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Regional Conference to Promote Energy Efficiency in the Central Asian Republics

Compendium of Conference Papers

Bishkek and Lake Issyk-Kul
Kyrgyz Republic

July 12-14, 1995

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Regional Conference to Promote Energy Efficiency in the Central Asian Republics

Sponsored by the
United States Agency for International Development and the
United States Energy Association

Bishkek and Lake Issyk-Kul, Kyrgyz Republic

July 12-14, 1995

Table of Contents

Map of the Central Asian Republics

Program for the Conference

Contact List from the Conference

Conference Papers

Benefits of and Policy Requirements for Promoting Energy Efficiency Tab 1
Gordon Weynand
Energy & Environmental Policy Advisor
USAID/Washington, D.C.

Energy Efficiency in Kazakstan Tab 2
Anatoly F. Yuriev
Deputy Minister of the Energy and the Coal Industry
Republic of Kazakstan

Energy Savings Policy in the United States Tab 3
Robert Lafferty
Manager, Demand Side Management Resources
Washington Water Power

Laws and Regulations Promoting Energy Savings Tab 4
Donald Irwin
Partner
Hunton & Williams

Designing Pricing and Tariffs Policies Tab 5
Richard Browning
Senior Manager, Energy and Environment Group
International Resources Group

Regulatory Programs to Encourage Energy Savings Tab 6
John Wilson
Advisor to the Chairman
California Energy Commission

Power Plant Reconstruction Tab 7
Sam Gerges
Managing Director
Burns and Roe

District Heat Power Plant Improvement Tab 8
Ned Popovic
Project Manager
Burns and Roe
Gerhardt Gron
EU/TACIS

Transmission Planning in a Transitional Economy: Problems and Solutions Tab 9
Thomas R. Fecho
Project Manager
AEP Energy Services, Inc.

Energy Efficiency in Residential and Commercial Buildings Tab 10
John Millhone
Senior Fellow
Battelle/Pacific Northwest Laboratories/USDOE

The World Bank's Role in Promoting Energy Efficiency Tab 11
Ziad Alahdad
Principal Energy Specialist and Head of the Energy Unit
The World Bank
J. Brzezinsky
EBRD

Summary of the Conference and Proposed Themes for Future Conferences Tab 12
Rolf Manfred
Chief of Party
International Development and Energy Associates, Inc.

The Central Asian Republics

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The objectives of the regional conference are:

- to encourage the information exchange among the energy industry sector leaders in the Central Asian Republics on the benefits of the policy requirements for national energy efficiency programs;
- to discuss the legal and regulatory frameworks for energy efficiency;
- to study the technical approaches undertaking to improve energy efficiency;
- to discuss the options for the financing of energy efficient projects and to study the policy, pricing, and regulatory changes necessary to encourage financing;
- to exhibit practical energy efficient goods and technologies.

Registration will take place on July 10-11, 1995 at the Hotel Dostuk and will continue on July 12, 1995 starting at 8:00 a.m. at the State Historical Museum

Tuesday, July 11, 1995 - State Historical Museum, Bishkek

2:00 p.m.	Exhibition of new energy efficient goods and technologies by companies and firms
6:00 p.m.	Dinner reception at the Naryn Restaurant in honor of the opening of the conference

6

Wednesday, July 12, 1995 - State Historical Museum, Bishkek

8:00 a.m.	Registration
9:00 a.m.	Introduction and opening remarks J. T. Tuleberdiev, President of the Kyrgyzenergoholding
9:10 a.m.	Welcoming Addresses A. Moiseev, Vice Prime Minister of the Kyrgyz Republic Eileen Malloy, United States Ambassador to the Kyrgyz Republic Gordon Weynand, USAID/Washington, D.C.

Focus Area I:
Current Energy Efficiency Policies in the CAR, the Black Sea Region, and Russia

Session Moderator - J.T. Tuleberdiev, Kyrgyzenergoholding

Speakers from the Central Asian Republics

10:00 a.m.	Kyrgyz Republic I.A. Davydov, First Vice President of Kyrgyzenergoholding
10:30 a.m.	Kazakstan A. F. Yuriev, Deputy Minister of the Energy and the Coal Industry
11:00 a.m.	Break
11:30 a.m.	Uzbekistan T. S. Muratov, Deputy Minister of Energy and Electrification
12:00 p.m.	Tajikistan A. N. Silantiev, First Vice President of the Energy Company "Barki Tochic"
12:30 p.m.	Turmenistan K. Atakariev, Deputy Minister of Economics and Finance
1:00 p.m.	Main Directions of Energy Efficiency Policy in the Kyrgyz Republic V. M. Kasymova, Head of the Department of the Kyrgyz Ministry of Economics
1:30 p.m.	Lunch
3:00 p.m.	Departure for Lake Issyk-Kul
7:30 p.m.	Arrival at the Hotel Sanatorium Issyk-Kul and Dinner

Thursday, July 13, 1995 - Hotel Sanatorium Issyk-Kul, Issyk-Kul

Focus Area II:
Development of Legal Regulatory Framework for Energy Efficiency
Promotion of Energy Efficiency Policy in the Central Asian Republics

Session Moderator - Rolf Manfred, International Development and Energy Associates

8:45 a.m.	Opening Remarks Rolf Manfred
9:00 a.m.	Energy Savings Policy in the United States Robert Lafferty, Washington Water Power
10:00 a.m.	Laws and Regulations Promoting Energy Savings Donald Irwin, Hunton and Williams
11:00 a.m.	Designing Pricing and Tariffs Policies Richard Browning, IRG
12:00 p.m.	Regulatory Programs to Encourage Energy Savings John Wilson, Energy Regulatory Commission of California
1:00 p.m.	Lunch

Focus Area III
Technical Approaches to Promote Energy Efficiency by USAID Contractors
Discussion of the Policy Framework and the Creation of Incentives in Energy Efficiency
Investigation of Special Technical Solutions Currently Being Implemented in the Central Asian Republics

Session Moderator - I.A. Davydov, Kyrgyzenergoholding

2:00 p.m.	Kazakstan Energy Efficiency Plan T. Mandaria, Aso Teck-Kuat
2:30 p.m.	Power Plant Reconstruction Sam Gerges, Burns and Roe
3:00 p.m.	District Heat Power Plant Improvement Ned Popovic, Burns and Roe and Gerhardt Gron, EU TACIS
4:00 p.m.	Reduction of Electric Transmission Loses Tom Fecho, American Electric Power

4:30 p.m.	Energy Efficiency in Residential and Commercial Buildings John Millhone, Battelle/Pacific Northwest Laboratories/USDOE
5:00 p.m.	Kyrgyz Residential Energy Efficiency Michael Lorsbach, Friedman & Johnson/EU TACIS
6:00 p.m.	Adjourn and Dinner Excursion

Friday, July 14, 1995 - Hotel Sanatorium Issyk-Kul, Issyk-Kul

Focus Area IV
Role of Financial Institutions in Energy Efficiency
Exploration of Energy Efficiency Projects in the Central Asian Republics

Session Moderator - Barry Primm, USAID

9:00 a.m.	The World Bank's Role in Promoting Energy Efficiency Ziad Alahdad, the World Bank and J. Brzezinsky, EBRD
10:00 a.m.	Summary of the conference Rolf Manfred, International Development and Energy Associates
10:30 a.m.	Discussion of future energy efficiency conferences in the Central Asian Republics Recommendation and comments on topics and issues for the next conference
11:30 a.m.	Lunch
1:30 p.m.	Departure for Almaty and Bishkek

For further information regarding the Regional Conference please contact:

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United States Agency for International Development

United States Energy Association

Regional Conference
to Promote Energy Efficiency
in the Central Asian Republics

"Benefits of and Policy Requirements for Promoting Energy Efficiency"

Gordon Weynand
Energy & Environmental Policy Advisor
United States Agency for International Development

July 12, 1995

Bishkek, Kyrgyz Republic

Gordon W. Weynand

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Gordon Weynand is an Energy and Environmental Policy Specialist working in the Bureau for Europe and the New Independent States (NIS), Office of Energy, Environment, and Urban Development, Division of Energy and Infrastructure (ENI/EEUD/EI) of the U.S. Agency for International Development (USAID). He supports the EI Division of the ENI/EEUD Office through planning, supervising and coordinating activities that relate to improving the efficiency and reducing the environmental burden of energy production and consumption in the NIS, supporting energy sector privatization and market reform, and reducing the safety risks of Soviet-designed nuclear power plants. His specific duties include:

- Serving as regional coordinator for division activities relating to the Central Asian Republics (CAR) and as contract manager for the U.S. Department of Energy (USDOE) PASA, which includes activities throughout all four NIS regions (Russia, West NIS, Caucasus, & CAR). In this position, he coordinates the development and implementation of strategies and plans for assigned projects/programs and the preparation of all relevant USAID documents.

- Serving as a liaison with USAID Missions, USAID regional bureaus and the Global Bureau, and host country governments with respect to assigned programs/project issues and activities, in order to respond to requests and inquiries, to disseminate information on technical developments, to identify pertinent opportunities, and to make proposals regarding country-specific activities.

- Serving as the liaison with USAID's Global Bureau on energy and energy-related environmental issues having significant trans-boundary impacts (e.g.: global climate change).

Previously, Mr. Weynand worked in the Global Climate Change Division of the U.S. Environmental Protection Agency (USEPA). While there, he prepared Congressional reports on methane emissions from the U.S. natural gas system and on economically-feasible mitigation options. He also investigated methane emissions from the natural gas system of the NIS and identified options for improving its efficiency.

Before joining the USEPA, Mr. Weynand worked for ARCO Oil & Gas Company in

Texas for over eleven years. In addition to exploring for oil and gas, he was also instrumental in developing company-wide computerized mapping information systems to support the effective search for and development of petroleum reservoirs.

In 1991, Gordon Weynand graduated from The George Washington University with a Master's degree in Environmental and Natural Resource Policy. In addition, he holds Bachelor and Master of Science degrees in Geophysics from Texas A&M University.

"Benefits of and Policy Requirements for Promoting Energy Efficiency"

Outline of the Presentation by

Gordon W. Weynand
Energy & Environmental Policy Advisor
United States Agency for International Development

Benefits of and Policy Requirements for Promoting Energy Efficiency

I. The Economic Importance of Energy Efficiency

II. The USAID Assistance Program

III. USAID's Energy Efficiency Activities

IV. Lessons Learned

I. The Economic Importance of Energy Efficiency

Increased Energy Efficiency:

a. Improves the competitiveness of the goods and services produced by a nation in the international marketplace.

1. In 1990, the economies of the members of the Commonwealth of Independent States had, on average, energy intensities:
   - 1.3 times greater than Central & Eastern Europe
   - 2.0 times greater than North America
   - 2.8 times greater than Western Europe

2. Energy intensity is a function of both the energy embodied in a product and the energy used by the process creating the product.

3. Industrial energy efficiency in the U.S. and other OECD countries has improved by about 30%, on average, because:
   - Market energy prices reflected the cost of supply, without subsidies, administered prices, or price controls;
   - Structural adjustment in the industrial sector, away from energy-intensive industry and toward services and high valued-added manufacturing;

- Increased awareness of energy efficiency techniques in industry to improve operations and maintenance; and
- Investments in improvements to moderate industrial processes.

b. In conjunction with improved commercial operations of utilities and industries, reduces the capital resource requirements needed to provide energy services to end users.

1. Governments around the world are finding that current energy and industrial sector development strategies no longer generate the capital necessary to deliver adequate energy for economic growth.

2. This capital shortage is aggravated by the poor financial performance of many state-owned energy utilities and industries, which necessitate large government subsidies. Tariffs and prices often fail to cover the cost of operations, never mind the costs of maintaining existing facilities or building new ones.

3. The increasing need to lessen environmental degradation is also worsening the capital problems of governments, utilities and industries.

II. The USAID Assistance Program

a. USAID Strategic Objectives

1. Economic Restructuring: Foster the emergence of a competitive, market-oriented economy in which the majority of economic resources are privately owned and managed.

2. Democracy: Support the transition to transparent and accountable governance and the empowerment of citizens through democratic political processes.

3. Quality of Life: Strengthen the capacity to manage the human dimension of the transition to democracy and a market economy, and help sustain the neediest sectors of the population during the transition period.

b. Components of the USAID Energy Program

1. Rationalize energy prices and develop sound national energy prices

2. Improve energy efficiency and reduce low-level emissions in

industry, buildings, and municipal heating systems

3. Restructure, commercialize, and privatize specific energy subsectors (power, oil, gas, and coal)

4. Increase the safety of Russian-designed nuclear reactors

5. Promote energy trade and integration with Eastern Europe and international energy markets

III. USAID's Energy Efficiency Activities

a. Implement projects to demonstrate energy savings (boiler controls, weatherization, steam traps, etc.).

b. Perform energy audits at selected facilities.

c. Develop energy pricing and tariff analyses.

d. Open energy efficiency centers (Bulgaria, Czech Republic, Poland, Russia, Ukraine).

e. Foster the creation of private energy service companies (Armenia, Bulgaria, Hungary, and Romania).

f. Encourage the formation of trade associations and linkages (e.g., Association of Energy Efficiency Engineers).

g. Implement demand side management (DSM) programs with cooperating utilities (Poland and Ukraine).

h. Introduce integrated resource planning concepts to place demand-side and supply-side options on a common footing.

I. Establish utility partnerships.

j. Provide in-country and U.S.-based training programs.

k. Assist in energy sector reform:
- Restructuring
- Corporatization
- Commercialization
- Private sector participation
- Legal & regulatory development

IV. Lessons Learned

a. Investments in energy efficiency can mitigate the effect of increased energy prices as shown by USAID's projects, which have demonstrated significant energy savings with quick paybacks even at extremely low energy prices.

b. Since energy efficiency investments can make sense even at low prices, the demand for the functions provided by private energy service and equipment companies will increase as energy prices rise, creating new jobs for energy professionals.

c. The results of the demonstration projects will be replicated more rapidly if industrial and utility enterprises operate as independent commercial enterprises and are held to hard energy budgets. Without hard energy budgets, the following outcomes are typical:

   1. Service is not terminated for nonpayment;

   2. Prices do not reach world levels, because nothing in particular propels them in that direction;

   3. Independent service firms will not become widely available to assist in designing optimal energy efficiency programs because there is little effective demand for their services;

   4. Financing is not available for new machinery since the paybacks from such investments are uncertain or absent; and

   5. The enterprise lacks the ability to keep for itself the gains from improved

d. Energy efficiency improves when a western economic infrastructure is created:

   1. Enterprise commercialization;

   2. Price reform;

   3. Financial institution reform; and

   4. Improved information systems and accounting.

e. Investments in energy efficiency are an integral part of a least-cost approach to providing energy services to end users. The regulatory system must encourage integrated resource planning and demand side management

programs that give investments in demand reduction the same consideration as investments in the supply side.

f. Energy efficiency promotion cannot be separated from macroeconomic reform and the restructuring of energy and industrial enterprises. Such reform efforts require that the role of the government, the market, regulatory agencies, and enterprises be separated and spelled out:

1. The government plays the role of setting national policy, especially with regards to fostering competitive environments or recognizing the existence of natural monopolies.

2. For unregulated enterprises operating in a competitive environment, prices for goods and services are set by the marketplace.

3. For enterprises forming natural monopolies, an independent regulatory body is needed to set tariffs that both protect the public interest and provide sufficient returns to the regulated enterprise.

4. Enterprises are responsible for providing goods and services to their consumers, while operating in a self-sufficient commercial mode.

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"Energy Efficiency in Kazakstan"

Anatoly F. Yuriev
Deputy Minister
Ministry of Energy and Coal Industry
Republic of Kazakstan

July 12, 1995

Bishkek, Kyrgyz Republic

Anatoly F. Yuriev

Deputy Minister
Ministry of Energy and Coal Industry
Republic of Kazakstan

No biographical information was available.

"Energy Efficiency in Kazakstan"

Anatoly F. Yuriev
Deputy Minister
Ministry of Energy and Coal Industry
Republic of Kazakstan

Kazakstan possesses rich resources of fuel and energy, sufficient to satisfy the Republic's needs in all kinds of energy for a long perspective.

At the same time, because of established structural and geographic characteristics of the national economy of the Republic in the composition of the Soviet Union, we must import some energy from the neighboring Republics.

Our national economy meets the demands in electric energy on 85%, petroleum - 86%, diesel oil - 74%, natural gas - 42%. Part of the region centers and big cities have 10-25% deficit of heat energy in heat capacity.

As a result of Kazakstan economic specifics and its technological level, energy intensity of the national income is 2-4 times higher than in western countries.

The price level for energy in our country approaches to the world standard. In this connection the cost of part of fuel and energy products is growing fast. It was 13% of the whole industry products in 1989, 30.01% in 1993, 38.4% in 1994, the prognosis for 1995 is 56.1%

Analysis of work of the national economic complex in the Republic showed that the level of industrial production decreased on 28.5%, at the same time, electric energy consumption decreased only on 10.3%. We have similar results with other kinds of energy resources.

This proves the urgency of energy and fuel resources savings tasks.

The problem of the energy savings is not new, but earlier developed programs had declaratory meaning and didn't touch economic interrelations between energy generators and energy consumers, which means that there was no interest in economy of energy and fuel.

If our technology corresponded to an average world standard it would give 19.26 million tenge of Fuel Equivalent (FE) economy against the facts or 24.0% reduction of energy consumption.

As the experience of other countries proved, the realization of this potential needs not so much technical and technological decisions, as appropriate conditions without, of course, excluding the former.

We must take into consideration that energy efficiency increase is a sluggish business that needs much investment. The experience shows that speed of energy intensity reduction in the world is within the limits of 1.0 - 1.7% a year. But during the first years the most available measures can be fulfilled and that will give the highest reimbursement - this will be our first and foremost task.

The development of the State energy savings program in the Republic will be determined by the calendar plan - schedule of immediate actions on realization of the Anticrisis Program, which was adopted by the resolution of the National Counsel of economic reforms of the Republic of Kazakstan.

In accordance with this task there was a resolution of the Cabinet of Ministers, where the Ministry of Energy and Coal Industry was appointed to be the main executive on developing of the program, while coordination of works was given to the Ministry of Economy.

The following documents were basic for the development of the program:

- National programs of industries development;
- Macroeconomical prognosis of Kazakstan for 1995 and for the period up to 200, performed by the scientific-research institute of economics and market relations in 1994;
- State program of getting out of the economical crisis;
- Indicators of economy development for 1994 further years, prepared by the State Statistics Committee
- The most important indicators of social-economic development of the Ministry of Economy and other industrial ministries
- Energy savings concept of the Republic of Kazakstan.

The purpose of the energy savings program will be the transference from the energy wasting to energy saving way.

In order to work out the program we were to define our place from the energy conservation point to view and to evaluate it in comparison with 1990, when the national economy worked stable and a recession hadn't begun yet.

We are in a new organizing stage of propaganda and realization of energy savings way, we should put into operation the mechanism of a market economy, which will encourage all energy consumers urgently find ways of using less energy without reduction of industrial production.

Our role here must be not retribution, but organizing. Organizing of technical help and legal support of stimulating measures - punishment and encouragement.

Let us look at changes of the integrated indicator of energy efficiency energy intensity per unit of a gross internal product (GIP) from 1990 to 1994.

GIP (in prices of 1994)

Indicators	1990	1991	1992	1993	1994
1. GIP (billions tenge)	1095.1	934.4	801.4	629.0	464.5
2. Energy Consumption (million FE)	100.49	100.23	98.77	95.55	85.00
3. Energy Intensity (FE/thousand tenge)	0.0918	0.1073	0.1232	0.1519	0.183

Thus, the energy intensity lag from world standards continues to enlarge because of the recession of the industry and economic crisis.

The reduction of the fun return follows in over-expenditure of energy for heating and ventilating of buildings and constructions.

In these conditions the main directions of the energy savings policy can be grouped into three blocks:

1. Economics
   - Economical levers of influence, directed to energy efficiency;
   - Mechanism of price establishment providing energy savings;
   - Recommendations about taxes and customs on energy saving equipment and technology.

2. Law and Regulations
   - Creation of the energy savings management bodies, on the Republican and regional level;
   - Standards, norms and regulations, providing decrease of energy intensity in material production and public utilities;
   - Legal support of the energy savings;
   - Creation of energy saving centers.

3. Technical

- System of measures, directed to energy efficiency policy in different branches of the national economy.

Now the first draft project of the State energy savings program is being discussed in ministries and departments of the Republic. In the third quarter, taking into account critic notes, suggestions and a program prepared by USAID experts, we will submit the final project to the Government for adoption.

We hope that this Seminar will help us to decide energy savings problems and to cooperate with others in this field. It is very important for our countries and we hope for further mutual cooperation. We want tot hank the organizers of the seminar for this meeting, for its war atmosphere and high level of organization.

Share of the Fuel and Energy Complex in the Republic's Industry Production

Years	1989	1993	1994	1995
Indicator	13.0	30.01	38.4	56.1 (prognosis)

Energy Generation in Kazakstan from the Whole Demand

Energy Resources	Percentage
1. Electric Energy	85.0
2. Petroleum	86.0
3. Natural Gas	42.0
4. Diesel	74.0

Initial Materials for State Energy Savings Program Development

1. National program of industries development
2. Macroeconomical prognosis of Kazakstan for 1995 and for the period up to 2000
3. State program of getting out of the economical crisis.
4. The facts of the State Statistics Committee
5. The facts of the Industry Ministries and Ministry of Economy
6. The main Indicators of social and economic development of the Republic.
7. Energy savings concept of the Republic of Kazakstan.

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Regional Conference to Promote Energy Efficiency in the Central Asian Republics

"Energy Savings Policies in the United States"

Robert Lafferty
Manager, Demand Side Management Resources
Washington Water Power

July 13, 1995

Lake Issyk-Kul, Kyrgyz Republic

25

Robert Lafferty

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Bob began work with the Washington Water Power company in Spokane, Washington 20 years ago after receiving degrees in engineering and business from Washington State University. He began his early career in the company's engineering department working on electric construction projects, principally in the area of substation design.

In 1984, Bob moved to the marketing area at Washington Water Power and has served in several different supervisory and management positions handling such areas as industrial sales, start-up of Washington Water Power's natural gas brokering subsidiary - Development Associates, temporary manager for the Spokane Industrial Park commercial real estate subsidiary, and electric marketing strategies and program implementation.

Currently, Bob holds the position of Manager, Demand-Side Management Resources and has responsibility for implementation of both electrical and natural gas demand-side management programs. (Demand-side management is the increased efficiency of an end-use of energy or "conservation" as some people call it.)

In addition to his duties as a manager, Bob has spent the past eight months working, with teams of other managers, on the merger of the Washington Water Power Company with Sierra Pacific Power Company of Reno, Nevada. The companies expect the merger to be approved this fall.

Bob is married and has three children, of which the oldest daughter is a senior at Washington State University. His two younger children, a daughter and a son, are very active in school, music and sports. Their activities keep the family very busy. When time is available, Bob and his family enjoy outdoor activities like skiing, running, biking, canoeing and camping.

Bob is a registered professional engineer in the State of Washington and has been active in the Spokane section for the Institute of Electrical and Electronics Engineers.

"Energy Savings Policies in the United States"

Outline of the Presentation by

Robert Lafferty
Manager, Demand Side Management Resources
Washington Water Power

Moving toward change requires a catalyst; somebody that wants to make something happen. If the market is not driving the change, then another force must come into play. This can be the role of government. The government in the United States has taken on such a role to ensure that our country makes progress toward a society that uses energy more efficiently.

The United States has created partnerships to make change occur. The partnerships have taken on several forms. Let's discuss some methods that have been used in the United States:

1. **Tax Incentives**

   Tax incentives are a benefit that government can provide when more efficient products are produced or purchased. The United States has provided tax incentives for certain energy efficiency upgrades in homes such as increased insulation.

   Tax incentives redistribute wealth into areas where you want improvements to occur. This approach has the benefit of being direct and in being relatively simple to implement. Once the more energy efficient products become more common in the marketplace, incentives can be removed and a lasting change will have occurred.

2. **Technology Information Resources**

   Creation of a government department or organization that has as its mission the identification of new technologies that can be used by manufacturers of products or citizens that use those products.

   This organization should make information easy to obtain. Being aggressive about getting the information out to industry and to people will increase the probability of success. This organization can assist industry to evaluate lower cost methods and materials and encourage their use. It can also provide training to the public and industry.

