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DOMESTIC POLICY REVIEW
INTERNATIONAL PANEL
POLICY OPTIONS

September 20, 1973

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EXECUTIVE SUMMARY

The world is faced with a clear need to increase the use of solar and other alternative/renewable energy sources to augment and supplant the depletable conventional and traditional fuel sources. Fossil fuels' availability is finite. Traditional energy resources such as wood are being rapidly depleted, causing local ecological difficulties and potential global problems. Nuclear energy has encountered delays and opposition in many countries. Rising world costs for imported oil are straining the economies of both developed and developing countries. Hence, it is to the overall global advantage as well in the U.S. interest to accelerate the transition from an almost complete reliance on depletable fossil fuel supplies to greater usage of alternative/renewable sources of energy.

To date, U.S. solar technology, development, and commercialization have concentrated on domestic needs. The international arena, however, provides the U.S. with an exceptional opportunity to advance several major foreign policy goals:

- o Helping to ease the pressure on world fossil fuel demand.
- o Cooperating with the industrialized countries in meeting the global energy challenge.
- o Helping the developing countries to attain greater energy and economic self-sufficiency.
- o Improving U.S. trade and balance-of-payment.

Through technical cooperation assistance and market stimulation, the U.S. can provide valuable solar systems technology, engineering, and equipment which can accelerate overall international solar use. Toward this end, the U.S. program must incorporate three interrelated initiatives, each of which is essential to a successful international effort:

- o Commercialization of solar energy abroad by market identification and development, to create general world-wide demand and promote international trade, in which all interested countries can participate along with the U.S.
- o Technical cooperation to bring about improvements in solar technologies, especially by developmental and demonstrational projects aimed at creating marketable, commercially viable systems and equipment.
- o Cooperation with developing countries to bring about optimum energy resource development, with the help of appropriate international financial and technical assistance.

Foreign Policy Background

The international development of solar/renewable energy sources provides the United States with an important opportunity to strengthen its economic and political ties with its allies as well as to increase U.S. cooperation with the developing countries. Bilateral and multilateral RD&D cooperation with the industrialized nations, particularly through the IEA, should be enhanced so as to gain maximum advantage of respective skills, scientific knowledge, and RD&D expenditures. While the overall political and economic benefits of such cooperative endeavors are significant, technological and market considerations should largely determine the areas and pacing of such cooperation.

Those developing countries in a position to make a significant contribution to solar RD&D and commercialization, have already begun to recognize the important role which alternative energy technologies can play in their own, as well as in the global energy future. Some of the key oil exporters are actively exploring indigenous use of solar energy, in view of the exhaustible nature of their petroleum resources and of their wish to conserve these resources for future export. The U.S. has encouraged these efforts through such arrangements as the collaborative agreement with Saudi Arabia. The U.S. can also benefit from cooperating with countries like India and Israel who have particular solar knowledge and expertise.

The use of solar/renewable energies is probably most important to the financially disadvantaged developing countries whose national development efforts have already been significantly set back by the escalation of world oil prices. Support for solar energy in these nations can help them attain a greater degree of national self-sufficiency through indigenous energy alternatives. Furthermore, the development of renewable energy sources will ameliorate the deforestation due to firewood burning. Deforestation and desertification have already caused extensive environmental damage in some areas and may become a global problem by the end of the century. In seeking to advance the use of solar energy within these countries, it is essential that the U.S. not only make its technology available but also help developing countries increase their capabilities to adapt, manufacture and apply systems that are specifically suited to the needs of individual countries.

Options Group I: Commercialization

Commercialization has to be a major emphasis in any effective approach to accelerate the use of solar energy internationally; the viability of the solar promise depends largely on successful commercialization. To assist this process, the U.S. must shoulder its fair share in a coordinated information exchange program with both developed and developing countries. The range of economically viable and suitable solar applications for each country or region must be explored and made known. As part of this, the U.S. will establish a global solar data center which would disseminate both international and U.S. solar information.

On the domestic side, the U.S. must encourage the private sector to

develop international markets, if we are to meet the technology and product demands of other nations. To help anticipate this demand, we must conduct a thorough global market survey of solar energy needs and develop a coordinated research and development program aimed at the international solar market.

