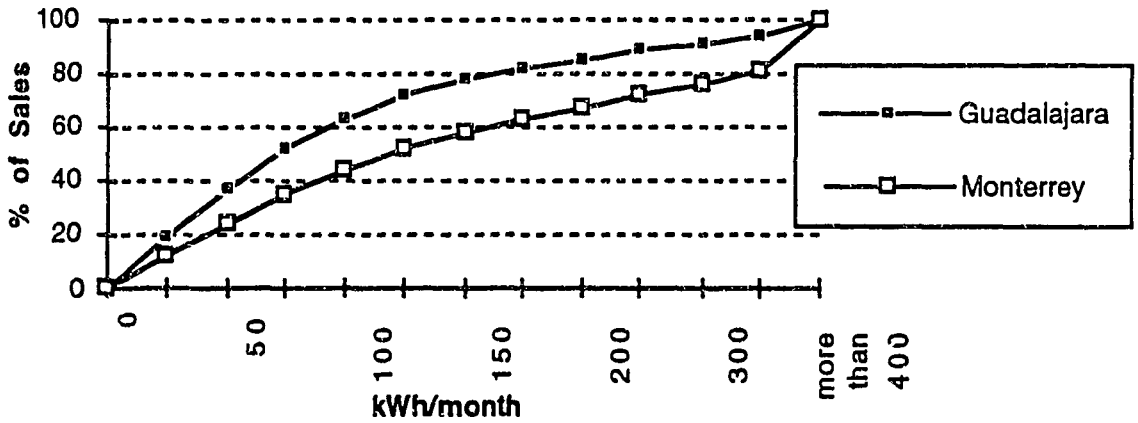
[6]CFE doesn't distribute electricity in Mexico City, Mexico's largest city. Mexico City's metropolitan area and of the surrounding cities are served by Compania de Luz, a formerly private utility that was created before CFE. Compania de Luz generates a small fraction of the electricity is sells and buys the rest from CFE at a fixed price.

[7] The estimation was based on December 1990 values and extrapolated to December 1992 using the growth rate from January to December of 1990.

Figure 1: Accumulated Sales by kWh/month. Guadalajara and Monterrey, 1990.



The difference observed in Fig.1 between the Guadalajara and Monterrey lines is due, among other factors, to the use of air conditioning in Monterrey. While for Guadalajara only about 15 percent of its customers have consumption of more than 200 kWh/month, this figure is 25 percent for Monterrey.

Residential-Tariff Structure

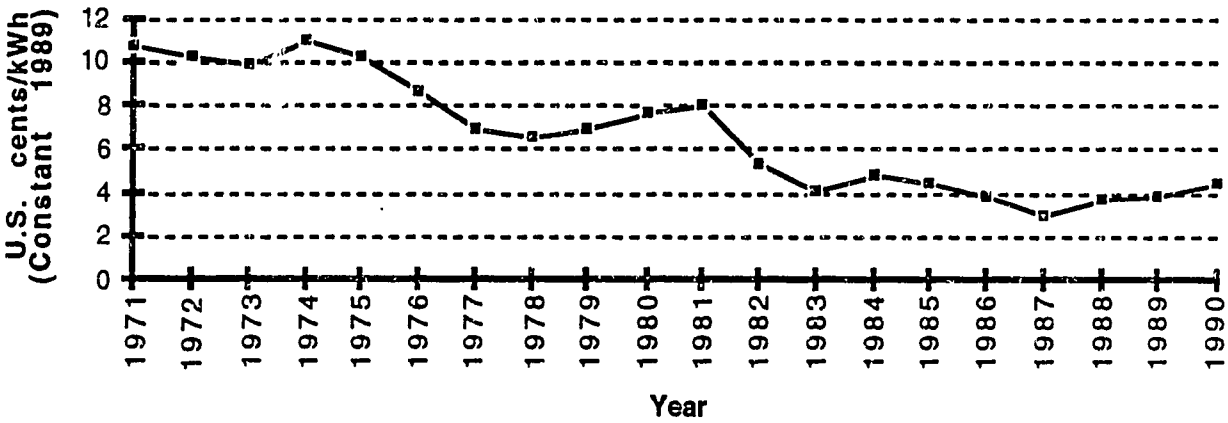
Electricity in Mexico is sold under 17 different rates that are classified according to the type of service. Five out of the 17 rates are residential and they are defined based on the average temperature of the two consecutive higher-temperature summer months. Rate 1 is the one that applies for locations with temperatures of less than 25°C. Rate 1-A is for locations with temperatures of more than 25°C, Rate 1-B is for equal or more than 28°C, Rate 1-C is for equal or more than 30°C, and Rate 1-D is for equal or more than 31°C.

Residential electricity tariffs in Mexico are established to charge more for higher consumption. The price for electricity for the residential customers in Mexico ranges from 0.015 (for the first 25 kWh in a month) to 0.143 $US/kWh (for kWh above 200 kWh/month).[8] Average price of residential electricity in 1990 was 0.043 $US/kWh (Fig. 2). This residential-tariff structure is a reflection of old social policies of the Mexican government that try to protect the purchasing power of the lower income sectors of the population. This structure, however, represents a high cost in subsidies.

The current residential tariff schedule is attached at the end of this section.

[8] The price for the top kWh will depend on the rate applicable for a given locality. In the most extreme case (Rate 1-D) customers are charged 0.143 $US/kWh only after 1000 kWh/month.

Figure 2: Average Residential Electricity Tariff, Mexico.



Average residential rates in 1990 were less than half of the average rates in 1971. Figure 2 shows how this average price has shifted over 20 years. The most dramatic shift occurred in the two year period between 1981 and 1983 when the tariff was reduced, in constant dollars, in half. This was a result of higher than expected inflation levels.[9] After 1983, as the figure shows, there was an attempt to recover some of the lost ground but inflation remained high and the adjustments were not sufficient. In 1988 a new presidential administration succeeded in controlling inflation and since then the average price of electricity for residential customers has been increasing.

Household Survey

A household survey was performed in the Summer of 1992 in Guadalajara and Monterrey to define the technical potential for replacement of incandescent lamps with CFLs. A replaceable lamp is an incandescent lamp that can be substituted with a CFL. The criteria used to decide on replaceability were: the incandescent lamp had to be in a fixture where a CFL would easily fit, the incandescent lamp in such a fixture needed to be at least 40 Watt in size, and had to be used at least 2 or 4 hours per day.

The sample size was set on 500 households per city, but the survey resulted in 480 households surveyed in Guadalajara and 526 in Monterrey (Table 1). The survey gathered data on household characteristics and on the number, type, power rating, and time of use of lamps, fixtures, and appliances. The survey also included a section on acceptability of CFL technology.

Table 1 shows the salient results from the survey. Most of the homes surveyed were single houses, which results from the fact that the majority of low-income dwellers

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[9] Up until the second half of the eighties, electricity tariffs were revised once a year and defined according to, among other factors, inflation expectations.

live in houses that they constructed on their own. The average number of occupants is greater for Guadalajara than Monterrey.

Regarding lighting, the survey showed that Guadalajara's houses have, on average, more fixtures per home and higher average per-lamp wattage. Monterrey's houses have, however, more lamps per house.

The number of replaceable lamps changes depending on the number of hours the lamp is used. Table 1 shows values for 2 and 4 hours of use per day. The number of replaceable lamps grows inversely to the number of hours. The number of replaceable lamps for Guadalajara's homes that are used 2 hours per day is 150 percent greater than those used 4 hours per day; in Monterrey the difference is less than a 100 percent. In both cases Monterrey's houses have a higher number of replaceable lamps.

The survey shows a predominance of the 60 Watt incandescent lamps in both Guadalajara and Monterrey. In Guadalajara this is more notorious, with more than half of the lamps having this Wattage. For both cities more than 75 percent of the lamps are 75 Watt or less.

Table 1. Guadalajara and Monterrey's Household-Survey Results

		Guadalajara	Monterrey
Sample Size		480	526
Type			
	House	386	374
	Apartment	52	15
	Other	12	16
Avg. No. of occupants		5.06	4.46
Total Average			
	Fixtures/house	6.26	5.06
	Watts per lamp	67.50	66.80
	Total lamps/house	8.70	11.10
Replaceable lamps/house			
	4 hrs/day	1.30	1.80
	2 hrs/day	3.20	3.40
Lamp size distribution (percent)			
	40 Watt	11	20
	60 Watt	53	32
	75 Watt	16	26
	100 Watt	20	18
	Other sizes	1	4
Number of households		567566	549285
Number of CFLs per city (x1000)			
	4 hrs/day	738	989
	2 hrs/day	1816	1868

Table 1 also shows a city wide extrapolation of the number of lamps that can be replaced. The maximum number (for lamps used 2 hrs/day) for Monterrey is 1,868 thousand

replaceable lamps. The project total for the two cities, assuming total replacement of all the lamps that are replaceable and that are used 2 hrs/day, could reach 3.6 million lamps.

The survey also collected data about the time of use of the lamps. The results show that most of the lamps are used at night when their use coincides with the peak load of the electrical system. The following graph shows the relative frequency of use of the lamps through the hours of the day. The graph shows very little use during most of the day except for the period that starts at 6 p.m. and ends by 11 p.m. Between 8 and 9 p.m. most of the lights are on. Those are the hours of greater power demand in Mexico's electricity system.

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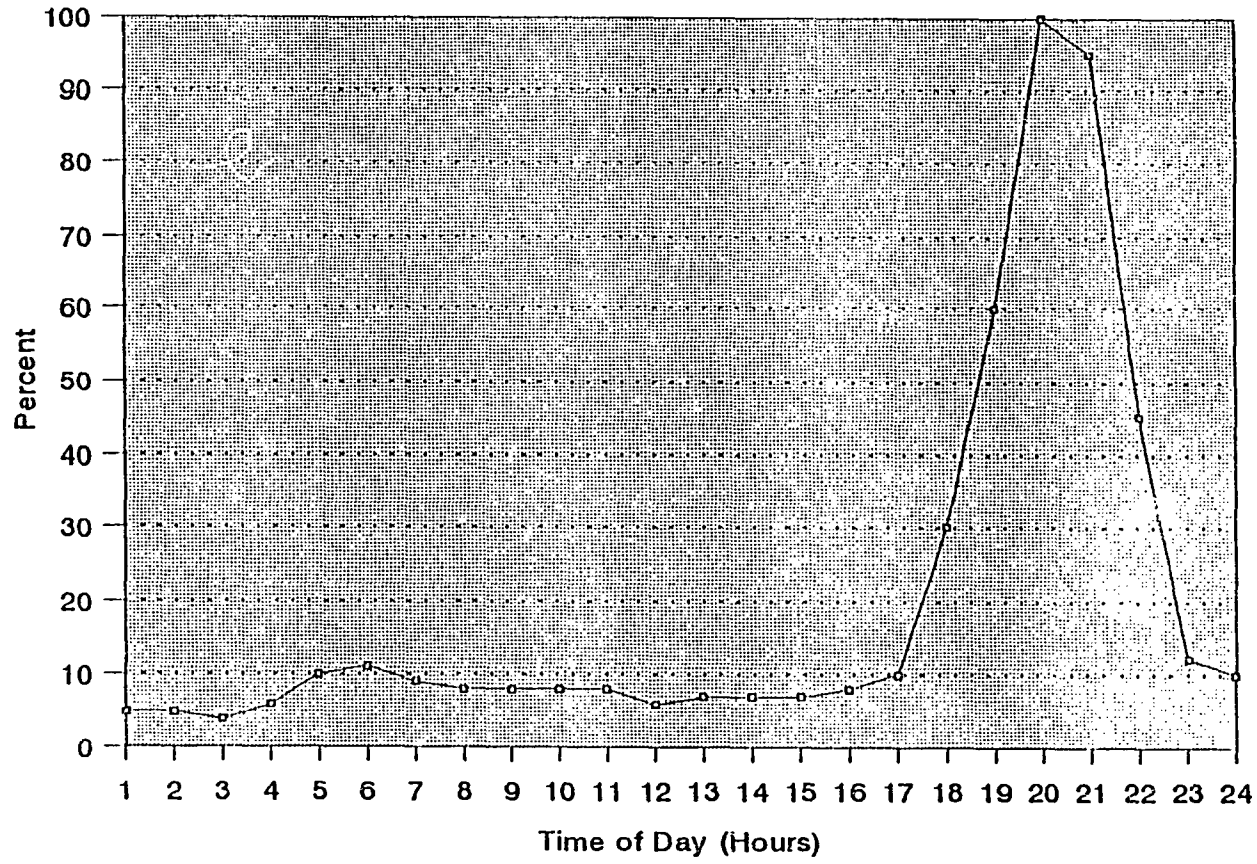
Percentage of Residential Lamps in Use

Guadalajara, Yearly Average, 1992



COMISION FEDERAL DE ELECTRICIDAD
ESTRUCTURAS TARIFARIAS VIGENTES
OCTUBRE DE 1992

TIPO DE SERVICIO	RANGOS DE CONSUMO (KWH)	CARGOS POR MANTEN. ($/Usuario)	CARGO FIJO ($/Usuario)	CARGOS DEMANDA POR KW	CARGOS ENERGIA $/KWh
1 RESIDENCIAL	0-25 4/	3,627			56.65
(FUERA DE VERANO)	26-50 4/	4,231			80.81
	51-75 4/	4,835			106.29
	76-100 4/	4,835			123.41
	101-200 4/	6,044			136.45
	201 Y Más 5/	9,086			433.46
1A RESIDENCIAL	0-25 4/	3,627			45.32
(VERANO)	26-50 4/	4,231			64.65
(Temperatura mínima 25°C)	51-75 4/	4,835			85.04
	76-100 4/	4,835			98.74
	101-200 4/	6,044			109.16
	201-250 4/	9,066			151.37
	251 y Más 5/	9,086			433.46
1B RESIDENCIAL	0-25 4/	3,627			45.32
(VERANO)	26-50 4/	4,231			64.65
(Temperatura mínima 28°C)	51-75 4/	4,835			85.04
	76-100 4/	4,835			98.74
	101-200 4/	6,044			109.16
	201-300 4/	9,066			121.12
	301 y Más 5/	9,086			433.46
1C RESIDENCIAL	0-25 4/	3,627			45.32
(VERANO)	26-50 4/	4,231			64.65
(Temperatura mínima 30°C)	51-75 4/	4,835			85.04
	76-100 4/	4,835			98.74
	101-200 4/	6,044			109.16
	201-500 4/	9,066			121.12
	501-750 4/	9,066			151.37
	751 y Más 5/	9,086			433.46
1D RESIDENCIAL	0-25 4/	3,627			45.32
(VERANO)	26-50 4/	4,231			64.65
(Temperatura mínima 31°C)	51-75 4/	4,835			85.04
	76-100 4/	4,835			98.74
	101-200 4/	6,044			109.16
	201-500 4/	9,066			121.12
	501-750 4/	9,066			151.37
	751-1000 4/	9,066			206.23
	1001 y Más 5/	9,086			433.46

TIPO DE SERVICIO	RANGOS DE CONSUMO (KWH)	CARGOS POR MANTEN. ($/Usuario)	CARGO FIJO ($/Usuario)	CARGOS DEMANDA POR KW	CARGOS ENERGIA $/KWh
GENERAL 2	0-50 5/	5,502	3,931.13		296.23
HASTA 25 KW /6	51-100 5/	5,502	3,931.13		370.46
	101 Y Más 5/	5,502	3,931.13		414.17
GENERAL 3 /5		9,170		40,973.62	203.75
25 KW y más /6					
5. ALUMBRADO	A.T.	9,999			410.76
PUBLICO (1/)	B.T.	9,999			489.32
5A. ALUMBRADO	A.T.	9,999			308.07
PUBLICO (2/)	B.T.	9,999			367.01
6. BOMBEO DE AGUAS POTABLES O NEGRAS			42,156.57		233.38
7. TEMPORAL /5 /6		9,170		25,731.16	643.38
9. BOMBEO DE AGUA	1-5000	3,000			89.62
PARA RIEGO AGRICOLA /3	5001-15000	3,000			107.13
	15001-35000	3,000			118.24
	35001 y más	3,000			131.29

1/ Para ser aplicada en el Distrito Federal, Monterrey y Guadalajara
2/ Para ser aplicada en el resto del país
3/ Se aplica un factor de ajuste mensual de 1.03 en el cargo por energía
4/ Se aplicará un factor de ajuste mensual de 1.0057 en todos los cargos
5/ Se aplicará un factor de ajuste mensual de 1.0079 en todos los cargos
6/ Se ajustará la facturación mensual por la variación en los precios de los combustibles.

7. Economic and Environmental Analysis

Introduction

This section presents the economic and the air pollutant emissions impact analysis for the Ilumex project, and for the project's expansion to the rest of Mexico. The purpose of this section is: (1) to illustrate the economic feasibility of the project, and (2) to estimate the reduction of air pollutant emissions created by the Ilumex project. In addition, the methodology and tools applied for this economic analysis may be used in the future for continued economic evaluation of the project in conjunction with the on-going evaluation component of Ilumex.[10]

Ilumex is a demonstration DSM project structured to promote faster penetration of compact fluorescent lamps in the 1.1 million residential households of Monterrey and Guadalajara.[11] The Comision Federal de Electricidad (CFE) is the sole supplier of electricity to residential users in each city. CFE anticipates that successful implementation of the Ilumex project will lead to Mexico-wide expansion of the project. The total electricity and capacity savings derived from an expanded project would be much larger than for the Ilumex demonstration in Guadalajara and Monterrey. The expanded project impacts are detailed at the end of this section of the study.

In this section we present the benefits and costs of the Ilumex project, and of a nationwide program, from the societal perspective, and the perspectives of CFE and the consumer. For each of the three perspectives, we illustrate the net present value of benefits, the internal rate of return, and the annual cash flow generated by the project. The payback period is estimated from the customer perspective in order to determine the attractiveness of the Ilumex project to the customers, and feasibility of the proposed lamp pricing structure.

Our analysis examines the economic and environmental impacts of the Ilumex project assuming the lamps are installed over a two year period as planned. For the Mexico-wide program, our analysis examines the impacts on a per lamp basis.