An example of this in the United States is the State of Washington's Energy Office. The Energy Office researches different technologies, publishes reports and other information for industry and citizens to use and also provides training. The Energy Office provides some guidance on energy efficiency projects in government buildings and schools.

3. **Efficiency Standards**

The government can pass into law new energy efficiency standards for equipment that is manufactured or sold in the United States.

The government can also pass into law new standards for the construction of everything from apartments and homes to offices and commercial buildings.

Practically, this type of approach can be relatively more difficult to implement because it requires a considerable amount of education of the affected groups and also requires a considerable amount of enforcement. The practical application of enforcement can be a real challenge. It is important to do inspections and verifications in order to assure compliance. These inspections or verifications must be done in a timely fashion that allows changes to occur where non-compliance is observed.

4. **Tax Surcharges (Price Signals)**

Tax surcharges are an additional cost to a business or the purchaser. They are assessed when inefficient products are manufactured or sold. One drawback to this approach, however, is that these extra costs will be born by consumers that may, as a result, have a harder time purchasing what they need.

An important assumption with this approach is that there will be other more efficient products taking their place in the market at a competitive price, thereby allowing consumers to have an alternative. It is also important that tax surcharges will not cause undue hardship on customer groups.

This is a more complex approach. Sending a price signal such as this is most effective where the market is well understood and the consumer response is predictable.

ENERGY SAVINGS POLICIES IN THE UNITED STATES

1) TAX INCENTIVES

2) TECHNOLOGY INFROMATION RESOURCES

3) EFFICIENCY STANDARDS

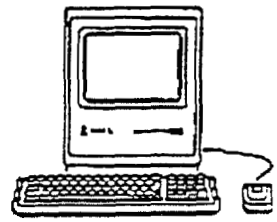
4) TAX SURCHARGES (PRICE SIGNALS)

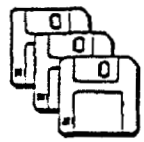
TAX INCENTIVES

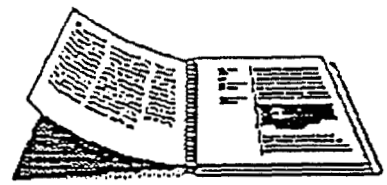
НАЛОГОВЫЕ СТИМУЛЫ

TECHNOLOGY INFORMATION RESOURCES

ИСТОЧНИКИ ИНФОРМАЦИИ О НОВЫХ ТЕХНОЛОГИЯХ







Role of Utilities in Supporting Energy Savings on the Demand Side

In the last session, I talked about change requiring a catalyst. The utility can play an important role as a catalyst for change in the efficient use of energy use in society. Utilities may choose to invest in energy efficiency and free-up wasted energy on the customer's side of the meter instead of constructing new generating plants. Many times, the cost of investing in energy efficiency is less than the cost of building new generation.

Utilities in the northwest region of the United States have been instrumental in saving of 5.7 megawatt-hours of energy over the past 15 years.

This is another opportunity for partnership to make a change happen. These are some of the approaches and methods that utilities in the U.S. have used:

1. **Incentives Payments to Customers**

   This has been a common method used by utilities to make an immediate impact and to increase the use of high efficiency products. Utilities give money to customers to partially offset the cost of purchase of high efficiency products. These funds usually provided in the form of a rebate or reduced interest loan, are provided to residential, commercial or industrial customers. The incentive funds may be directed at products such as home insulation, space heating equipment, water heating equipment, air conditioning equipment, building ventilation design, high efficiency motors, and high efficiency lighting.

   Incentives redistribute wealth into areas where you want improvements to occur. This approach has the benefit of being direct and in being relatively simple to implement.

2. **Manufacturer Partnerships**

   This method is similar to the incentives discussed above. Except, in this case the money is provided to a manufacturer directly to produce a certain energy efficiency product. The utility contribution lowers the cost of the product to the customer. Utilities in the northwest region of the United States have recently conducted such a program with manufacturers of high efficiency manufactured homes.

   Again, incentives redistribute wealth into areas where you want improvements to occur.

3. **Customer Education**

   Utilities can be an important source of information to customers regarding energy efficiency and energy efficient products. It is important to provide information often and in a variety of different ways. It takes a concerted effort to communicate

enough to create the broad understanding and knowledge across the marketplace necessary to cause change to occur. The benefit of this approach, however, is that the change has a very broad affect on the market and is a long-term change.

Utilities in the United States have used newsletters, television and radio advertising to communicate energy efficiency messages. Another approach that has been effective is to have energy auditors on staff of the utility that are available to go out to the customer's residence or business upon request. The energy auditor provides the customer with a written assessment, including monetary savings benefits, of installing certain energy efficiency items.

4. **Energy Price Signals**

By increasing the price of electric demand and energy, the utility can encourage customers to become more conscious of their energy consumption pattern and will encourage them to use more efficiently.

This is more complex approach. Sending a price signal is most effective where the market is well understood and where consumer response is predictable.

ROLE OF UTILITIES IN SUPPORTING ENERGY SAVINGS ON THE DEMAND SIDE

1) INCENTIVE PAYMENTS TO CUSTOMERS

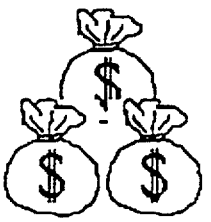
2) MANUFACTURER PARTNERSHIPS

3) CUSTOMER EDUCATION

4) ENERGY PRICE SIGNALS

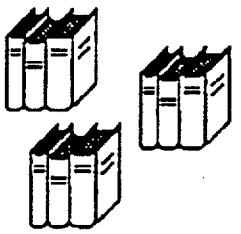
INCENTIVES

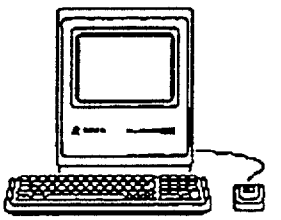
ПООЩРИТЕЛЬНЫЕ ПЛАТЕЖИ ПОТРЕБИТЕЛЯМ

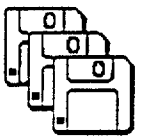


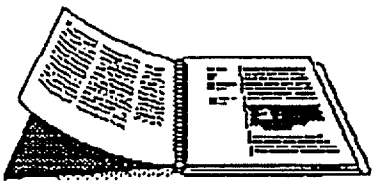
CUSTOMER EDUCATION

ИНФОРМАЦИОННЫЕ МЕРОПРИЯТИЯ









MANUFACTURER PARTNERSHIP

ПАРТНЕРСТВО С ИЗГОТОВИТЕЛЯМИ

United States Agency for International Development

United States Energy Association

Regional Conference
to Promote Energy Efficiency
in the Central Asian Republics

"Laws and Regulations to Promote Energy Savings"

Donald P. Irwin
Partner
Hunton & Williams

July 13, 1995

Lake Issyk-Kul, Kyrgyz Republic

37A

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A partner in the Administrative Law Group, Mr. Irwin has worked on a wide variety of energy and environmental problems since graduating from law school and joining the firm in 1971. His principal areas of focus have been the nuclear and electric utility industries, with some work in project finance and environmental areas. He has represented electric utilities, as well as equipment vendors and individuals, in a wide variety of nuclear licensing and business-related issues. He has been particularly involved in issues involving conflicting positions taken by multiple levels of government, e.g. radiological emergency planning for nuclear power plants. In the past four years Mr. Irwin has become active in nuclear work involving nuclear facilities in the former Soviet Union and Eastern European countries. He is presently representing the Ministry of Atomic Energy of the Russian Federation, MINATOM, and its subsidiary ROSATOM, in various matters in the United States.

Mr. Irwin's work on project finance issues has involved electric and water utilities in the United States and overseas. This work includes, most recently, representation of the Government of Pakistan in the privatization of its 15-unit Kot Addu power station. Mr. Irwin spent three months in the winter of 1994-1995 in Pakistan working on this project. In addition, in the spring of 1995 he participated in the evaluation of the privatization of a large water utility district in South America.

Mr. Irwin has also worked on a variety of "pure" environmental issues for non-utility clients involving various of the principal U.S. environmental statutes, and has represented Potentially Responsible Parties in various "Superfund" cleanup proceedings.. He has also participated in the representation of the firm clients in development on Independent Power Projects and Quality Facilities under the Public Utilities Regulatory Policies Acto of 1978. Most recently, he has been working on the privatization of an existing 15-unit fossil-fired power complex in Pakistan.

"Laws and Regulations to Promote Energy Savings"

Summary of the Presentation by

Donald P. Irwin
Partner
Hunton & Williams

I. Introduction

Assigned topic of this talk is "Laws and Regulations Promoting and Encouraging Energy Savings."

Frame of reference: the United States electric utility industry and its regulation. Requires brief discussion of the industry, its structure, and its history.

1. US Industry characteristics, since they may differ in some respects from yours and this is important in understanding the applicability of what is happening in US:

   - mammoth industry
   - over 200 systems, some private some public, spread over 50 states
   - diverse in fuel sources: coal, nuclear, gas, oil, hydro, some exotic (wind, solar, etc.)
   - diverse geographically: different fuel sources used in different parts of the country
   - complex regulatory pattern: regulated for some purposes on federal level, but for most traditional purposes, including setting of retail rates, on state level: thus potentially 50 different approaches
   - US has been fully electrified since the 1930's; thus question is most efficient growth patterns for it.
   - basically a fully interconnected system, though the nation is so large that it is difficult to imagine a system event that could affect more than a single metropolitan area.
   - there is adequate capacity on the system, both nationally and in all regions; US electric issues are not ones of availability, but of cost of operation of differing kinds and ages of plants using a variety of fuels, of the environmental effects of different fuels, and the resource questions concerning consumption.

- present period one of tremendous change, from primarily regulated environment to a competitive one -- and the idea of "energy savings" is a central focus of that change

2. Define Topic:

"Savings" can mean either of two quite different things:

- simply generating or using less electricity -- conservation, rationing, or doing without. Can apply to instantaneous peak demand, or to consumption over time.
- supplying or using electricity more efficiently: not directly limiting generation or consumption, but achieving a given amount of generation with less expenditure of resources or getting more result from consumption of a given amount of electricity.

Both meanings have applications in the electric energy policy shifts now taking place in the US. Both are relevant to designing an efficient system anywhere. I'll discuss both this morning. Will try to keep them clear, since they are both important.

3. My approach:

   1. Describe the major points of the laws encouraging energy savings and efficiency now in effect in the United States, and the changes that are taking place as a result of them, beginning with a little history.

   2. Apply principles from changes in U.S. laws to design of a utility system elsewhere, e.g., Kyrgyzstan, Kazakstan, Tadjikistan, Turkmenistan or Uzbekistan

   3. Capsule Summary of Two Primary Forces for Promoting Savings and Efficiency in the U.S. Electric Utility Industry:

      a. <u>Increase efficiency of power supply within the utility industry</u>: Permitting non-utilities to enter the field of electric generation without becoming subject to regulation as utilities, as long as they don't sell to retail customers; and providing means for them to gain access to utility transmission systems.

      b. <u>Increase efficiency of consumption of electricity by electric consumers</u>: Host of mandatory and market-oriented measures ranging from efficiency standards on appliances and equipment to requirements that utilities seek to lower instantaneous demand and

consumption over time on their systems, to rate structures tending to dampen demand.

II. Factual Background: Historic Growth of Utility System in US

- "Natural monopoly"
  - definition
  - structure initially private -- large holding companies;
  - beginning in the 1930's, federal (FPA, PUHCA) and state regulation
  - growth of a series of systems operating in defined territories
  - regulated to prevent monopoly abuses in terms of
  - dependability of service
    - fair rates
    - financial stability
  - "regulatory compact," which worked from about 1935 to the 1970's

- Revolutionary Changes beginning in late the 1960's
  - cost relationships changed -- no more economies of scale
  - outside effect: environmental constraints
  - cost, availability of all fuels changed: oil, gas, nuclear, coal

Result: spiraling construction costs, regulatory reluctance to pass costs on, concerns with conservation, efficiency

- 20 Years Experience with Policies intended to conserve resources, eliminate uses deemed wasteful and encourage those deemed desirable.
  - will not discuss specific statutes or regulatory policies as such in the United States
  - will discuss means or policies chosen, their intended effects, and their apparent success, drawbacks, and the like.

III. Structure of the Industry: Improving Efficiency in Production

1. Abandonment of the "Natural Monopoly" Concept -- incentives for efficiency
   - cogeneration
   - independent power generation
   - access through wholesale transmission system

2. Separation of Generation from Transmission and Distribution:
   - PUHCA preference to Cogenerators and QFs (fuel choice); utilities required to buy their output at avoided cost; utilities no longer able to ignore generation competitors
   - Has produced effective competition: over 50% of new generation in US has been from cogen/QFs.
   - But most burn oil or gas

3. Realization that wholesale market competition, rather than regulatory fiat, could effectively discipline wholesale power markets. Remaining problems: transmission access, PUHCA regulation of non-qualifying QFs.

4. Transmission:

   FPC: Government has no authority to order wheeling

   PURPA: FERC can order wheeling consistent with not damaging existing competitive relationships --e.g., no procompetitive wheeling orders. FERC never issued any wheeling orders under PURPA, though occasionally has attached wheeling orders as conditions to other orders (e.g., permitting market pricing rather than cost-based pricing of service; or in mergers)

   EPAct: FERC can order any "transmitting utility" to provide wholesale wheeling services to any applicant [any person generating electricity for resale] whenever it finds that the requested transmission can be provided consistent with maintaining reliability and would be in the public interest. FERC can order not only hookups to existing transmission but can order construction of new transmission if that is necessary to satisfy the application. FERC may NOT order "retail" wheeling, i.e., to any ultimate consumer of electricity.

   Pricing of these transmission services and allocating costs among affected transmission owners is a major issue under EPA. Is an opportunity to consider transmission in the cost of siting power plants.

5. Generation:

   PURPA QFs -- cogeneration, or limited size and fuel selection

   EPAct: Exempt Wholesale Generators (EWGs): Organizations exclusively in the business of selling electricity at wholesale can build facilities without restriction on size or fuel type. Only restriction is that their output must go exclusively to wholesale market.

   Potential Effects: Creation of more entities supplying electricity to wholesale market. But it doesn't work automatically. FERC must wrestle with (1) determining and allocating costs of transmission, (2) determining how to price the cost of generation -- cost-based or market-based. The more nearly market-based its determinations are, the more competitive, and theoretically efficient, the structure will be.

   - Structural note: much of the growth of independent power sector in US in the 1980's was in the peaking or mid-load sectors, where low-cost projects (turbines) worked. By 2000 in US, there will be more need for baseload

projects that are a lot more expensive and time-consuming to build. It is not clear how successfully non-utility generators can compete in these types of projects. One possibility is that the EWGs will affiliate with utilities.

IV. Improving Efficiency of and Savings in Electricity Consumption

1. Background in US:
   - Driving forces are (1) risks of foreign oil dependency, exposed in 1973 and 1978-79; (2) increasingly powerful environmental movement, which is concerned both with resource (fuel) conservation and air pollution (coal plants); (3) increasing costs of construction of new plants, which has led utilities to be wary of building them.
   - Recurrent theme in US legislation and policy: (1) how much to address in law, v. how much to leave purely to market forces; (2) appropriate level of government to administer, and (3) within areas addressed by law, whether to require action, encourage action, or merely require examination of an issue. This reflects perpetual tension in US legislation between governmental compulsion and faith in market forces, particularly in economic regulation. The general premise in U.S.: Leaving decisions to the private sector generally promotes more efficient allocation of resources than having governments make them; thus, governments tend to steer rather than dictate. This is true here.

2. Most current U. S. law on the subject -- Energy Policy Act of 1992 -- is at least the 5th in a series of laws dealing with the subject of energy consumption, going back to the 1970's. And it affects three other, older statutes (two of them enacted 60 years earlier) in significant ways. Thus (1) it won't do to try to trace specific statutes in detail -- I'll try to give bottom line information, and (2) the current policies in current law will remain basically unchanged for at least the next several years. By that time the electric utility industry will have largely transformed itself into a competitive industry -- really, several industries -- in which generation of electricity has been largely separated from its transmission and its distribution to ultimate customers.

3. Policies and Requirements under the EPAct and its Predecessors

   1. Energy efficiency requirements and efficiency disclosure requirements for

      a. office buildings and manufactured homes: Implemented at state level with reporting to US DOE.
      b. lighting fixtures and lamps --goal to get offices and homes converted from incandescent bulbs to compact fluorescent and other kinds of high-efficiency fixtures

c. major appliances: refrigerators, stoves, hot water heaters, washers, dryers, etc.
d. furnaces
e. heat pumps
f. electric motors

Focus of these standards is on both commercial and industrial customers, and individual consumers. Energy efficiency standards and, within those standards, rating labels are now included on all new equipment sold.

g. federal government use of energy in buildings

These and related requirements, promulgated by DOE, have been in effect in one form or another since the late the 1970's, and have unquestionably raised the overall efficiency of the stock of electrically powered appliances in the U.S.

2. Energy Conservation as Part of Utility Rate Design and System Planning: Demand Side Management and Integrated Resource Planning

a. Demand Side Management: The goal here is to reduce electric consumption (both peak load and overall consumption), primarily by utility rate design. There are two major statutes: PURPA (Public Utility Regulatory Policies Act), passed in 1978; and Energy Policy Act, passed in 1992. Various of these policies have been in effect since 1978 with enactment of PURPA; others were added in 1992 by EPAct.
   i. PURPA Policies for Electric Rates and Services (§ 111):
      1. rates should reflect actual cost of power generation and distribution;
      2. rates should not decline with increase in electric power use unless the cost of providing the power decreases as consumption increases;
      3. rates should reflect the daily variations in the actual cost of electric power generation;
      4. rates should reflect the seasonal variations in the actual cost of electric power generation;
      5. rates should offer a special "interruptible" electric power service rate for commercial and industrial customers;
      6. each utility must offer load management techniques to their customers that will be practicable, cost effective and reliable, as determined by state public utility commissions

These policies were, in major ways, changes from previous generally accepted utility rate designs. PURPA does not require

implementation of these policies. Rather, it requires state commissions to consider each one and make a determination concerning whether or not it is appropriate to implement it to carry out the purposes of [PURPA] within three years of the law's enactment.

ii. PURPA Standards for retail electric rates and service (§ 113):

1. service to multi-unit residential buildings should not be measured by a "master meter";
2. rates should not increase under automatic adjustment clauses unless other specific requirements are met;
3. services should provide information to electric utility customers concerning electric power rates;
4. electric utility service may not be terminated except in accordance with specified procedures;
5. all promotional and political expenditures by utilities are to be borne by shareholders, not by ratepayers.

As with policies above, these are not required to be implemented by state commissions. Commissions were merely required to consider within two years whether their adoption was appropriate.

iii. UPSHOT OF PURPA: Implementation of PURPA policies and standards under §§ 111 and 113 has not been complete. Nevertheless, the statute has gotten both utilities and regulators into the process of thinking about the true cost of electricity and pricing it accordingly.

More specifically: Most state rate commissions have required utilities to incorporate PURPA policies and standards into their rate designs, in varying degrees. For instance, virtually all states require information about rates and rate structures, and virtually all utilities offer energy efficiency audits to all classes of customers. Many utilities charge different seasonal rates since with current residential metering, which measures cumulative consumption but not instantaneous consumption, seasonal rate differentials can be implemented with monthly meter reading. Time-of-day rates have been established for many large commercial and industrial customers whose metering permits recording of instantaneous demand; but it has not been implemented for residential customers except on experimental basis: cost and effort to re-meter. But it is gradually coming.

Thus as time has gone along, the concept that demand and energy savings could be quantified and a value put on them has

become increasingly accepted. From this realization two others followed. First, rate structures could and perhaps should be designed to encourage reductions in demand and reductions in overall energy consumption. Second, increases in electric demand (and in the new generation equipment necessary to meet it) should be allowed only where the cost of further conservation exceeded the cost of providing additional capacity or energy, as needed. Through the PURPA policies and standards, outlined above, and these rate-design realizations, came the beginnings of what is now known as Demand Side Management.

Some measures -- such as encouraging reduction in peak-hour loads (which require utilities to bring their costliest, least profitable units on line to satisfy demand) -- were relatively easy to effect and unquestionably profitable for utilities. However, utilities had to subsidize the participation by their customers in many of the other measures called for by Demand Side Management to reduce their electric demand or consumption. Under these circumstances, as customers' electric consumption decreased, so did utility revenues, while utility costs might actually rise. Thus Demand Side Management carried with it a potential for decline in utility profits, unless utilities were allowed to structure their rates so as to recover their additional costs associated with reducing peak demand or consumption. This led to a natural reluctance by utilities to carry their DSM programs beyond a certain preliminary stage.

This problem was addressed in 1992, in the Energy Policy Act.

iv. Energy Policy Act of 1992: Retained the policies of PURPA, and added three more:

1. requires that rates allowed to be charged make a utility's investment in demand-side measures "at least as profitable, giving appropriate consideration to income lost from reduced sales, ... as its investments in and expenditures for the construction of new generation, transmission and distribution equipment." In other words, investment in reduction of demand is to be compensated at least as fully as investment in satisfaction of demand.
2. utilities are required to adopt least-cost or integrated resource plans for long-term system planning. This process will be discussed more below.

3. utility rate policies must not be designed to permit utilities to gain an unfair advantage over small businesses engaged in the sale of goods and services related to energy conservation.

v. UPSHOT OF THE EPACT: Legal encouragement is now in place for the full range of demand-side management measures that are mutually acceptable to utilities and their state regulatory commissions. This has given rise to a wide range of questions which can be answered only by experience, and over which there is live debate raging in the United States right now. Of these, the most basic are:

1. Quantification issues: How does one determine the actual effectiveness, in terms of reduction of demand or energy consumption, of a given measure or set of measures? Again, some situations are far clearer than others.
2. Valuation issues: How does one value a unit of capacity or energy reduction? In some cases, such as shaving a given number of megawatts off the top of a peak load, the answer is relatively clear. In other cases, it is nowhere near as clear.
3. Allocation issues: Who pays for the cost of these measures? Clearly, the customers who are using less electricity (and often have been subsidized to do so) are paying less than they were previously. Clearly also, if the utility is allowed to recover its costs from implementing these consumption-reduction measures, those customers who have not reduced their consumption will have to pay extra to make the utility whole. If these customers have simply refused to implement measures which would reduce their consumption, then perhaps their increased cost of service is fair. But if they simply cannot, or cannot afford to, reduce their consumption, it is fair for them to subsidize the customers who are in fact using less electricity?
4. What kinds of measures work best: market-driven or compulsory?

b. Integrated Resource Planning: The EPAct required, for the first time, that all utilities employ "integrated resource planning," that they file and update such plans annually with their regulatory commissions, and that they make such plans available for public scrutiny.

All utilities have long done forecasting of expected load and of associated generation requirements. The goal is to provide the right amount of new generation, and the right kind (e.g., base-load or

peaking) to meet expected load characteristics, using economically available fuels, and sited logically with relation to transmission and load centers. This is generally referred to as "system planning."

Integrated Resource Planning is similar to this discipline, but with the additional requirement to seek cost-effective ways to reduce electric consumption. Two statutory definitions from the EPAct are pertinent here:

The term "integrated resource planning" means, in the case of an electric utility, a planning and selection process for new energy resources that evaluated the full range of alternatives, including new generating capacity, power purchases, energy conservation and efficiency, cogeneration and district heating and cooling applications, and renewable energy resources in order to provide adequate and reliable service to its electric customers at the lowest system cost. This process shall take into account necessary features for system operation, such as diversity, reliability, dispatch ability, and other factors of risk; shall take into account the ability to verify energy savings achieved through energy conservation and efficiency and the projected durability of such savings measured over time; and shall treat demand and supply resources on a consistent and integrated basis.

The term "system cost" means all direct and quantifiable net costs for an energy resource over its available life, including the cost of production, distribution, transportation, realization, waste management and environmental compliance.

Thus the Integrated Resource Planning process is a means of including Demand Side Management measures formally into a utility's long-range planning process and providing regulators with an opportunity to remain informed on the process and to give them the right to approve it.

3. Technical and Financial Incentives
   a. subsidized mortgage funding for homes meeting energy efficiency standards and improvements to homes which increase their energy efficiency.
   b. assistance to state agencies in carrying out their multiple responsibilities under EPAct.

V. Implications for Energy Policy in the United States

The following implications are plain for the utility industry in the United States:

1. Recent statutory changes have opened the door wide to competition between utilities for both wholesale and retail customers. Utilities can now form subsidiaries to build power projects in each other's service territories, without encountering the crippling regulatory penalties that they used to face. U. S. utilities are now also allowed to build projects abroad without risking regulatory penalty. This should, as a practical matter, increase the pool of potential suppliers of electric energy projects in each of your republics.