We must inform and work with U.S. industry to identify and develop these and other overseas opportunities. Federal guidance and support should enable the U.S. solar industry--a new, potentially important industry with a promise of far-reaching benefits--to become self-sustaining in the international market, by encouraging it to develop exportable solar systems design, technology, components, and engineering knowhow. An increase in international sales will also help to enhance the range of domestic solar applications and to lower effective costs, thus stimulating both domestic and overseas use of solar energy.

Legislative requirements would probably include statutes that authorize DOE, DOS, Action, Export-Import Banks, SBA and others to play an expanded function in international solar commercialization efforts. In addition, several existing acts might need amendment to remove specific restrictions. The global market survey and the solar education efforts recommended within this and the solar education efforts recommended within this option would benefit by specific authorizing legislation.

Total cumulative expenditures for FY 80-85 would be \$16 million at a moderately accelerated level and \$28 million at the maximum accelerated level.

Options Group II: Technical Cooperation

Solar energy holds great promise to both the United States and the rest of the world; it offers us an opportunity to help relieve the world pressure on dwindling fossil fuels, to create new and meaningful employment, to bring more sophisticated sources of energy to regions of the world where conventional sources are uneconomical, and to reduce the hazards to our environment from conventional energy sources. Recognizing our particular responsibility in the energy field as a leading country in solar technology, the U.S. will expand research, development, and demonstration efforts with both industrialized and developing countries to accelerate the world-wide development and application of solar technologies.

This initiative stresses the need to share the cost of research with other countries and to exchange information and ideas with nations which have relevant experience and technical knowhow. Such technical cooperative agreements within the International Energy Agency and other multilateral forums as well as on bilateral relationships. Through these international agreements and joint programs with the industrialized nations, with the oil-exporting nations, and with other developing countries, the U.S. can promote mutually beneficial programs to stimulate solar energy use.

While no new major legislation will be needed, additional legislation or clarification of existing legislation may be called for. Total cumulative expenditures for FY 80-85 would be \$110 million on an increased level, while \$200 million would be required for a maximum level of effort.

Options Group III: Cooperation with Developing Countries

The U.S. will undertake a cooperative program with developing countries to advance their development and use of solar technologies. The program would help to meet U.S. commitments made at the recent Bonn Economic Summit meeting and elsewhere to intensify energy assistance to developing countries and to develop, along with other Summit nations and international financial institutions, a coordinated effort to bring into use renewable energy technologies.

The cooperative program consists of: (1) an enhanced U.S. research and development effort on solar technologies for specific applications in developing areas of the world; (2) analysis of the special energy needs, resources and uses in developing countries, carried out in conjunction with each country; (3) support for training and the expansion of indigenous technical capability in developing countries; (4) testing and adaptation of solar technologies in developing countries (5) demonstration and application of tested and suitable solar technologies; and (6) an international program to exchange information and increase awareness about solar technologies and applications.

It is essential that the U.S. work closely with the Summit and other interested nations, particularly through the OECD, and with the major international organizations, as we proceed to develop a coordinated international effort. Close coordination will also be needed within the USG and between government and industry to achieve a well-thought-out and integrated program. In addition, the U.S. would encourage the World Bank and other international financial institutions, as well as its own export assistance agencies, to explore the use of solar energy sources in their major programs and to fund, where possible, those solar

applications which are economically justified.

Necessary budgetary support could probably be met by changes in the annual authorizing legislation. Total budgetary expenditures for FY 80-85 would be \$380 million at an increased level and \$600 million at the maximum level of effort.

1. INTRODUCTION

Solar energy is clearly an important energy source of the future: it is virtually inexhaustible and will represent an increasing share of the market as the price of nonrenewable fuels rises over time. The U.S. government can facilitate the transition to a new energy mix by providing better, practical, and comprehensive information on the international market for solar technology as a part of a coordinated domestic attempt to accelerate commercialization of solar energy in the U.S. and abroad. The lack of this information may impede investment in solar technology both by the private sector and by the Federal Government in support of technical cooperation and development assistance.