We present the general assumptions followed by a discussion of the market potential for dissemination of lamps in Guadalajara and Monterrey, the economic analysis of the Ilumex project, environmental implications of the project, and an analysis of the sensitivity of economic benefits to customer tariffs, and to higher project transaction costs.

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[10]For example, we have assumed a very conservative cost of 30,000 pesos per CFL plus the calculated administrative cost of 3,520 pesos per lamp. The Ilumex team fully expects that CFE will pay significantly less than 30,000 pesos per lamp through the international bid process which will improve the net project benefits. Southern California Edison, for example, purchases CFLs at close to 15,000 each through bulk purchase arrangements.

[11]At the end of 1990, the number of residential users was 567,566 in Guadalajara and 549,285 in Monterrey. This is a total of 1,116,851 residential customers in both cities. The number of residential users increased at about 3.9 percent during 1990 in both cities. If this growth continues, one could expect to have 1.161 million residential users by September of 1993 and 1.176 million residential users by December of 1995.

Finally the analysis explores the benefits of expanding the Ilumex project throughout Mexico.

Methodology

The use of CFLs will result in fuel savings, deferment of generation and transmission and distribution capacity, and avoided incandescent light bulb purchases. In a cost-effective project, these savings will outweigh the additional cost of a CFL and its delivery project.

Perspectives

- From the customers' perspective--the use of CFL lamps will reduce their electricity bills. Customer will also forego purchases of incandescent bulbs. These benefits will be offset by the purchase price of the CFL, including the administrative cost of the Ilumex project.[12]

- From CFE's perspective-- the introduction of CFLs in the residential sector will reduce its fuel use for electricity generation and allow it to defer generation, transmission, and distribution capacity. CFE will lose revenue because it will sell less electricity in the future.[13] The Ilumex project's focus on low-use tariff customers could shift usage away from subsidized customers to high tariff users, resulting in actual revenue increases, if the project works as intended. Revenue loss could be avoided if CFE were to add project costs to the rate base calculation which would permit it to recoup the additional costs of a CFL project. This practice is followed by some US utility regulatory agencies and companies when dealing with private utility DSM investments. In the Ilumex project, CFE will actually derive revenues directly from lamp sales which will offset all project costs.

- From society's (national) perspective gains arise since Mexican citizens can obtain the same amount of light (lumens) at a lower cost than before. The nation will incur the CFL cost and the transaction cost of administering a CFL project. It will gain because of capacity deferment, reduced fuel use (which free oil resources for export), and avoided incandescent lamp purchases.

Cash Flows

- The customer's cash flow is relatively straight forward to estimate. He would incur an up front cost in the investment in the CFL. This would be offset by recurrent electricity and incandescent lamp savings. In selecting the payment-overtime purchase option,

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[12]A CFL lamp lasts about 9,000 hours and the CFL ballast between 30,000 and 50,000 hours. With modular CFLs, when the lamp "burns out", it can be replaced. Lamps cost a fraction, typically 1/4 that of a CFL with ballast. In our analysis we did not consider the option of replacing the lamp when it burns out. We could not ensure that CFE would still be running a program to entice the customer to continue to use CFLs. If such circumstances could be programmatically assured, the 9,000 hour benefit could be extended considerably at a fractional cost securing kWh for electricity service to less than 1 percent per kWh.

[13]A Mexico-wide CFL program may not pose a lost revenue problem, given a 6 percent annual electricity growth rate. Each kWh saved in the program can be resold. Given that the cost of saved electricity is less costly than new generation, CFE would minimize Present Value Resource Required (PVRR).

customers can obtain a constant positive cash flow over the course of lamp ownership, with only the initial 5,000 peso outlay.

- The utility company's cash flow is more difficult to estimate. Several techniques are used to estimate the benefit to the utility company from avoided energy use and avoided capital costs for new plants. The simplest and best technique would be to simulate utility operations and plans under successively lower peak loads. In our study, this would be accomplished by simulating a peak load reduction in increments of 25 MW in each city up to a total of 100 MW. The resulting fuel and capacity savings would then provide a basis for determining the benefit to CFE and the nation from a CFL program. Unfortunately, CFE was not able to provide the Ilumex team with this information. However, an earlier tariff study had determined the long run marginal cost of energy and demand at the distribution level.[14] The demand cost was estimated at US $132.5/kW-year and the energy cost at US 6.2 cents/kWh.

Another approach, which is also used in the US, is to estimate the deferred generation and transmission and distribution capacity resulting from a demand-side management project. The energy benefit is estimated on the basis of the most expensive short-term generation costs. The assumption here is that a utility company would curtail operations of fuel oil or diesel power plants in order to reduce its immediate operating costs. The reduced fuel use will result in reduced emissions of various air pollutants.

An alternative approach would be to estimate the capacity deferment and energy savings from CFL use. The capacity and energy figures would then be translated into corresponding monetary benefit to CFE and the nation.

In our approach, we have tried to use the best information available to the Ilumex team. Since the long-run marginal demand and energy costs at the distribution level were available to the team, we have used these to determine the value of capacity and energy savings to CFE and the nation.

Fuel savings were estimated on the basis of avoided use of fuel oil plants. Air pollutant emissions were also estimated on the same basis.

The number of years that the generation and transmission and distribution (T&D) capacity is deferred will depend on the duration of the project. Since we cannot determine the duration of the program (something CFE will have to decide based in part on the experience of the Ilumex project), we have used the useful life of the CFL instead as the duration of the project, i.e., about 6 years at 4 hours of use per day.[15]

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[14] Electricite de France. Tariff Study, December 1991.

[15] A long term involvement by CFE in the promotion of CFLs could ensure permanence of savings. This could be done through incentive programs to users to assure that they replace worn out CFL lamps with similar lamps. Another possibility is to target CFL manufacturers and distributors to obtain a significant reduction in the price of CFLs to consumers, so that they will replace the CFLs with CFLs when the initial lamps no longer work.

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General Assumptions and Data

Table 1 shows the data used in the economic analysis for the three perspectives.[16] We use a 10 percent discount rate for the societal perspective. A 12 percent discount rate is used for estimates from CFE's perspective, which is consistent with current practice at CFE, and at the World Bank for CFE projects. Customers traditionally have a higher discount rate than the utility company or society. However, we do not have estimates of discount rates for Mexico customers (which also vary by income group). Our limited information reveals that credit card rates for borrowing money are as high as 36 percent in Mexico and rates for car and home purchase are around 24 percent. Current inflation is reportedly at 12 percent. These figures suggest real discount rates between 12 percent and 24 percent. We have chosen 18 percent as the average discount rate to use in examining the economic impact from a customer's perspective.

An exchange rate of 3,000 pesos per US $ is used in all the calculations. All figures given are in pesos, unless noted as US$. The real discount rate is assumed because, as CFE moves to marginal cost pricing, the avoided cost of electricity is expected to rise faster than inflation. In effect, the use of a 24 percent discount rate as a sensitivity run allows us to include inflation in our calculations as well, providing a nominal discount rate for the analysis.

Table 1:
Assumptions and Data for the Economic Analysis

	Societal	CFE	Customer
Discount Rate (Real)	10%	12%	18%
Exchange Rate (Pesos/US$)	3,000	3,000	3,000
CFL Life (Hrs.)	9,000	9,000	9,000
Costs:			
Investment (Pesos/unit):[d]			
CFL Price	30,000		30,000
Project Costs[a] per CFL	4,920		3,750
Recurrent (Pesos/kWh):			
Revenue Loss to CFE (Electricity Price)		150[e]	

[16]Below we discuss the main assumptions taken in determining the values of the benefit and cost factors we evaluated in carrying out the benefit-cost calculations. Thus, for example, our discussion of the revenue loss to CFE should be seen as a cost factor while the deferred generation by CFE is a benefit. Whether the net present value of benefits is positive or not depends on all the pertinent factors described in Table 1 and the values we assumed for each as enunciated below.

	Societal	CFE	Customer
Benefits:			
Investment (Pesos/kW):			
Long-Run Marginal Demand Cost at Distribution Level (US $/kW-year)[f]	132.5	132.5	
Recurrent (Pesos/kWh):			
Avoided Long-Run Marginal Energy Cost at Distribution Level (US Cents/kWh)[f]	6.2	6.2	
Avoided Elec. Price			150[e]
Avoid. Inc. Bulb Price[bc](Pesos)	1,420		1,420
T&D Loss			
Energy Loss (percent)	18%		18%
Capacity Loss (percent)	22%		22%

Notes:

a. Project costs were estimated by the Ilumex team at 4,920 pesos per CFL.
b. Incandescent lamp purchase is avoided at the beginning and again every 750 hours, which is the assumed life of the lamp.
c. Bulb price fixed by the government. Subsidy, if any, was not available to the authors.
d. CFL bulb and lamp are assumed to carry no taxes. Price to the society and consumer is same.
e. This is the weighted average of the marginal electricity prices for residential customers in Guadalajara and Monterrey. The values for each city were 156 and 143.3 pesos/kWh for Guadalajara and Monterrey respectively.
f. Source: Tariff Study prepared by Electricite de France for CFE on December, 1991.

The Ilumex team concluded that a CFL could be procured at a price of 30,000 pesos (see Section 3 for details). This was a conservative estimate based on utility procurement experience in North America, factoring in the particular manufacturer requirements for the Ilumex project.[17] The team also determined that the project costs, which include project execution and evaluation, would amount to US$ 1.64 per lamp, including project evaluation costs.[18] These costs would increase to US$ 2.02 per lamp in the worst case scenario in which all the CFLs have to be sold at neighborhood locations. (Section 3 provides details on how these project costs are derived). We conservatively assume a CFL life of 9,000 hours.[19]

[17]Experience with large-scale procurement by Southern California Edison shows prices in the 15,000 peso range.

[18]This figure is for a program where 1.2 million CFLs are sold at CFE agencies (with implementation cost of 3,237 pesos per CFL) and 0.3 million CFLs are sold in the neighborhoods (at an implementation cost of 4,650 pesos per CFL). An additional cost of 1,400 pesos per CFL is for program evaluation.

[19]The CFL has two main components: a ballast and a lamp (as discussed in more detail in Module 2 of the program menu prepared by the Ilumex team). The ballast can last between 30,000 and 50,000 hours, while the lamp lasts about 9,000 hours. A modular (non-integral) CFL allows the user to take advantage of the extended ballast life. Thus when the lamp portion is no longer working, it can be replaced with a

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The customers' avoided electricity cost is based on the weighted average marginal price of electricity for all residential customers in each city. We use marginal price of electricity since reduced use will decrease customer bills and CFE's revenue at the marginal tariff rate. However, this is a conservative estimate as Ilumex targets low-use tariff customers who pay rates less than the cost of generation. (See tariff schedule, Section 6).

The delivery mechanism for CFLs is such that CFE will try to recover all project costs associated with Ilumex through the price charged for CFLs sold through the project.

Ilumex Project

The Ilumex project implementation is expected to run for 2 years in the cities of Guadalajara and Monterrey.[20] During this time, the project is expected to introduce 1.5 million CFLs among the households of both cities.

The household survey results (see Section 6) indicate that the average wattage of CFL-replaceable incandescent lamps in the two cities is 67.2 watts. In order to provide equal or better light levels from CFLs operating at efficiency levels required for Ilumex, an average CFL wattage of 16.8 watts would be needed. The retrofits would save 50.4 Watts per bulb (not including T&D savings).

Tables B.1 through B.25 in Appendix B show the cash flow from the perspective of the society, customer and CFE. Each table illustrates the economic impact of an Ilumex project which would consist of 1.5 million lamps that are installed over a two year period in 1994 and 1995. The lamps last 6.2 years at a usage of 4 hours per day and will run out in 2000 and 2001, depending upon the year of their installation.

Societal Perspective:

Tables B.1 through B.3 in Appendix B show the economic analysis and cash flow for the Ilumex project from the societal perspective. Below we summarize the results in Table 2. The net present value (NPV) of the project at a 10 percent societal discount rate is 114,996 pesos per CFL. For the 1.5 million CFL project, this translates into a total NPV of 172,494 million pesos. The corresponding internal rate of return (IRR) is very high, since the cash flow is negative only in the first year to a small degree. The results at a 12 percent discount rate are also shown in Tables 2 and B.2. If the high cost scenario in which all the CFLs are sold in the neighborhoods (with a delivery cost of 6,020 pesos per CFL), societal NPV decreases by about one percent, to 170,919 million pesos (see Table B.3). A comparison of Tables B.20 and B.21 shows that if the CFLs are used an average of only 2 hours per day, the societal NPV of benefits per CFL increase by 21 percent over the 4 hour per day situation (139,650 instead of 114,996 pesos per CFL), due to the longer deferral of capital-intensive capacity investments, even though energy savings are reduced as well.

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similar, and relatively inexpensive lamp. The incandescent bulb on the other hand, only has a useful life of around 750 hours.

[20]CFE's participation will continue beyond this period to administer the lamp financing option.

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Table 2
Economic Indicators from the Societal Perspective[a,b,c,d]

	Discount Rate 10%	12%	High Project Cost 6,020 pesos/CFL
1. Net Present Value (NPV) of Benefits Per CFL (Pesos)	114,996	108,277	113,946
2. Total NPV (Million Pesos)	172,494	162,415	170,919
3. Internal Rate of Return	1,298%	1,298%	897%

Notes:
a: CFL used 4 hours a day.
b: Based on initial investment of 34,920 pesos per CFL (4920 pesos being for project administration and evaluation). High project cost case assumes 6,020 pesos/CFL and 10 percent discount rate.
c: Based on 1.5 million lamps.
d: for details see Tables B.1, B.2, and B.3.

The technical indicators are shown in Table 3. Capacity savings amount to 78 MW and the avoided electricity generation is 135 gWh per year. Fuel savings amount to 265 Thousand barrels of oil equivalent. The emission reductions are shown in Table 3 on a per year basis.

Table 3
Technical Indicators[a,b]

1. Capacity Savings (MW)[c]	78
2. Avoided Generation (GWh/Year)[d]	135
3. Fuel Savings (KBOE[e]/Year)[f]	265
4. Carbon Savings (Thous.Tons of C/Year)[g]	27.5
5. SO_2 Savings (Thous.Tons/Yr.)[h]	1.5
6. NO_x Savings (Tons/Yr.)[i]	175

Notes:

a: CFL use of 4 hours a day.
b: 1.5 million lamps.
c: 1.5 million lamps * 50.4 watts/CFL /(1-.22) * 0.8
CFLs * W/CFL /(1-T&D Loss) * Peak Coincidence Factor
d: 1.5 M. CFLs * 50.4 watts/CFL * 4 hrs/day * 365/(1-.18)
CFLs * W/CFL * Lamp hrs./day * #days/year/(1-T&D loss)
e: KBOE – Thousand Barrels of Oil
f: Based on 1852 kWh thermal/barrel of oil and power plant efficiency of 27.53 percent.
g: Carbon content of fuel oil at 0.32 Kg. per Kg. of fuel oil or 0.204 Kg. carbon per kWh.
h: Emissions coefficient of 0.011 Kg./kWh.
i: Emissions coefficient of 0.0013 Kg./kWh.

It is important to note that these savings are achieved at a net benefit to the economy, CFE and its customers (Table 4). The cost of reducing carbon emissions is *negative* 1,023 pesos per kilogram of carbon saved, negative 18,668,831 pesos per kilogram of SO2, and negative 160,065 pesos per kilogram of NOx saved.

Table 4
Cost of Reduced Emissions[a]

1. Cost of Conserved Carbon (pesos/kg C saved)	-1,023
2. Cost of Conserved SO_2 (pesos/kg SO_2 saved)	-18,668,831
3. Cost of Conserved NOx (pesos/kg NOx saved)	-160,065

Notes:

a: Calculated by dividing NPV of benefits of Table 2 (172,494 million pesos) by emissions savings of Table 3 and by the life of the lamp.

Customer Perspective:

Tables B.4 through B.14 in Appendix B show the annual cash flows from the customer perspective. Tables 5 through 7 below summarize the results.

At 4 hours per day of CFL use, the average customer enjoys a positive net present value (see Table 5). The NPV per bulb ranges from 15,145 pesos at a discount rate of 24 percent to 27,146 pesos at 12 percent. The internal rate of return range as high as 59 percent.

However, the payback period is quite high, ranging from 3.2 years to 4.3 years. The payback period is the number of years before the customer recovers his initial investment of 34,920 pesos per CFL. In the USA, a 2 to 3 year payback period is considered to be acceptable. We do not have any firm indicators of the acceptable payback period for Mexican households. A conservative estimate would suggest that since Mexican households have lower incomes, they may demand a payback period of 2 years. However, the experience of CFE and PAESE in undertaking seven small-scale demand side management lighting pilot projects has given CFE the impression that the proposed 34,920 peso price for the CFLs will not be a significant barrier to selling 1.5 million lamps, as projected. The CFE experience is largely anecdotal and is based on the observation that the Mexican market values highly advanced technologies, such as CFLs, beyond simply their energy cost savings. CFE has developed no consumer discount rate data from its initial pilot projects, which were largely deficient in evaluation data.

Reducing the CFL price charged to customers could lower the payback period to 2 years. This price is shown in Table 6. The price ranges from 23,300 pesos at 12 percent discount rate to 20,100 pesos per CFL at 24 percent. A price reduction would require that CFE share the cost of the CFL. CFE would have to absorb a cost between 11,620 and 13,370 pesos if the customer discount rate is 12 percent and 24 percent, respectively. The economic impact on CFE is shown in Table 9.