2. Within their own service territories, utilities are now being compelled, by the required use of demand side management concepts, to design rates which will not only seek to maximize efficient use of generating capacity (both in demand and overall power generation), but will actively seek to reduce consumption of electricity.

3. Numerous other regulatory pressures, including equipment efficiency standards and labeling, tend to enforce energy savings.

4. The long-term planning process -- the Integrated Resources Planning process -- also compels consideration of reducing consumption of electricity, both on an instantaneous basis and over time.

5. Significant questions remain to be sorted out with experience. Prime among these are three. First, how does one value a reduction in electric consumption? Second, how does one allocate the "saving" from it among customers. Third, how does one structure rates so as to maximize the likelihood that consumers will receive correct cost/price signals and make the most rational decisions?

VI. Application to Electric Systems of Central Asian Republics

a. Changes in Structure of Utility Industry to Promote Efficiency: If your tradition is that there is one utility company in the country, then there may be relatively little opportunity for the kinds of competition for generation that is now being seen in US. However, to the extent that you have regional utilities that have the capital to build new plants and to compete for generation with each other, then the separation of generation from transmission and distribution now going on in US may be useful (as long as access to transmission lines is afforded).

   Even if you have one monopolistic company per country, there are still possibilities:

   (1) other heavy industrial concerns may wish to enter power supply business

(2) foreign investors, including now U. S. utility companies, are interested in building plants for long-term contracts -- can they compete in terms of real costs?

b. Use of Demand Side Management Tools to Promote Efficient Consumption and Consumption Reductions

There are widespread potential applications of DSM tools for enhancing the efficiency of electric consumption. What they rely on -- as does any efficient market -- are (a) accurate cost information and (b) informed participants -- both suppliers (the utility) and customers.

1. A Reminder: Efficiency in Use and Limitations on Use (reductions in use) aren't necessarily identical: one can achieve peak generation limits -- and thus limit use -- by (a) imposing rolling blackouts or other forms of rationing, or (b) substituting more efficient equipment for less efficient, or © using price incentives to steer consumption away from certain times of day, to flatten out the peak load. These have far different economic and resource impacts.

2. Assume that efficient use is part of the goal, then

   The more you know about your system and your customers, the better: The most basic questions:
   - who is using how much, when?
   - how much does it really cost to provide service? That includes accurate knowledge of, e.g., costs today and, to the extent they are foreseeable, in future years -- fuel costs a potentially good example

   THIS IS TRUE REGARDLESS OF WHETHER THE SYSTEM IS COMMAND-DRIVEN, MARKET-DRIVEN, OR SOMEPLACE IN BETWEEN.

   Efficiency also requires that the utility be rewarded for achieving efficient uses. For instance, if a utility loses revenue whenever it encourages a more efficient use pattern and thereby lessens consumption, it will have little incentive to pursue active demand-side management measures.

   Information needed about Customers:
   - amount of electric demand; instantaneous, over time
   - cyclic variations with time: daily, weekly, seasonal
   - to what extent is demand now constrained by capacity limitations?
   - how much of electric demand comes from different customer classes: industrial, commercial, residential public?

Information Needed about Your System:

- reliability of specific units
- cost of generation from specific units
- cost of generation at varying load conditions and levels -- including categories of cost (fuel, labor, etc.)

3. The more your customers know about the implications of their electric consumption choices, the better:
   - cost of service and how it is billed
     - accurate metering and billing by amount used essential

     Q: WHAT KINDS OF METERING DO YOU HAVE? Industrial, commercial, individual residential?
   - consumption implications of various types of electric equipment: nameplate data, etc.

4. Tools for Promoting Efficient Electric Use: Assuming that **Efficiency** is a component of operation, then certain things follow:

   (I) Flattening peaks: determine relationship of average load to peak load, and make the difference as small as possible: allows you to avoid running least efficient units. Tools for accomplishing that:

   Command-driven tools: (a) Rolling blackouts, (b) prohibitions on certain users or categories of use at given times (may require metering). Can be accomplished on short notice, has clear effects, has other economic and social costs.

   Market-driven tools: (a) Rates, (b) Equipment Efficiency, (c) Pricing Incentives, (d) Taxes

   Rates

   (a) Daily peaks: Time-of-use pricing (probably not feasible for residential users). Effective use requires accurate billing showing amount consumed, unit cost at different times.
   (b) Seasonal peaks: Can charge more per kWh in peak months; or can charge more for use over a given threshold (e.g., 500 kWh) in peak months -- doesn't require instantaneous metering ability.
   (c) Interruptible rates -- permits interruption of service at any time, upon notice (e.g., 15 minutes) to customer. Good tool for large customers; time can be picked by utility under pre-selected conditions (thus costs and avoided costs can be

predicted, and rate discounts to customers pegged accurately).

Equipment Efficiency

- Encourage development of more efficient appliances, e.g. [in US] air conditioners
  - efficiency standards
  - nameplate disclosure of efficiency and operating costs
  - potential pricing subsidies to purchasers of efficient equipment (buying consumption reduction) -- long term pricing and special offers
- Takes time -- requires consumers to understand and act on pricing information; may require equipment cycle to wear out;
  - depends on good information
  - relies on people to make rational judgments based on cost
  - assumes that utility will be compensated, in rate design, for reduction in consumption

Pricing Incentives

- Purchase-cost discounts or rebates for more efficient equipment or fixtures (e.g., long-life compact fluorescent light bulbs) -- requires that the utility (I) know its own costs (to ensure that it is not losing money on the incentives offered -- cost of generation displaced must be greater that the cost of the incentive) and (ii) be compensated for loss in generation.

Taxes

- Function the same say as pricing incentives, only in reverse: dampen demand. The only difference is that instead of the utility collecting the revenue (and thus factoring appropriate cost into rates based upon known costs), government keeps the revenue; and it may not be as well calibrated to true costs of service.

(II) Lessening Wasteful Uses: Many uses can be encouraged or discouraged by appropriate pricing signals. For instance, if users pay a flat fee for service, or if metering charges are collected seldom or irregularly, or if the price charged for service does not reflect its true cost, then consumers will have no incentives to calibrate their use. For instance, in a flat-fee arrangement, they have no incentive to turn off light bulbs, to use air conditioning equipment only when needed, to purchase

more efficient appliances rather than less efficient ones, and the like. Utilities can discourage wasteful uses by use of most of the means outlined above. But they must all start with accurate pricing of service, and conveying price and related information to consumers. These measures take time.

Utility losses may be the first problem to attack: line losses from long low-voltage runs or loosely connected equipment, or theft of electricity from distribution lines, should be eliminated as a first order of business.

(III) Encouraging Efficient Use: Much the same tools outlined above are applicable. However, the goal here is to induce people to take positive action. Therefore, affirmative pricing incentives on efficient equipment are paramount. These measures take time.

There is no theoretical limit on the number or types of measures utilities can use now under the name "demand side management" to help shape demand. For them to work, however, requires accurate information on demand and on the costs of servicing that demand, and communication of that information to customers so that they can make rational choices.

5. If **Reduced Consumption** is desired: then much the same set of tools that promote efficiency are useful. Consumption reduction may be useful for its own sake where there are certain external circumstances, e.g., resource limitations (e.g., fuel supply availability or dependability) or environmental constraints (e.g, air pollution not readily remediable by improvements on power plants themselves). Requires knowing true costs.

C. Use of Integrated Resource Planning to Enhance Efficiency

All utilities plan. You have planned for decades. You have maintenance and construction schedules for your plants planned out for years ahead, if not decades. You will continue to do this.

Integrated Resource Planning adds one additional element: a deliberate consideration of the issue of whether it makes more sense to build another unit of electric capacity to satisfy anticipated demand, or to take steps to decrease that demand. The answer will depend on a lot of things, including the nature of the demand (how much, what type) as well as social or economic goals. For instance, since electric growth is always associated with economic growth, dampening demand to the point where desired economic growth was also hurt would not make sense.

However, growth in peak loads relative to average system loads is not a desirable trend, and even if you are attempting to stimulate overall load growth, you may want to try to hold down growth in peak loads. Integrated Resource Planning can help make these decisions, by forcing you to calculate the cost of increasing generation versus the cost of taking steps to prevent the increase.

For this to be successful, again, requires (a) accurate information, (b) communicating of that information to customers, and (c) allowing the utility to collect revenues in rates that compensate it for lost generation. Even if your systems are primarily in a period of growth to help fuel economic growth, IRP can help channel the allocation of scarce construction funds most efficiently.

United States Agency for International Development

United States Energy Association

Regional Conference to Promote Energy Efficiency in the Central Asian Republics

"Designing Pricing & Tariff Policies"

Richard Browning
Senior Manager, Energy and Environment Group
International Resources Group

July 13, 1995

Lake Issyk-Kul, Kyrgyz Republic

55

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Mr. Browning is an energy economist with more than 15 years of experience in economic, energy, and public policy analysis, macroeconomics and hydrocarbon forecasting, strategic planning, project consultation and database development. Since 1992, he has worked on seven assignments in Central Asia, including as Team Leader on projects that formulated guidelines for the pricing and taxation of fossil fuels, electricity, and heat. He examined for the U.S. Office of Technology the benefits of technology transfer and technical assistance to the energy sector for the following countries: Poland, Hungary, Ukraine, Russia, Kazakstan, Kyrgyzstan, and Azerbaijan.

Currently he is manager of an USAID project to assist the Government of Kazakstan in preparing a National Program for Energy Savings. The scope of this project is broad and includes the following tasks: (1) development of legislative and regulatory principles for energy savings, (2) identification of government energy savings policies and programs, (3) development of guidelines for energy pricing and tariffs, (4) identification of technical and operational energy savings measures, with emphasis on the industrial, power and district heating sectors, (5) estimation of energy savings and efficiency gains resulting from specific investments, and (6) conducting energy savings seminars at several plants.

Through his work with private sector energy firms, he has developed and promoted the use of scenarios, risk-adjusted analyses and modeling and has regularly presented outlooks on future energy market trends and global business conditions to Boards of Directors, senior management, and operating managers. He has extensive experience evaluating oil and gas markets on a global basis and coal and electricity markets in North America, Europe, and Central Asia. Mr. Browning has also formulated alternatives on energy and environmental public policy issues and participated in industry studies focussing on supply-demand for all regions of the world. He has advised demand outlook and the underlying details, including sales by sector, generation by source, fuel costs and fuel mixtures, and capacity additions.

56

Overhead 1

Pricing Principles

- Price levels must be set "X%" higher than cost; with "X" representing the necessary return on investment needed to meet projected demands. This will assure the energy sector can self-finance the investments needed to meet future demands.

- Retail Price levels also set "X%" higher than costs and set to achieve government/society's goals, including:

  - Contributing revenues needed to finance energy-sector related subsidies
  - Contributing to the state budget
  - Establishing inter-fuel price relationships which encourage the development and use of indigenous resources
  - Encouraging fuel use patterns which reflect the full environmental costs of fuel consumption
  - Stimulating conservation measures

- Energy prices must also take account of the need to internalize certain externalities, such as the costs associated with environmental protection.

- Energy prices should be characterized by transparency so that consumers and producers can make economically efficient decisions.

Pricing Principles (continued)

- Price levels must be set so that marginal costs of energy supply are fully recovered; in the short-term to include all variable operating costs and in the longer term, to include fixed costs.

- When traded in world markets, prices of energy commodities should reflect full border equivalent of available export markets, fully accounting for transportation costs and quality differentials, appropriately measured.

- Tariffs should reflect cost of service to different classes of customers, e.g. households, agricultural and industrial consumers.

- Regional Energy Prices should reflect different transportation and distribution costs and regional demand pressures.

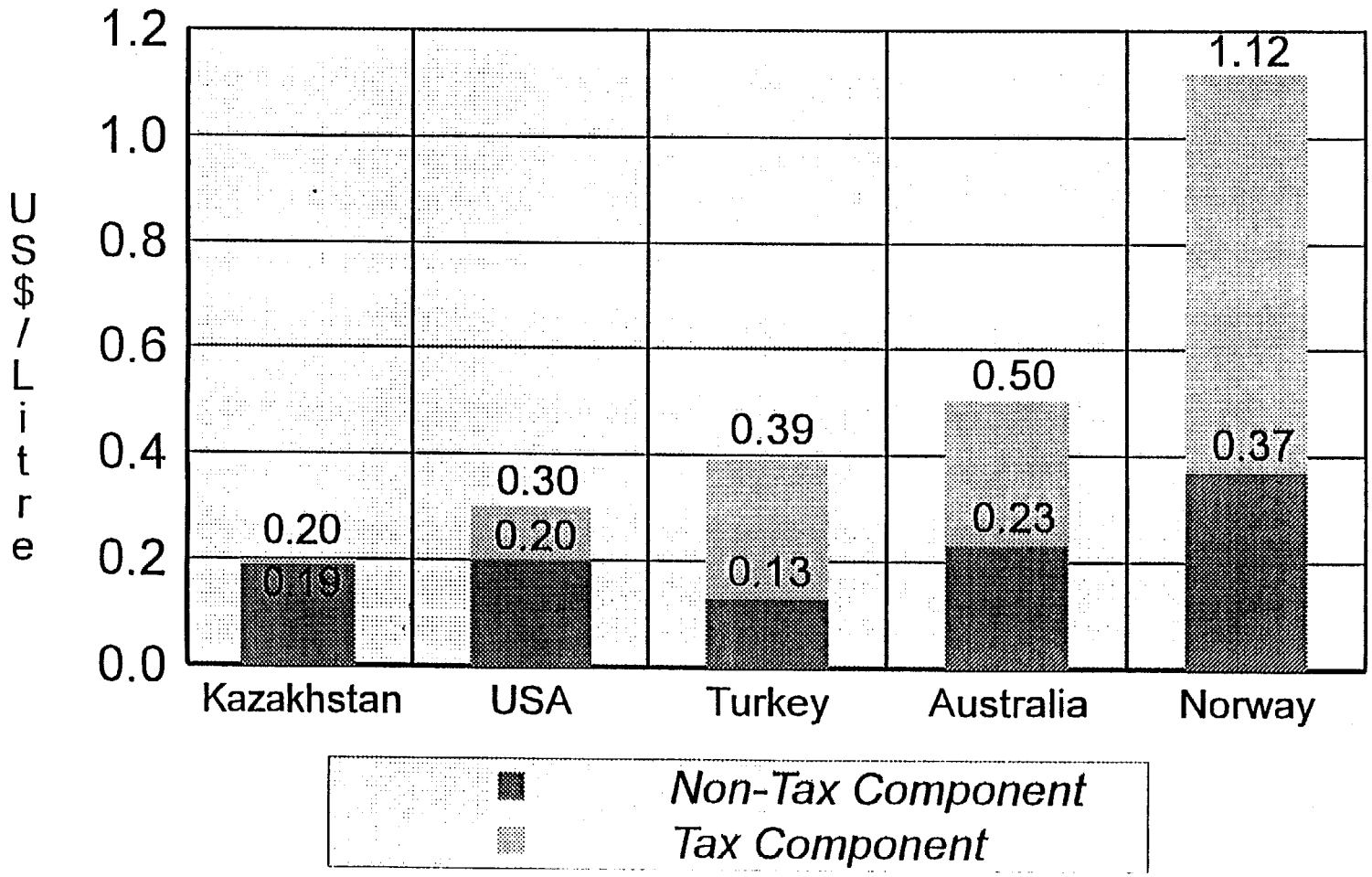
- Proper weight should be given to energy policy objectives when considering tax policies.

- Quantities of energy demanded and supplied must be permitted to vary in response to changes in price; not allocated according to an annual plan developed by the Government.

- Assure that all citizens have the essential minimum supply of vital fuels at an affordable price.

Overhead 2

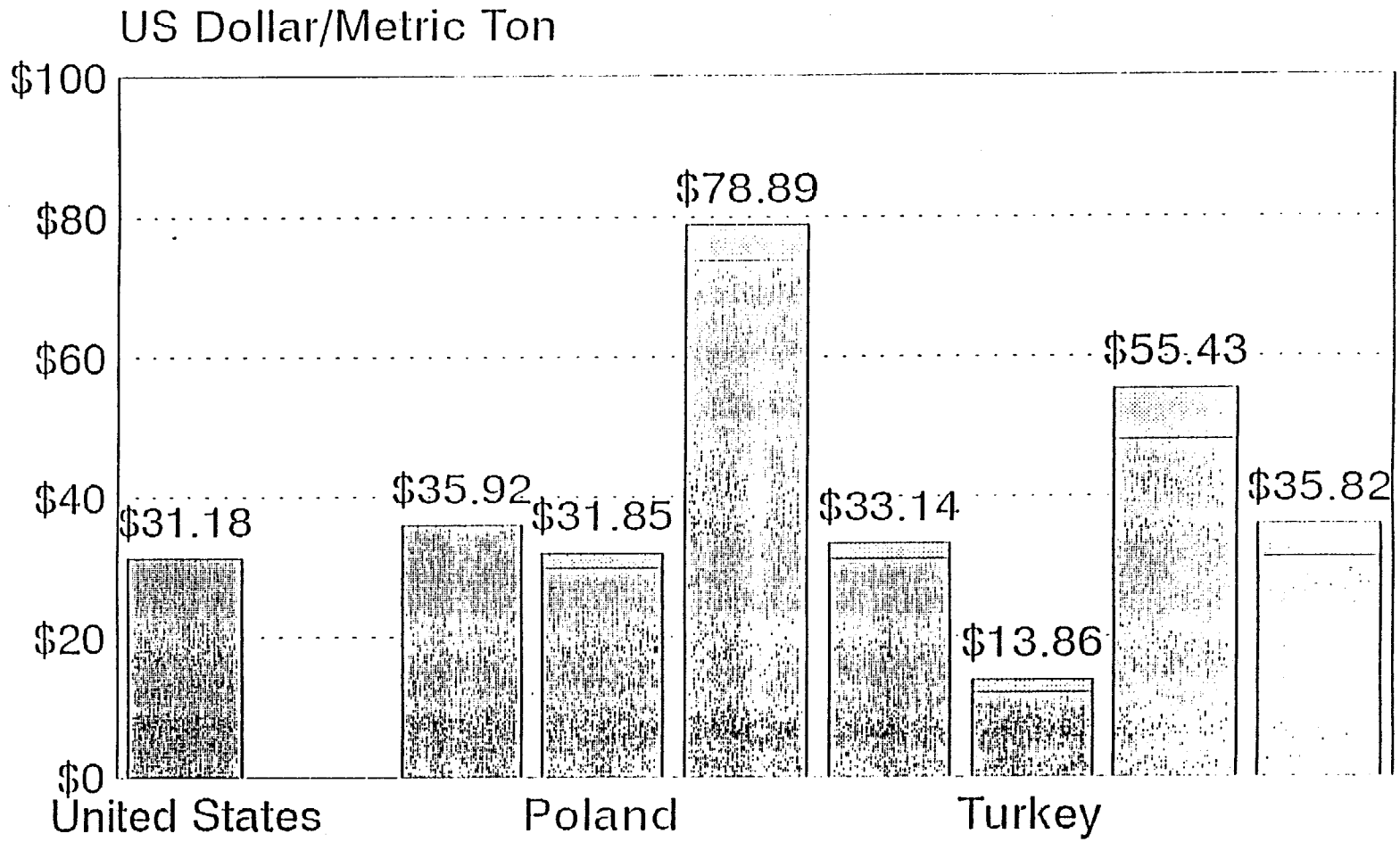
Comparison of Gasoline Prices and Taxes



Overhead 3

Comparative Steam Coal Prices and Taxes

1st Quarter - 1994



Tax Component % = n/a n/a 6.5 6.5 6.5 13 13 13

1st Bar = Electricity Generation Steam Coal Consumption

2nd Bar = Household Steam Coal Consumption (US Data n/a)

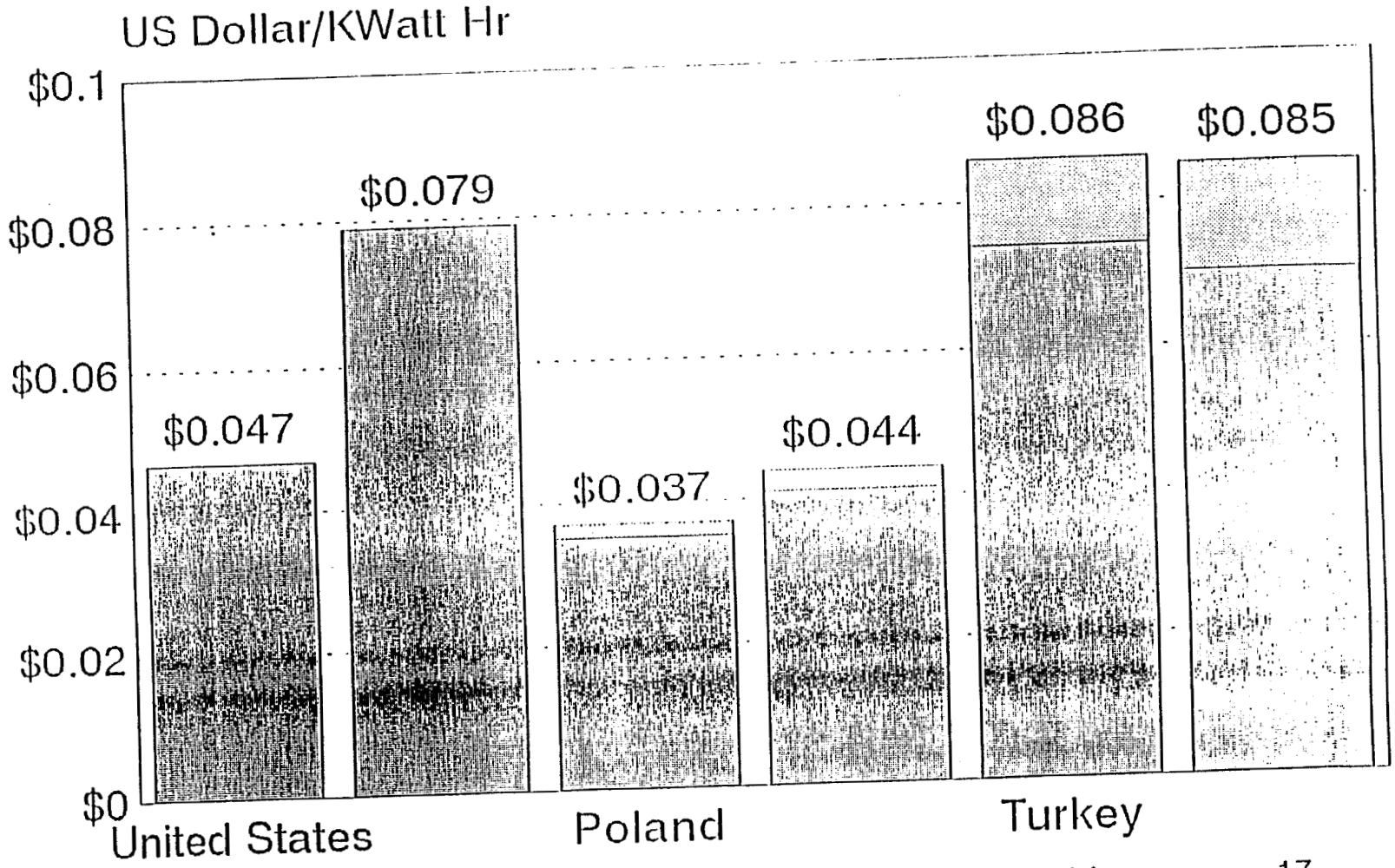
3rd Bar = Industrial Steam Coal Consumption

Source: IEA

Overhead 4

Comparative Electricity Prices and Taxes

1st Quarter - 1994



Tax Component % = n/a n/a 5.4 6.5 14 17

1st Bar = Industrial Electricity Consumption

2nd Bar = Household Electricity Consumption

Source: IEA

Overhead 5
Comparison of World Netback Prices to Central Asian Prices

Energy Type	World Price Assumption	Netback* (US$/MT or MCM)	Netback** (LC/MT or MCM)	Current Domestic Price (LC/MT or MCM)	Ratios (Percent)
1	2	3	4	5	6=5/4
Crude Oil	FOB Black Sea	78	4009	1600	40
Diesel Fuel	Rotterdam Gasoil				
Natural Gas	Turkey Imports				
Steam Coal	EEC Imports				

LC: Local Currency

Overhead 6

Example of Regional Market Steam Coal Pricing (US Dollars/MT)

Ekibastuz minemouth price	
Rail transport charges	
Delivered price to Sverdlovsk[1]	
Kuzbass minemouth price	
Rail transport charges	
Delivered price to Sverdlovsk[2]	

1 The distance to Almaty and Sverdlovsk are both about 1000 km.
2 The distance to Sverdlovsk is about 1800 km.

Overhead 7

Objectives of Electric Power Tariffs

- Be free of political influence.
- Be transparent and easy to understand.
- Allocate national economic resources efficiently.
- Satisfy certain principles relating to fairness and equity.
  - Allocate costs among consumers according to burdens imposed on system.
  - Avoid large price changes from year to year.
  - Include lifeline rates to low income consumers.
- Raise sufficient revenues to meet financial requirements.
- Facilitate the metering and billing of customers.
- Satisfy other economic and political requirements, such as:
  - Subsidized rates to certain sectors to enhance economic growth
- Encourage demand side management/system efficiency goals.