The groundwork for greater reliance upon solar energy must be laid now. Regardless of the time frame in which solar energy will comprise a major part of world energy supplies, it can make a significant contribution in this century toward meeting the needs of many countries. The extensive use of this resource will vary widely depending upon the nature of the energy uses, geography, capabilities, and national resources. Decisions made in the next few years can greatly influence the course of utilization of solar energy systems to the end of the century and beyond. In this context, a contribution of even 5 percent to total world energy use between the mid-1980's and the year 2000 could very well have a significant effect on prices and supplies at the margin of energy resource availability.

The following options have been identified:

- o Commercialization of solar energy abroad by market identification and encouraging its development by the private sector, to increase solar applications worldwide and promote international trade, in which all interested countries can participate along with the U.S.;

- o Technical cooperation to bring about improvements in solar technologies, especially by development and demonstration projects aimed at creating marketable, commercially successful systems and equipment; and
- o Cooperative programs with developing countries to bring about optimum energy resource development, with the help of appropriate international financial and technical assistance.

1.1 Objectives

Use of solar energy can help meet a number of important objectives:

- o Assist in the transition from almost complete reliance on depletable petroleum supplies to greater use of alternatives and essentially renewable sources of energy;
- o Reduce the rate of growth in demand for oil, leading to:
 - Reduced competition between major consumers over limited oil supplies;
 - Reduced dependence by many countries on imported oil;
 - Reduced the long term upward pressure on oil prices;
 - Reduced the balance of payments deficits for many countries;
- o Contribute to the economic, political and social advancement of developing countries;
- o Lessen the harmful environmental effects from continued or accelerated traditional fuel use and conventional, fossil-fueled power generation;
- o Contribute to the more appropriate use of other energy sources by better matching the characteristics of each energy source to its intended end-use;
- o Encourage international scientific and technological cooperation through the cooperative development and demonstration of solar energy systems and equipment;
- o Generally advance foreign relations by:
 - Promoting international cooperation,
 - Strengthening relations with particular countries,
 - Reinforcing the U.S. leadership role in addressing the world's energy needs.

- o Facilitate international trade in solar equipment and technology, thus bringing about:
 - A progressive expansion of the solar market,
 - International competition in supplying equipment and technology,
 - Development by particular countries of their respective comparative advantages in producing solar goods and services;
- o Enhance the commercial availability of solar equipment and technology in the U.S., as a result of increased international sales of such goods and services, leading to:
 - Lower production costs due to economies of scale in manufacturing,
 - Lower prices to consumers, in the U.S. and overseas,
 - Improvements in the quality and durability of equipment and services as firms acquire experience on a sizable scale.

1.2 Current Programs

Ongoing cooperative international solar/renewable energy resource development efforts by the U.S. are:

- o Technologically broad-based, ranging from solar heating and cooling to wave energy conversion;
- o Geographically widespread, ranging from France to Peru and from Upper Volta to Japan;
- o Distributed between industrialized and developing countries. International Energy Agency (IEA) and bilateral programs involve 14 industrialized countries. A pilot energy assessments program for developing countries--as well as ongoing Agency for International Development (AID) programs in renewable energy--involving a number of developing countries;
- o In many cases, designed with feedback mechanism to modify or expand activities as may be deemed appropriate, as, for example, in the IEA's solar thermal project and in our bilateral activities with Spain and Saudi Arabia.

In the area of commercialization, the U.S. has:

- o Sent a working group into the field under Department of Energy auspices, thereby beginning the market identification and analysis effort;

- o Initiated efforts to sponsor solar equipment trade fairs or exhibits under Department of Commerce auspices, including a successful show in Tehran last May.

However, there is as yet no satisfactory analysis of the international market and no coherent, overall international technical development and commercialization implementation strategy for solar energy systems. Correspondingly, among USG agencies there is no coordinated, integrated management and funding strategy for international solar energy development activities. This should be rectified within the context of our broader energy strategy.