Table 7 shows the project results for the lowest, next-to-lowest, and highest tariff customers. Our calculations show that because of the subsidized electricity rates paid by the lowest tariff customers, they have a negative net present value of - 5,905 pesos per CFL at a discount rate of 18 percent (see Table B.10). The corresponding payback period is quite long at 14.5 years. For the next tariff customer our calculations show a net present value benefit of 833 pesos per CFL and 7.8 year payback, at a discount rate of 18 percent (see Table B.11). For the highest tariff customer our calculations show a net present benefit of 98,947 pesos per CFL and a 1.2 year payback (see Table B.12). In order to maintain payback periods of two years or less, CFE would have to share in the cost of the

CFL to the lowest and low-tariff customers.[21] The CFL cost, including the project cost, would have to decline to 10,800 pesos for the lowest tariff customer and to 13,600 pesos for the low tariff customer in order to maintain a 2 year payback period at 18 percent discount rate (see Tables 6, B.13 and B.14).[22]

A comparison of Tables B.22 and B.23 shows that if the CFLs are only used 2 hours per day, the average customer's NPV of benefits per CFL decrease to only 19 percent of the 4 hour per day situation (3,789 instead of 20,374 pesos per CFL), due to the decrease in yearly electric bill savings.

Table 5
Economic Indicators from Average Customer Perspective[a,b]

Discount Rate	12%	18%	24%
1. Net Present Value (NPV) of Benefits Per CFL (Pesos)	27146	20374	15145
2. Total NPV (Million Pesos)[c]	40719	30561	22718
3. Payback Period (Yrs.)	3.2	3.7	4.3
4. Internal Rate of Return	59%	59%	59%

Notes:

a: Average customer paying 150 pesos/kWh. CFL use of 4 hours a day.
b: Based on initial investment of 34920 pesos per bulb. For details, see Tables B.4, B.5, and B.6.
c: Based on 1.5 million lamps.

Table 6
CFL Price for a 2 Year Payback Period from a Customer Perspective[a,b]

Discount Rate	12%	18%	24 %
Average Customer (150 pesos/kWh)	23300	21600	20100
Lowest Tariff Customer (56.33 pesos/kWh)		10800	
Low Tariff Customer (80.35 pesos/kWh)		13600	

Notes:

a: CFL use of 4 hours a day.
b: For details, see Tables B.7, B.8, B.9, B.13, and B.14.

[21]CFE subsidies for CFL purchases by CFE's low tariff, subsidized electricity customers would be offset by savings in electricity subsidies on each kWh of electricity not used by these customers as a result of CFL usage.

[22]It is important to note that it is likely that CFE will be able to procure the lamp for significantly less cost than the 30,000 peso/CFL projected. This savings would result in a direct price reduction for CFE customers.

Table 7
Economic Indicators from Different Customer Perspectives[a,b,c,f]

Tariff Class[d]	Lowest	Low	High
1. Net Present Value (NPV) of Benefits Per CFL (Pesos)	-5905	833	98947
2. Total NPV (Million Pesos)[e]	-8858	1250	148420
3. Payback Period (Yrs.)	14.5	7.8	1.2
4. Internal Rate of Return	8 %	20 %	6744 %

Notes:

a: CFL use of 4 hours a day.
b: Based on initial investment of 34920 pesos per bulb.
c: Discount rate of 18 percent.
d: Tariff Class: Lowest -- 56.33 pesos/kWh, Low -- 80.35 pesos/kWh, High -- 430.06 pesos/kWh
e: Based on 1.5 million lamps.
f: For details, see Tables B.10, B.11, and B.12.

CFE Perspective:

Tables B.15 through B.19 in Appendix B show the economic impacts of the Ilumex project from the CFE perspective. The benefit to CFE is based on the long-run marginal demand cost of $132.5 per kW-year and at the long-run marginal energy cost of 6.2 cents/kWh. Table 8 below summarizes the results. It shows that CFE enjoys significant positive benefits from implementing the CFL project despite the revenue loss from reduced electricity sales. A 1.5 million CFL project would net CFE a sizable benefit of 122 billion pesos with a per CFL NPV of 81,131 pesos. CFE would enjoy higher per CFL NPV of 111,188 pesos for lamps used by customers in the lowest-tariff category. By contrast, due to revenue losses, CFE would lose money equivalent to an NPV of - 8735 pesos per CFL on sales to the highest tariff customers.

Table 8
Economic Indicators from CFE Perspective[a,b,e]

Tariff Class[c]	Lowest	Average	Highest
1. Net Present Value (NPV) of Benefits Per CFL (Pesos)	111,188	81,131	-8,735
2. Total NPV (Million Pesos)[d]	166,782	121,696	-13,103
3. Internal Rate of Return	NA	NA	NA1

Notes:

NA: CFE enjoys a positive NPV from the first year.
NA1: CFE incurs a negative cash flow over the CFL life.
a: CFL use of 4 hours a day and a discount rate of 12 percent.
b: Based on CFE incurring zero CFL cost.
c: Tariff Class: Lowest -- 56.33 pesos/kWh, Average -- 150 pesos/kWh, High -- 430.06 pesos/kWh
d: Based on 1.5 million lamps.
e: For details, see Tables B.15, B.16, and B.17.

As discussed in the section on Customer Perspective, CFE may not be able to pass on the full cost of the CFLs to the average customer since his payback period at 3.7 years may

be too high. Sharing some of the first cost would reduce CFE's net benefit (see Table 9), but its NPV of 102,787 million pesos would still remain at 86 percent of that shown in Table 8 above. The NPV would decline to 79 percent for the lowest tariff customer.

Table 9
Economic Indicators from CFE Perspective[a] to Maintain a 2-year Customer Payback Period

Tariff Class[b]	Lowest	Average
1. CFE's Share of CFL Cost (Pesos/CFL)	22,950	13,320
2. Net Present Value (NPV) of Benefits Per CFL (Pesos)	88,360	68,525
3. Total NPV (Million Pesos)[c]	132,540	102,787
4. Internal Rate of Return	NA	NA

Notes:

NA: CFE enjoys a positive NPV from the first year.
a: CFL use of 4 hours a day and a discount rate of 12 percent.
b: Tariff Class: Lowest -- 56.33 pesos/kWh, Average -- 150 pesos/kWh.
c: Based on 1.5 million lamps.
d: For details see Tables B.18 and B.19.

A comparison of Tables B.24 and B.25 shows that if the CFLs are only used 2 hours per day, CFE's NPV per CFL increases by 51 percent over the 4 hour per day situation (122,129 instead of 81,131 pesos per CFL), due to the increase in time deferral of capacity investments.

Expanding to a Mexico-Wide Program: Technical Potential

Expanding the pilot programs to cover all of Mexico would proportionately increase the net benefit to the society. In determining the figures in Table 10, we assume that the Guadalajara results would apply to 11.1 of the approximately 15.1 million residential customers, and the Monterrey results would apply to the rest.[23] The Mexico-wide results are averages weighted using the above figures for the Ilumex project.

The Ilumex project experience will help determine more precisely the impact of a Mexico-wide CFL program. Ilumex will help several key program design uncertainties, such as whether it is possible to focus only on 4 hour of daily use lamps, or if it will be necessary to consider also replacing lamps used more than 2 hours per day. As Table 10

[23]Mexico has 5 residential tariffs depending on how warm it is in a geographical region during the summer. These are tariffs 1, 1a, 1b, 1c, and 1d. Tariff 1 is applied to all customers during the winter months. Tariffs 1a through 1d are applied to select areas during the summer months. Guadalajara falls under tariff 1 while Monterrey is in 1b. In extrapolating the Guadalajara and Monterrey results to get Mexico-wide results, we assumed that all tariff 1 and 1a customers could be represented by Guadalajara results, while tariff 1b through 1d customers could be represented by Monterrey results.

shows, going to 2 hours per day greatly increases the number of lamps that are replaceable.[24]

The deferred capacity would total 1.19 GW for lamps used 4 hours a day and 2.58 GW if the project were expanded to include lamps used 2 hours a day. A nation-wide program for replacing incandescent illumination with CFLs in Mexican homes could thus make a significant contribution towards meeting the planned capacity expansion of 15 GW between 1991 and 2000.[25]

Similarly, if all the avoided generation is fuel oil-fired, then about 3.2 million barrels of fuel oil would be saved annually. Carbon, SO2, and NOx savings would increase to the figures shown in Table 10. Emissions reductions are obtained at a net economic gain, thus the cost of saving these emissions is negative. The economic benefits derived from such an expansion are large. The society (nation) would benefit to the extent of 2.6 to 7 trillion pesos (882 to 2,327 million dollars) annually.

Table 10
Expanding Ilumex to a Mexico-wide Program

	4 Hours per day	2 Hours per day
Number of Customers (millions)[a]	15.1	15.1
Number of CFLs (millions)[b]	23	50
Avoided Peak Demand Capacity (GW)[c]	1.19	2.58
Avoided Energy (tWh/Year)[d]	2.07	2.25
Fuel Saved (Million Bbls/Year)[e]	4.05	4.40
Carbon Savings (kTons/Year)[f]	421	458
SO2 Savings (kTons/Year)[f]	22.7	24.7
NOx Savings (kTons/Year)[f]	2.7	2.9
Net Present Value (10^9 Pesos)[g]		
Societal (Economic)	2,645	6,982
Financial		
Utility Company(ies)	1,866	6,106
Customer	469	189

Notes:

a: This was the number of customers in December 1990. During 1990 the number of customers increased by three percent and similar growth is expected in the future.
b: These figures were obtained by combining the survey results of Guadalajara and Monterrey on number of lamps replaceable at 4 and 2 hours of daily use. The Mexico-wide calculations assumed that 11.1 million customers (Tariffs 1 and 1A) would behave as Guadalajara, and the remaining 4 million customers (Tariffs 1B through 1D) as Monterrey.
c: Avoided Demand = # CFLs * 50.4 Wsaved/CFL * 0.8 (peak coincidence factor) * 1/0.78 (T&D loss).
d: Avoided Energy = # CFLs * 50.4 Wsaved/CFL * # hours used/year * 1/0.82 (T&D loss for Energy).

[24]Replaceable lamps are those that are physically easily retrofitable with CFLs and are of at least 40 Watts.

[25] Taken from POISE, 1992.

e: Fuel saved = # kWh saved/y * 1 barrel oil/1852 kWh thermal * 1/0.2753 (oil plant efficiency).
f: CO2, SO2, and NOx savings are annual, not over the 9,000 hour life of the CFL. Carbon content of fuel oil at 0.82 Kg. per Kg. of fuel oil or 0.204 Kg. carbon per kWh. For SO2 have emissions coefficient of 0.011 Kg. SO2/kWh, and for NOx used 0.0013 Kg.NOx/kWh. These values are from US DOE.
g: The net present value of benefits are obtained from Tables B.20 through B.25. It is important to emphasize that results are based on a two-year CFL project assuming that the Ilumex experience would be replicated similarly all over Mexico.

Conclusions

Overall, the Ilumex project shows net positive economic benefits to society and financial benefits to CFE and the customer. Only the lowest-tariff customers need a price discount for the CFL to have a positive net benefit. Average customer payback period is 3.7 years, which may be too long. Ilumex experience will dictate how much of a price reduction will be required for customers to purchase the number of CFLs envisioned in the program. CFE can easily pay for part of the CFL and program costs to reduce customer payback periods and still obtain tremendous economic benefits..

The Ilumex project delivers carbon, SO_2, and NO_x savings, each at a negative cost. The cost of conserved carbon is about -0.3 US$/Kg. of carbon. Ilumex would provide over 27 KTons of annual carbon savings at this rate. Similarly, about 1.5 KTons of SO_2 and 175 T of NOx would be saved annually, also at a negative cost. With 1.5 million lamps installed, Ilumex will allow the deferral of 78 MW of new generating capacity, for 135 MWh/year in electricity savings, freeing up 265 million barrels of oil.

Expanding the Ilumex project to a Mexico-wide program could result in capacity deferral of 1.2 GW if the program only replaces those lamps that operate more than 4 hours per day. If the program were to include lamps that operate at least 2 hours per day, then 2.6 GW would be saved. Given CFE's planned addition of 15 GW of generation capacity by the year 2000, CFLs could make a significant contribution towards meeting new electricity demand. Carbon savings could reach 421 to 458 thousand tons annually. The net present value of benefits for a Mexico-wide program could reach 2.6 to 7 trillion pesos (882 to 2,327 million dollars). Such benefits are very impressive when compared to the 60 billion peso (20 million dollars) initial investment in the revolving fund.

IX. Bibliography for Economic Analysis:

CFE. 1990. **Precios Internos y Externos de Referencia de los Principales Energeticos.** Mexico DF. (September).

CFE. 1991. **Costos y Parametros de Referencia para la Formulacion de Proyectos de Inversion en el Sector Electrico.** Mexico DF. (July).

CFE. 1991. **Estadisticas del Sector Electrico Nacional 1978-1990.** Mexico DF.

CFE. 1991. **Resultados de Explotacion 1990.** Mexico DF.

CFE. 1992. **Programa de Obras e Inversiones del Sector Electrico-Preliminar.** Mexico DF. (May).

CFE. 1992. Personal communications with CFE Distribution on Tariffs, CFL market prices and sales in Mexico, and deferred investments.

Krause F., Koomey J. and Busch J. Incorporating Global Warming Risk in Power Sector Resource Planning: Case Study of New England., LBL Report No. 37797, 1992.

Masera, O., O de Buen, R. Friedmann. "**Consumo Residencial de Energía en México: Estructura, Impactos Ambientales y Potencial de Ahorro**", in Primera Reunión Internacional Sobre Energía y Medio Ambiente en el Sector Residencial Mexicano. UNAM, Mexico City, Dec. 2-3, 1991.

US DOE., Energy Technology Characterization Handbook: Environmental Pollution and Control Factors, DOE/EP-0093, March 3,1983.

World Bank. 1990. **Staff Appraisal Report Mexico Transmission and Distribution Project.** Washington DC. (March 20).

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8. Evaluation

The objective of the project evaluation is to determine how well the Ilumex project is succeeding in achieving its goals. The U.S. Ilumex team worked with CFE in developing an evaluation plan to track each stage of the Ilumex project. Four days of evaluation training was provided by the U.S. team to help institutionalize an evaluation process at CFE that will initially be adapted for the Ilumex project. The evaluations will address the following issues surrounding these Ilumex project goals:

1. Annual Electricity Savings And Critical Load Reductions

a. Total Annual Electricity Savings and Critical Load Reductions. The evaluations will estimate the annual savings attributable to compact fluorescent lamps installed under the project during the first year of operation.

b. Net Energy Savings and Critical Load Reductions. The evaluation will estimate the net energy savings and critical period load reductions that are directly attributable to the project over and above those that would have occurred in the absence of the project.

c. Rebound Effects. The evaluation will estimate any changes in utilization rates of fixtures with compact fluorescent lamps installed under the project.

d. Impact of Project on Compact Fluorescent Sales Outside of Project. The evaluation will assess the effect of the project on sales of compact fluorescent lamps by retail outlets outside the project.

e. Sales and Savings by Model of Lamp. The evaluation will estimate the sales and savings by model of lamp sold under the project.

f. Effectiveness of Publicity. The evaluation will assess the effectiveness of the publicity and sales promotion strategies in creating awareness and stimulating sales of the compact fluorescent lamps.

g. Impacts of Project on Reducing Pollution. The evaluation will estimate the effects of the energy savings from the project in reducing pollution emissions at generating plants.

h. Cost/Benefit Analysis of Project. The evaluation will estimate the cost/benefit ratios of the project from the perspectives of various parties in the electricity market.

2. Project Impact on Customers

a. Distribution of Participation, Sales, and Savings by Customer Usage Group. The evaluation will estimate the variations in participation rates, lamp sales, and savings by residential customer usage group. This will be used to estimate the distribution of the project benefits by customer usage level.

b. Distribution of Project Impacts by Payment Method and Sales Strategy. The evaluation will estimate the variations in project impacts (participation, sales, and savings) by payment method (cash or time installment payments) and sales strategy (sales from CFE offices versus sales from door-to-door) to determine which are more effective in delivering the project benefits to low usage customers.

c. Market Penetration of Compact Fluorescent Lamps. The evaluation will estimate the market penetration of compact fluorescent lamps sold under the project. The market penetration impacts will be estimated as a percentage of fixtures and consumers by customer subsector.

3. Development of Project Design and Management Capabilities in CFE

a. Procedures Manual. The evaluation will review the procedures manual that will be developed as part of the pilot project to assess their adequacy in training future project personnel in how to deliver the project services.

b. Staff Training. The evaluation will review the staff training procedures to assess its adequacy in preparing new personnel in the implementation of the project in other parts of CFE's service territory.

c. Monitoring and Evaluation Capabilities. The evaluation will review CFE's performance in designing and conducting its monitoring and evaluation of the pilot project to assess whether its staff has developed the capability to perform this function in future programs.

d. Adequacy of Project Monitoring System. The evaluation will review CFE's project monitoring data base to assess whether it captures the information necessary to track the program's performance and whether it produces useful summary reports in a timely manner to assist the project implementation.

4. Economic Sustainability of the Project

a. Adequacy of the System of Accounting, Sales Tracking, and Cost Control. The evaluation will review the project accounting system to audit the receipts and expenditures and to determine whether the system tracks the information necessary for revenue, inventory, and cost control.

b. Budgeting Process. The evaluation will review the project budget, receipts, and expenditures to assess whether the project was managed soundly from a financial standpoint and to identify variations in expenditures and receipts from the original budget.

c. Determination of the Prices of Lamps. The evaluation will review the prices charged for the lamps under the project to determine whether they are adequate to recover the costs of the equipment and project administration.

5. Customer Satisfaction

a. Models of Compact Fluorescent Lamps. The evaluation will examine customer satisfaction with the prices, performance, and other characteristics of the compact fluorescent lamp models sold under the project.

b. Payment Alternatives. The evaluation will address the customer satisfaction with the installment payment plan option offered to participants.

c. Sales Strategy and Treatment by CFE Personnel. The evaluation will assess the relative effectiveness of the sales through the CFE offices versus the sales through the door-to-door contact. Participants will be asked about their satisfaction with the service they received from CFE representatives.

d. Information About the Lamps. The evaluation will address customer satisfaction with the informational materials provided by CFE under the project.

e.Reasons for not Purchasing Lamps. The evaluation will investigate the reasons that customers did not participate in the project and why participants did not purchase the maximum number offered lamps available to them.