Overhead 8

AVERAGE INCREMENTAL COST (AIC)

$$AIC = \frac{\sum \text{discounted investments and operating costs}}{\sum \text{discounted volume of gas supplied due to expenditures}}$$

Average Incremental Cost-Transmission Component

Cost in Millions of Rupees

	CAPITAL	O & M	mmscfd
1992	3.306	82.7	30
1993	3.899	184.3	80
1994	2.897	265.9	223
1995	2.004	329.3	363
1996	855	367.1	363
1997		385.5	363
1998		404.8	363
1999		425.0	363
2000		446.2	363
2001		468.6	363
2002		492.0	363
2003		516.6	363
2004		542.4	363
2005		569.5	363
2006		598.0	363
2007		627.9	363
2008		659.3	363
2009		692.3	363
2010		726.9	363
2011		763.2	363
2012		801.4	363
2013		841.5	363
2014		883.5	363
2015		827.7	363
2016		974.1	363
	12,961	13,975.7	8,319

Cost in Millions of SUS

	CAPITAL	O & M	mmscfd
1992	132.2	3.31	30
1993	156.0	7.37	80
1994	115.9	10.64	223
1995	80.2	13.17	363
1996	34.2	14.69	363
1997		15.42	363
1998		16.19	363
1999		17.00	363
2000		17.85	363
2001		18.74	363
2002		19.68	363
2003		20.66	363
2004		21.70	363
2005		22.78	363
2006		23.92	363
2007		25.12	363
2008		26.37	363
2009		27.69	363
2010		29.08	363
2011		30.53	363
2012		32.06	363
2013		33.66	363
2014		35.34	363
2015		37.11	363
2016		38.96	363
	518.4	559.03	8,319

AIC = 8.8712 Rs/mcf (0% Disc.)
18.2474 Rs/mcf (15% Disc.)
19.8164 Rs/mcf (17% Disc.)
22.2272 Rs/mcf (20% Disc.)

AIC = 0.3548 SUS/mcf (0% Disc.)
0.7299 SUS/mcf (15% Disc.)
0.7927 SUS/mcf (17% Disc.)
0.8891 SUS/mcf (20% Disc.)

NOTES: 1) Based on exchange of SUS=25Rs
2) All Costs are expressed in NOMINAL terms
3) Annual operating costs assumed to be 2.5% of incremental capital facilities.
4) Inflation assumed to be 5% per annum
5) Incremental production considered from:
- Qadirpur
- Dhodak
- Kandanwari, and
- Sui Plant (incr. plant capacity)

Overhead 9

Representative Costs of Electricity Supply*
(US cents/Kwh)

Generation Cost (coal-based)	2.50	4.50
Transmission	2.00	3.00
Cost to HV customer	4.50	7.50
Distribution & Connection	3.00	5.00
Cost to LV customer	7.50	12.50
Generation Cost (hydro-based)	1.95	3.50

Note: *Assuming efficient operations and low loss levels

Source: Hydro Quebec reports and deLucia & Associates' estimates as presented in briefing report for The World Bank.

Overhead 10

DSM Rate Incentives

• Discount rates:	Lower rates that are offered to facilities meeting certain conservation requirements
• Time-of-use rates:	Rates that are higher during the utility's peak demand hour or season
• Demand charges:	Charges based on a customer's highest peak demand in a billing period
• Interruptible rates:	Rates that require customers to reduce their use when so requested by the utility.

Overhead 11
Time of Use Pricing & Load

This overhead was unavailable.

Overhead 12

Real Energy Prices and Energy Intensity
(Cumulative percentage change)

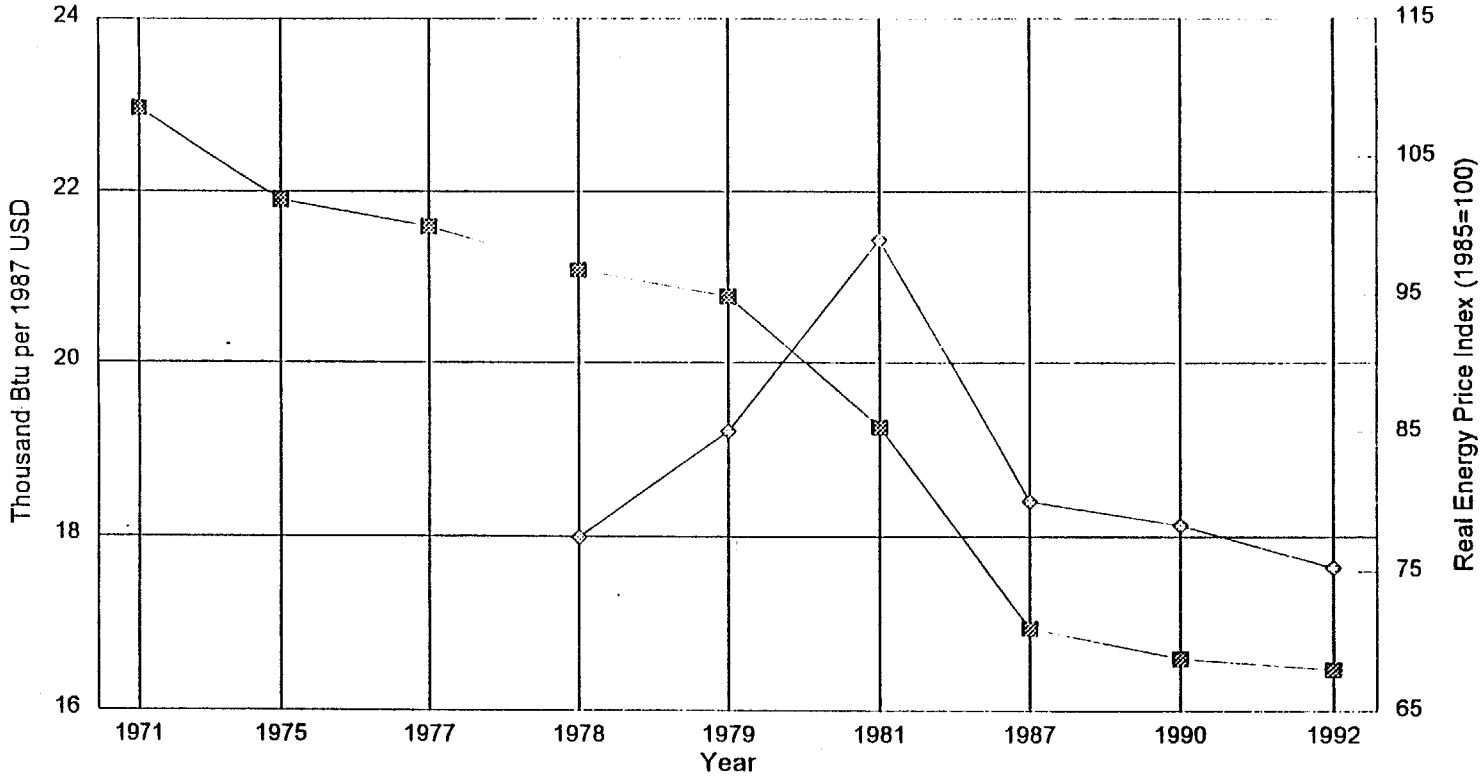
	Changes in Real Energy Prices[1] 1978-82	Changes in Energy Intensity[2] 1978-82	Ratio of Intensity Changes to Price Changes 1978-82
Residential/Commercial[3]			
United States	40.6	-11.4	-.28
Germany	23.5	-4.0	-.17
Canada	78.9	-9.0	-.11
Total OECD	46.2	-14.1	-.31
Industry[4]			
United States	42.1	-23.4	-.56
Germany	32.0	-24.8	-.78
Canada	77.7	-29.5	-.38
Total OECD	49.9	-24.9	-.50
Transportation			
United States	32.8	-18.6	-.57
Germany	34.5	-2.8	-.08
Canada	34.9	-23.6	-.68
Total OECD	30.8	-18.3	-.59

1 Change in end-use prices.
2 Change in the index of final energy demand divided by the change in the index of real GDP.
3 Includes public and agricultural use.
4 Includes non-energy use.

Source: IEA, Energy Price Data and Energy Balances of OECD Countries.

Overhead 13

US Energy Intensity and Real Energy Prices



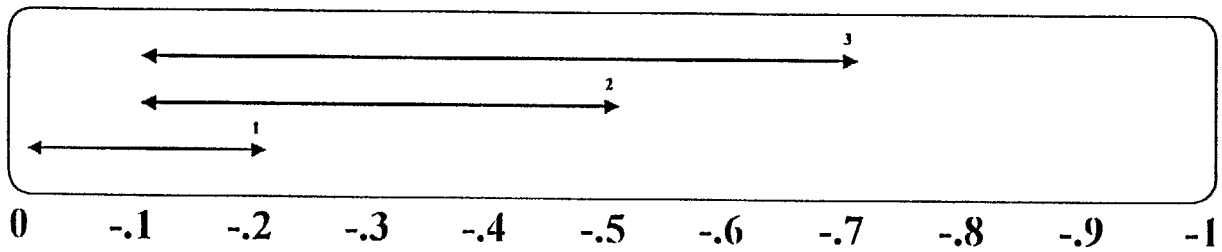
Source: U.S. Department of Energy and International Resources Group. Ltd.

Overhead 14

Poland Energy Pricing and Consumption

	Average Annual Growth Rates	
	Real Prices (1987-92)	Energy Consumed (1991-92)
Gasoline	6.9	
Electricity		
Industrial	8.7	-5.8
Households	25.5	-6.3
Natural Gas		
Industrial	-0.9	-16.5
Households	38.4	
Steam Coal		
Industrial	12.6	-4.7
Electrical Power	5.1	
Households	17.9	

Overhead B-1
Energy Price Elasticities



1. Short-Term
2. Medium-Term
3. Long-Term

United States Agency for International Development

United States Energy Association

Regional Conference to Promote Energy Efficiency in the Central Asian Republics

"Regulatory Programs to Encourage Energy Savings"

John Wilson
Advisor to the Chairman
California Energy Commission

July 13, 1995

Lake Issyk-Kul, Kyrgyz Republic

13

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John Wilson works for the California Energy Commission, and serves as Advisor to the Chairman. The CEC is California's energy planning and policy making agency. The Commission performs demand forecasting and supply assessments for electricity and fossil fuels, establishes efficiency standards for buildings and appliances, sponsors research and development of new energy technologies, and is the permitting agency for electric power plants over 50 megawatts. Mr. Wilson has degrees in economics from the University of California.

"Regulatory Programs to Encourage Energy Savings"

Summary of the Presentation by

John Wilson
Advisor to the Chairman
California Energy Commission

Today I am going to present a brief overview of government policies that can encourage energy savings. This includes options such as setting regulatory standards for minimum energy efficiency, government and utility programs to encourage efficiency. Before doing so I want to give a brief overview of the role of energy efficiency in California, and the role of California's government and utilities in influencing demand.

Energy Efficiency in California

The Energy Commission is a state government agency responsible for long-range energy planning as well as issuing permits for new power plants in California. The Commission was created in response to electricity demand growth rates that were as high as 7 percent per year in the early 1970's, which resulted in statements by utilities that they were going to have to build as many as 50 nuclear or coal plants. Consequently, they wanted a "one stop" state level siting agency that would issue permits to build the plants, and have authority to override the opposition of local governments and their citizens. At the same time, environmental advocates wanted to insure that alternatives to nuclear power were fully considered by an independent agency before the plants were built. As a result, the Commission was given the ability to influence demand by setting efficiency requirements for buildings and appliances, and to influence the mix of supply options by fostering research and development of alternative energy technologies. The Commission carries out these responsibilities in the context of a biennial planning process in which information is collected, evaluated in public hearings, and an energy plan is adopted by the Commission and delivered to the Governor and Legislature. That policy report also guides decisions on the need for new power plants.

What happened over the last 20 years is that no new nuclear or coal plants have been built beyond the one that was already under construction in 1974, and instead new energy demand has been met by more efficient uses of energy and a combination of cogenerated electricity and renewable energy sources. In general, our integrated resource plan, which is adopted every two years, shows that three-fourths of future increases in demand will be met by energy efficiency, and the remainder will be one-half natural gas-fired electricity from plants that are much more efficient and less polluting than existing thermal plants, and one-half from renewable plants, such as geothermal and wind.

Specifically, demand rates have been reduced from 7 percent to about 2 percent per year,

despite rapidly growing population. Part of the reduction was due to faulty utility demand forecasting techniques that did not account for changes in electricity use patterns. But a large part was due to increases in energy efficiency brought about by a combination of high energy prices, building and appliance efficiency standards, and utility-sponsored conservation programs. For example, we project demand will be 16,000 MW (or 21 percent) lower in the year 2003 due to standards and utility programs. Some specific examples of the efficiency improvements can be seen by looking at appliances, which have shown efficiency improvements of 50 to 100 percent since 1972.

At the same time, the mix of generating resources has changed dramatically over time. In 1975 about three-fourths of California's electricity was generated from oil, with predictably disastrous results on electricity prices. We adopted a policy which we thought was very ambitious: to displace one-half of that oil-fired electricity with other sources. In fact, what occurred was oil use for electricity generation went essentially to zero. This was largely due to utilities switching to natural gas, to the huge increase in cogeneration by industries, and to a lessor, but still significant extent, the increase in renewable generation by non-utility sources. In total, non-utility owned cogeneration, biomass, geothermal, wind, solar, and small hydro went from near zero MW in 1980 to about 12,000 MW. The effect has been to reduce utility generation of electricity by about 10 percent.

California is quite proud of these increases in efficiency and shift toward cogeneration and renewable technologies. We have diversified our energy sources by using cogeneration that has made our industries more efficient and profitable. We have also created new energy industries which have created an active energy technology export program at the Commission. And, while California has high electricity prices, we have among the lowest energy costs per person and per dollar of gross state product of the other 49 states because we use energy more efficiently in our homes and businesses. We are also 45th out of the 50 states in carbon emissions per person, and we estimate that if all the states had the same per person emissions that California had, that the U.S. carbon emissions could be reduced by 40 percent.

Energy Efficiency Standards

The State of California established energy efficiency standards for buildings and appliances starting in 1977. In 1987 Congress established national appliance efficiency standards based largely on the California standards. In 1992 Congress established a national program to encourage state and local governments to adopt building efficiency standards. The combined effect of these programs will be to dramatically reduce energy use in homes and businesses, and saving billions of dollars in energy costs.

Energy efficiency standards establish a minimum level of efficiency (or maximum energy use). For example, the minimum efficiency level for a home in a certain climate zone might be 25,000 BTu per square foot per year for the energy used for space heating and cooling, and water heating (other end uses are not counted). Building efficiency standards are enforced by the local building department who inspect plans, and the building as it is constructed, for

various mechanical, electrical and plumbing requirements. Key to the success of the building efficiency standards is providing building architects and engineers with design assistance to show them what efficiency measures they can use to show compliance with the standards.

Appliance efficiency standards are set for major types of equipment, such as: water heaters, furnaces, air conditioners, heat pumps, lighting ballasts, and refrigerators. For example, the appliance efficiency standard for a refrigerator might be 700 kWh per year for an average size unit (the standard for refrigerators is different depending on the volume of the refrigerator). Appliance manufacturers are required to test their equipment according to a specified test procedure, and certify that their equipment meets the minimum efficiency standard for that equipment. Manufacturers can be penalized if they offer for sale equipment that does not meet the efficiency requirement.

In the process of setting standards the Energy Commission (or federal government) examines the engineering options available, and the energy savings and cost of each measure. Another important input to the analysis is the cost of energy. Then measures are added to the equipment to determine the minimum "life cycle cost," that is the combination of measures that may increase the "first cost" of purchasing the appliance or building, but reduce the energy cost by a greater amount.

Government Programs

Federal and state governments sponsor many programs to provide funding for efficiency programs, to disseminate accurate information on energy savings technologies, and to sponsor research and development of new energy efficiency technologies. The source of federal funds is the federal taxes on personal and business income. The source of funds to the California Energy Commission is either a surcharge on all electricity sold in California, or the federal government.

As an example of a funding program, the Energy Commission funds energy efficiency measures for local governments. This program sends qualified energy auditors and engineers to inspect the buildings and recommend which measures should be installed. The payback period (that is, the initial cost divided by the annual energy cost savings) is seven years or less. The Energy Commission then provides a combination of grants and loans to the local government to pay for the improvements, and the local government pays for the loans from their reduced utility bills. The money that is repaid to the Energy Commission is available to be loaned again to future program participants. Similar programs are offered to schools, hospitals, and farms.

An example of an information program is the publication of "advanced lighting guidelines" by the Energy Commission. The guidelines are developed by an advisory group of experts from the lighting industry who recommend technologies and design techniques that provide effective and energy efficient lighting for homes and businesses. Another example is the development of "home energy rating systems" in which auditors inspect homes in order to provide a list of recommended energy efficiency improvements to the homeowner. The list

can also be provided to prospective home buyers in order to inform them of the likely energy cost to heat and cool the home, and which measures can be added to reduce that cost. The importance of the "system" is that it is an accurate and uniform way to evaluate energy efficiency measures, so that consumers can rely on the information and make informed choices.

Utility Programs

Since the oil crisis in the mid-1970's, utilities have sponsored a range of energy efficiency programs for their customers. In general utilities were required to carry out these programs by state government regulators, and they were allowed to recover the costs of those programs in the cost of electricity and natural gas sold. In some cases utilities wanted to offer the programs because utility rates were rising due to high fuel costs and expensive power plant additions, and the energy efficiency measures reduced customer bills and frustration over high rates. The utility programs included a wide range of financial assistance, information programs, and cooperative research efforts. In contrast to federal and state programs that target local government facilities, utilities address a broader range of residential and business customers.

More recently (around 1990) California regulators initiated "shareholder incentive" programs in order to give utility managements an incentive to pursue aggressive, innovative and effective programs. The problem was that utilities had been reducing their energy efficiency programs in response to lower energy prices and increasing competition from non-utility energy suppliers. Shareholder incentive programs allow utilities to profit from their efforts, regardless of whether they are providing traditional energy supply or demand-side management services. Utilities also initiated programs to complement energy efficiency standards by offering financial incentives to home builders who *exceed* the efficiency requirements. The result of that program is to help commercialize new technologies so that they gain a broader market, reduce their costs, and become candidates to be included in future building standard revisions.

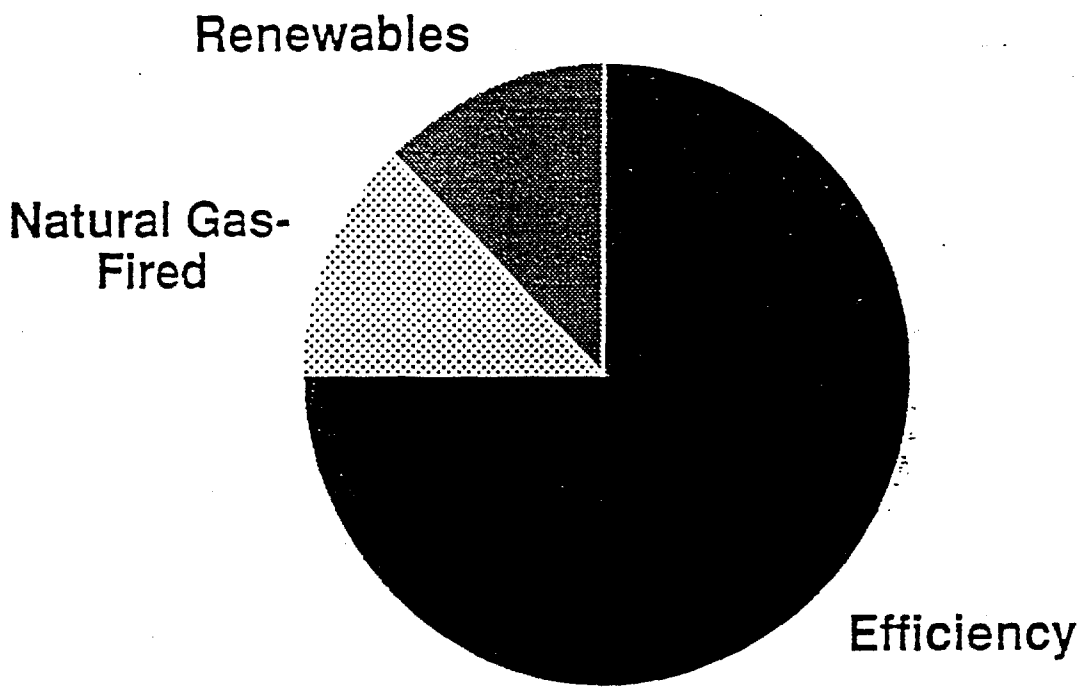
As competition has grown at the wholesale level, especially for electricity, there is a significant incentive for utilities to lower their costs so they do not lose customers. As a result, energy efficiency programs have been reduced, and have been focused on programs that both satisfy total customer needs (that is, not just energy) as well as help retain customers. This shift will likely result in lower overall utility energy efficiency spending, and creates a need to find alternative funding sources for energy efficiency programs. There is a growing consensus that there should be a surcharge on all electricity and natural gas sold, and those funds would be directed by either the state government or the utilities to fund energy efficiency programs. By applying to all energy sales (including utility competitors) the disincentive created by competition is eliminated.

Implications for Central Asian Republics

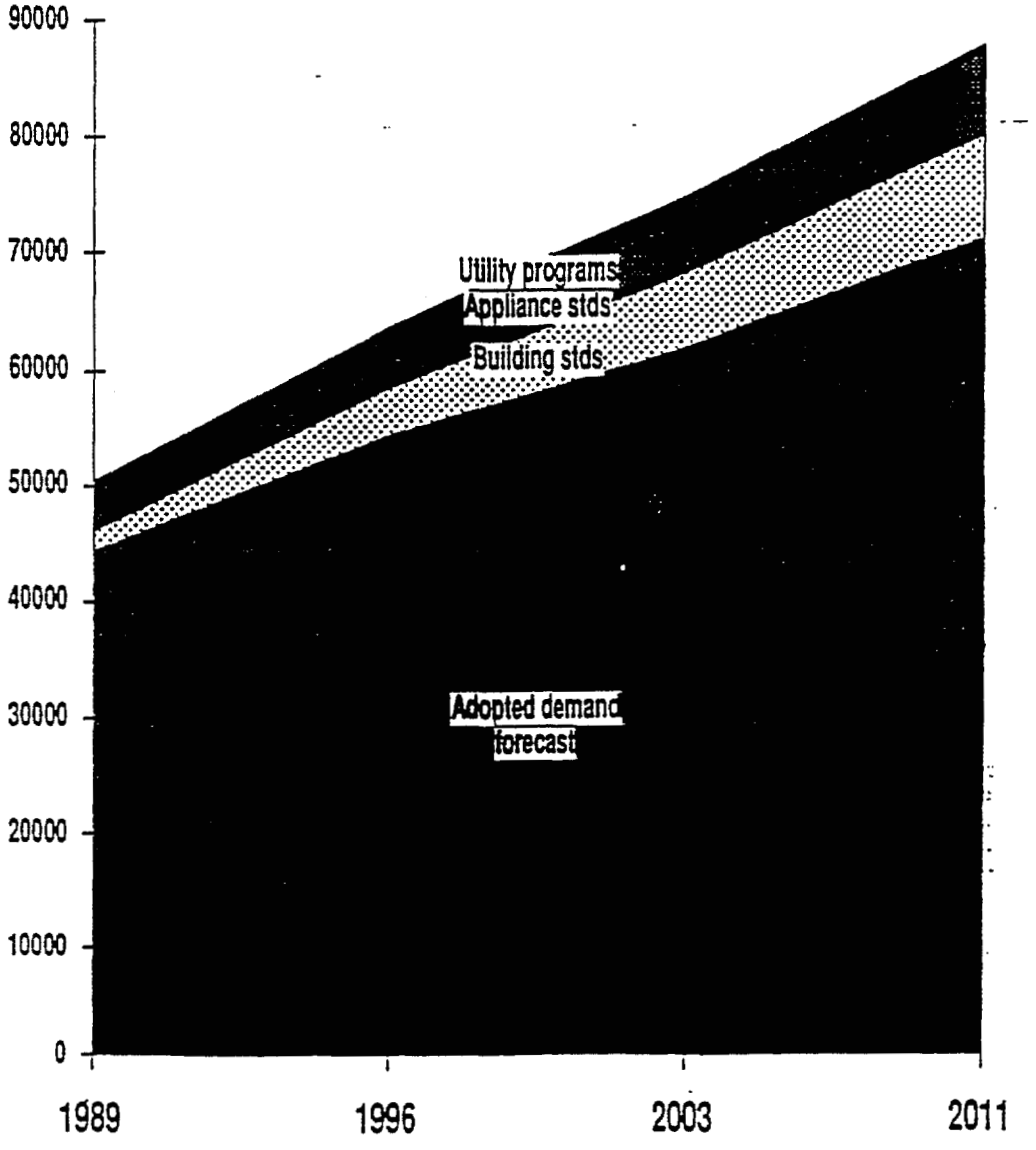
There are many differences between the U.S. and the Central Asian Republics in terms of

government, utilities, and the sources and uses of energy. Nonetheless, many of the approaches used in the U.S. could be applied in Central Asia. A beginning point should be the development of information on the costs of energy supply and their alternatives, so that governments and utilities can make informed decisions on how to use energy and reduce costs. Based on that information, funding should be provided for energy efficiency projects that can reduce costs. In addition, since some republics export energy, energy efficiency should be viewed as a way to reduce domestic energy use and make more energy available for export.