1.3 Options for Future Action

Possibilities for the implementation of new international solar efforts-- as well as for the expansion and improvement of present U.S. projects and programs--emerge quite naturally from the activities outlined above. Options for future action have been arranged in three groups which are interdependent and mutually supportive. They generally respond to more than one of the objectives in 1.1, above, and serve to organize the discussion and recommendations about future U.S. activities. These groups are:

- o Option Group #1, Commercialization of solar energy abroad by market identification and encouraging its development by the private sector, to increase solar applications worldwide and promote international trade, in which all interested countries can participate along with the U.S.;
- o Option Group #2, Technical Cooperation to bring about improvements in solar technologies, especially by research, development and demonstration (RD&D) projects aimed at creating marketable, commercially feasible systems and equipment;
- o Option #3, Cooperation with Developing Countries to bring about optimum indigenous energy resource development, with the help of appropriate international, financial, and technical assistance.

2. FOREIGN POLICY FRAMEWORK

International activities in solar/renewable energies have several unique features not present in a purely domestic program. Chief among these are the implications for and effects on U.S. foreign relations, and hence on global political, economic, and social concerns. It would therefore be useful to consider briefly the foreign policy context of international solar activities before discussing specific new initiatives which might be undertaken.

The development and use of solar/renewable energy technologies has a number of significant implications for our overall relationships with other countries. These fall into three general groupings:

- o Political and economic links with other industrialized countries growing out of collaboration in research and development (R&D) of solar technologies;
- o Political and economic relationships with selected developing countries that are in a position to make significant financial or technical contributions to solar development, demonstration and commercialization;
- o Relationships established with developing countries where U.S. assistance in the greater use of solar energy supports the overall national development efforts.

2.1 Cooperation with Other Industrialized Countries

Such cooperation provides for closer political ties and better understanding between peoples. Scientific cooperation benefits the overall development of our international relationships, because it strengthens ties based on the recognition of common needs and opportunities.

Solar technology cooperation carries with it a special political appeal in that it addresses a worldwide problem whose resolution will, in the long term, affect future generations of all nations.

Joint work on solar technologies in the International Energy Agency, for example, represents one element of a coordinated effort among 19 nations to decrease oil import dependency and thus lessen the risk of supply interruptions or unrestrained price increases. As solar energy increasingly assists in reducing this dependency, the national security and economic positions of participating countries will be improved.

Similarly, our bilateral cooperation in solar technology development with countries such as Japan emphasizes our special economic relationships with these countries.

Some countries have expressed the concern that joint work may result in adverse trade effects. The U.S. has encouraged the view that there is no intrinsic reason why such concerns, for example, on patent and intellectual property rights, cannot be resolved through negotiation. Also, the overall economic importance of technical progress to user nations may outweigh certain short-term commercial benefits.

In general, our current level of solar technology cooperation with other industrialized nations is seen as responsive to political needs as well as U.S. technical interests. While opportunities for expansion exist and can be politically useful, the basic pacing should continue to be guided by technological and market-related opportunities. A disproportionate emphasis on political impact could be counter-productive from both a political and technical viewpoint.

2.2 Relationships with Developing Countries in a Position to Make Significant Contributions to Solar R&D and Commercialization

Oil price and supply developments since October 1973 have radically changed our relationships with our principal oil suppliers.

Their good will, trust, and perception of our goals have become key elements influencing U.S. security. Our relationships in energy matters continue to be fundamental in this process. Reaction of these countries to the U.S. drive to accelerate R&D in alternative energy technologies have changed over time. Our efforts were viewed initially as somewhat provocative and confrontational. However, the current position of most major oil exporters appears to recognize the fact that renewable energy technologies will play an important, beneficial role in their long-term marketing plans and also in their own domestic energy policies.

Oil exporting countries acknowledge that oil is a limited resource. It therefore makes sense for all countries to explore energy resources that might be used over the long term and to search out relationships and arrangements providing access to advanced technologies such as solar.

Concrete steps have already been taken by the U.S. to establish and strengthen relationships of this type including arrangements with several countries which encompass elements of solar energy cooperation. The collaborative agreement between the U.S. and Saudi Arabia is especially noteworthy because of: a) the size of the financial commitment (\$50 million from each side over 5 years), and b) the fact that the initiative, which was put forward by the Saudis, was open ended on specific topics to be covered. Informal expressions of interest in such cooperation have been received from other OPEC countries.