6. Impact on Market for Compact Fluorescent Lamps

a. Market Prices for Compact Fluorescent Lighting Products. The evaluation will examine the impact of the project on the prices of compact fluorescent lamps available through the normal retail distribution channels.

b. Relations between CFE and Manufacturers and Distributors. The evaluation will investigate the effect that the project has on the relation between CFE and lighting product manufacturers and distributors.

c. Sales Volumes in Retail Market. The evaluation will study the effect of the project on the volume of compact fluorescent sales in the retail market.

Evaluation Methods

The evaluation of the Efficient Lighting Project will use a combination of surveys, interviews, engineering calculations, and statistical analyses to examine the issues summarized above. These will be performed under a series of studies that will be conducted over the course of the project. The scopes of these studies are summarized below.

1) Base Study of Compact Fluorescent Lighting Market. This is a base study that will be conducted before the implementation of the Efficient Lighting Project to determine the availability, prices, and sales volumes of compact fluorescent lighting products in the retail market in the cities of Monterrey and Guadalajara. It will also address manufacturers and distributors attitudes toward CFE's planned project and ways to obtain their cooperation. The results of this study will be used as a base for comparison against a comparable study that will be performed after the Lighting Project has been in the field for two years. The changes in prices and product availability observed between these two studies will be used to evaluate the impacts of the project on the retail market for compact fluorescent lighting products.

2) Formative Evaluation. A formative evaluation will be performed after the project has been under way for three months. The objective of the evaluation will be to analyze the program's early performance and identify modifications that may be appropriate to correct delivery features and other project attributes to improve the project effectiveness. The formative evaluation will encompass interviews of key personnel in the project delivery process as well as surveys of participants and nonparticipants under both sales through CFE offices and sales through the trailer components of the project. The formative evaluation will consist of the following tasks:

a. Internal Evaluation of Office Sales. Under this task the evaluators will interview the key personnel involved in the delivery of the project. These include the Lighting Project project manager, the CFE employees responsible for the direction of the project (five in each city), the employees who sell the lamps to the public (5 in each city), the employee responsible for the lamp inventory control (one in each city), and the three lamp manufacturers. Separate interviews will be conducted in each

city where the project is offered (Monterrey and Guadalajara). The evaluators will ask respondents about the adequacy of the training and procedures manuals, the effectiveness of the project data base in facilitating their work, the effectiveness of coordination and support for the project delivery, inventory control, their perceptions of customer satisfaction and problems, and related information.

b. Internal Evaluation of Trailer Sales Component. In addition, the evaluators will interview the personnel responsible for the delivery of the project through the trailer component of the project. The evaluators will interview the employees who direct this component of the project as well as a sample of the people who make the door-to-door solicitations. The evaluators will ask similar questions as those posed to the other project personnel.

c. Survey of Office Sales Participants. CFE will conduct a survey of a sample of customers who have participated in the office sales component of the project during the first three months, as well as a sample of nonparticipants. The surveys will ask respondents questions on the following topics:

- Installations of Compact Fluorescents - number, locations, changes in wattage, hours of operation (by model and total), other disposition of bulbs.
- Satisfaction - illumination levels, light quality, price (by model and total), performance, payment of options, quality of service from CFE, usefulness of information received.
- Preferences among lamp models
- Awareness and Attitudes - why the respondent bought the lamps, whether respondent would buy more, whether they knew of lamps before project, how they learned about the project, whether they had previously bought compact fluorescents, whether they would have bought lamps without the project, plans to buy lamps in the future, perceptions of savings.
- Socioeconomic Characteristics - household size, ages, number of workers, etc.
- Dwelling Characteristics - type, size, age, etc.
- Appliance Ownership and Characteristics

d. Survey of Non participants in Office Sales. CFE will conduct a survey of a sample of non participants. The survey will ask the respondents if they were aware of the project and, if so, why they did not participate. They will also be asked if they plan to participate in the future.

e. Survey of Participants and Non participants in Trailer Sales Component. CFE will conduct a survey of the who customers were offered the lamps through the trailer delivery strategy. The survey will be administered to both participants and non participants. The survey will ask the same types of questions as those in the survey of office sales participants and non participants.

3) Comprehensive Process Evaluation. One year after the project has been in the field, CFE will commission a comprehensive process evaluation to examine the program's

performance. The process evaluation will include interviews of project personnel, review of documents, and surveys of participants, non participants, and a control group of customer in another area of CFE's service territory. The process evaluation will consist of the following tasks:

a. Review of Project Documents. The evaluators will review project documents including regular reports, memoranda, training materials, and procedures manuals. This review will be used to document the performance of the project to date and to determine the adequacy of the procedures and record keeping.

b. Staff Interviews. The evaluators will interview the staff at CFE responsible for the delivery of project services. The interviews will be conducted on the same people who were contacted for the formative evaluations. The purpose of the interviews will be to determine whether earlier problems have been adequately addressed and to identify any additional concerns that have arisen since the last evaluation.

c. Surveys. The evaluation will include surveys of project participants under both the office and trailer sales components of the project, non participants in both components, and a survey of a control group who were not offered the project. The participant and non participant surveys will be similar in scope to those administered during the formative stage of the project. The control group survey will be administered in a separate geographical area whose economy is similar to the cities where the project was conducted. The control group survey will serve as a baseline against which to compare the penetrations of compact fluorescent lamps in Monterrey and Guadalajara.

4) Impact Evaluation. CFE will conduct a comprehensive impact evaluation after the project has been in the field for one year. The purpose of the impact evaluation will be to estimate the annual electricity savings and reductions in critical period loads that have occurred as a result of the project. The impact evaluation will employ direct metering, statistical analyses, and engineering methods to estimate these impacts. The result using of each of these methods will be compared and assessed for reliability. The evaluation will include the following components:

a. Direct Metering. CFE will conduct a direct metering study to measure the time-of-use and total hours of operation of the compact fluorescent lamps installed under the project. The metering study will use light sensitive meters that can be installed in the lighting fixtures to record the times that the fixtures are turned on. The data from this metering study will confirm the reliability of customers' own estimates of hours of operation, and they will provide load profiles for the compact fluorescent lamps that can be used to determine impacts during critical load periods. The metering studies will be conducted on a sample of 100 fixtures in each city where the project is conducted. The study will use both simple light loggers that record aggregate hours of operation and time-of-use meters.

b. Statistical Analyses of Billing Data. CFE will conduct a series of statistical analyses of changes in customers' monthly consumption before and after the installation of the compact fluorescent lamps. The analyses will include both simple statistical comparisons of means across participant and non participant subpopulations (bill analysis) and regression analyses that relate the changes in consumption to lamp model types and customer characteristics (conditional demand analysis). The bill comparisons will be performed on large representative samples of participants and non participants. The differences in the changes from before to

after participation will be attributed to the installation of compact fluorescent lamps. The comparisons will be conducted for various participant subpopulations representing different consumption levels, model purchases, and project treatment (office versus trailer sales). The conditional demand analysis will be performed on the samples of customers who were surveyed as part of the process evaluation. The conditional demand models will relate the changes in consumption to the [illegible] and types of compact fluorescent lamps installed and the customers' soci[illegible] and dwelling characteristics.

c. Engineering Analysis. CFE will perform a series of engineering analyses of the impacts of the project. The analyses will use information about changes in fixture wattages and hours of operation from the participant surveys to estimate the savings from the fluorescent lamps. This information will be obtained as part of the surveys conducted under the process evaluation. The engineering analysis will calculate the savings by customer usage level, lamp model, and delivery component (office versus trailer sales). The engineering calculations will also include estimates of critical period load reductions based on information from the survey and the load profiles obtained in the direct metering study. The results from the engineering study will compared with those from the statistical analysis and the direct metering studies.

d. Environmental Impact Study. CFE will estimate the effects of the project on reductions in pollution emissions. These will be estimated using existing models that CFE uses internally.

e. Cost/Benefit Analysis. CFE will estimate the cost effectiveness of the lighting project using the estimates of electricity and critical load savings from the impact evaluation along with the actual costs of the lamps and the project administration. The cost effectiveness will be evaluated from the various perspectives as defined in the California Standard Practice Manual.

5) Accounting Audits of Revenues and Expenses. CFE will have the project audited on an annual basis to track revenues from the sales of the lamps, costs, and the control of inventory. The audits will be performed by CFE's accounting firm.

6) Second Study of Compact Fluorescent Lighting Market. CFE will conduct a second study of the retail market for compact fluorescent lighting at the end of the two year pilot period for the project. The purpose of the study will be to determine the availability, prices, and sales volumes of compact fluorescent lighting products in the retail markets in Monterrey and Guadalajara after the completion of the project. It will also address manufacturers and distributors attitudes toward CFE's planned project. The results of this study will be compared against a comparable study that will have been performed prior to commencement of the Lighting Project. The changes in prices and product availability observed between these two studies will be used to evaluate the impacts of the project on the retail markets for compact fluorescent lighting products in each city.

7) Persistence Study. CFE will conduct a study of the persistence of the compact fluorescent lamps one year after the end of the pilot project in Monterrey and Guadalajara. The study will survey a sample of participants to determine what percentage of the lamps that were sold under the project are still installed in fixtures and the disposition of the others.

The following chart is a summary of the schedule and estimated budgets for each of the studies:

Ilumex Evaluation Schedule

Function	Date	Budget ('000s of $) (Dollars)
1. Base Lighting Market Study	8/93 (+3 mos.)	$10.
2. Formative Evaluation		
a. Internal Evaluation of Office Sales	2/94 (+4 mos.)	30.
b. Internal Evaluation of Trailer Sales	*	5.
c. Survey of Office Sales Participants	2/94 (+4 mos.)	20.
d. Survey of Trailer Sales Participants	*	15.
3. Comprehensive Process Evaluation		
a. Staff Interviews	1/95 (+13 mos.)	20.
b. Surveys		
Participants and Non participants	1/95	60.
Control Group	1/95	30.
c. Document Review	1/95	10.
4. Impact Evaluation		
a. End-Use Metering Study	1/95	55.
b. Statistical Analysis	1/95	30.
c. Engineering Analysis	1/95	2.
d. Environmental Impact Analysis	1/95	2.
e. Cost/Benefit Analysis	1/95	1.
5. Accounting Audits (twice per city)	10/94,95	30.
6. Second Lighting Market Study	10/95	10.
7. Persistence Study	10/96	20.
Total per City		***$350.***
Grand Total Evaluation Budget		***$700.***

* Evaluations of the trailer component will be completed four months after this sales strategy is undertaken.

9. Conclusion & Recommendations

Ilumex: A Limited Scope

The Ilumex project is intended to demonstrate the effectiveness of utility DSM programs for residential sector lighting retrofits in a developing country context. This is an important step because of concerns by some that demand-side resources are not viable energy service expansion options for developing countries. This perception remains strong despite the growing adoption of DSM on a large scale globally (representing $2 billion in the United States in 1991, for example), as DSM is integrated into the power planning investment choices used by utilities in their resource planning efforts.

The CFE Distribution Division, working with PAESE, has undertaken the initial steps for identifying demand side resources, and establishing an institutional capacity to develop these resources. In undertaking seven small-scale DSM projects over the previous two years, the utility has established an understanding of the particularities of DSM, and in focusing on residential lighting in each of these efforts, has come to understand the specific market to which the proposed Ilumex project is directed. Unlike the previous pilots, Ilumex includes a significant evaluation component which assures its value as a replicable demonstration for other efforts in Mexico and throughout the developing world. The scope of Ilumex represents a significant commitment by CFE to DSM. Indeed, the commitment of the CFE Distribution Division resources for the Ilumex project development process have been considerable. These efforts included the September evaluation training workshop in Mexico City run by the U.S. Ilumex team members, and the July 1992 California mission that included meetings with CFL manufacturers, testing laboratories, DSM implementation contractors, and several U.S. utilities that are heavily involved in DSM.

CFE's commitment to expand Ilumex, once implemented and operational, to a nationwide project encompassing the entire Mexican residential lighting sector, provides tremendous leveraging value for the Ilumex project. CFE's plan to work with FIDE and PAESE to use Ilumex as a means for establishing an infrastructure to deliver DSM resources throughout Mexico means that the project will lay a foundation with benefits well beyond those quantified in this study. As such, Ilumex represents a vehicle for spurring the expansion of CFE's DSM efforts into the commercial and industrial sectors, where the DSM resource represents even greater promise than that illuminated by the small scope of the Ilumex project. However, it is important to note that the limited focus of Ilumex -- CFL retrofits for residential lighting -- while restricting the range of savings opportunities available in the short term, does allow CFE to concentrate its efforts and develop its expertise intensely to assure success within the scope of the project.

In the statement of priorities that was used in developing the Ilumex project, the utility valued most highly Ilumex's in developing within CFE a capacity to deliver DSM resources. It is with this objective in mind that Ilumex was developed. It is the institutional commitment of CFE-FIDE-PAESE that will assure the project's success.

Indications of the Study for the Success of Ilumex

Foremost, the study indicates that the proposed project to promote rapid penetration of CFLs can be cost effective in Mexico. The dissemination of CFLs as proposed for the Ilumex project would generate significant economic benefits to the customer, CFE, and the

nation. The customer avoids purchase of incandescent bulbs and uses less electricity. These savings have a regressively beneficial value, according to the tariff structure currently in place at CFE. Yet, as the utility moves towards marginal cost pricing across all user groups, the benefits will accrue with increasing value to low-use customers as well. CFE benefits from this effect for it provides a resource to enable the utility to more easily and effectively raise rates within the subsidized user groups. CFE is thus targeting these customers in the Ilumex project in order to fully utilize this benefit and reduce subsidy payments. The utility also benefits from the capital savings of deferred generation, transmission, and distribution investments, as well as the energy cost savings. Mexican society enjoys the benefits of these customer and utility savings, as well as the significant environmental benefits of the project that result from emissions reductions.

The analysis shows that the economic rate of return to the nation is extremely high. The rate of return for CFE is also substantial, *even without accounting for the reduced subsidy payments* that will accrue from Ilumex if the objective of targeting these subsidized users is successful. The average customer also enjoys a positive economic value from participating in the project. However, the data on consumer discount rates in Mexico is uncertain. Assuming an 18% discount rate, consumers -- and particularly those in the low-use tariff bracket -- might need an inducement, such as a subsidized CFL price, to participate at the levels projected for Ilumex. (see below) CFE can easily provide such inducement, and still benefit economically, if the early Ilumex monitoring results indicate that lamp sales are inadequate with the full cost pricing.

The study shows that internationally-available CFL technology can be used in Mexico -- indeed the technology is already proven on a small scale in the market. Yet, Ilumex represents an opportunity to establish an improved CFL technology which is "utility friendly" in meeting the objectives of CFE, and that is reliable enough to assure the projected economics under the rigorous evaluation process to be applied to the project. Ilumex is necessary for introducing CFL technology on a significant scale in the Mexican market.

Ilumex Project Uncertainties

• *Number of CFLs that can be sold*: CFE's intent to regenerate the entire $20 million Ilumex budget for application to an expanded, nationwide program might need to be modified if the price at which the CFLs are initially offered proves to be too high for the market. CFE is confident of its ability to sell 1.5 million lamps in Monterrey and Guadalajara in two years at the projected Ilumex price. Yet, the data on market price elasticity in Mexico is poor. CFE's information is largely anecdotal, based on its unquantified experience with small scale pilot projects undertaken in seven communities across Mexico. These projects lacked the rigorous evaluation component central to Ilumex, and thus are of limited value for this, or other future DSM projects outside of the experience gained by the primary implementers at CFE, FIDE, and PAESE.

CFE can retain significant economic benefits and still subsidize the price of the lamp. Also, it is likely that CFE will be able to purchase the CFLs through the international bidding process at a price less than projected. This has been the experience of U.S. utilities to date. If so, the lamp price paid by customers through the Ilumex project would be similarly reduced. Finally, the project timeframe can be expanded, with some variation of the delivery mechanisms incrementally introduced to improve sales. This adjustment (a time extension for project implementation) is also economically feasible. The proposed expansion to a nationwide program could still move forward, even simultaneous with the latter stages of the Ilumex implementation.

• *CFL performance*: The Ilumex team has taken considerable care in developing performance specifications, testing procedures, and contractual procurement guidelines that provide a comfortable level of assurance that the technology employed in the Ilumex project will deliver the DSM resource in a reliable and cost-effective manner. In developing these guidelines, the team has drawn heavily from the large-scale procurement experience of North American utilities, the experience of lighting test laboratories experienced in CFL testing, and from product engineers. The team has even solicited input on the proposed standards from manufacturers in the industry in order to ensure that the standards reflect technological and market realities, *even as Ilumex strives to push the technology ahead to develop a superior developing country technology that "leapfrogs" the market.*

The Ilumex team has also conducted power quality tests and market surveys for the cities of Monterrey and Guadalajara to establish a series of models for the conditions under which the CFLs will be expected to function. While lamp price will be a key criterion in selecting lamp suppliers for the project, all CFLs accepted will surpass an extensive set of minimum performance standards. Beyond that, lamps which surpass the standard performance threshold will be allotted points for superior performance in areas that effect product reliability. Also, manufacturers who display a track record for service and reliability will be given favor in the selection process. Finally, the specifications do not restrict the manufacturers to a technology type, or even to a particular wattage of the CFLs to be purchased. Instead, all specifications are *performance-based*, thus allowing market innovation to drive the results and maximize the impact of the procurement process on product innovation in the global market.

• Meeting project objectives through the Ventas de Agencia delivery method: The point-of-sales delivery method was chosen as the first option for Ilumex in an effort to minimize administrative costs for the project. However, the experience of North American utilities in the delivery of CFL residential retrofit programs overwhelmingly favors a direct installation approach to project delivery. While this method is significantly more expensive (on the order of $30 per house, according to Southern California Edison), it holds multiple benefits that contribute to project effectiveness and successful implementation consistent with project goals. From a cost-effectiveness perspective, direct installation programs are therefore viewed as superior to lower-cost sales efforts. *(See discussion in the Ilumex Project Menu.)*

Direct installation programs carry multiple benefits, including:

• Persistence of savings -- Direct installation programs provide greater certainty that the initial savings will continue to be produced over the expected life of the lamp installed. By controlling where and how the lamp is installed, and educating the consumer on its proper use to assure long product life, long-term performance is enhanced.