California's Mix of Future Resource Additions



Efficiency has Reduced Electricity Demand (MW)



PERCENT IMPROVEMENT IN EFFICIENCY IN MAJOR RESIDENTIAL APPLIANCES

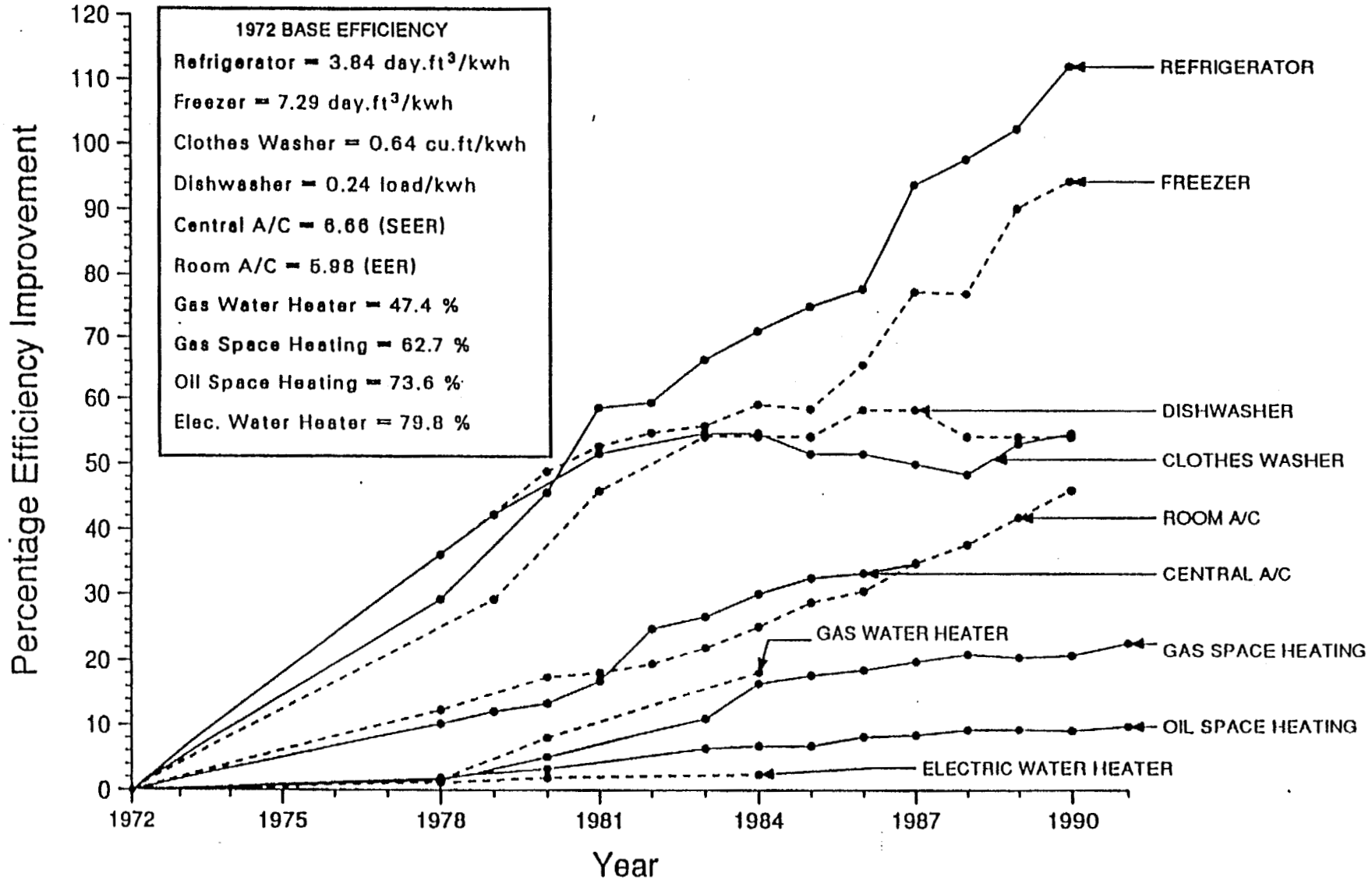
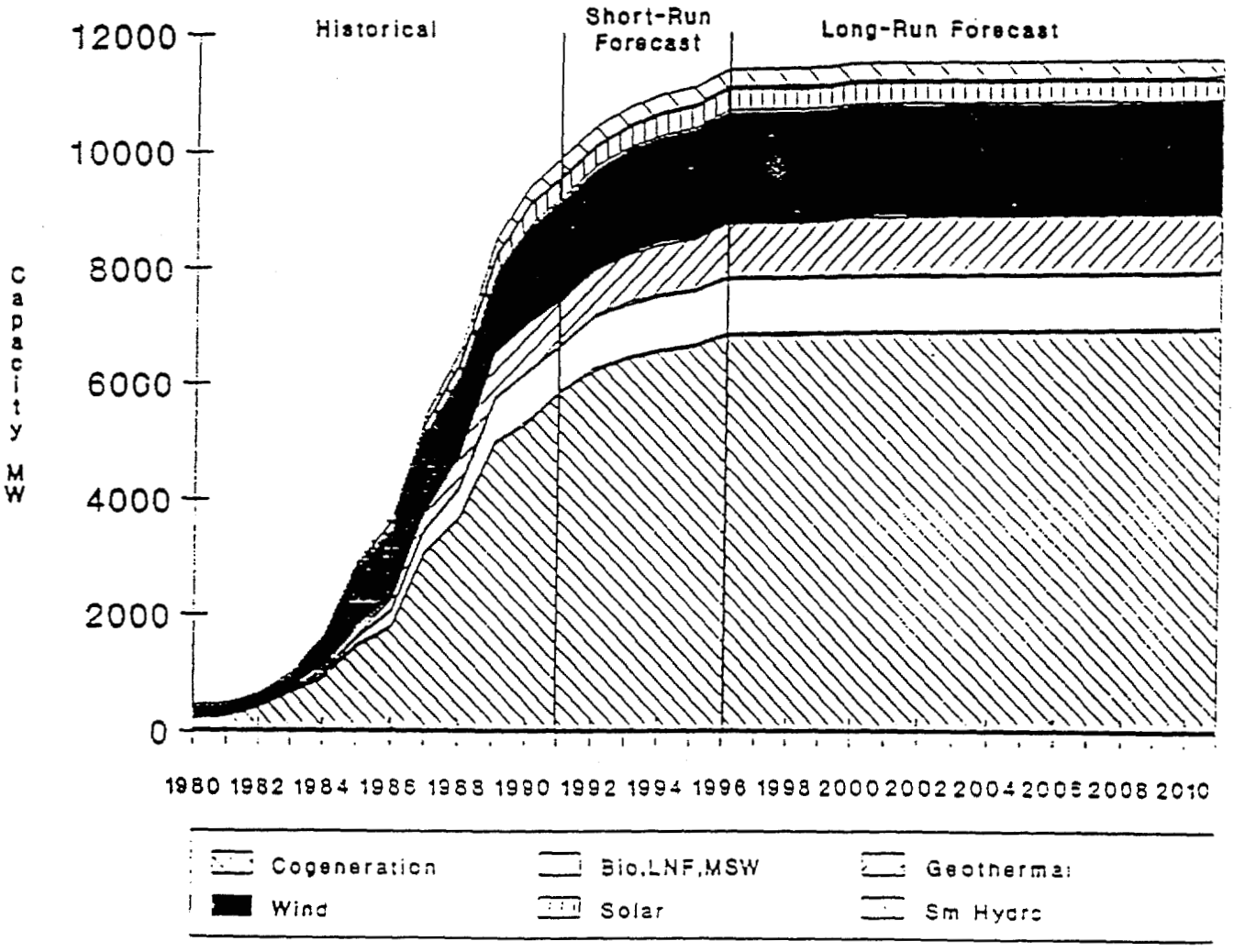


Figure 3-4
QF & Self Generation in California
Cumulative Additions by Technology Type
Contract (Installed) Capacity

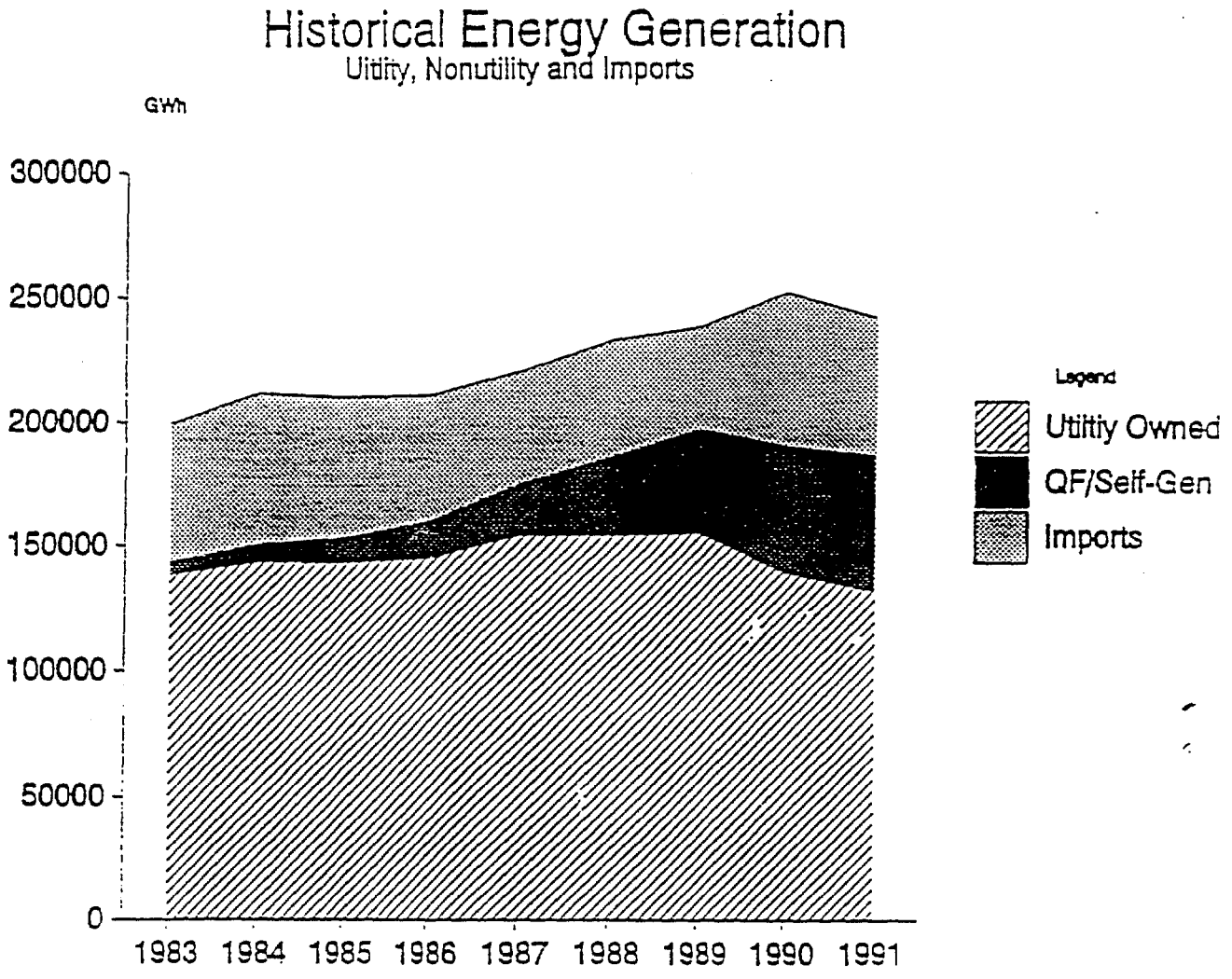


83

Non-Utility Generation (MW in 1994)

• Cogeneration	6,636	60.0%
• Geothermal	906	8.2%
• Biomass	962	8.7%
• Solar	398	3.6%
• Hydro	342	3.1%
• Wind	1,867	16.8%
• Fuel cells	4	<.1%
• TOTAL	11,115	

FIGURE 3-3


Historical Energy Generation
Utility, Nonutility and Imports
GWh
300000
250000
200000
150000
100000
50000
0
1983
1984
1985
1986
1987
1988
1989
1990
1991
Legend
Utility Owned
QF/Self-Gen
Imports

Regulatory Programs to Encourage Energy Savings

Energy efficiency standards

Buildings

- Space heating and cooling, and water heating
- Energy per square foot per year
- Life cycle cost analysis

Appliances

Government programs

Funding energy efficiency projects

- local government facilities
- schools, hospitals, farms

Accurate information on energy measures

Research and development

Utility programs

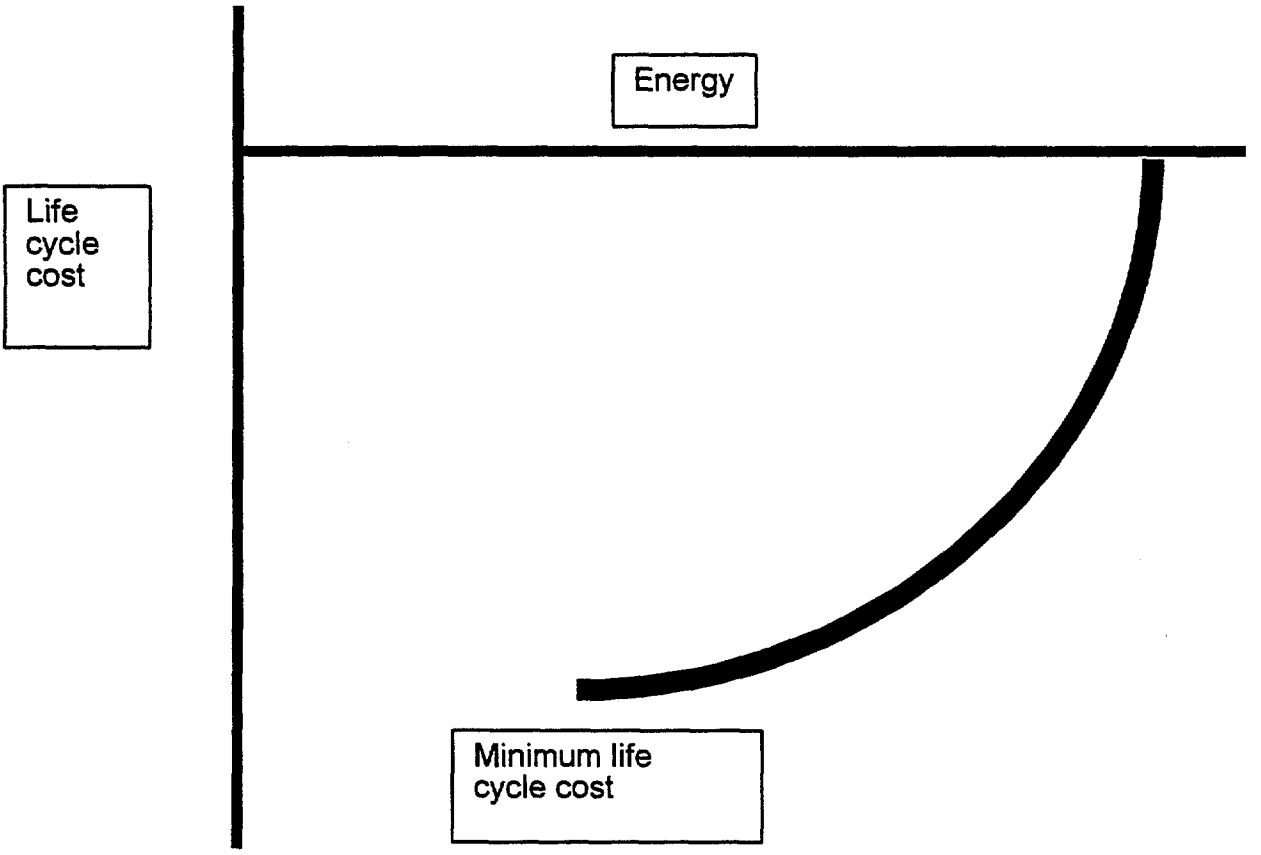
Funding

- homes
- businesses

Information to customers

Research and development

Life Cycle Cost Analysis



United States Agency for International Development

United States Energy Association

Regional Conference to Promote Energy Efficiency in the Central Asian Republics

"Power Plant Reconstruction"

Sam Gerges
Managing Director
Burns and Roe NIS Consortium

July 13, 1995

Lake Issyk-Kul, Kyrgyz Republic

88

Sam B. Gerges

Managing Director
Burns and Roe NIS Consortium
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(202) 408-6835 fax

Sam B. Gerges is a senior executive with extensive background in leadership of organizations whose charter is to provide management consultancy in support of utility planning, engineering, procurement, and construction service to electric utilities, government, and industrial clients.

Mr. Gerges is currently a managing director of Burns and Roe, an engineering and construction company whose main business is the design and construction of fossil and nuclear power plants.

He is currently overseeing, among other responsibilities, a major energy related program to provide technical assistance and technology based services to the former republics of the Soviet Union, sponsored by USAID.

Prior to Burns and Roe, Mr. Gerges served as a vice president and general manager of a profit/loss operating division of Brown & Root/Hilliburton NUS involving projects of annual construction value of 200-250 Million USD, encompassing new and rehabilitation projects for utility, remediation, and restoration projects for government agencies and industrial clients.

Mr. Gerges has had increasing responsible tenures with firms such as Brown Boveri and ESSO of Switzerland, and Parsons of England, before joining EBASCO, a major engineering and construction firm in New York in 1967.

Mr. Gerges holds PD, Master's and Bachelor's degrees in engineering from Columbia University in New York.

"Power Plant Reconstruction"

Outline of the Presentation by

Sam B. Gerges
Managing Director
Burns and Roe NIS Consortium

Introduction to Burns and Roe Company

Established in 1932, Burns and Roe is an independent consulting engineering organization devoted to the practice of engineering and design, construction, and related supporting services for major utility cogeneration, waste-to-energy, wind power, industrial, chemical and research projects both domestic and international. The company's activities cover the entire spectrum of technical and project management services from project inception through startup and operation.

From its inception, the company has been known for its accomplishments in the engineering, design and construction of fossil-fueled power generating stations and associated transmission and distribution facilities. Current and completed projects include 122 generating units totaling over 25,000 mw of capacity.

The company has also been involved in many forms of advanced technologies, including solar energy, magneto hydrodynamics, fuel cells, energy storage, pressurized fluidized bed combustion, ocean thermal energy conversion, and advanced gas turbine design.

Burns and Roe has been active in the international electric power industry for several decades. We have long term experience with power plant projects in many countries including Korea, Thailand, Indonesia, India, Australia, Hong Kong, People's Republic of China, Russia and the Newly Independent States, to name a few.

Burns and Roe has recent design experience in many of these countries and we are currently involved with some of the first developments of private power projects in association with such U.S. developers as mission energy and cogentrix.

Burns and Roe is a major contractor to U.S. AID and provides technology and market reforms services for the Newly Independent States and Russia. Specifically, these countries are: Armenia, the Republic of Georgia, Kazakstan, the Kyrgyz Republic, the Russian Federation and Ukraine.

Kazakstan

The thrust of the program is to provide technical assistance and services directed toward improving the energy, environment and operating efficiencies of production, conversion, transportation and generation of coal thermal plants.

The work is comprised of the following tasks:

Task 1:	National energy savings plan
Task 2:	Heat and power system efficiency improvements
Task 3:	Coal cleaning program
Task 4:	Regional environmental improvements study

Kyrgyz Republic

The thrust of the program is to provide technical assistance and services, directed toward improving the energy, environment, efficiencies, conversion and life extension of thermal generating plants. In addition, assessment of export markets for new hydro generating capacity will be examined.

The work is comprised of following tasks:

Task 1:	Improvement of Bishkek power plant and district heating system
Task 2:	Improvement of the electrical transmission and distribution system for the Kyrgyz Republic
Task 3:	Assessment of export markets for Kambarata electricity

All work maximizes participation of local companies and local organizations.

Power Plant Reconstruction

Under U.S. AID financing, a study called "Kyrgyzstan - Energy Efficiency and Market Based Reform Project" was started in mid-1994 by Burns and Roe Company (BRC).

The primary objective of the power plant reconstruction project is to support economic growth of the Kyrgyz Republic through following:

- Rehabilitation of energy infrastructure;
- Improvement of efficiency;
- Improvement of availability and reliability;
- Reduction of losses;
- Reduction of environmental impact;
- Life extension of existing assets.

Major Reconstruction Recommendations:

- Retrofitting boilers:
  - New ball mills;
  - New coal silo and feeder;
  - Additional burners and modify furnace tube walls;
  - Improve insulation, repair casing.
- Install new turbine-generator.
- New rotary car dumper.
- Improve makeup water system.
- Extension of ash storage pond and mitigation of its present adverse environmental impact.
- Replacement of outdated plant instrumentation and control devices.
- Installation of monitoring devices for emissions (SOx, NOx, etc.).
- Equipment for metal testing laboratory.

In addition, the other major objective is to prepare a plan with cost estimates to implement plant reconstruction.

Recommended reconstruction plan will aid the World Bank to begin their appraisal process for negotiating a loan to cover implementation.

Burns and Roe and technical staff from Kyrgyz National Energy Company (KNEC) worked jointly to develop plant reconstruction recommendations.

United States Agency for International Development

United States Energy Association

Regional Conference to Promote Energy Efficiency in the Central Asian Republics

"District Heat Power Plant Improvement"

Ned Popovic
Project Manager, Energy Technology
Burns & Roe Enterprises, Inc.

Gerhardt Gron
Carl Bro Group/EU TACIS
Denmark

July 13, 1995

Lake Issyk-Kul, Kyrgyz Republic

93

Ned Popovic

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Mr. Popovic is an experienced manager for Energy and Environmental projects for utility industry, independent power producers, and government. He has twenty-six years of experience in the areas of energy technology management. Mr. Popovic's major assignments and responsibilities include managing a broad range of technical and economic energy studies, fuel resource studies, fuel conversion, life extension and energy processes. Mr. Popovic is considered an effective manager and a persuasive multi-level communicator, able to organize and direct diverse groups. Mr. Popovic is viewed also as attentive to detail without losing sight of the overall project goals. In addition, Mr. Popovic's experience includes detail engineering, design, procurement, and management of major fossil power plants and cogeneration facilities.

For the Kyrgyzstan project, Mr. Popovic is the Project Director for the Burns and Roe Team performing services related to Tasks 1 and 2. In addition, for the Kazakstan project, he is the Project Director for the Burns and Roe performing services related to Tasks 1-3.