In addition to the major oil exporters, there exists a second group of countries, the "upper tier" or advanced developing nations that are also

in a position to contribute financially or technically to solar energy development and commercialization. In the case of Brazil, for example, their large program for the manufacture and use of alcohol from plant material as a transportation fuel could benefit our own efforts in this area. Other countries, because of unique geographic, economic, or social factors, have done and are capable of doing advance work on some element of solar energy use.

Collaboration with this group serves a number of purposes in addition to technical considerations:

- o Assists in the definition, rationalization, and development of all energy resources and development options that may be available to a country to meet its energy needs. In many cases this can help to avoid undue reliance on oil imports with associated balance of payments, development, and political costs;
- o Assists in the process of expanding and improving a country's ability to provide its own technical solutions to a range of national problems;
- o Confirms to the participating country that its relationship with the U.S. is on a basis of equality and that its national contributions have world standing.

2.3 Relationships with Other Developing Countries

Adequate energy supplies, at reasonable costs, are critical to the national development process. At a more basic level, the availability of energy directly affects the quality of life. Steep price increases for petroleum in oil-deficient developing countries have slowed progress toward development goals and eroded or neutralized the gains made by the countries themselves or resulting from the assistance provided by the U.S. and other donors. Moreover, oil price increases have seriously threatened their ability to repay the international loans they have depended on for development.

Support for development is vital to our relationship with the developing world and we are conscious of the role of energy in this

process. In addition to development assistance, there are a number of other factors that merit attention.

- o Many of the poorer developing countries are forced to look to the major oil suppliers for relief from the crushing burden of oil payments. Helping to improve access to indigenous and renewable resources could increase these nations' ability to be more independent in determining their foreign policies.
- o Increased unmanaged demand for firewood which leads to deforestation is creating environmental damage with far-reaching effects both on the ability of people in these areas to feed themselves and the quality of waters draining the affected regions. This is a problem now and viewed by many as posing a major threat by the end of the century in some areas. A possibility exists that increased use of fossil fuels may be damaging the biosphere itself. Use of solar energy could significantly improve the human health, agricultural, and overall economic situation worldwide.
- o A number of countries have clustered into "North-South" groupings in the past few years. A complex mix of economic, political, and psychological elements characterize the division. All three are important and need to be taken into account in assessing any cooperative program. Many countries see the role of "technology" or "technology transfer" as playing a special role in linking the two groups and assisting the poorer nations to achieve the breakthroughs needed to improve their positions. Energy technology is of special interest in this regard for two reasons. It is recognized as dealing with an element fundamental to economic growth and certain technologies, such as nuclear, carry with them the symbolism of being on the "cutting edge" of technological progress.
- o Our credibility relies on demonstrating that certain technologies based on renewable energy resources are clearly advanced. They are suited for developed and developing country uses, where decentralized, onsite energy production has economic and technical advantages. The scope of our federal and private programs validates the seriousness of our approach to expanding the use of solar energy in our own future energy mix.

The United States has begun a number of activities bilaterally as well as with other countries through the UN, to improve its energy cooperation with oil-importing nations. These ongoing activities represent separate responses to initiatives from a variety of sources.

2.4 Implementation of Policy and the Need for a U.S. International Solar Energy Development Strategy

A clear challenge, if the U.S. is to conduct effectively an international solar program having three components--commercialization, technical cooperation, and cooperative programs with developing countries--is to develop a comprehensive national strategy. The International Panel recommends that the President direct the definition of an overall strategy and direct the Cabinet to assure that implementation will be managed in a coordinated fashion.

3. Options

Options for the expansion and improvement of present U.S. international solar energy projects and programs, and for the possible implementation of new efforts in the future, are arranged in three groups:

- o Commercialization.
- o Technical Cooperation
- o Cooperation with Developing Countries

These groups for future action are interdependent and mutually supportive, comprise options which meet more than one of the objectives of U.S. policy and provide a framework for discussions and proposed U.S. activities. A rational strategy for encouraging the global use of solar energy must combine elements from all three option groups; the interrelated nature of these activities is such that failure to proceed with at least some elements of each group would undermine the effectiveness of the others.