• Consumer education -- Consumers, as operators of the CFL electricity-saving "generating plants", must understand the technology fully, including its proper use, limitations, and capabilities in order to assure maximum performance from the CFLs. A direct installation project can provide consumer education on a variety of maintenance and electricity product use issues which can produce savings with no net capital investment by CFE. For example, the Los Angeles Department of Water and Power demonstrates to users how they can properly clean refrigerator coils to maximize refrigerator operating efficiency. This is done as a part of the utility's CFL installation project for low-income customers.

• Assurance of CFL's proper use -- Direct installation allows the utility to control the point of use for the CFLs installed. By controlling installation, CFE can ensure that the Ilumex

minimum hours of use criterion (four hours per day), is adhered to, thus yielding the CFE, societal, and customer benefits projected in the economic analysis. Customer satisfaction is also improved when the technology is properly applied, avoiding situations where customers purchase the wrong (or ill-fitting) CFL for their specific application.

• Access to the customer base of the utility -- In visiting the customer homes, the utility can greatly improve its understanding of the potential demand side resources available in the residential sector.

Addressing the concerns through Ilumex

The utility's best use of this direct installation process is to implement multiple DSM technologies in the course of each single installation visit. This allows for better utilization of the high cost delivery method, essentially leveraging the installation investment by installing several different DSM resources simultaneously. Ilumex's single technology approach would not allow for leveraging the high cost of the direct installation method across several different technologies. Instead, the delivery cost per lamp would be significantly higher than CFE wishes to budget per lamp, on this initial DSM project.

To compensate for the lost benefits in not employing a direct installation approach, Ilumex is designed with a very strong marketing/consumer education effort, which will commence before lamp distribution begins. The lamp sales personnel will be trained and will provide to each customer a comprehensive lesson on CFL use and installation. This education will address directly each of the areas of concern (described above) characteristic of a point-of-sales approach. The Ilumex monitoring and evaluation plan will provide CFE with the sort of oversight (including telephone surveys of CFL purchasers) that will identify performance and persistence of savings problems in time for a project response to address the problem. The second and third stage delivery methods that CFE can employ, as needed, under the Ilumex project plan includes a direct installation option. This higher cost method, and modifications of it, can be employed as need is determined in the evaluation process. The economics of an exclusive reliance on this more expensive delivery option are detailed in Section 7 of this study.

Achieving Maximum Returns from Ilumex

In limiting the scope of Ilumex to one sector (residential), one end-use product category (lighting), and one technology (CFLs), Ilumex limits the potential impact that a DSM project of the proposed size might have. The tremendous savings potential represented in the commercial and industrial sectors should not be overlooked as perhaps the DSM resources best available to Mexico. Likewise, the range of energy efficiency technologies available for DSM investments provides a variety of responses for every DSM objective.

CFE's interest in the low-use residential sector of its customer base is well-served by a focus on residential applications for the CFL technology. The company's experience in DSM has prepared it best for a focus on this technology and sector. The Ilumex project's narrow scope is perhaps an advisable approach for CFE's first large-scale foray into DSM.

Ilumex is designed to regenerate the initial project funds by establishing a stream of project revenue to replenish the funds from CFL sales. This will allow CFE to extend the initial $20 million pool of capital to leverage a much larger nationwide effort. The economic and environmental benefits of such an expanded program are clearly illustrated in

this study. However, extending this project nationwide introduces a degree of uncertainty and risk, even with the lessons learned through the Ilumex project. These risks and rewards should be compared with the benefits and risks of expanding the post-Ilumex (and the latter stage/second stage Ilumex effort) to include non-residential sectors and non-CFL technologies. If Ilumex is to truly give rise to a significant institutional capability and willingness to develop the DSM resource in Mexico, then the medium term scope of the project, and its offshoots, should encompass a broader range of DSM resource opportunities.

Beyond Residential CFLs

There are very different and compelling advantages to be gained from implementing CFL DSM programs beyond the residential sector. Considering only the CFL technology, in order to maximize the Ilumex experience, CFL installation in non-residential buildings accrue multiple advantages, as the following chart shows.

CFL Installation in Non-Residential Buildings Accrue Multiple Advantages

- **Utility rates are closer to LRMC, providing a better incentive on the part of customers to cut monthly utility bills;**
- **The technology's demand reduction impact are of additional value for non-residential users typically paying demand charges;**
- **Non-residential users tend to have higher numbers of bulbs per building, allowing for more CFLs to be placed per installation, lowering the delivery cost per CFL;**
- **Bulb duty factors are significantly higher, leading to higher kWh savings per CFL and greater environmental benefits;**
- **Ability of non-residential building occupants to understand the advantages of monthly lease fees is superior to most residential customers;**
- **The introduction of super-long service life ballasts (30,000 to 60,000 hours) also offer superior non-electric economic benefits for customers (e.g. savings on replacement bulbs and labor savings) which are best realized in a commercial setting.**

Programs to promote lighting efficiency have been the most common efficiency effort undertaken by North American utilities. Most of their focus has been on commercial and industrial (C&I) customers, although increasing attention is now being directed to residential customers, as in Mexico with the Ilumex project. The resources applied to the Ilumex project could meet the objectives of the Ilumex team while being leveraged further to identify and begin tapping the non-residential DSM resource, as well.

Expanding Ilumex (or its successors) to utilize other DSM resources and energy efficiency technologies -- including efficient motors and industrial drive systems, which typically account for over half of the electricity demand in the world-- would provide maximal leverage for the Ilumex effort, with potentially even greater economic and environmental benefits to CFE, its customers, and the nation.

(See Appendix C for a more extensive discussion of the non-residential, non-CFL DSM resource potential in Mexico.)

Ilumex: The Opportunity at Hand

Ilumex would prove DSM as a feasible energy resource for Mexico. It would also provide the impetus for establishing the institutional mechanism at CFE to develop the resource further. The narrow focus of Ilumex limits its immediate environmental and economic benefits, but the scope of the project addresses effectively CFE's primary objectives. In the absence of GEF funding, the Ilumex project would not have been developed to date, and the institutional will of CFE, FIDE, and PAESE might not have been strong enough to establish the momentum required to undertake the initiative with the commitment necessary for success. DSM is a new and largely undeveloped resource in Mexico, as well as throughout Latin America and the developing world. The technologies made available on the international market have penetrated these economies with only marginal success. The high first costs characteristic of these technologies, the lack of adequate information about the technologies (within these markets), and about the markets (among the manufacturers) serve as impediments to their widespread adoption. CFE can take advantage of the superior economics of the CFL technology, and of the opportunity to target its subsidized customers with CFLs as a means of reducing usage within this customer class while raising its rates to reflect marginal costs. However, absent the GEF inducement, it is not likely that the institutional motivation to be a pioneer in the development of this resource would arise in Mexico in the near future. A significant opportunity for Mexico and the world would be lost.

Appendix A: Product Specification Test Schedules

Example of Test Schedule: 120V

Measurements of the Operating Lamp-System: Initial Operating Performance
Initial Operating Performance:

	Minimum Voltage	Nominal Voltage	Maximum Voltage
1) Input Voltage, True RMS, (V)	108	120	132
2) Input Current, True RMS, (A)			
3) Input Current, Peak Value, (A)			
4) Input Current, Crest Factor			
5) Watts, RMS, (W)			
6) Volt-Amps, RMS (#1 X #2), (VA)			
7) Power Factor (#5/#6)			
8) Lumen Output, (lm)			
9) Lamp Efficacy (#8/#5), (lm/W)			
10) Color Temperature, (°K)			
11) Color Rendering Index			
12) Percent Harmonic Distortion, (percent)			
3rd			
5th			
7th			
9th			
Higher Harmonics			
Total Harmonic Distortion			

Time-to-Start, (sec)
(minimum starting temp - °C)
(specified by manufacturer)

Time-to-Start at 25°C, (sec)

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Example of Test Schedule: 127V

Measurements of the Operating Lamp-System: Initial Operating Performance
Initial Operating Performance:

1) Input Voltage, True RMS, (V)	118	127	140
2) Input Current, True RMS, (A)			
3) Input Current, Peak Value, (A)			
4) Input Current, Crest Factor			
5) Watts, RMS, (W)			
6) Volt-Amps, RMS (#1 X #2), (VA)			
7) Power Factor (#5/#6)			
8) Lumen Output, (lm)			
9) Lamp Efficacy (#8/#5), (lm/W)			
10) Color Temperature, (°K)			
11) Color Rendering Index			
12) Percent Harmonic Distortion, (percent)			
3rd			
5th			
7th			
9th			
Higher Harmonics			
Total Harmonic Distortion			

	Minimum Voltage	Nominal Voltage	Maximum Voltage
Time-to-Start, (sec) (minimum starting temp - °C) (specified by manufacturer)			
Time-to-Start at 25°C, (sec)			

Example of Test Schedule: 120V & 127V

Measurements of the Operating Lamp-System: Initial Operating Performance
Initial Operating Performance:

1) Input Voltage, True RMS, (V)	108	120	127	140
5) Watts, RMS, (W)				
6) Volt-Amps, RMS (#1 X #2), (VA)				
7) Power Factor (#5/#6)				
8) Lumen Output, (lm)				
9) Lamp Efficacy (#8/#5), (lm/W)				
10) Color Temperature, (°K)				
11) Color Rendering Index				
12) Percent Harmonic Distortion, (percent)				
3rd				
5th				
7th				
9th				
Higher Harmonics				
Total Harmonic Distortion				

	Minimum Voltage	Nominal Voltage	Maximum Voltage
Time-to-Start, (sec) (minimum starting temp - °C) (specified by manufacturer)			
Time-to-Start at 25°C, (sec)			

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Example of Test Schedule

Measurement of the Components of the Operating Lamp-System:
Initial Operating Performance:

Component-Ballast Measurements:

Nominal Input Voltage (V)
120V and/or 127V.....

1) Starting Method for Light Source
2) Current to Lamp, RMS, (A)
3) Current to Lamp, Peak Value, (A)
4) Current to Lamp, Current Crest Factor
5) Current to Lamp, Amplitude Modulation (percent)
6) Power to Lamp, RMS, (W)
7) Power to Ballast, RMS, (W)
8) Frequency of Operation, (Hz)
9) Ballast Factor

Starting Tests:

Components - Ballast measurements:

1) Starting Method for Light Source

( ) Rapid Start ( ) Preheat
( ) Modified Rapid Start ( ) Instant Start

2) Time to Initiate Discharge, (sec)
3) Filament Current During Starting Operation, (A)

Example of Test Schedule

Measurement of the Components of the Operating Lamp-System: (continued)
Initial Operating Performance:

Component-Lamp Measurements:
(using a Reference Ballast at 120V):

10) Voltage to Lamp, RMS, (V)
11) Current to Lamp, RMS, (A)
12) Power to Lamp, RMS, (W)
13) Lumens, (lm)
14) Lamp Efficacy, (lm/W)
15) Color Temperature, (°K)
16) Color Rendering Index) Voltage to Lamp, RMS, (V)

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Example Test Schedule

Life Test Measurements of Operating Lamp-Systems:

	-10 percent Nominal Voltage	-5 percent Nominal Voltage	+5 percent Nominal Voltage	+10 percent Nominal Voltage
1) Life Test: 25°C, Base-up				
Mean time to failure (hrs)				
			Nominal Voltage	
2) Life Test: 60°C, Base-up,				
Mean time to failure (hrs)				
			Nominal Voltage	
3) Rapid Cycle Test:				
Mean time to failure (# cycles)				

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Example Test Schedule

Lamp Failure Tests of Operating Lamp-System:

Preheat Lamp-System:
(After 100 hours of testing)

	Nominal Input Voltage (V) 120V and/or 127V
1) Voltage to Lamp, RMS, (V)	
2) Current to Lamp, RMS, (A)	
3) Current to Lamp, Peak Value, (A)	
4) Current to Lamp, Current Crest Factor, (A)	
5) Current to Lamp, Amplitude Modulation (percent)	
6) Power to Lamp, RMS, (W)	
7) Power to Ballast, RMS, (W)	
8) Frequency of Operation, (Hz)	
9) Ballast Factor	

Electronic Lamp-Systems:
(After 100 hours of testing)

	Nominal Input Voltage (V) 120V and/or 127V
1) Voltage to Lamp, RMS, (V)	
2) Current to Lamp, RMS, (A)	
3) Current to Lamp, Peak Value, (A)	
4) Current to Lamp, Current Crest Factor, (A)	
5) Current to Lamp, Amplitude Modulation (percent)	
6) Power to Lamp, RMS, (W)	
7) Power to Ballast, RMS, (W)	
8) Frequency of Operation, (Hz)	
9) Ballast Factor	

Example Test Schedule

Lamp Failure Tests of Operating Lamp-System: (Continued)

Lamp Removal: (After 100 hours of testing)	Nominal Input Voltage (V) 120V and/or 127V
1) Voltage to Lamp, RMS, (V)	
2) Current to Lamp, RMS, (A)	
3) Current to Lamp, Peak Value, (A)	
4) Current to Lamp, Current Crest Factor, (A)	
5) Current to Lamp, Amplitude Modulation (percent)	
6) Power to Lamp, RMS, (W)	
7) Power to Ballast, RMS, (W)	
8) Frequency of Operation, (Hz)	
9) Ballast Factor	

TABLE B.1. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- NATIONAL PERSPECTIVE (10% Discount Rate)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFLs	-22500	-22500	0	0	0	0	0	0
Program Costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-26190	-26190	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Demand Capacity	11966	23932	23932	23932	23932	23932	12325	0
Avoided Energy	10264	20529	20529	20529	20529	20529	10572	0
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Total Benefits	24305	48610	48610	48610	48610	48610	25034	0
Net Benefits (Cash Flow)	-1885	22420	48610	48610	48610	48610	25034	0
NPV of Benefits	-1885	20382	40174	36522	33201	30183	13917	0
Total NPV of Benefits	172494							
EIRR	1289%							

Assumptions:

National Discount Rate =	10%
Exchange Rate (pesos/US$) =	3000
LRMC of Demand @ distribution (US$/kW-y) =	132
LRMC of Energy @ distribution (pesos/kWh)	186
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4
Peak Coincidence Factor (%) =	80%

0.75 million CFLs installed each year for 2 years (375000 per city per year).
CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFLs = # CFLs * $/CFL

Program Costs = # CFLs * $/program

Avoided Demand Capacity = # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy = # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

Avoided Incandescent lamps = # CFLs * # h/d * 365 d/y * 1 Inc./750 h * $/Inc.

TABLE B.2. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- NATIONAL PERSPECTIVE (12% Discount Rate)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFLs	-22500	-22500	0	0	0	0	0	0
Program Costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-26190	-26190	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Demand Capacity	11966	23932	23932	23932	23932	23932	12325	0
Avoided Energy	10264	20529	20529	20529	20529	20529	10572	0
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Total Benefits	24305	48610	48610	48610	48610	48610	25034	0
Net Benefits (Cash Flow)	-1885	22420	48610	48610	48610	48610	25034	0
NPV of Benefits	-1885	20018	38752	34600	30893	27583	12455	0
Total NPV of Benefits	162415							
EIRR	1289%							

Assumptions:

National Discount Rate =	12%
Exchange Rate (pesos/US$) =	3000
LRMC of Demand @ distribution (US$/kW-y) =	132
LRMC of Energy @ distribution (pesos/kWh)	186
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4
Peak Coincidence Factor (%) =	80%

0.75 million CFLs installed each year for 2 years (375000 per city per year).
CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFLs = # CFLs * $/CFL

Program Costs = # CFLs * $/program

Avoided Demand Capacity = # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy = # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

Avoided incandescent lamps = # CFLs * # h/d * 365 d/y * 1 inc./750 h * $/inc.

TABLE B.3. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- NATIONAL PERSPECTIVE ($ 6020/CFL Program Cost)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFLs	-22500	-22500	0	0	0	0	0	0
Program Costs	-4515	-4515	0	0	0	0	0	0
Total Costs	-27015	-27015	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Demand Capacity	11966	23932	23932	23932	23932	23932	12325	0
Avoided Energy	10264	20529	20529	20529	20529	20529	10572	0
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Total Benefits	24305	48610	48610	48610	48610	48610	25034	0
Net Benefits (Cash Flow)	-2710	21595	48610	48610	48610	48610	25034	0
NPV of Benefits	-2710	19632	40174	36522	33201	30183	13917	0
Total NPV of Benefits	170919							
EIRR	897%							

Assumptions:

National Discount Rate =	10%
Exchange Rate (pesos/US$) =	3000
LRMC of Demand @ distribution (US$/kW-y) =	132
LRMC of Energy @ distribution (pesos/kWh)	186
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	6020
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4
Peak Coincidence Factor (%) =	80%

0.75 million CFLs installed each year for 2 years (375000 per city per year).
CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFLs = # CFLs * $/CFL

Program Costs = # CFLs * $/program

Avoided Demand Capacity = # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy = # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

Avoided Incandescent lamps = # CFLs * # h/d * 365 d/y * 1 Inc./750 h * $/Inc.