Gerhardt Gron

Carl Bro Group/EU TACIS
Denmark

No biographical information was available.

"District Heat Power Plant Improvement"

Ned Popovic
Project Manager, Energy Technology
Burns & Roe Enterprises, Inc.

Gerhardt Gron
Carl Bro Group/EU TACIS
Denmark

Problems in District Heating Systems

- Low efficiency production
- High environmental impact
- High losses in energy
- Low end user efficiency
- Lack of maintenance
- Lack of economic and financial resources

Alternatives of Decentralized Heating

- Electrical alternatives
- Gas alternative

Electrical Alternative

Option 1: Electrode mass boilers located at pumping stations

Option 2: Electrode mass boilers located at TES #1

Option 3: Resistive space heating

Option 1:

11 Boiler Stations
Boiler station upgrade and electric transmission upgrade for new installed capacity of 2200 MWt

	Thous USD
Cost of boilers	54.480
Cost of electric transmission upgrade	448.200
Total	502.680

Option 2:

Boilers of TES #1
Boiler upgrade and electric transmission upgrade for new installed capacity of 2030 MWt

	Thous USD
Cost of Boilers	24.600
Cost of hot water transmission upgrade	5.000
Cost of electric transmission upgrade	415.000
Total	444.600

Option 3:

Resistive Space Heating
Transmission and distribution upgrade for new installed capacity of 2030 MWt.

	Thous USD
Electric transmission upgrade	415.800
Electric distribution upgrade	20.146
Buildings upgrade (3.400 buildings)	80.584
Total	516.530

Gas Alternative

Gas mass boilers located at the present pumping stations

	Thous USD
Cost of pipeline	1.100
Cost of gas boilers	67.200
Total	68.300

United States Agency for International Development

United States Energy Association

Regional Conference
to Promote Energy Efficiency
in the Central Asian Republics

"Transmission Planning in a Transitional Economy: Problems and Solutions"

Thomas R. Fecho
Project Manager
AEP Energy Services, Inc.

July 13, 1995

Lake Issyk-Kul, Kyrgyz Republic

99

Thomas R. Fecho

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As a Principal Electrical Engineer, Mr. Fecho is responsible for planning studies and analyses of electrical transmission systems. More specifically, such responsibilities include: the origination of long-range conceptual transmission system development plans; technical and economic evaluation of alternative transmission plans to integrate generating capacity into the existing network; technical and economic evaluation of transmission developments, from 138 kV to 765 kV, to reinforce major load areas to meet present and projected electric power and energy requirements; technical and economic evaluation of alternative means for transmission interconnection between utilities to improve economy and efficiency of operations; development of information to satisfy regulatory reporting requirements and support of utility positions on complex technical matters relating to transmission system design and operation; research and development of alternative means to control power flow on alternating current transmission systems; instructor on subject of transmission system fundamentals for in-house power system concepts course training program.

Mr. Fecho holds MS and BS degrees in Electrical Engineering and a Masters degree in Business Administration. He has 19 years of experience in the planning of utility electrical transmission systems, and has authored numerous reports and technical papers addressing various matters related to planning such systems.

For the project in the Kyrgyz Republic, Mr. Fecho is the Project Manager for the AEP Energy Services team performing services related to Task 2. Mr. Fecho has recent relevant experience from his work in the Republic of Georgia and participation in the Joint Russian-American Energy Alternatives Study (JEAS, Working Group 4).

"Transmission Planning in a Transitional Economy: Problems and Solutions"

Summary of the Presentation by

Thomas R. Fecho
Project Manager
AEP Energy Services, Inc.

Summary of the Slides

Slide 1 - Electric Utility System Facility Planning

System Planning is an essential function in designing a power system that will provide a reliable supply of electricity to consumers. Transmission system planning is essential to insure that all elements of the system, including power plants and load centers, are properly integrated so the network as a whole will perform in the manner intended.

Analyses of the performance of the transmission system is made possible by computer simulation. The simulation of the performance of the power system is essential because it provides the means for the power system planning engineer to visualize the performance of the network. The simulated testing of system performance also allows the analyst to test alternative transmission configurations so as to determine whether the power system design will meet planning performance criteria.

The mathematical models of the power system can be used to simulate the expected network performance for a wide range of conditions selected by the analyst. The simulated testing of the network for both current and future conditions provides information that can be used to judge the adequacy or inadequacy of alternative system designs. Information obtained from the simulations of system performance can also be used to evaluate alternative measures to reduce technical system losses. Such measures can include reconfiguration of the transmission system or additions to the network such as shunt or series capacitor compensation.

System planning involves three broad and inter-related areas. The information required to plan the power system of the future includes: 1) characteristics of consumer loads for present and forecasted conditions, 2) characteristics of generating plants now operable or planned for future construction and, 3) electric characteristics and configurations of the transmission and distribution systems.

At American Electric Power, we believe system planning is an essential, continuous and evolutionary process. A professional staff of analysts is dedicated to the task of forecasting

future electric power and energy requirements. This staff works closely with engineers dedicated to the tasks of evaluating alternative generation expansion and transmission reinforcement needed to meet the future demands at least capital and operating cost. The reduction of future losses is one of the many factors that are considered in judging the effectiveness of alternative generation and transmission expansion plans.

In the former Soviet framework, the planning of the power system was organized within the specialized Institutes located throughout the Soviet Union. The on-going reorganization and restructuring of the Commonwealth of Independent States (CIS) economies and power system industry make it imperative that power companies, such as KYRGYZENERGO, strengthen their skills in the planning area. Specialized software and increased computer hardware will be required. Training will also need to be increased to provide a staff that is skilled in planning the power system in a period of high uncertainty. This is essential to ensure the future power system will be designed properly to meet the forecasted future consumer demands in a cost effective manner.

It will also be essential for each energy company to substantiate and justify its future plans, especially if financing from international lending institutions or foreign investors will be sought to implement the plans. Without substantiation and appropriate planning studies it can not be expected that foreign sources will look favorably on the expansion program.

Slide 2 - Transmission Planning in Uncertain Times

Planning and designing a power system that will meet both current and future power and energy requirements in a cost effective manner is not an easy task. This task is made even more difficult in periods of high uncertainty. This is now the environment that confronts all of the Central Asian Republics.

The disruptions in fuel supply and associated pricing structures has disrupted power plant operations. The changes in composition and magnitude of customer loads has made it more difficult to forecast both current and future demands for electricity. The unavailability of spare parts and the capital shortage has severely hampered the performance of maintenance of existing transmission and generation facilities. The problem of non-payment of electricity bills is adding to the growing financial problems confronting the utility companies. The following slides illustrate the dramatic changes in KYRGYZENERGO load and energy consumption patterns that have occurred in the last few years.

Slide 3 - Total Energy Consumption in the Kyrgyz Republic

This chart indicates the energy consumption in the Kyrgyz Republic grew rather steadily through 1990. After 1990, the consumption leveled off and declined gradually in the last three years. This is interesting in that it shows the total consumption has remained nearly constant, however, it masks the fact that the components of total energy consumption have changed rather dramatically. Slides 4-7 illustrate the consumption for major sectors of the economy.

Slide 4 - Agricultural Energy Consumption

This chart shows the energy consumption in the agricultural sector has declined about twenty percent from its peak in 1990.

Slide 5 - Commercial Energy Consumption

This chart shows the energy consumption in the commercial sector declined about fifteen percent from its peak in 1992.

Slide 6 - Industrial Energy Consumption

This chart is especially noteworthy in that it shows a dramatic drop in industrial energy consumption in the past several years.

Slide 7 - Population (Residential) Energy Consumption

This chart clearly shows the large increase in electricity use by the general population. The use of electricity for home heating and cooking is largely responsible for the increase.

Thus, as previously noted in slide 3, it is interesting to observe that the absolute level of energy consumption has remained nearly constant over the past several years while the consumption by individual sectors of the economy have changed significantly as demonstrated by slides 4 through 7.

Slide 8 - Average Monthly Peak Loads

This chart shows the peak demand, by month, for the periods of 1990-1991 and 1993-1994. It is evident from this slide that the increase in heating demands has significantly increased the maximum loads in the winter period.

Slide 9 - January Peak Loads

This slide further demonstrates the large rise in the maximum demand experienced in the past three years resulting from the increased use of electric heat as a substitute for other methods.

Slide 10 - August Peak Loads

This slide shows a decline in the maximum demand in the summer month of August which can be contrasted with the great increase observed in the winter month of January.

Slide 11 - The Kyrgyz Republic Transmission Project

Power system planning in Central Asia is especially difficult as a result of the problems in the

areas of fuel supply, shifting patterns of consumer maximum loads and energy use, under-collection of payments from electricity consumers, unavailability of spare parts and equipment and the increasing expectations of electricity consumers that electric power supply should be continuous and of high quality.

The collaborative transmission planning project undertaken by AEP Energy Services, Inc. and the Kyrgyz National Energy Holding Company, with support from the United States Agency for International Development (USAID), has several objectives. The first objective is to assess the condition of the power supply facilities in the capital city of Bishkek and in a representative rural area. The other objective is to jointly develop a mid- to long-range program of transmission reinforcements that will meet the dual objectives of increasing the reliability of power supply in an efficient and cost effective manner.

The approach adopted was to jointly develop a detailed computer model of the power system serving Bishkek and other areas. This detailed model was used to simulate the operation and performance of the transmission system under a wide range of operating conditions. The power flow simulation studies provide the means to develop transmission improvement plans that will satisfy the future increase in loads according to alternative (pessimistic, expected, and optimistic) forecasts of load growth.

Slide 12 - Steps Involved in the Joint Planning Study

This slide summarizes the several steps undertaken by the joint project team to develop the program of transmission reinforcements. The objective of the work is to define the scope, cost and timing of the transmission projects as warranted by the current forecasts of power and energy consumption.

Slide 13 - Creation of Power Flow Model and Simulation of Steady-State Power System Operation

This slide summarizes the information required to assemble the power flow model. The three major model components include: 1) characteristic data of transmission system components, 2) characteristic data of generation system components and, 3) future load forecast.

Slide 14 - Analyses of Transmission System Operations Through Power Flow Simulation Studies

The transmission planning period covered three planning horizons: 1997, 2000 and 2005. The simulated studies of future performance for both expected and optimistic load growth forecasts indicated the transmission system will be severely stressed without major improvements. The performance problems observed through simulation studies included: 1) thermal overloading of transmission lines and transformers and 2) extreme under-voltage.

Slide 15 - Results of Transmission Planning Study

The goal of the transmission planning study is to develop a cost effective program of transmission reinforcements that can guide the development of the transmission system, taking into account both near-term and long-term requirements. This slide summarizes a few of the recommended projects and the benefits expected from their implementation.

Slide 16 - Conclusions

This slide offers some observations and thoughts with respect to the need to strengthen the capabilities of the CAR utilities to perform transmission planning studies. Furthermore, stabilization of the economy and growing consumer expectations of a reliable supply of electricity will result in a need for even more stringent planning criteria. It is essential that thorough planning studies are conducted since electric infrastructure improvements involve large capital expenditures and have long lives if properly maintained.

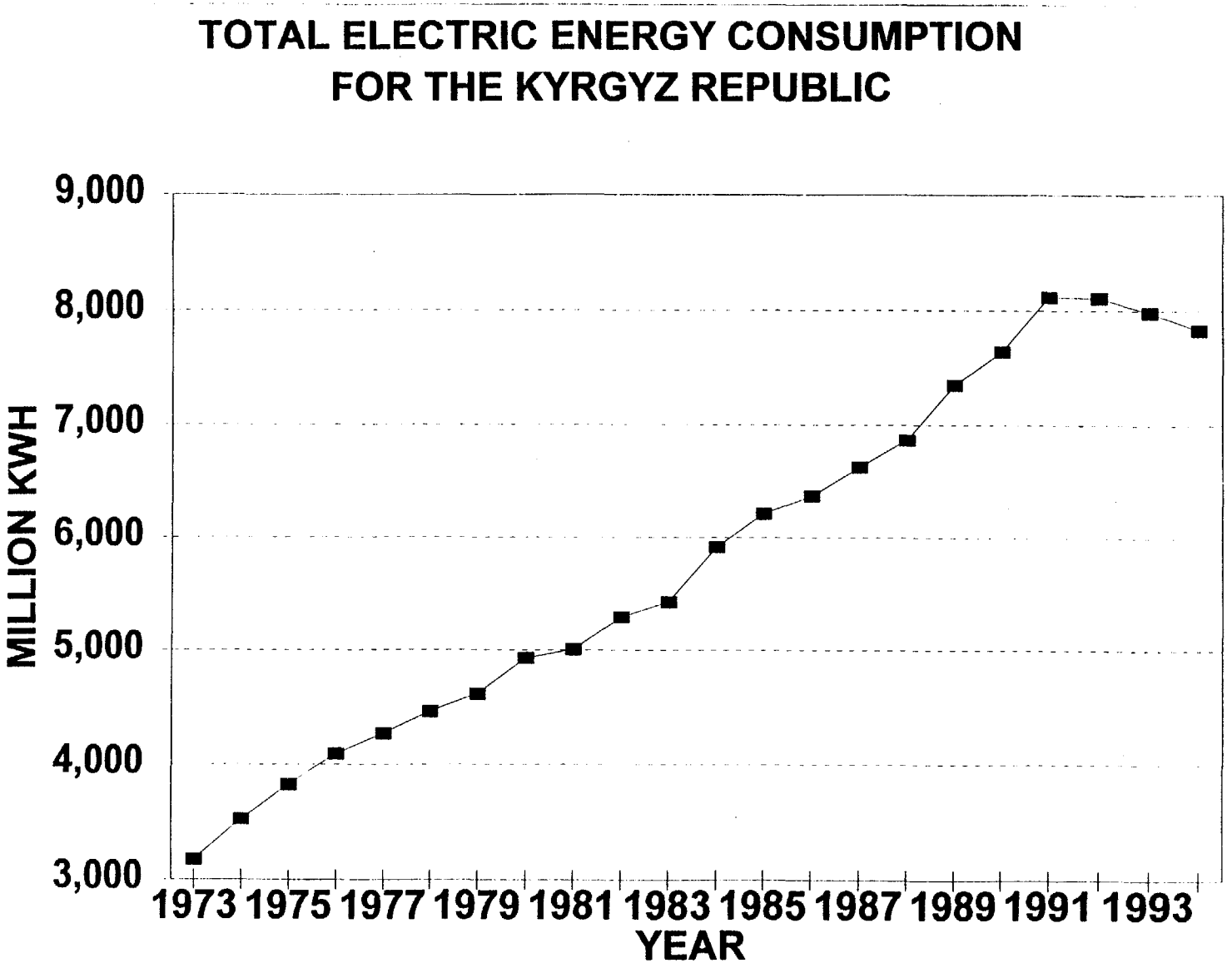
Slide Presentation

Slide 1 - Electric Utility System Facility Planning

- Electric utility systems planning involves the visualization of the future system
- Without visualization there can not be realization
- Electric utility system planning encompasses three broad and inter-related areas
  - Analyses of present and forecasting of future consumer loads
  - Analyses of present and future electric generation requirements
  - Analyses of present and future transmission and distribution systems to adequately and reliably meet present and future consumer loads
- Our view of system planning is that it is an essential continuous and evolutionary process
- A centralized professional staff is committed to the load forecasting, generation planning, and transmission planning functions

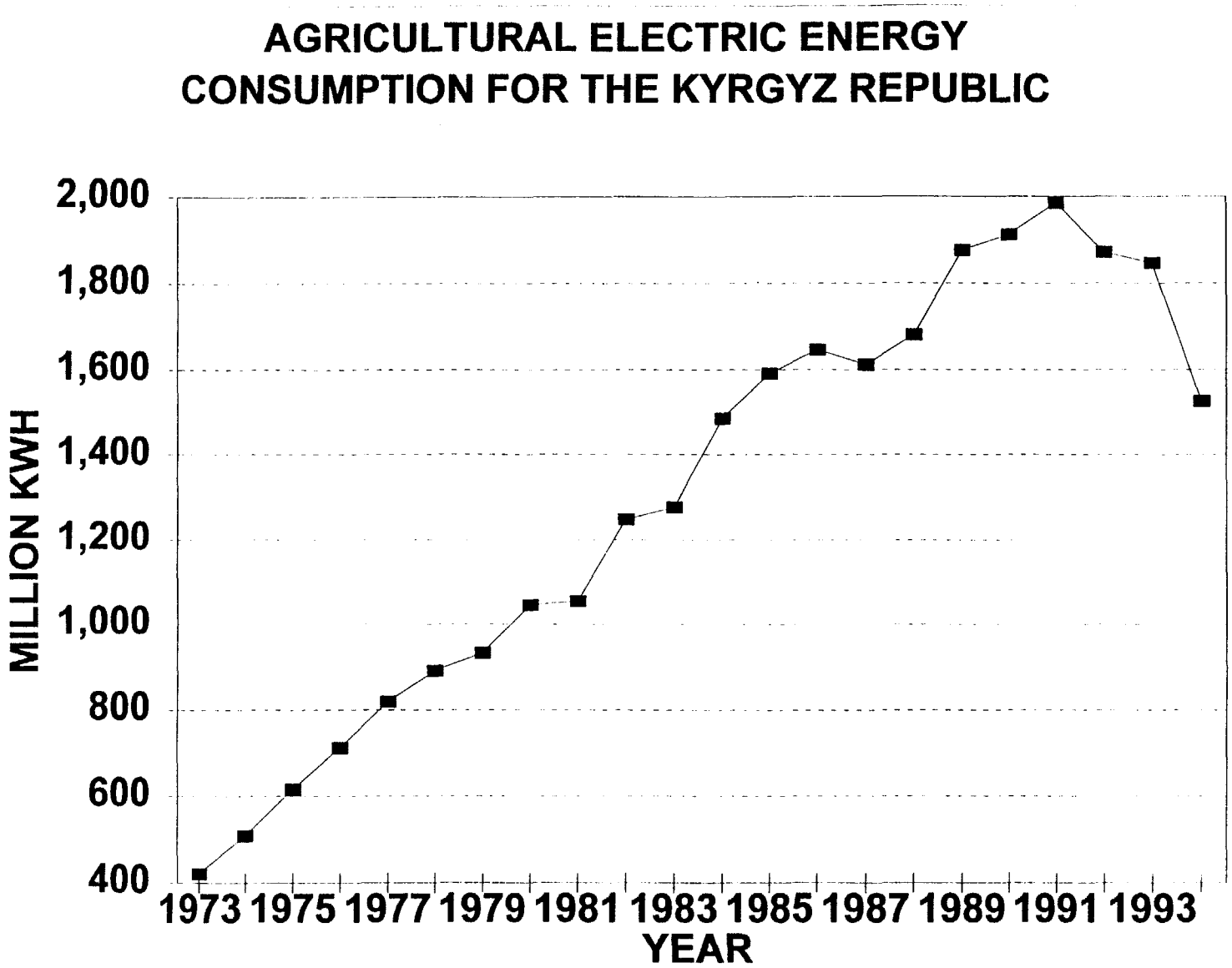
Slide 2 - Transmission Planning in Uncertain Times

- Disruptions in fuel supply affect power plant operations
- Magnitude and composition of customer loads changing and difficult to forecast
- Spare parts unavailable or in short supply resulting in reduced frequency and scope of maintenance and repairs
- Sustained under-recovery of utility operating expenses
- Increasing consumer expectations


TOTAL ELECTRIC ENERGY CONSUMPTION
FOR THE KYRGYZ REPUBLIC
MILLION KWH
9,000
8,000
7,000
6,000
5,000
4,000
3,000
1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993
YEAR

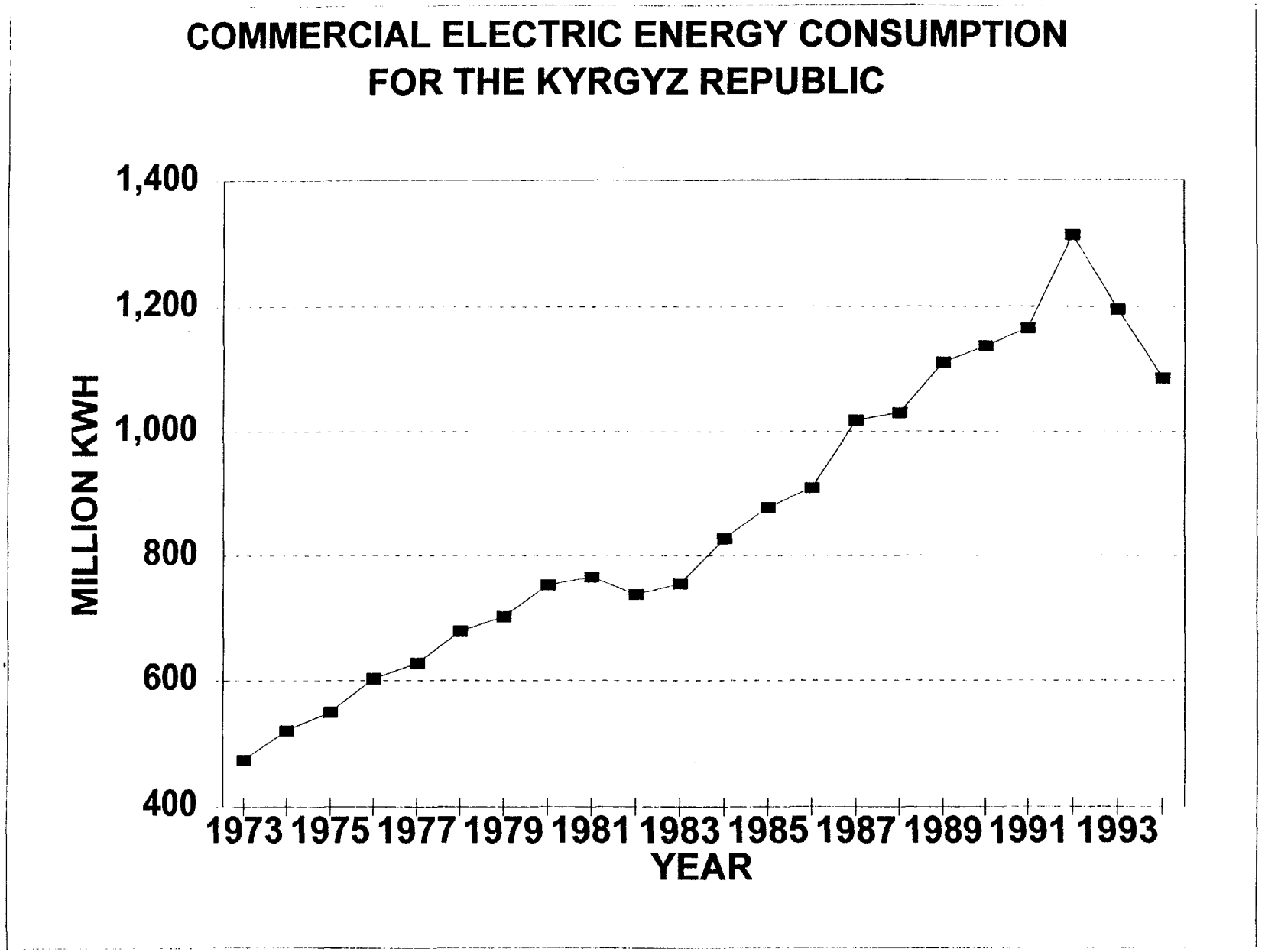
Slide 3

107


AGRICULTURAL ELECTRIC ENERGY
CONSUMPTION FOR THE KYRGYZ REPUBLIC
MILLION KWH
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993
YEAR

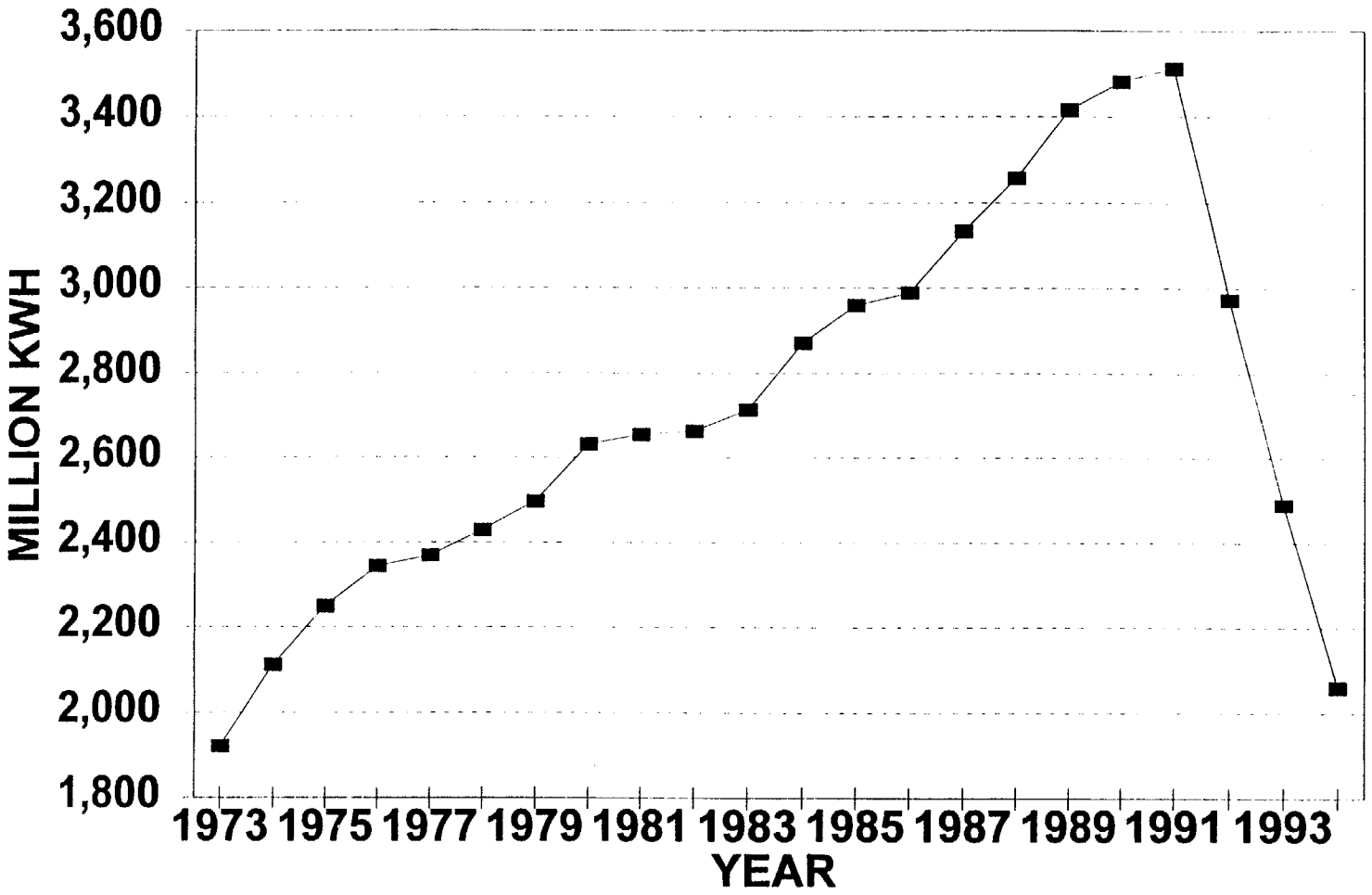
Slide 4

108

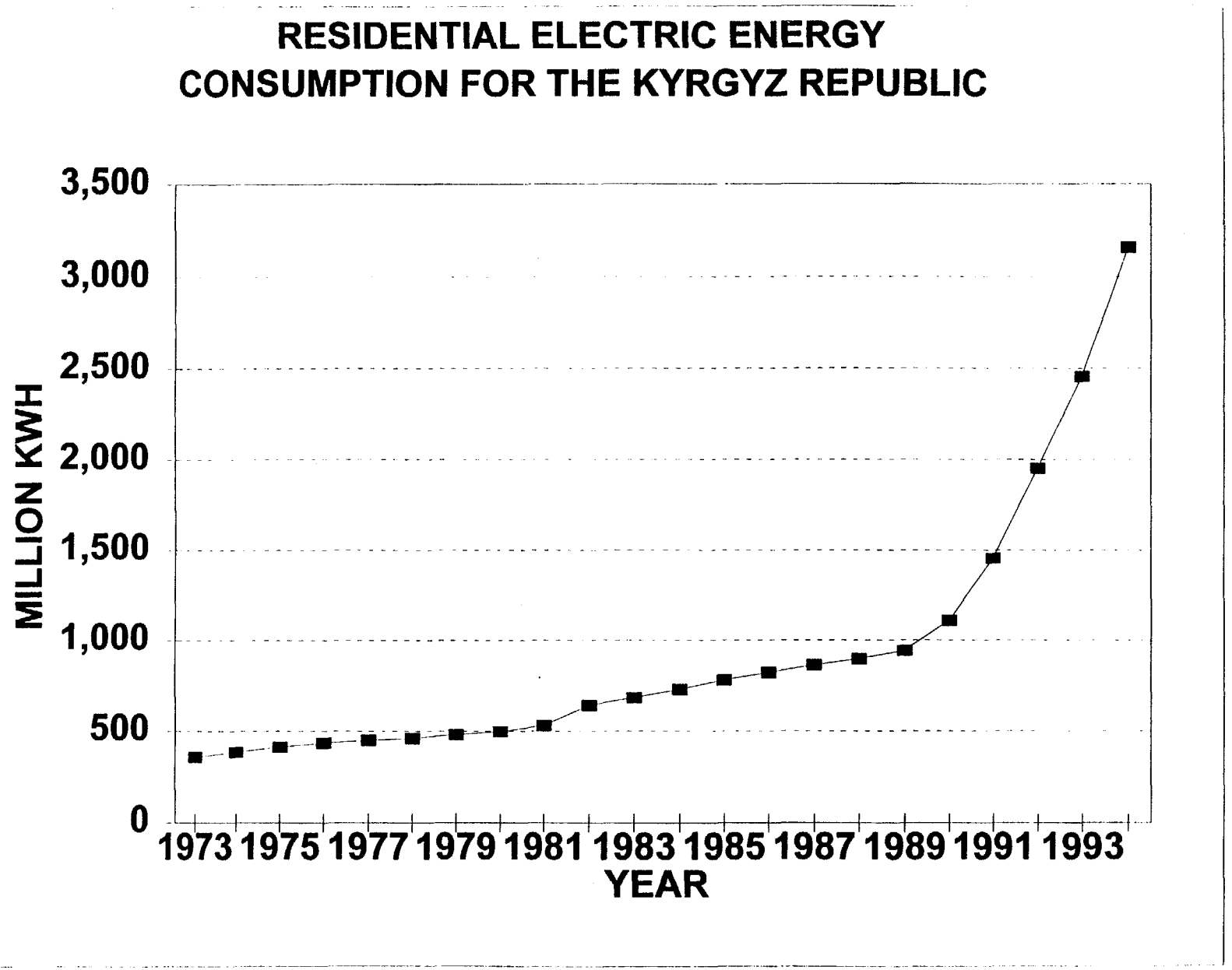

COMMERCIAL ELECTRIC ENERGY CONSUMPTION
FOR THE KYRGYZ REPUBLIC
MILLION KWH
1,400
1,200
1,000
800
600
400
1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993
YEAR

Slide 5

INDUSTRIAL ELECTRIC ENERGY CONSUMPTION FOR THE KYRGYZ REPUBLIC

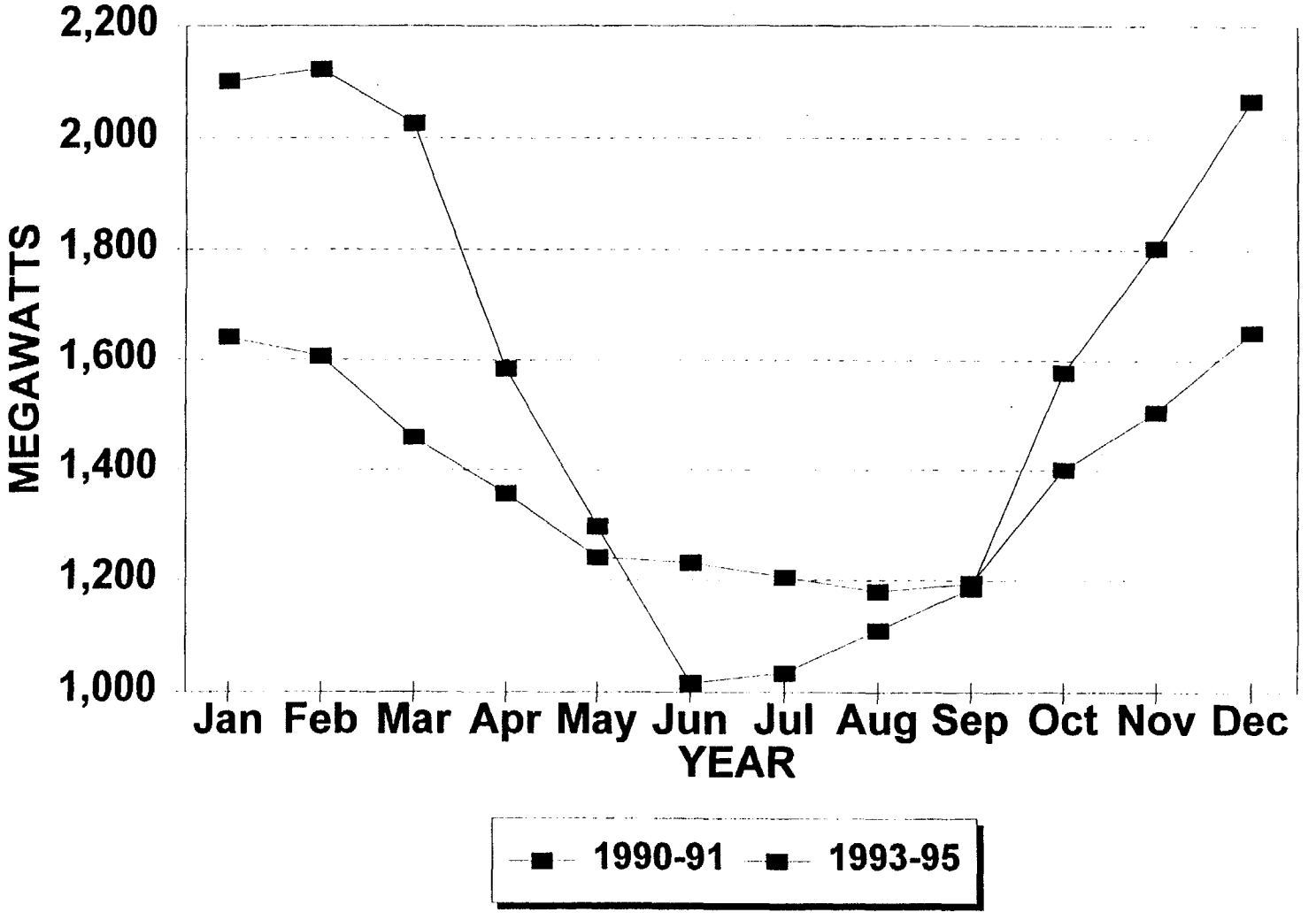


Slide 6


RESIDENTIAL ELECTRIC ENERGY
CONSUMPTION FOR THE KYRGYZ REPUBLIC
MILLION KWH
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993
YEAR

Slide 7

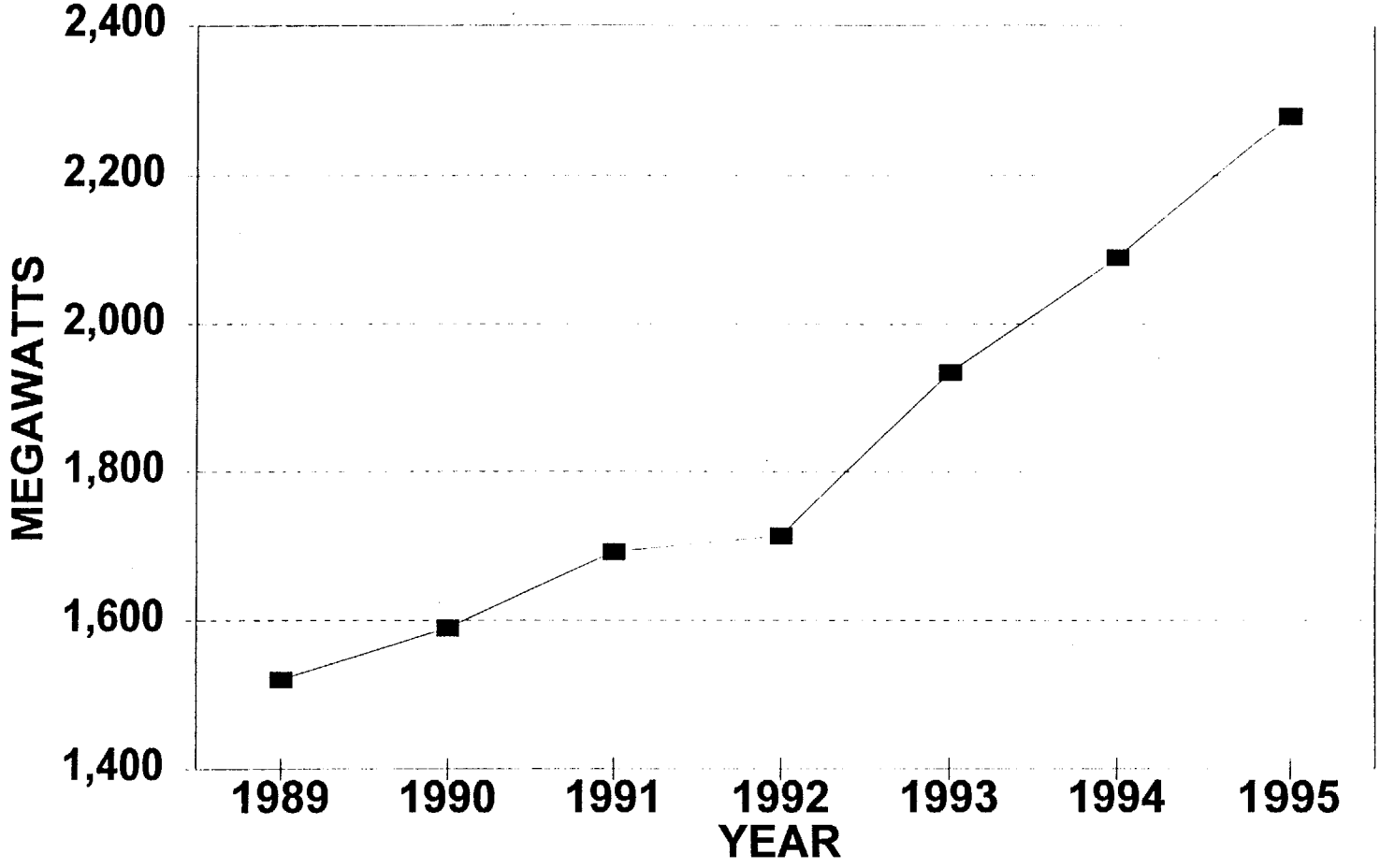
AVERAGE MONTHLY PEAK LOADS FOR THE KYRGYZ REPUBLIC



Slide 8

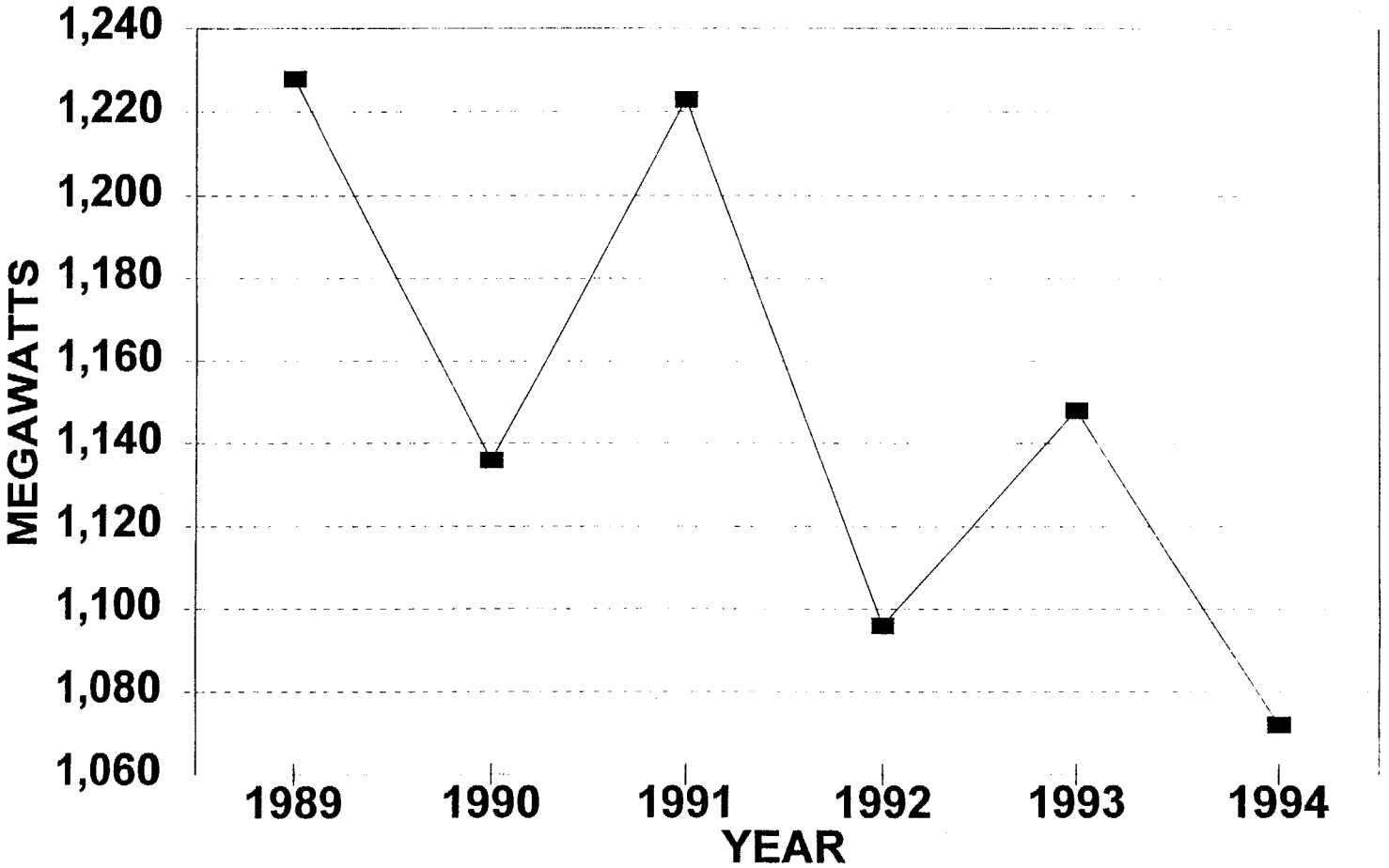
112

JANUARY PEAK LOADS FOR THE KYRGYZ REPUBLIC



Slide 9

AUGUST PEAK LOADS FOR THE KYRGYZ REPUBLIC



Slide 10

Slide 11 - The Kyrgyz Republic Transmission Project

Objectives:

- To analyze the present condition of the power system serving the capital city of Bishkek and a rural service area
- To develop mid- to long-range plans for the improvement of the reliability of power supply to the city and other areas of the Kyrgyz Republic
- To seek ways to reduce technical transmission losses

Our Approach:

- Member of the joining American/Kyrgyz project team have collaborated to develop computer models of the transmission system serving the city and the rural area

- The power flow model was used by the project team to analyze expected performance of the system for present and future condition based on expected and maximum assumptions of the loads forecast for the areas of study

- Improvements or reinforcements to the present transmission system needed to meet the future load growth have been identified and prioritized

Slide 12 - Steps Involved in this Joint Planning Study

- Review of control measurements and actual operating data

- Development of expected and maximum load forecasts for planning periods of 1997, 2000 and 2005 based on different assumptions of future developments

- Creation of power flow model to accurately simulate the performance of the transmission systems in the city and the rural area

- Analyses of power flow simulations for various assumed future conditions for the purpose of identifying transmission improvements to increase the reliability of power supply

- Estimation of the cost of the recommended transmission projects comprising the reinforcement program (in progress)

- Documentation of the study results (in progress)

Slide 13 - Creation of Power Flow Model and Simulation of Steady-State Power System Operation

Information Requirements for Network Power Flow Studies

- Characteristic data of transmission system components
  - Impedance of transmission lines
  - Impedance of transformers and winding tap ratios
  - Ratings of transmission lines and transformers
  - Topology or connectivity of network components

- Characteristic data of generation system components
  - Generator plant output
  - Generator voltage and ratings

- Loan forecast
  - Forecast and distribution of loads at 6-10 kV Substations

Slide 14 - Analyses of Transmission System Operation through Power Flow Simulation Studies

- The computer model of the power system provides the foundation upon which to test and analyze the performance of the network

- The jointly developed model was compared to control measurements to validate its accuracy in recreating the performance of the real power system

- A set of power flow models were developed and analyzed to simulate expected future conditions as follows:

1997 expected	1997 maximum
2000 expected	2000 maximum
2005 expected	2005 maximum

- Thermal overloads of transmission lines and transformers were identified

- Deterioration of voltages were observed

- Facility additions needed to improve voltages and reduce or avoid thermal overloads have been identified and analyzed to demonstrate the expected improvement in system performance

Slide 15 - Results of Transmission Planning Study

- The transmission improvements foreseeable over the next five to ten years can be grouped into four principal categories:
  - Improvements that provide for more effective operation of the transmission system

    Example: Ala Archa 220/110 kV substation
    and related improvements

  - Improvements that increase operational flexibility and reliability of the high voltage transmission system

    Example: Addition of 110 kV switchgear to avoid
    Interruption serval 110/lower voltage
    Substitutions for a single disturbance

  - Addition of shunt capacitors to improve voltage profile and reduce active and reactive power losses

    Example: Several hundred MVAR distributed at
    35 kV, 110 kV AND 220 kV substations

  - Improvements to meet increased loads resulting from new residential and other developments

    Example: Orok 110/10 kV

Slide 16 - Conclusions

- System planning, both short term (operational planning) and longer-term is essential to meet increased customer loads in a reliable and cost-effective manner

- Over time, as operating revenues increase and the economy stabilizes and recovers, the planning criteria can be made more stringent such that single disturbances to 110 kV facilities will not result in widespread power outages

- The load power factor should be improved through reactive correction distributed at transmission stations and at customer premises, including provisions in tariff structures

United States Agency for International Development

United States Energy Association

Regional Conference to Promote Energy Efficiency in the Central Asian Republics

"Energy Efficiency in Residential and Commercial Buildings"

John P. Millhone
Senior Fellow at the Advanced International Studies Unit
On Assignment from the USDOE
Battelle/Pacific Northwest Laboratory

July 13, 1995

Lake Issyk-Kul, Kyrgyz Republic

18

John P. Millhone

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John P. Millhone is a Senior Fellow at the Advanced International Studies Unit of the Battelle/Pacific Northwest Laboratory. In November 1994, he began a two-year assignment at Battle from the U.S. Department of Energy. His assignment is to support the transfer of U.S. energy efficiency policy and program experience to the countries with economies in transition in Central and Eastern Europe and the Former Soviet Union.

Before taking this assignment, Mr. Millhone was the Deputy Assistant Secretary for Building Technologies at the U.S. Department of Energy, where for 15 years he supervised the department's building energy efficiency and solar research activities, the building and appliance standards programs, and the Federal government's own in-house energy management programs. Before joining the U.S. DOE, he was the director of the Minnesota and Iowa state energy offices.

Long active in international activities, he is a past chairman of the International Energy Agency's End Use Working Party, which he supervises cooperative energy efficiency research activities of the IEA member countries. He supervised community systems, advanced heat pumps, solar building technologies, district heating and cooling, and technology transfer.

He is a frequent speaker and writer on energy efficiency subjects. In 1994, he received a Certification of Appreciation from the American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE) for his support for the U.S. building standards program. In 1994, the U.S. Energy Association named Mr. Millhone the public servant of the year.

During his two-year assignment, he is doing special studies on the role of neighborhood, local, and regional governments in the delivery of energy efficiency programs. He participates in the U.S. Country Studies program as the project officer for the Russian Climate Change Study. He recently was elected chairman of the Energy Conservation Committee of the U.S. Energy Association.

"Energy Efficiency in Residential and Commercial Buildings"

Summary of the Presentation by

John P. Millhone
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On Assignment from the USDOE
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Since the oil embargo of 1974, the United States has given a high priority to improving the energy efficiency of the building sector, including residential and commercial buildings. The program has been successful. The goal of this presentation is to provide information from the U.S. experience that may be helpful to the Central Asian Republics and other participants in this conference.