TABLE B.4. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- AVE. CUSTOMER PERSPECTIVE (18% Discount Rate)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-22500	-22500	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-26190	-26190	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	8278	16555	16555	16555	16555	16555	8526	0
Total Benefits	10352	20705	20705	20705	20705	20705	10663	0
Net Benefits (Cash Flow)	-15838	-5485	20705	20705	20705	20705	10663	0
NPV of Benefits	-15838	-4649	14870	12601	10679	9050	3847	0
Total NPV of Benefits	30561							
EIRR (%)	59%							
Payback time (years)	3.67							

Assumptions:

Customer Discount Rate =	18%
Electricity Billed at (pesos/kWh) =	150
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 inc./750 h * $/inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year)	2766
Reduction in el. bill ($/year)	11037

TABLE B.5. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- AVE. CUSTOMER PERSPECTIVE (12% Discount Rate)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-22500	-22500	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-26190	-26190	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	8278	16555	16555	16555	16555	16555	8526	0
Total Benefits	10352	20705	20705	20705	20705	20705	10663	0
Net Benefits (Cash Flow)	-15838	-5485	20705	20705	20705	20705	10663	0
NPV of Benefits	-15838	-4898	16506	14737	13158	11748	5305	0

Total NPV of Benefits	40719
EIRR (%)	59%
Payback time (years)	3.19

Assumptions:

Customer Discount Rate =	12%
Electricity Billed at (pesos/kWh) =	150
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 inc./750 h * $/inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year)	2766
Reduction in el. bill ($/year)	11037

TABLE B.6. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- AVE. CUSTOMER PERSPECTIVE (24% Discount Rate)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-22500	-22500	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-26190	-26190	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	8278	16555	16555	16555	16555	16555	8526	0
Total Benefits	10352	20705	20705	20705	20705	20705	10663	0
Net Benefits (Cash Flow)	-15838	-5485	20705	20705	20705	20705	10663	0
NPV of Benefits	-15838	-4424	13466	10859	8758	7063	2834	0

Total NPV of Benefits	22718
EIRR (%)	59%
Payback time (years)	4.34

Assumptions:

Customer Discount Rate =	24%
Electricity Billed at (pesos/kWh) =	150
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 Inc./750 h * $/Inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year)	2766
Reduction in el. bill ($/year)	11037

TABLE B.7. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- AVE. CUSTOMER PERSPECTIVE (18% Discount Rate, 2 Year Payback)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-12510	-12510	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-16200	-16200	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	8278	16555	16555	16555	16555	16555	8526	0
Total Benefits	10352	20705	20705	20705	20705	20705	10663	0
Net Benefits (Cash Flow)	-5848	4505	20705	20705	20705	20705	10663	0
NPV of Benefits	-5848	3818	14870	12601	10679	9050	3847	0
Total NPV of Benefits	49017							
EIRR (%)	176%							
Payback time (years)	2.00							

Assumptions:

Customer Discount Rate =	18%
Electricity Billed at (pesos/kWh) =	150
CFL Cost (pesos/CFL) =	16680
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 inc./750 h * $/inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year)	2766
Reduction in el. bill ($/year)	11037

TABLE B.8. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- AVE. CUSTOMER PERSPECTIVE (12% Discount Rate, 2 Year Payback)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-13785	-13785	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-17475	-17475	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	8278	16555	16555	16555	16555	16555	8526	0
Total Benefits	10352	20705	20705	20705	20705	20705	10663	0
Net Benefits (Cash Flow)	-7123	3230	20705	20705	20705	20705	10663	0
NPV of Benefits	-7123	2884	16506	14737	13158	11748	5305	0
Total NPV of Benefits	57215							
EIRR (%)	144%							
Payback time (years)	2.00							

Assumptions:

Customer Discount Rate =	12%
Electricity Billed at (pesos/kWh) =	150
CFL Cost (pesos/CFL) =	18380
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 Inc./750 h * $/Inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year)	2766
Reduction in el. bill ($/year)	11037

TABLE B.9. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- AVE. CUSTOMER PERSPECTIVE (24% Discount Rate, 2 Year Payback)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-11385	-11385	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-15075	-15075	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	8278	16555	16555	16555	16555	16555	8526	0
Total Benefits	10352	20705	20705	20705	20705	20705	10663	0
Net Benefits (Cash Flow)	-4723	5630	20705	20705	20705	20705	10663	0
NPV of Benefits	-4723	4540	13466	10859	8758	7063	2834	0
Total NPV of Benefits	42796							
EIRR (%)	219%							
Payback time (years)	2.00							

Assumptions:

Customer Discount Rate =	24%
Electricity Billed at (pesos/kWh) =	150
CFL Cost (pesos/CFL) =	15180
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 Inc./750 h * $/Inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided Incandescent: ($/year)	2766
Reduction in el. bill ($/year)	11037

TABLE B.10. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- SMALLEST CUSTOMER PERSPECTIVE (56.33 $/kWh tariff)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-22500	-22500	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-26190	-26190	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	3109	6217	6217	6217	6217	6217	3202	0
Total Benefits	5183	10366	10366	10366	10366	10366	5339	0
Net Benefits (Cash Flow)	-21007	-15824	10366	10366	10366	10366	5339	0
NPV of Benefits	-21007	-13410	7445	6309	5347	4531	1926	0

Total NPV of Benefits	-8858
EIRR (%)	8%
Payback time (years)	14.52

Assumptions:

Customer Discount Rate =	18%
Electricity Billed at (pesos/kWh) =	56.33
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 Inc./750 h * $/Inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year)	2766
Reduction in el. bill ($/year)	4145

TABLE B.11. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- SMALL CUSTOMER PERSPECTIVE (80.35 $/kWh tariff)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-22500	-22500	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-26190	-26190	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	4434	8868	8868	8868	8868	8868	4567	0
Total Benefits	6509	13017	13017	13017	13017	13017	6704	0
Net Benefits (Cash Flow)	-19681	-13173	13017	13017	13017	13017	6704	0
NPV of Benefits	-19681	-11163	9349	7923	6714	5690	2418	0

Total NPV of Benefits	1250
EIRR (%)	20%
Payback time (years)	7.78

Assumptions:

Customer Discount Rate =	18%
Electricity Billed at (pesos/kWh) =	80.35
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 Inc./750 h * $/Inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year)	2766
Reduction in el. bill ($/year)	5912

TABLE B.12. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- LARGEST CUSTOMER PERSPECTIVE (430.06 $/kWh tariff)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-22500	-22500	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-26190	-26190	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	23733	47465	47465	47465	47465	47465	24445	0
Total Benefits	25807	51615	51615	51615	51615	51615	26582	0
Net Benefits (Cash Flow)	-383	25425	51615	51615	51615	51615	26582	0
NPV of Benefits	-383	21546	37069	31414	26622	22561	9589	0
Total NPV of Benefits	148420							
EIRR (%)	6744%							
Payback time (years)	1.22							

Assumptions:

Customer Discount Rate =	18%
Electricity Billed at (pesos/kWh) =	430.06
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 inc./750 h * $/inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year) 2766

Reduction in el. bill ($/year) 31644

TABLE B.13. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- SMALLEST CUSTOMER PERSPECTIVE (56.33 $/kWh tariff, 2 Year Payback)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-4410	-4410	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-8100	-8100	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	3109	6217	6217	6217	6217	6217	3202	0
Total Benefits	5183	10366	10366	10366	10366	10366	5339	0
Net Benefits (Cash Flow)	-2917	2266	10366	10366	10366	10366	5339	0
NPV of Benefits	-2917	1921	7445	6309	5347	4531	1926	0
Total NPV of Benefits	24562							
EIRR (%)	177%							
Payback time (years)	2.00							

Assumptions:

Customer Discount Rate =	18%
Electricity Billed at (pesos/kWh) =	56.33
CFL Cost (pesos/CFL) =	5880
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 Inc./750 h * $/Inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year) 2766

Reduction in el. bill ($/year) 4145

TABLE B.14. ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- SMALL CUSTOMER PERSPECTIVE (80.35 $/kWh tariff, 2 Year Payback)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-6510	-6510	0	0	0	0	0	0
Program costs	-3690	-3690	0	0	0	0	0	0
Total Costs	-10200	-10200	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Incandescent lamps	2075	4149	4149	4149	4149	4149	2137	0
Reduction in electric bill	4434	8868	8868	8868	8868	8868	4567	0
Total Benefits	6509	13017	13017	13017	13017	13017	6704	0
Net Benefits (Cash Flow)	-3691	2817	13017	13017	13017	13017	6704	0
NPV of Benefits	-3691	2388	9349	7923	6714	5690	2418	0

Total NPV of Benefits	30791
EIRR (%)	175%
Payback time (years)	2.00

Assumptions:

Customer Discount Rate =	18%
Electricity Billed at (pesos/kWh) =	80.35
CFL Cost (pesos/CFL) =	8680
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 Inc./750 h * $/Inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year)	2766
Reduction in el. bill ($/year)	5912

TABLE B.15 ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS FOR C.F.E. (12% Discount Rate, Ave. Customer)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS								
Cost of CFLs	0	0	0	0	0	0	0	0
Program Costs	0	0	0	0	0	0	0	0
Revenue loses	-8278	-16555	-16555	-16555	-16555	-16555	-8526	0
Total Costs	-8278	-16555	-16555	-16555	-16555	-16555	-8526	0
BENEFITS								
Avoided Demand Capacity	11966	23932	23932	23932	23932	23932	12325	0
Avoided Energy	10264	20529	20529	20529	20529	20529	10572	0
Total Benefits	22230	44461	44461	44461	44461	44461	22897	0
Net Benefits (Cash Flow)	13953	27906	27906	27906	27906	27906	14371	0
NPV of Benefits	13953	24916	22246	19863	17734	15834	7150	0
Total NPV of Benefits	121696							
EIRR	-100%							

Assumptions:

Discount Rate used (%) =	12%
Exchange Rate (pesos/US$) =	3000
Ave. electric tariff ($/kWh) =	150
LRMC of Energy @ distribution (pesos/kWh)	186
LRMC of Demand @ distribution (US$/kw-y) =	132
CFL Cost (pesos/CFL) =	0
Program costs (pesos/CFL) =	0
Incandescent Lamp Cost (pesos/lamp) =	0
Watts saved per CFL (W/CFL) =	50.4
Hours of use per day (h/d) =	4
Peak Coincidence Factor - PCF (%) =	80%

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use for a net saving of 50.4 W/CFL.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.
Avoided demand capacity investments calculated using result (132 US$/kW-year) of EDF's electric tariff study for Mexico. This value includes
Assumed peak lamps-on coincidence factor of 0.8.

Calculations:

Revenue loss: # CFLs * kW/CFL * h/d * 365 d/y * $ tariff/kWh

Avoided Demand Capacity: # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy: # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

TABLE B.16 ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS FOR C.F.E. (Smallest Customer)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS								
Cost of CFLs	0	0	0	0	0	0	0	0
Program Costs	0	0	0	0	0	0	0	0
Revenue loses	-3109	-6217	-6217	-6217	-6217	-6217	-3202	0
Total Costs	-3109	-6217	-6217	-6217	-6217	-6217	-3202	0
BENEFITS								
Avoided Demand Capacity	11966	23932	23932	23932	23932	23932	12325	0
Avoided Energy	10264	20529	20529	20529	20529	20529	10572	0
Total Benefits	22230	44461	44461	44461	44461	44461	22897	0
Net Benefits (Cash Flow)	19122	38244	38244	38244	38244	38244	19696	0
NPV of Benefits	19122	34146	30488	27221	24305	21701	9799	0
Total NPV of Benefits	166782							
EIRR	-100%							

Assumptions:

Discount Rate used (%) =	12%
Exchange Rate (pesos/US$) =	3000
Ave. electric tariff ($/kWh) =	56.33
LRMC of Energy @ distribution (pesos/kWh)	186
LRMC of Demand @ distribution (US$/kw-y) =	132
CFL Cost (pesos/CFL) =	0
Program costs (pesos/CFL) =	0
Incandescent Lamp Cost (pesos/lamp) =	0
Watts saved per CFL (W/CFL) =	50.4
Hours of use per day (h/d) =	4
Peak Coincidence Factor - PCF (%) =	80%

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use for a net saving of 50.4 W/CFL.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.
Avoided demand capacity investments calculated using result (132 US$/kW-year) of EDF's electric tariff study for Mexico. This value includes
Assumed peak lamps-on coincidence factor of 0.8.

Calculations:

Revenue loss: # CFLs * kW/CFL * h/d * 365 d/y * $ tariff/kWh

Avoided Demand Capacity: # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy: # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

TABLE B.17 ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS FOR C.F.E. (Largest Customer)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS								
Cost of CFLs	0	0	0	0	0	0	0	0
Program Costs	0	0	0	0	0	0	0	0
Revenue loses	-23733	-47465	-47465	-47465	-47465	-47465	-24445	0
Total Costs	-23733	-47465	-47465	-47465	-47465	-47465	-24445	0
BENEFITS								
Avoided Demand Capacity	11966	23932	23932	23932	23932	23932	12325	0
Avoided Energy	10264	20529	20529	20529	20529	20529	10572	0
Total Benefits	22230	44461	44461	44461	44461	44461	22897	0
Net Benefits (Cash Flow)	-1502	-3005	-3005	-3005	-3005	-3005	-1547	0
NPV of Benefits	-1502	-2683	-2395	-2139	-1909	-1705	-770	0
Total NPV of Benefits	-13103							
EIRR	-100%							

Assumptions:

Discount Rate used (%) =	12%
Exchange Rate (pesos/US$) =	3000
Ave. electric tariff ($/kWh) =	430.06
LRMC of Energy @ distribution (pesos/kWh)	186
LRMC of Demand @ distribution (US$/kw-y) =	132
CFL Cost (pesos/CFL) =	0
Program costs (pesos/CFL) =	0
Incandescent Lamp Cost (pesos/lamp) =	0
Watts saved per CFL (W/CFL) =	50.4
Hours of use per day (h/d) =	4
Peak Coincidence Factor - PCF (%) =	80%

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use for a net saving of 50.4 W/CFL.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.
Avoided demand capacity investments calculated using result (132 US$/kW-year) of EDF's electric tariff study for Mexico. This value includes
Assumed peak lamps-on coincidence factor of 0.8.

Calculations:

Revenue loss: # CFLs * kW/CFL * h/d * 365 d/y * $ tariff/kWh

Avoided Demand Capacity: # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy: # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

TABLE B.18 ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS FOR C.F.E. (Ave. Customer, 2 Year Payback)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS								
Cost of CFLs	-9990	-9990	0	0	0	0	0	0
Program Costs	0	0	0	0	0	0	0	0
Revenue loses	-8278	-16555	-16555	-16555	-16555	-16555	-8526	0
Total Costs	-18268	-26545	-16555	-16555	-16555	-16555	-8526	0
BENEFITS								
Avoided Demand Capacity	11966	23932	23932	23932	23932	23932	12325	0
Avoided Energy	10264	20529	20529	20529	20529	20529	10572	0
Total Benefits	22230	44461	44461	44461	44461	44461	22897	0
Net Benefits (Cash Flow)	3963	17916	27906	27906	27906	27906	14371	0
NPV of Benefits	3963	15996	22246	19863	17734	15834	7150	0
Total NPV of Benefits	102787							
EIRR	-100%							

Assumptions:

Discount Rate used (%) =	12%
Exchange Rate (pesos/US$) =	3000
Ave. electric tariff ($/kWh) =	150
LRMC of Energy @ distribution (pesos/kWh)	186
LRMC of Demand @ distribution (US$/kw-y) =	132
CFL Cost (pesos/CFL) =	13320
Program costs (pesos/CFL) =	0
Incandescent Lamp Cost (pesos/lamp) =	0
Watts saved per CFL (W/CFL) =	50.4
Hours of use per day (h/d) =	4
Peak Coincidence Factor - PCF (%) =	80%

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use for a net saving of 50.4 W/CFL.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.
Avoided demand capacity investments calculated using result (132 US$/kW-year) of EDF's electric tariff study for Mexico. This value includes
Assumed peak lamps-on coincidence factor of 0.8.

Calculations:

Revenue loss: # CFLs * kW/CFL * h/d * 365 d/y * $ tariff/kWh

Avoided Demand Capacity: # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy: # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

TABLE B.19 ILUMEX PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS FOR C.F.E. (Smallest Customer, 2 Year Payback)

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number of CFLs introduced	750000	750000	0	0	0	0	-750000	-750000
Number of CFLs present	750000	1500000	1500000	1500000	1500000	1500000	750000	0
COSTS								
Cost of CFLs	-18090	-18090	0	0	0	0	0	0
Program Costs	0	0	0	0	0	0	0	0
Revenue loses	-3109	-6217	-6217	-6217	-6217	-6217	-3202	0
Total Costs	-21199	-24307	-6217	-6217	-6217	-6217	-3202	0
BENEFITS								
Avoided Demand Capacity	11966	23932	23932	23932	23932	23932	12325	0
Avoided Energy	10264	20529	20529	20529	20529	20529	10572	0
Total Benefits	22230	44461	44461	44461	44461	44461	22897	0
Net Benefits (Cash Flow)	1032	20154	38244	38244	38244	38244	19696	0
NPV of Benefits	1032	17995	30488	27221	24305	21701	9799	0
Total NPV of Benefits	132540							
EIRR	-100%							

Assumptions:

Discount Rate used (%) =	12%
Exchange Rate (pesos/US$) =	3000
Ave. electric tariff ($/kWh) =	56.33
LRMC of Energy @ distribution (pesos/kWh)	186
LRMC of Demand @ distribution (US$/kw-y) =	132
CFL Cost (pesos/CFL) =	24120
Program costs (pesos/CFL) =	0
Incandescent Lamp Cost (pesos/lamp) =	0
Watts saved per CFL (W/CFL) =	50.4
Hours of use per day (h/d) =	4
Peak Coincidence Factor - PCF (%) =	80%

0.75 million CFLs installed each year for 2 years (375000 per city per year). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use for a net saving of 50.4 W/CFL.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.
Avoided demand capacity investments calculated using result (132 US$/kW-year) of EDF's electric tariff study for Mexico. This value includes
Assumed peak lamps-on coincidence factor of 0.8.