Primary Energy Flows

The starting point in the development of energy efficiency programs is to characterize the energy use in a country. The United States used 84.9 quadrillion Btu's (Quads) of primary energy in 1992, including coal, natural gas, petroleum, nuclear "yellow cake" and other primary energy sources. These primary energy sources were used directly and indirectly through the generation of electricity and thermal energy systems (district heating).

The energy was used in four end use sectors: industry (32.5 Quads), residential buildings, non-residential buildings (30.0 Quads, combined), and transportation (22.4 Quads). The goal of an energy efficiency program is to meet the needs and wants of those in these end use sectors with the minimal amount of primary energy.

In meeting this goal, it is useful to disaggregate energy efficiency programs into six areas:

1. Minimizing the primary energy required to deliver electricity to end-use customers;
2. Minimizing the primary energy required to deliver thermal energy (district heating) to end-use customers;
3. Minimizing the energy required by the industry sector;
4. Minimizing the energy required by the residential building sector;
5. Minimizing the energy required by the non-residential building sector; and
6. Minimizing the energy required by the transportation sector.

In this presentation, I'll focus on the programs in the two building sectors.

Primary Energy Consumption by Fuel Type

In the United States, the two building sectors consume 36% of the nation's energy use. Nearly two thirds of this energy is electricity (66%). The largest other sources are natural gas (26%)

and petroleum (8%). These figures are based on the primary energy used to generate electricity.

Electricity Use and Expenditures

In the United States, buildings dominate the use of electricity at 19 Quads. The building sectors use 65% of the electricity generated in the United States; the industrial sector uses 35%. The building sectors customers paid 72% of the electricity tariffs, compared with 28% of the tariffs paid by the industrial sector. The building sector paid a little higher price per kWh because of the additional costs incurred by utilities to service the larger number of building customers. Because of this use pattern, the U.S. has given a high priority to reducing the electricity use by the building sectors. For each megawatt of electricity demand reduced, at least $2 million of power plant capital costs is saved.

Building Consumption by End Use

In designing building energy efficiency programs, the U.S. has taken a closer look at how energy is used in buildings. This information has helped us target our programs at the uses that offer the largest possible savings. The residential sector used 16.9 Quads; the non-residential sector (commercial sector) used 13.1 Quads. The largest targets in residential sector are space heating, 37%; water heating, 14%; refrigerator and freezers, 12%; space cooling, 9%; lighting, 6%; and cooling, 4%. The largest targets in the non-residential sector are lighting, 29%; space heating, 18%; and space cooling 6%. In the large "other" category, the energy use of computers and other electrical office equipment is rapidly growing energy use that is approaching lighting energy use in some new office buildings.

Buildings Goal and Objectives

The overall goal of the U.S. buildings program is to increase the efficiency of total energy use in the building sector by 30% over 1988 levels by the year 2010. The goals also include the increased use of renewable energy, the elimination of CFCs as refrigerants and insulation blowing agents, and the reduction of energy use in the Federal sector, so that the Federal government is a "good example" to other energy users.

Strategies for Achieving Building Energy Goals

The U.S. uses a mix of five strategies to achieve its building energy goals. These strategies are applied to each of the important energy end uses. They include:

1. Energy prices that reflect the real cost of energy, so that consumers are motivated to avoid wasting energy.
2. The development of metrics ("yardsticks" or performance indicators) that can be used to accurately measure the energy used to meet an end use.
3. The use of mandatory standards that eliminate energy wasteful products from the marketplace.
4. Incentive and education programs that encourage users to select efficient products.
5. Research and development that introduces new, more energy efficient, and more affordable products into the market place.

Residential Systems Activities

For example, in the residential sector, we have supported the development of a metric (home energy rating systems) which can inform buyers of the energy efficiency, and anticipated energy costs, of new and existing residences. We have supported the implementation by states of new energy-efficient building codes. We have education programs for home owners and new home buyers. And we have supported research on advanced, energy-efficient designs for new housing, including the broadened use of solar energy.

Non-residential System Activities

In the non-residential sector, we have provided a similar mix of metrics, support for standards, education, and research programs. In the United States, the energy use in this sector is growing faster than in any other end use.

DOE-2 Energy Simulation

One of our success stories is the development of the DOE-2 computer program that simulates the energy consumption of a building from its design drawings. One firm reports that by using this DOE-2 tool, it was able to design an airport terminal that uses 75% less energy than a conventional existing terminal of similar size. U.S. utilities frequently use the DOE-2 simulation tool in their design assistance programs.

Materials and Structures

In this program, we have supported the use of a rating system (metric) that is being used to label the energy performance of window systems. We have provided design guidebooks for architects and builders. Research has developed high performing, non-CFC insulations.

Heating and Cooling Equipment

Energy efficiency standards prohibit the sale in the U.S. of heating and cooling equipment that would waste energy. Working with U.S. utilities, we are creating funds to purchase

energy-efficient equipment to stimulate their entry into the market. Research is accelerating the development of advanced heating and cooling technologies.

Lighting

Recent U.S. legislation mandates the sale of energy efficient fluorescent lamps and ballasts. Another new program supports an industry program to label the energy performance of lamp fixtures. Research supported by DOE and industry have lead to a rapid commercialization of new lamp technologies.

Lighting Efficiency Improvements

The revolutionary improvements in lighting technologies are shown by a graph of the improvements in the lumens/watt performance of new lamps over time. A major breakthrough has been the commercial introduction of a compact fluorescent lamp that can replace an incandescent lamp and that uses only one-third as much electricity and can last 10 times longer.

Appliances

The mandatory standards program for residential appliances was recently extended (1992) to many commercial appliances. The collaboration with utilities to produce a buyers fund that awards the manufacturer of new, efficient products has been used successfully to introduce a new, Super-Efficient Refrigerator, that exceeds the existing mandatory standards by 30% and uses no CFCs.

Refrigerator Efficiency Improvement

A graph shows the steady decline in the electricity requirements for refrigerators that has been achieved through the combination of the metric, standard, incentives, and research strategies.

Energy Efficiency and Renewables Support National Objectives

Through these programs, the U.S. government, working with utilities and manufacturers, is making progress in saving energy and accelerating the use of solar and other renewable energy sources. The benefits of these activities extend far beyond the saving of energy. They reduce the energy costs of homeowners and other consumers. The elimination of CFCs reduces the depletion of ozone gases that provide protection against skin cancers and other ailments. By lowering energy costs, our goods and services are more competitive in the global marketplace. Finite energy resources are saved for those who will follow us. We reduce the emission of greenhouse gases and acid rain. We improve our national security by reducing our dependence on energy imports. Energy efficiency is a high priority, because it helps us secure all of these important national goals.

National Priorities Require Multiple Strategies

Although I've described the national government's program, these activities require a large number of other participants to be successful. Energy use depends ultimately on individual decisions . . . decisions that can be improved by the right price signals and education and information programs. Community scale efforts are required to translate goals to the unique conditions that exist at the local level. Individual companies must recognize that energy efficiency goods and services represent a huge, potential growth industry. Utilities need to be given a regulatory environment that encourages them to meet the energy needs of their customers by the most cost-effective mix of supply-side and demand-side programs.

In many programs, the national governments will not be successful unless they obtain the active support of state, regional, and local governments. Beyond the national activities, there is a growing, worldwide recognition that the energy and environmental needs of the human race are so important that they require an unprecedented commitment to cooperation at the international level. It is this recognition that has led to this conference, which can serve as a major step forward in meeting our shared goals.

United States Agency for International Development

United States Energy Association

Regional Conference to Promote Energy Efficiency in the Central Asian Republics

"The World Bank's Role in Promoting Energy Efficiency"

Ziad Alahdad
Principal Energy Specialist and Head of the Energy Unit
The World Bank

July 14, 1995

Lake Issyk-Kul, Kyrgyz Republic

125

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Mr. Ziad Alahdad has graduate and post graduate qualifications in engineering, economics and management. Over his 26 years of experience, he has worked in both the public and private sectors, for the most part in energy. Since 1981, he has held a position at the World Bank and is currently the Principal Energy Specialist and Head of the Energy Unit in the World Bank's Regional Mission for Central Asia. Mr. Alahdad's private sector experience has concentrated mainly on the natural gas industry covers system operations, project preparation and engineering design. In the public sector, he has worked on production, engineering, project management and general management. With the World Bank, Mr. Alahdad has contributed to projects in Southern and Eastern Asia, Africa, Central and Eastern Europe, Russia and Central Asia. Primarily, Mr. Alahdad is responsible for the management of operations, which have included two projects, one in Nigeria and one in Russia, each totaling over one billion dollars.

"The World Bank's Role in Promoting Energy Efficiency"

Outline of the Presentation by

Ziad Alahdad
Principal Energy Specialist and Head of the Energy Unit
The World Bank

A. World Bank Experience and Lessons Learned

1. World Bank Activities

1.1. Significant increase in World Bank support for increasing energy efficiency and promoting economically justified fuel-switching.

1.2. The World Bank has provided support for:

- Policy, Pricing and Institutional Reform

- The Power Sector:
  - Rehabilitation of power plants to increase efficiency and extend life;
  - Strengthening and upgrading of transmission and distribution systems to reduce technical losses;
  - Improvement of commercial practices to reduce non-technical losses;
  - Promotion of least-cost system planning and operations to supply power from the most cost-efficient plant;
  - Establishment of energy audits to reduce wastage;
  - Upgrading of technology;
  - Setting up dedicated energy efficiency institutions.

- Oil and Gas Sector:
  - Combination of energy efficiency components similar to the power sector focusing on loss reduction, load management, plant operational improvement, better operating procedures, process modification, enterprise management and institutional strengthening;
  - Refinery projects mainly focused on rehabilitation to achieve both operational and energy efficiency rather than financing expansion or new facilities;

- Promotion of natural gas and energy efficient fuel;

- Introducing methods for increasing management accountability and for encouraging private sector participation (the same applies to World Bank financed power projects).

- Industry Sector
  - Rehabilitation of plants;
  - Technology retrofitting;
  - Energy audits;
  - Reduction of market barriers to competition.

2. Lessons Learned

2.1. Individual efficiency components of Bank financed projects generally successful.

2.2. In the future, some initiatives require more emphasis both on supply and demand sides. These include aspects such as boiler tuning, improved plant housekeeping, and increased efficiency in appliances. In particular, the following factors have tended to impair performance:

- Inadequate follow-through on agreed commitments to efficiency-related policy and institutional change;
- Weak or absent competitive market forces in the commercial and industrial sectors;
- Subsidized fuel and electricity prices;
- Administered trade barriers and discriminated taxes and subsidies;
- Lack of local financing at competitive rates;
- The need to upgrade in-country technical knowledge of energy efficiency options;
- Lack of indigenous industries for supply of energy-efficient products and efficiency services;
- The relatively high weight given to first-cost consideration when making equipment purchases;
- Absence of specific incentives for increasing efficiency, such as mandated energy performance codes and standards for industry, transport and buildings.

3. Criteria for World Bank Financing

3.1. General criteria

3.2. Possibility of grant financing under the GEF (Global Environmental Facility).

B. Forces Driving Increased Energy Efficiency

1. Growing Energy Demand in Developing Countries

1.1. Comparisons with USA and Western Europe.

1.2. Factors affecting commercial energy demand growth in developing countries.

1.3. Some basic facts and figures.

2. Financing Constraints

2.1. The capital intensive nature of energy investments.

2.2. Scarcity of official capital and the need to mobilize private sector investments.

3. Environmental Considerations

3.1. Contribution of energy to environmental pollution.

3.2. Measures:
- Fuel switching;
- Improvement of efficiency through prices that reflect cost;
- Environmental taxes and regulations.

4. High Potential for Improved Energy Efficiency in Developing Countries

4.1. The current low efficiency base indicates potential for significant gains.

4.2. Examples from the power sector.

4.3. Potential benefits.

C. Recommended Actions

1. Country Policy Priorities

1.1. Integrated energy strategies.

1.2. Country-wide incentive structures:
- Energy prices to reflect the real cost of energy supply:
  - International levels;
  - Long-run marginal costs (LRMC);
- The importance of competitive markets:
  - Making consumers responsive;
  - Making supply side institutions responsive through institutional and regulatory reform.

2. Sector Priorities

2.1. Increased market competition.

2.2. Demand side management.

2.3. Energy efficiency institutions for promoting:
- Information dissemination;
- Technical assistance;
- Technology intermediation;
- Financial intermediation.

D. World Bank Emphasis for the Future: A Four-Point Program

1. Energy efficiency issues need to be tackled at an early stage in the policy dialog with individual countries.

2. Greater selectivity in lending to energy supply institutions.

3. Higher in-country visibility of demand-side management.

4. Greater emphasis on energy saving and pollution-abating technology transfer.

United States Agency for International Development

United States Energy Association

Regional Conference to Promote Energy Efficiency in the Central Asian Republics

"Summary of the Conference and Proposed Themes for Future Conferences"

Rolf Manfred
Chief of Party
Energy Advisor to the USAID Mission for Central Asia
International Development and Energy Associates, Inc.

July 14, 1995

Lake Issyk-Kul, Kyrgyz Republic

131

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Rolf Manfred has over 30 years experience in the areas of energy and environmental engineering, alternative fuels, commercialization, project management, and clean coal technology. For twenty years he has been directly involved with energy related contract research and development, form process conceptualization through development and marketing. His expertise includes technical and fiscal management of Clean Coal Technology project to develop and demonstrate the slagging combustion process. Mr. Manfred is an international known expert in coal technology development and coal combustion.

In the mid-1970's, Mr. Manfred served as Business Area Manager of Energy Systems for the Acurex Corporation. As the Manager of Energy Systems Profit Center, Mr. Manfred was responsible for design, construction, and start-up of systems such as fluid beds, gasifiers, custom-designed furnaces, and alternative fuel systems. He was also responsible for the identification of business targets, planning, selling, and organizing the project team.

Throughout the 1980's Mr. Manfred concentrated on fossil plant availability and coal technology. He managed projects to improve performance and extend life of utility plant components, developed advanced coal cleaning combustion technology, and investigated boiler technology, blade and rotor technology, and improvements of feed pump and heat exchangers. Mr. Manfred managed a coal cleaning test plant project and developed a Coal Quality Impact Model to predict performance of specific coals at specific sites. In addition, he managed EPRI's efforts to develop and commercialize alternative fuels (including heavy oils, petroleum industry by-products, peat, wood, and municipal waste) emphasizing coal/water/slurry as an oil replacement. He was involved in EPRI projects to improve performance and extend the life of utility plant components, develop advanced coal cleaning combustion technology, and integrate these technologies with the environmental control functions of power plants. Furthermore, Mr. Manfred investigated boiler technology, blade and rotor technology, and improvements of feed pumps and heat exchangers.

From 1988 to 1991 Mr. Manfred was responsible for technical and fiscal management of the TRW Clean Coal Technology projects to develop and demonstrate slagging

combustion processes. His leadership of this project involved coordination with local utilities, an architectural engineering firm, and state and institutional sponsors (Electric Power Research

Institute, Ohio Coal Development Office, New York State Energy Research and Development, and ESEERCO).

From 1991 to 1992 Mr. Manfred worked as the Chief of Party for IDEA Combustion Technology Projects in Indonesia, also serving as the resident advisor on coal combustion projects. During the following two years he acted as a private consultant on UNIDO projects. In 1994, Mr. Manfred took the position of Senior Energy Advisor to USAID and was assigned the overseas staff in Kazakstan to assist in the development of projects in Central Asia.

"Summary of the Conference and Proposed Themes for Future Conferences"

Outline of the Presentation by

Rolf Manfred
Chief of Party
Energy Advisor to the USAID Mission for Central Asia
International Development and Energy Associates, Inc.

Strategic Objectives

To assist in:

- forming a more market-oriented energy sector which fosters increased private investment and competition;
- improving public welfare by increasing efficiency and reducing health risks.

Activities

1. Policy Support Tasks
    - Laws and Regulations
    - Restructure/Corporatization
    - Price and Tariffs
    - Market Analyses
    - Investment
2. Energy Efficiency
    - Energy Savings Planning
    - Plant Reconstruction
    - Transmission
    - New Generation Planning
    - Plant Environmental Technology
    - Coal Resource Efficiency
    - Oil Refinery Efficiency

3. Intellectual Exchange Tasks

- Partnerships
- Executive Courses
- Conferences

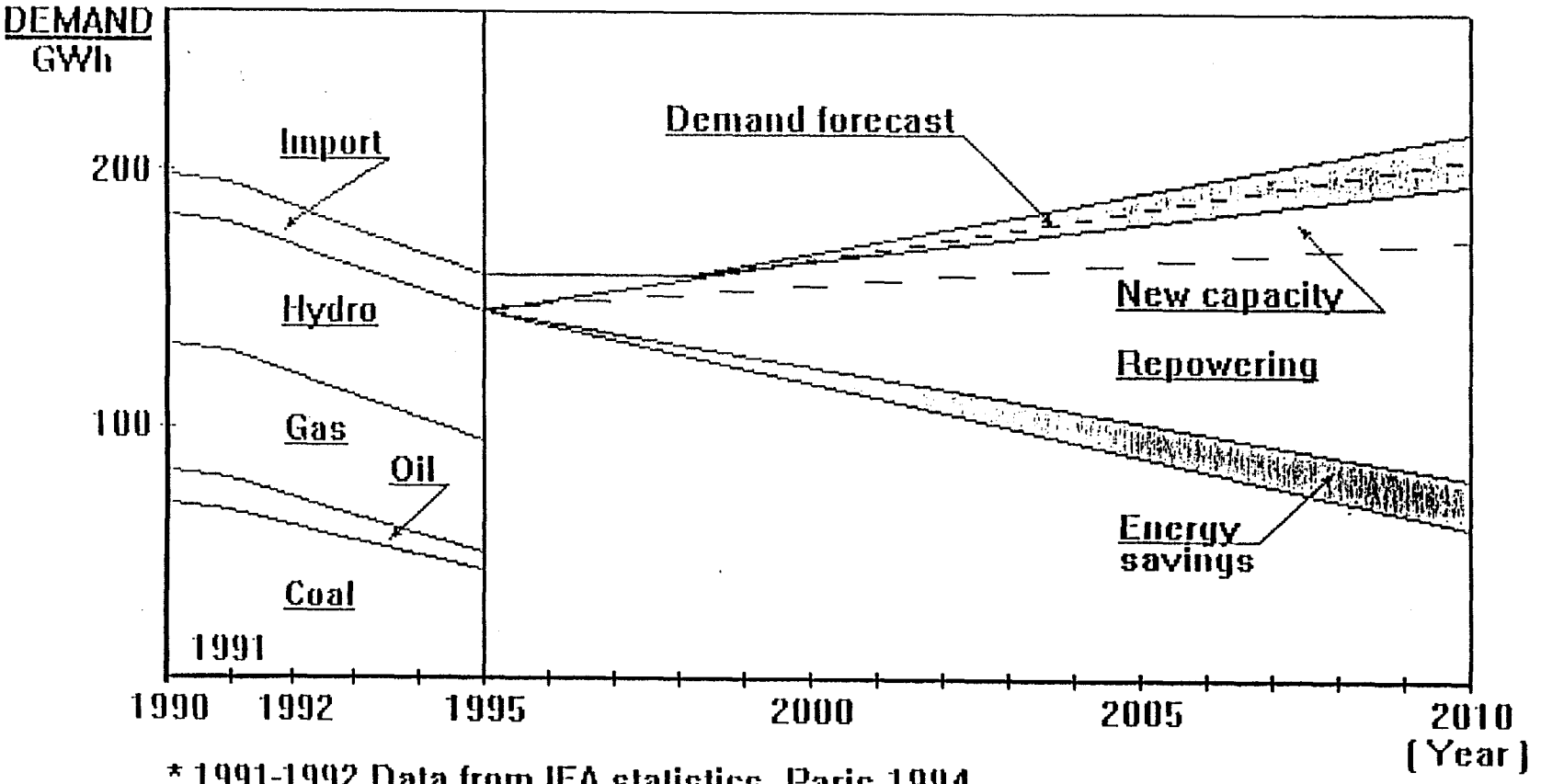
Proposed Themes for the Future Conferences

- Energy Trade
- Uniform Contracts
- Energy Pricing
- Water Usage
- Fuel Resource Environment
- Power Plant Environment
- Electricity Dispatch
- Energy Transportation

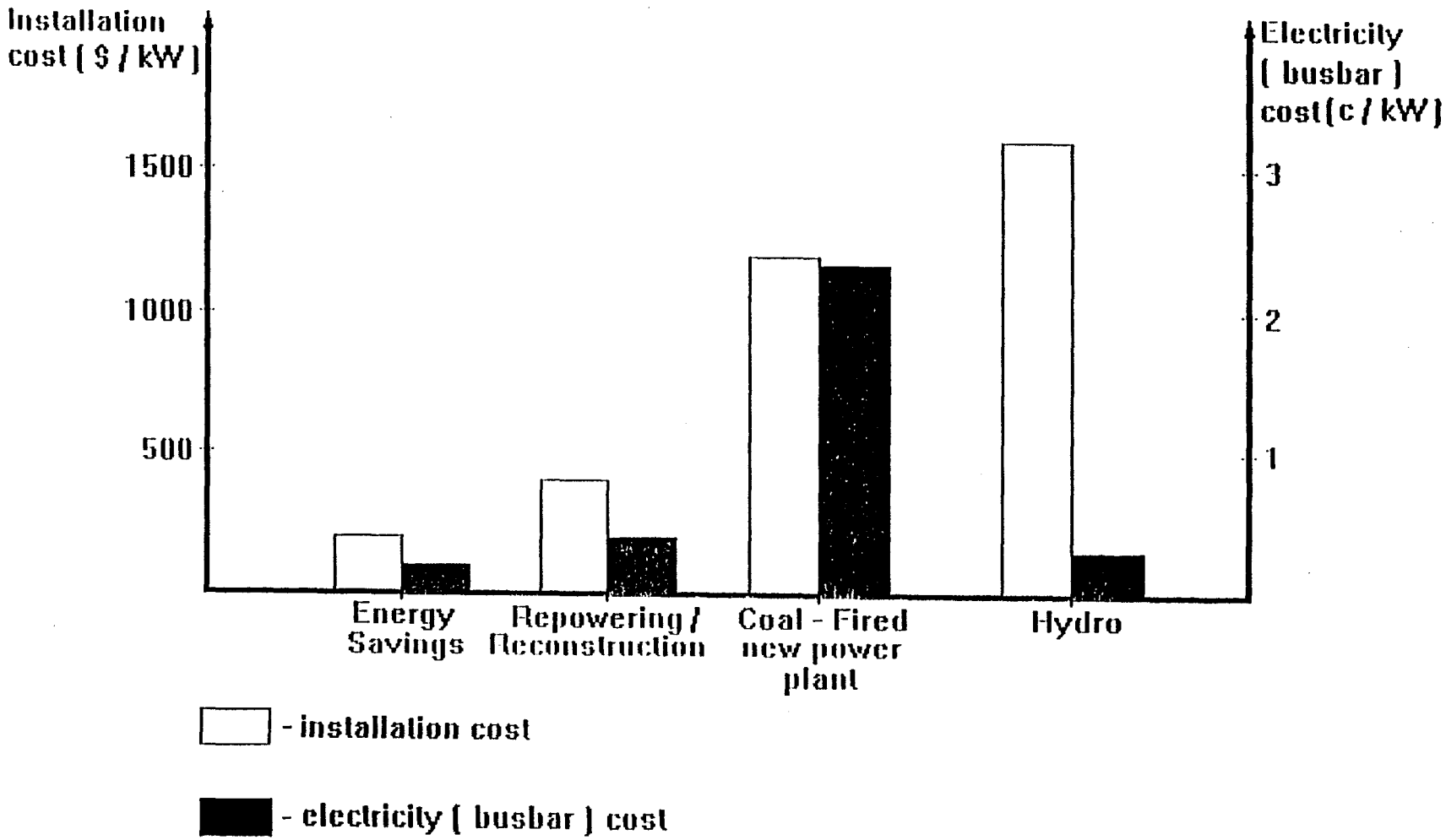
Energy Exports/Imports

W - water
G - gas
O - oil
C - coal
E - electricity

REGIONAL DEMAND STRATEGY



* 1991-1992 Data from IEA statistics. Paris 1994


Installation cost ($ / kW)
1500
1000
500
Electricity (busbar) cost(c / kW)
3
2
1
Energy Savings
Repowering / Reconstruction
Coal - Fired new power plant
Hydro
- installation cost
- electricity (busbar) cost