Calculations:

Revenue loss: # CFLs * kW/CFL * h/d * 365 d/y * $ tariff/kWh

Avoided Demand Capacity: # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy: # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

TABLE B.20. MEXICO-WIDE PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- NATIONAL PERSPECTIVE (CFL used 4 Hour/Day)

Year	1	2	3	4	5	6	7	8
Number of CFLs introduced	11500000	11500000	0	0	0	0	-11500000	-11500000
Number of CFLs present	11500000	23000000	23000000	23000000	23000000	23000000	11500000	0
COSTS (Millions of pesos)								
Cost of CFLs	-345000	-345000	0	0	0	0	0	0
Program Costs	-56580	-56580	0	0	0	0	0	0
Total Costs	-401580	-401580	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Demand Capacity	183481	366961	366961	366961	366961	366961	188985	0
Avoided Energy	157387	314774	314774	314774	314774	314774	162108	0
Avoided Incandescent lamps	31811	63622	63622	63622	63622	63622	32765	0
Total Benefits	372678	745357	745357	745357	745357	745357	383859	0
Net Benefits (Cash Flow)	-28902	343777	745357	745357	745357	745357	383859	0
NPV of Benefits	-28902	312524	615997	559997	509089	462808	213399	0
Total NPV of Benefits	2644912							
EIRR	1289%							

Assumptions:

National Discount Rate =	10%
Exchange Rate (pesos/US$) =	3000
LRMC of Demand @ distribution (US$/kW-y) =	132
LRMC of Energy @ distribution (pesos/kWh)	186
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4
Peak Coincidence Factor (%) =	80%

11.5 million CFLs installed each year for 2 years.
CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFLs = # CFLs * $/CFL

Program Costs = # CFLs * $/program

Avoided Demand Capacity = # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy = # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

Avoided Incandescent lamps = # CFLs * # h/d * 365 d/y * 1 Inc./750 h * $/Inc.

TABLE B.21. MEXICO-WIDE PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- NATIONAL PERSPECTIVE (CFL used 2 Hour/Day, 50 Million CFLs)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Number of CFLs introduced	25000000	25000000	0	0	0	0	0	0	0	0	0	0	-25000000	-25000000
Number of CFLs present	25000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	25000000	0
COSTS (Millions of pesos)														
Cost of CFLs	-750000	-750000	0	0	0	0	0	0	0	0	0	0	0	0
Program Costs	-123000	-123000	0	0	0	0	0	0	0	0	0	0	0	0
Total Costs	-873000	-873000	0	0	0	0	0	0	0	0	0	0	0	0
BENEFITS (Millions of pesos)														
Avoided Demand Capacity	398871	797742	797742	797742	797742	797742	797742	797742	797742	797742	797742	797742	409508	0
Avoided Energy	171073	342145	342145	342145	342145	342145	342145	342145	342145	342145	342145	342145	175635	0
Avoided Incandescent lamps	34577	69154	69154	69154	69154	69154	69154	69154	69154	69154	69154	69154	35499	0
Total Benefits	604521	1209041	1209041	1209041	1209041	1209041	1209041	1209041	1209041	1209041	1209041	1209041	620641	0
Net Benefits (Cash Flow)	-268479	336041	1209041	1209041	1209041	1209041	1209041	1209041	1209041	1209041	1209041	1209041	620641	0
NPV of Benefits	-268479	305492	999208	908371	825791	750719	682472	620429	564027	512751	466138	423762	191815	0
Total NPV of Benefits	6982496													
EIRR	225%													

Assumptions:

National Discount Rate =	10%
Exchange Rate (pesos/US$) =	3000
LRMC of Demand @ distribution (US$/kW-y) =	132
LRMC of Energy @ distribution (pesos/kWh)	186
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	2
Peak Coincidence Factor (%) =	80%

25 million CFLs installed each year for 2 years (total of 50 million Mexico-wide).
CFLs last 9000 hours @ 2 h/d = 12.32 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 1.02 years and cost 1420 pesos each.

How calculations done:

Cost of CFLs = # CFLs * $/CFL

Program Costs = # CFLs * $/program

Avoided Demand Capacity = # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy = # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

Avoided Incandescent lamps = # CFLs * # h/d * 365 d/y * 1 Inc./750 h * $/Inc.

TABLE B.22. MEXICO-WIDE PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- AVE. CUSTOMER PERSPECTIVE (CFL used 4 Hour/Day)

Year	1	2	3	4	5	6	7	8
Number of CFLs introduced	11500000	11500000	0	0	0	0	-11500000	-11500000
Number of CFLs present	11500000	23000000	23000000	23000000	23000000	23000000	11500000	0
COSTS (Millions of pesos)								
Cost of CFL lamps	-345000	-345000	0	0	0	0	0	0
Program costs	-56580	-56580	0	0	0	0	0	0
Total Costs	-401580	-401580	0	0	0	0	0	0
BENEFITS (Millions of pesos)								
Avoided Incandescent lamps	31811	63622	63622	63622	63622	63622	32765	0
Reduction in electric bill	126925	253850	253850	253850	253850	253850	130733	0
Total Benefits	158736	317471	317471	317471	317471	317471	163498	0
Net Benefits (Cash Flow)	-242844	-84109	317471	317471	317471	317471	163498	0
NPV of Benefits	-242844	-71279	228003	193223	163748	138770	58982	0
Total NPV of Benefits	468603							
EIRR (%)	59%							
Payback time (years)	3.67							

Assumptions:

Customer Discount Rate =	18%
Electricity Billed at (pesos/kWh) =	150
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	4

11.5 million CFLs installed each year for 2 years (Total of 23 million CFLs). CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided incandescent lamps: # CFLs * h/d * 365 d/y * 1 Inc./750 h * $/Inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided incandescent: ($/year)	2766
Reduction in el. bill ($/year)	11037

TABLE B.23. MEXICO-WIDE PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS -- AVE. CUSTOMER PERSPECTIVE (CFL used 2 Hour/Day, 50 Million CFL

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Number of CFLs introduced	25000000	25000000	0	0	0	0	0	0	0	0	0	0	-25000000	-25000000
Number of CFLs present	25000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	25000000	0
COSTS (Millions of pesos)														
Cost of CFL lamps	-750000	-750000	0	0	0	0	0	0	0	0	0	0	0	0
Program costs	-123000	-123000	0	0	0	0	0	0	0	0	0	0	0	0
Total Costs	-873000	-873000	0	0	0	0	0	0	0	0	0	0	0	0
BENEFITS (Millions of pesos)														
Avoided Incandescent lamps	34577	69154	69154	69154	69154	69154	69154	69154	69154	69154	69154	69154	35499	0
Reduction in electric bill	137962	275924	275924	275924	275924	275924	275924	275924	275924	275924	275924	275924	141641	0
Total Benefits	172539	345078	345078	345078	345078	345078	345078	345078	345078	345078	345078	345078	177140	0
Net Benefits (Cash Flow)	-700461	-527922	345078	345078	345078	345078	345078	345078	345078	345078	345078	345078	177140	0
NPV of Benefits	-700461	-447392	247829	210025	177987	150837	127828	108328	91804	77800	65932	55875	23053	0
Total NPV of Benefits	189444													
EIRR (%)	22%													
Payback time (years)	14.60													

Assumptions:

Customer Discount Rate =	18%
Electricity Billed at (pesos/kWh) =	150
CFL Cost (pesos/CFL) =	30000
Program costs (pesos/CFL) =	4920
Incandescent Lamp Cost (pesos/lamp) =	1420
Watts saved per CFL =	50.4
Hours of use per day =	2

25 million CFLs installed each year for 2 years (Total of 50 million CFLs). CFLs last 9000 hours @ 2 h/d = 12.32 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use.
Incadescent lamps last 750 hours = 1.02 years and cost 1420 pesos each.

How calculations done:

Cost of CFL lamps: # CFLs * $/CFL

Program Cost: # CFLs * $/program

Avoided Incandescent lamps: # CFLs * # h/d * 365 d/y * 1 Inc./750 h * $/inc.

Reduction in electric bill: # CFLs * kW/CFL * # h/d * 365 d/y * $tariff/kWh

On a per CFL basis have:

Avoided Incandescent: ($/year)	1383
Reduction in el. bill ($/year)	5518

TABLE B.24 MEXICO-WIDE PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS FOR C.F.E. (CFL used 4 Hour/Day)

Year	1	2	3	4	5	6	7	8
Number of CFLs introduced	11500000	11500000	0	0	0	0	-11500000	-11500000
Number of CFLs present	11500000	23000000	23000000	23000000	23000000	23000000	11500000	0
COSTS								
Cost of CFLs	0	0	0	0	0	0	0	0
Program Costs	0	0	0	0	0	0	0	0
Revenue loses	-126925	-253850	-253850	-253850	-253850	-253850	-130733	0
Total Costs	-126925	-253850	-253850	-253850	-253850	-253850	-130733	0
BENEFITS								
Avoided Demand Capacity	183481	366961	366961	366961	366961	366961	188985	0
Avoided Energy	157387	314774	314774	314774	314774	314774	162108	0
Total Benefits	340867	681735	681735	681735	681735	681735	351093	0
Net Benefits (Cash Flow)	213943	427885	427885	427885	427885	427885	220361	0
NPV of Benefits	213943	382040	341107	304560	271929	242794	109636	0
Total NPV of Benefits	1866009							
EIRR	-100%							

Assumptions:

Discount Rate used (%) =	12%
Exchange Rate (pesos/US$) =	3000
Ave. electric tariff ($/kWh) =	150
LRMC of Energy @ distribution (pesos/kWh)	186
LRMC of Demand @ distribution (US$/kw-y) =	132
CFL Cost (pesos/CFL) =	0
Program costs (pesos/CFL) =	0
Incandescent Lamp Cost (pesos/lamp) =	0
Watts saved per CFL (W/CFL) =	50.4
Hours of use per day (h/d) =	4
Peak Coincidence Factor - PCF (%) =	80%

11.5 million CFLs installed each year for 2 years. CFLs last 9000 hours @ 4 h/d = 6.16 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use for a net saving of 50.4 W/CFL.
Incadescent lamps last 750 hours = 6.16 months and cost 1420 pesos each.
Avoided demand capacity investments calculated using result (132 US$/kW-year) of EDF's electric tariff study for Mexico. This value includes T&D losses.
Assumed peak lamps-on coincidence factor of 0.8.

Calculations:

Revenue loss: # CFLs * kW/CFL * h/d * 365 d/y * $ tariff/kWh

Avoided Demand Capacity: # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy: # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

TABLE B.25 MEXICO-WIDE PROGRAM: ECONOMIC ANALYSIS AND CASH FLOWS FOR C.F.E. (CFL used 2 Hour/Day; 50 Million CFLs)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Number of CFLs introduced	25000000	25000000	0	0	0	0							-25000000	-25000000
Number of CFLs present	25000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	50000000	25000000	0
COSTS														
Cost of CFLs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Program Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Revenue loses	-275924	-551847	-551847	-551847	-551847	-551847	-551847	-551847	-551847	-551847	-551847	-551847	-283282	0
Total Costs	-275924	-551847	-551847	-551847	-551847	-551847	-551847	-551847	-551847	-551847	-551847	-551847	-283282	0
BENEFITS														
Avoided Demand Capacity	398871	797742	797742	797742	797742	797742	797742	797742	797742	797742	797742	797742	409508	0
Avoided Energy	342145	684290	684290	684290	684290	684290	684290	684290	684290	684290	684290	684290	351269	0
Total Benefits	741016	1482032	1482032	1482032	1482032	1482032	1482032	1482032	1482032	1482032	1482032	1482032	760777	0
Net Benefits (Cash Flow)	465093	930185	930185	930185	930185	930185	930185	930185	930185	930185	930185	930185	477495	0
NPV of Benefits	465093	830523	741538	662088	591150	527812	471261	420769	375686	335434	299495	267406	118196	0
Total NPV of Benefits	6106449													
EIRR	-100%													

Assumptions:

Discount Rate used (%) =	12%
Exchange Rate (pesos/US$) =	3000
Ave. electric tariff ($/kWh) =	150
LRMC of Energy @ distribution (pesos/kWh)	186
LRMC of Demand @ distribution (US$/kW-y) =	132
CFL Cost (pesos/CFL) =	0
Program costs (pesos/CFL) =	0
Incandescent Lamp Cost (pesos/lamp) =	0
Watts saved per CFL (W/CFL) =	50.4
Hours of use per day (h/d) =	4
Peak Coincidence Factor - PCF (%) =	80%

25 million CFLs installed each year for 2 years. CFLs last 9000 hours @ 2 h/d = 12.32 years.
CFLs replace on average a 67.15 W incandescent, saving 3/4 of the electricity at point of use for a net saving of 50.4 W/CFL.
Incadescent lamps last 750 hours = 1.02 years and cost 1420 pesos each.
Avoided demand capacity investments calculated using result (132 US$/kW-year) of EDF's electric tariff study for Mexico. This value includes T&D losses.
Assumed peak lamps-on coincidence factor of 0.8.

Calculations:

Revenue loss: # CFLs * kW/CFL * h/d * 365 d/y * $ tariff/kWh

Avoided Demand Capacity: # CFLs * kW/CFL * PCF * $/kW-y

Avoided Energy: # CFLs * kW/CFL * # h/d * 365 d/y * $/kWh

Appendix C:
DSM Beyond Ilumex

Beyond Residential CFLs

A review of international commercial and industrial (C&I) lighting programs through early 1991 found nearly 200 programs offered by 93 utilities serving 43 states.[26] CFLs typically represent just one among a range of lighting upgrade options. Lighting upgrades are now being packaged into whole-building assessments involving other advanced efficient end-use equipment (including HVAC, advanced window glazings, appliances, and water heating, water-conserving devices).

Expansion Into All-DSM Portfolio Approach

Utilities are discovering that a DSM "portfolio" approach, which looks at all cost-effective efficiency opportunities in a building or facility, helps reduce the administrative, program and delivery costs per kWh saved. While it is prudent to accumulate experience demonstrating a single DSM measure like CFLs, as that experience is gained it makes increasing sense to expand towards the portfolio approach. (The Ilumex Project Menu discusses some of these issues in more detail).

From a Present Value Resource Required (PVRR) perspective, a Total Resource Cost (TRC) test perspective, and a Return on Investment (ROI) perspective, CFE gains from expanding DSM activities into all sectors. In many cases CFE will find that larger savings can be achieved at lower cost than even the cost-effective residential CFL project.

As described in some detail in the Project Menu that supplements this feasibility study, there are a number of recommended steps that CFE can take to deepen and broaden its expertise and experience with DSM opportunities.

In the broad scheme of utility expansion planning, CFLs represent just one among scores of cost-effective DSM investment options. This is readily apparent in examining the least-cost electricity supply curves prepared by a range of institutions shown in the Ilumex Menu.[27] Lighting improvements are among the most cost-effective options (for expanding energy services), and CFLs are among the most cost-effective options within lighting

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[26] Barakat & Chamberlain, Inc., Green Light Utility Program Database, Version 0.5, 1991, prepared for the U.S. Environmental Protection Agency, Office of Air and Radiation, Global Change Division, Washington, DC.

[27] Illustrative supply curves are taken from reports prepared by a cross-section of government, public and private institutions , including the American Council for an Energy Efficient Economy (ACEEE), Bonneville Power Administration (BPA), Lawrence Berekeley Laboratory (LBL), New York State Energy Research and Development Administration (NYSERDA), Rocky Mountain Institute (RMI), and the Swedish National Electricity Board (Vattenfal). Countless more examples are available.

improvements. However, there are many other equally cost-effective lighting opportunities, including:[28]

- Daylighting design for new buildings, which includes use of advanced window glazings, light-colored walls/ceiling/ floors and furniture, clerestories, light shelves, reflector window shades, skylights, etc.;

- Occupancy sensors to turn lights off when unused;

- Highly efficient long-tube fluorescent fixtures that include T-8 lamps, 4-lamp-dimmable electronic ballasts, specular (mirror-like) reflectors, and polarizing lens;

- High-efficiency halogen incandescent bulbs where CFLs are unable to satisfy economic, physical, or aesthetic criteria;

- Promotion of task lighting;

- Replacement of incandescents with high-intensity discharge and metal halide lamps, where appropriate.

There are also many non-lighting DSM options, some lower in cost than CFLs, or comparable in cost-effectiveness relative to new supply options. These typically include:

- Industrial drive equipment
    - proper sizing with high-efficiency motors
    - electronic adjustable speed drives
    - power factor controllers/soft-start devices
    - fast-speed controllers for turbomachinery
    - power factor correction
    - process controls
    - efficient gears, chains, belt couplings, bearings
    - maintenance

- Advanced, highly efficient Appliances
    - refrigerators
    - freezers
    - dishwashers

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[28]Detailed descriptions and discussions of the following list of cost-eefective DSM options can be found in the State of the Art Volumes on Advanced Techniques for Electric Efficiency, available from Competitek, 1050 Walnut Street, Suite 205, Boulder, Colorado 80302-5140, (303) 440-8500, Fax: (303) 440-8502. Other studies are also available from: Lawrence Berkeley Laboratory's Center for Buidling Sciences, 1 Cyclotron Road, Berkeley, California 94720, (510) 486-4834; from the Electric Power Research Insitute's (EPRI) Demand-Side Management Program, 3412 Hillview Avenue, Palo Alto, California 94304, (415) 855-2411; from the California Energy Commission, Publications Office, MS-13, 1516 Ninth Street, P.O. Box 944295, Sacremento, CA 94244-2950, (916) 324-3016; and from the American Council for an Energy Efficient Economy (ACEEE), 1001 Connecticut Avenue N.W., Washington, DC, (202) 429-8873.

- clothes dryers
- clothes washers
- commercial refrigeration
- commercial cooking

- Advanced, highly efficient Office Equipment

  - computers
  - imaging technologies
  - communication equipment

- Cooling systems

  - landscaping and light-colored surfaces
  - HVAC and lighting interactions
  - advanced glazings
  - efficient air conditioners
  - maintenance

Scores of electric utilities in North America operate DSM programs that focus on a variety of energy efficiency opportunities, because each of these categories are proving cost-effective when evaluated with power supply expansion plans.[29]

Moreover, utilities engaged in "third generation" DSM programs typically bundle multiple end-use efficiency improvements into integrated project incentive packages. As DSM experts John Plunkett et. al. note:[30]

> "DSM programs have evolved through three generations of project design and implementation. The first generation (spanning the late 1970s to the mid-1980s) relied almost exclusively on information from utilities to customers about efficiency options.
>
> "Second-generation demand-management programs, recognizing that more than just information is needed to overcome market barriers to energy efficiency, added financial incentives to offset modest fractions of measure costs, or to reduce borrowing costs. Second generation programs are geared toward individual end-uses and specific technologies, with project strategies focused on a single market barrier. Such efforts were considered to represent the state of the art in the early 1980s, and are now fairly common among utilities today.
>
> "The third and most advanced generation of utility demand-management programs takes aim at specific conservation markets by employing aggressive financial incentives, intensive technical and installation assistance, and comprehensive treatment including all cost-effective energy-efficiency measures. Third generation programs recognize that multiple market barriers impeded least-cost consumer choice, and that

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[29]See, for example, the **Keeping Current** case studies prepared by Southern California Edison and distributed to customers. Samples are included in the Ilumex Menu.

[30]From John Plunkett and James Peters, Resource Insight, Inc. and Blair hamilton, Vermont Energy Investment Corporation, Inc., Assessment of Ontario hydro's 1993 Demand Management Plan, Volumes 1 and 2, presented to the Ontario Energy Board, June 1992.

these barriers usually interact. Special effort is made to capture "lost- opportunity resources" in new construction and equipment replacement."

Take three examples, profiled by The Results Center.[31]

In New England Electric System's (NEES) **Small Commercial and Industrial** DSM project portfolio was a $24,100 retrofit of the town library in Southbridge, Massachusetts, resulting in annual savings to the town of $3,933. The retrofit involved 514 fluorescent lamps, 66 fluorescent ballasts, 166 fluorescent fixtures, 30 energy-efficient incandescent screw-in units, and 9 compact fluorescent hard-wired fixtures. These improvements reduced the library's load from 47.8 kW to 27.1 kW, and its electricity bill by half.[32]

Pacific Gas & Electric Company's **Customized Electric Rebates** program provides rebates up to $300,000 to large commercial, industrial and agricultural customers, but not exceeding 50 percent of the direct project cost, to install any measures that save electricity. Projects range from commercial lighting retrofits to industrial process changes and agricultural irrigation equipment installations. The cost of saved energy for the 1991 project is 0.7 cents per kWh (calculated at a 5 percent discount rate, or 0.89 cents/kWh at a 9 percent discount rate).[33]

Northeast Utilities' **Energy Conscious Construction** (ECC) program "provides building owners and designers with the education, technical assistance, and direct financial incentives to incorporate energy-efficient design principles and technologies into new construction and major renovation projects."[34] Participating buildings have cut electricity consumption 25 percent below non-participating buildings. Technology options are drawn from a long technology menu similar to the list above. The program saved 11 million kWh in 1990 at a cost of saved energy of 2.95 cents per kWh (calculated at a 5 percent discount rate, or 3.93 cents per kWh at a 9 percent discount rate).

As these and numerous other examples demonstrate, there are many cost-effective ways to deliver electricity services. In fact, third generation DSM program designs, like the ones just noted, tend to have lower administrative costs per kWh saved, higher participation rates among eligible consumers, and deeper electricity savings by participants,

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[31]The Results Center, operated by IRT Envrionemnt Inc., produces a series of profiles on the most effective energy efficiency programs in North America. Each profile is intended to provide a thorough understanding of the DSM program and its unique elements of success. For further information, contact The Results Center, P.O. Box 10990, Aspen, Colorado 81612-9689, Phone (303) 927-3155, Fax (303) 927-9428.

[32]**New England Electric System, Small Commercial & Industrial,** Profile #1, The Results Center, IRT, 1992.

[33]**Pacific Gas & Electric, Customized Electric Rebates**, Profile #4, The Results Center, IRT, 1992.

[34]**Northeast Utilities, Energy Conscious Construction,** Profile #6, The Results Center, IRT, 1992.

than were seen in first or second generation programs.[35] Germane to this discussion is the fact that these third generation programs move beyond single end-use technologies like CFLs, to examining whole building or whole industrial facility DSM opportunities.

In this manner, the experience generated by the Ilumex project, and the subsequent DSM delivery capability development at CFE, can be leveraged to advance the DSM resource in Mexico to a point where CFE can effectively tap the end-use efficiency resource across all sectors of its customer base. As such, the utility will be able to integrate DSM fully into its resource planning process and select energy service expansion resources based on a rational comparison of the economic, technical feasibility, and environmental values of each competing alternative.

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[35]Plunkett et.al.

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COMISION NACIONAL DE ENERGIA
TEATINOS 120 - SANTIAGO - CHILE

Santiago, 27 de octubre de 1992
ADE/9313/91/04 - 164/92

Mr. Robert Kwartin, Director
EPA Green Lights Program
US EPA 6202J
401 M Street S.W.
Washington,D.C. 20460

Dear Mr. Kwartin,

We are writing to inquire about the USEPA Green Lights initiative. The Chilean National Energy Commission is interested in the Green Lights program and is considering adopting it for use in Chile. It has apparently been very successful in the United States and it compliments our government's policy of keeping the private sector in a primary role in new business initiative. We understand from our recent discussios with Mr. John Lebens of the International Institute for Energy Conservation, that EPA is open to the idea of providing some support for a Chilean Green Lights program. We recognize that funding is limited, but we would like ot begin discussions with you about the possibilities for cooperation.

We would be very interested in receiving a package of current information about the program. Mr. Lebens has presented the Green Lights slide show and has given us the first annual report and some brochures, but we want to make sure that we have the most current information. Also, we are considering the possibility of funding such a program and we would like to know what specific financial or technical support EPA may be able to provide.

Please contact Mr. Leonardo Miranda at the National Energy Commission if you have any questions about this request (phone: 562/699-0070, fax: 562/699-1618).

Sincerely,

REPUBLICA DE CHILE
SECRETARIO EJECUTIVO
COMISION NACIONAL DE ENERGIA

ANGEL MAULEN RIOS
Secretario Ejecutivo
Comisión Nacional de Energia

c.c.: John Lebens, IIEC

PROPOSAL FOR A "GREEN LIGHTS" PROGRAM IN BRAZIL

A. Background

In order to encourage greater use of energy-efficient lighting and thereby prevent pollution, the U.S. Environmental Protection Agency operates the Green Lights program in the United States. As of fall 1992, over 200 corporations or governmental entities had voluntarily enlisted as Green Lights partners. These participants have agreed to install cost-effective lighting efficiency measures in at least 90 percent of their floor space over a five-year period. EPA estimates that lighting upgrades have been completed or are underway in over 150 million square feet of floor space owned by Green Lights partners in the United States. Hundreds of other companies or organizations are Green Lights allies or endorsers.

Brazil is an excellant candidate to replicate the successful U.S. program. A wide range of energy-efficient lighting technologies are produced in Brazil or imported, including compact fluorescent lamps, T-8 lamps, high pressure sodium lamps, dicroic halogen lamps, electronic ballasts, occupancy sensors, and fixtures with specular reflectors. However, these technologies are relatively new and are infrequently purchased in the marketplace.

There is a good foundation for energy conservation initiatives in Brazil. A national electricity conservation program (PROCEL) has existed for about six years. A new private, non-profit organization known as the National Institute for Energy Efficiency (INEE) was recently established. INEE is ready to start up projects such as a Brazilian Green Lights program. Furthermore, some companies in Brazil are concerned about their "environmental image" and want to take actions that are both financially and environmentally sound.

Initial discussions concerning establishing a Brazilian Green Lights program were held in June, 1992. There was considerable interest among key organizations in Brazil, a number of follow-up meetings were held, and the plans for a Brazilian program (known as Luz Verde) were developed by September, 1992.

B. Objectives

The primary objective of this project is to catalyze a transition to energy-efficient lighting technologies in Brazil. Major private companies would become familar with the technologies, recognize their benfits, and begin to purchase them routinely and on a large scale. There should also be a "multiplier effect" as other companies and organizations observe what the participants in Luz Verde are doing, and manufacturers market energy-efficient products broadly.

The objectives of the initial two-year phase are to set up the Luz Verde program, get the different organizations working well together, and to introduce energy-efficient lighting technologies to some major companies. At the end of the initial phase, the companies should be ready to make a deeper commitment (similar to the commitment made by Green Lights partners in the United States).

Another objective of the Luz Verde project is to help INEE get off the ground. Managing a successful project such as Luz Verde will go a long way towards building the credibility and stature of this new organization.

In the second phase of the program, the goal will be to ensure that energy-efficient lighting technologies are widely sold and used in Brazil. Ambitious but achievable five-year goals are as follows:

- o increase compact fluorescent lamp sales to 5 million units per year, more than ten times the sales level in 1990
- o increase T-8 lamp sales to 10 million units per year, around one-third of the total fluorescent lamp market
- o increase electronic ballast sales to at least 20 percent of the total market for fluorescent lighting ballasts
- o increase high pressure sodium lamp sales to at least 1.5 million units per year, equivalent to at least one half the total HID lamp market
- o use of specular reflectors in at least 20 percent of new fluorescent light fixtures.

If these goals are achieved, large economic and environmental benefits would result. Moreover, the transition to high efficiency lighting technologies would be well underway in Brazil.

C. Description

This description applies to the first two years of Luz Verde, termed phase one. INEE will coordinate the project (analagous to the role of EPA in the United States), but will work closely with other participating organizations. These organizations include PROCEL, FBDS (the Brazilian chapter of the Business Council for Sustainable Development), and BNDES (the national development bank). An agreement will be signed by INEE, PROCEL, FDBS, and BNDES defining each organization's role (a draft agreement already has been approved in principal). In brief, the different roles are as follows:

o INEE will coordinate the project and promote participation among companies, maintain relevant data bases, work with affiliates such as lighting manufacturers, lighting designers, and engineering companies, monitor implementation and energy savings by participants, and disseminate information on the program via a newsletter.

o FDBS will promote participation among its member companies. In the initial two-year phase, audits and retrofits will be performed in the headquarters building of 30-40 companies. These companies include members of FDBS as well as Brazilian subsidiaries of U.S. multinationals that are participating in Green Lights in the United States. The participating companies will agree to install a large fraction of cost-effective efficiency measures in their headquarters building in the first phase (details to be worked out).

o PROCEL, working together with local utilities, will perform the lighting audits and possibly assist with monitoring and evaluation of savings. There will be no charge to the companies for the audits.

o Manufacturers of lighting products (e.g., G.E., Philips, Sylvania, and Osram) will participate as "Luz Verde allies" by providing technical and marketing assistance.

o BNDES will provide financing for retrofits by national companies, up to around 65% of the project cost. The terms will be the normal favorable loan terms provided by BNDES.

In addition to working with the private companies, INEE will also encourage and assist CEPEL, the research institute for the electric sector. CEPEL has promised to retrofit its main building and possibly assist with monitoring and evaluation of lighting retrofits by private companies. The CEPEL lighting retrofit is expected to be the first actual retrofit under Luz Verde.

It is hoped that U.S. EPA will authorize use of the Green Lights trademark, provide software and training, encourage U.S. companies with subsidiaries in Brazil to participate in Luz Verde. In addition, partial funding for Luz Verde will be solicited if EPA has funds for replicating Green Lights outside the United States.

At the end of phase one, a plan for phase two will be developed, It is envisioned that in phase two, major companies will sign agreements whereby they commit to widely implementing cost-effective lighting efficiency measures throughout their facilities and buildings.

D. **About INEE**

INEE is a newly formed non-profit, non-governmental organization dedicated to advancing energy efficiency within Brazil. INEE plans to conduct policy analysis and advocacy and provide consulting services. INEE was started by prominent energy efficiency experts in Brazil, with input and advice from ACEEE. In the first year, this project will be supervised and conducted primarily by Fernando Milanez, the first director of INEE. In the second year, a qualified professional will be hired to work on the program under the direction of Milanez. Also, various short-term consultants will be hired by INEE as necessary.

The ALLIANCE To Save Energy

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June 1, 1992

Mr. Israel Klabin
Israel Klabin Irmaos
Av. Rio Branco, 81-14th Floor
20040 Rio de Janeiro, RJ
BRAZIL

Dear Israel:

I apologize for being so late in sending you this letter, but I have been preoccupied with a number of Alliance projects prior to leaving for Rio today. I will be staying at the Rio Palace Hotel on Av. Atlantica 4240 (55-21-521-3232) from June 2 to June 13.

I have recently had the opportunity to discuss the Brazilian Foundation for Sustainable Development in a number of meetings with energy efficiency experts at U.S. non-governmental organizations and with the U.S. Environmental Protection Agency (EPA). My colleagues here have been impressed by the level of commitment to the global environment clearly evidenced by the establishment of your foundation.

During the course of these meetings, it was agreed that the most innovative Federal energy efficiency program put forth by the U.S. government in recent years is the U.S. EPA's Green Lights Program. The Green Lights Program was launched in the U.S. in 1991 to promote the adoption of energy-efficient lighting by large commercial, institutional, governmental and industrial lighting users. Each of these major companies, called "Green Lights Partners," signs a voluntary Memorandum of Understanding with EPA which calls for companies:

1) to survey all U.S. facilities and consider a full set of lighting options that maximize energy savings while providing an annualized internal rate of return that is at least equivalent to the prime interest rate plus six percentage points;

2) to complete a retrofit of 90 percent of the square footage of its facilities for which retrofits are appropriate within five years of signing the agreements;

3) to re-survey facilities and reanalyze options at each facility no later than five years after completing a retrofit; and

4) to agree to educate employees about the advantage of efficient lighting and encourage employees to purchase such products.

EPA's goal is to recruit 1500 partners by the end of 1992, and embody every U.S., corporation by 1993. By the end of 1992, approximately 5 billion square feet is expected to be committed to a lighting retrofit.

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The basis of the program is the superior financial returns of such retrofits to the building owners, most of whom do not realize that they are earning far lower returns on their liquid capital assets. For example, Energy User News' annual report on Returns on Investment (ROI) of efficiency improvements typically finds that these investments outperform the Dow-Jones Industrial Average, Treasury Certificates of Deposit, and companies' liquid capital investment by a two- to four-fold margin.

The program addresses inadequacies in corporate and institutional technology procurement practices which obscure these superior investment opportunities for top-level management. By eliciting the procurement commitment directly from high-level management, the process is invigorated to take advantage of superior technologies. What conventionally are perceived as "costs centers" (paying utility bills) get transformed into "profit centers" (generating healthy capital and operating savings and cost-free pollution reductions).

Recently, the head of the National Commission for Energy Efficiency in Mexico (CONAE), Ingeniero Guillermo Fernandez de la Garza, expressed his conviction that the Green Lights Program should be adopted in Mexico.

The Green Lights Program clearly represents a "win-win-win" solution to corporations concerned about the economics of energy efficiency, and the environment. First, because lighting consumes an average of 40 percent of a commercial building's electricity, Green Lights can cut commercial lighting electricity consumption by 50 to 75 percent while improving light quality. These savings translate into reduced operating costs for building energy managers and Green Lights Partners. Secondly, the Green Lights Partnership allows corporations concerned about the environment to take action that not only demonstrates a corporate commitment to improving the environment, but makes economic sense as well. Third, Green Lights participation supports EPA's commitment to addressing technical and manufacturing issues related to energy-efficient lighting, and strengthens an innovative industry's ability to capture opportunities represented by energy efficiency improvements.

I should note that a Green Lights program would complement the existing Procel efficiency program and could later be expanded into other areas of corporate energy use along the lines being discussed at EPA for the U.S., i.e. "Green Pipes" or "Green Computers." Finally, by creating a strong domestic market for energy efficient lighting, it could lead to increased export potential by Brazilian firms.

As a result, I would like to propose a meeting which would include you, colleagues of mine who work extensively on international energy efficiency, and the Board Members of the Brazilian Foundation for Sustainable Development. A number of my colleagues will be in Rio de Janeiro for the UNCED conference. I hope we will be able to discuss this program in greater detail at that time. I will contact you after I arrive in Rio to arrange an appropriate time for my colleagues and me to meet with you while we are at UNCED. I look forward to seeing you then.

Best regards,

Bill

William A. Nitze
President

cc: Howard Geller
Deirdre Lord

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FOR IMMEDIATE RELEASE

NEWLY RELEASED REPORT ON ENERGY EFFICIENCY IDENTIFIES POTENTIAL FOR TRILLION DOLLAR SAVINGS IN DEVELOPING NATIONS AND EASTERN EUROPE

The global economy, which now seems to measure growth by the amount of natural gas, oil, coal and electricity consumed by its countless cars, lamps, factories and appliances, hurtles toward a rude awakening in the decades to come. According to a newly released report by a coalition of authors led by Dr. Mark D. Levine, the myth that developmental progress comes hand-in-hand with energy consumption must change in order to ensure a sustainable economic, energy and environmental future, especially for developing countries and Eastern Europe. The report submitted to the U.S. Working Group on Global Energy Efficiency establishes "a common framework and understanding of the issues and the actions required to move energy efficiency into a more appropriate place among development strategies" (p.6).

Why change existing development procedures? Although per capita energy consumption in developing countries and Eastern Europe remains well below that of industrialized countries, the rate of energy growth over the past two decades in these areas has outpaced OECD countries. An

overview of developing countries shows commercial energy consumption there exceeding gross domestic product from the years 1973 to 1988. The new report warns that this rapid rate of energy growth and demand for power will increase and "will require [at current efficiency levels] $1.7 to $4 trillion over the next two decades" in developing countries alone (p.3). This projected capital investment for power production, 1.5 to 4 times current levels, would displace other investments in essential social and economic activities, and will increase environmental costs in the long term.

Levine et. al. demonstrate realizeable energy efficiency potential through a comparison of an "efficiency scenario" with a "reference scenario", which represents moderate technical and efficiency adjustments to existing energy use. The "efficiency scenario," on the other hand, employs existing technologies in cost-effective energy efficiency improvements which could "achieve a 25% reduction in consumption in developing countries" (p.3). The benefits of the "efficiency scenario" are tremendous. Aside from cutting energy requirements equivalent to more than half current world consumption, thus reducing global carbon dioxide emissions from fossil fuels as well as avoiding production of other harmful pollutants, 50% of the projected capital energy investments would be avoided. The report provides a brief overview of existing projects and programs in various developing countries that have proven cost- and energy-efficient.

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For more information contact Michael Totten or Deborah Bleviss at the Secretariat for the Global Energy Efficiency Initiative/ U.S. Working Group:

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