To permit an overview of the options in all three option groups, a composite table comprised of information presented separately in sections 3.1, 3.2 and 3.3 is provided as table 3.0. The cost estimates included in the Tables are Panel estimates and should be developed in detail for implementation.

TABLE 3.0

OPTIONS WITH PRIORITY, IMPACT TIMING AND ESTIMATED COST (\$ in million)

OPTION GROUP NO. 1, COMMERCIALIZATION

| Most (f) Important | Impact: Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative |
|-----------------------|---|--|-------------------|-----------------|----------------------------|
| | | | 1980 Increased | 1980 Maximum | |
| | | a. <u>INCREASED SOLAR AWARENESS AND UNDER- STANDING IN U.S. AND ABROAD</u> | | | |
| | | a.1 <u>EDUCATION OF U.S. INDUSTRY AND STATE AND LOCAL GOVERNMENTS</u> | | | |
| * | N | a.1.1 <u>U.S.G. Information Services:</u> | | | |
| | | - Incorporate Solar Overseas Market Information into a Data Bank accessible to U.S. industry | .30 | .50 | .55-.75 |
| 12 | | | | | |
| * | L | - Global market survey and evaluation to include compilation of Long range Demand/Supply Projections, by product, firm, country, export intentions, for Data Bank. | 1.00 | 1.00 | 2.00 |
| | L | | | | |
| | N | - Establish (in the U.S.) Regional Solar Reading/Info Services available to the public | | | |
| * | N | - Establish an International Solar Oppor- tunities Section in the Commerce Business Daily | | | |
| * | | - Survey all Federal Agencies to identify existing programs which can be modified to assist international solar commercial- ization and disseminate information as appropriate | .02 | .02 | .02 |

| Most Important | Impact Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative |
|----------------|----------------------------------|---|-----------------|--------------|-------------------------|
| | | | 1980 Increased | 1980 Maximum | |
| | | a.1.2 <u>U.S.G. Overseas Market Awareness Program</u> | | | |
| * | L | - Regional solar seminars for U.S., industry, state and local officials, and the public. Topics include export possibilities/potential, techniques, pitfalls, foreign warranty standards requirements, spare parts problems, and U.S. and other financing programs and loan criteria. | .30 | .50 | 4.0-5.0 |
| | L | - Selective U.S.G./Industry joint overseas visits at U.S.G. expense, to verify/discuss Solar Commercialization with Foreign Industry, officials. | .20 | .40 | 1.6-3.2 |
| | | - Encourage industry-organized, Government approved (IOGA) overseas solar trade missions | | | |
| | N | - Selected U.S. officials stationed overseas to be trained and required to make regular solar market opportunity reports for Data/Bank U.S. Industry. | .05 | .10 | .40-.80 |
| | N | - Training for U.S. foreign service personnel overseas (Brussels, Tokyo, etc.), and coordination of their activities with DOS/DOC/DOE. | .03 | .05 | 0.9-1.5 |
| | | a.1.3 <u>Foreign Products Information Collection and Dissemination</u> | | | |
| | N | - Data on foreign patents, tariffs, quotas, standards, catalogued for Data Bank, on continuing basis. | -- | -- | -- |
| | N | - Foreign solar hardware and technology catalogued for Data Bank/U.S. Industry. | .01 | .02 | .04 |

| Most Important | (f) | Impact: Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative | |
|----------------|-----|---|--------|--|-----------------|----------------------------|---------|
| | | | | 1980 Increased | 1980 Maximum | | |
| | | | a.2 | <u>EDUCATION OF FOREIGN CUSTOMERS</u> | | | |
| | | | a.2.1 | <u>Trade Fairs, Trade Centers, Meetings</u> | | | |
| * | | N | | - Sponsor more U.S. solar trade fairs | .40 | .80 | 3.2-4.8 |
| * | | N | | - Train selected U.S. mission local employees to support U.S. solar export activities. | -- | -- | -- |
| | | N | | - U.S.G. provide assistance for U.S. small industry participation in international solar fairs, meetings. | | | |
| * | | L | | - Establish Regional U.S. Solar Education/ Training Centers in U.S. Trade Centers. | | | |
| 14 | | | a.2.2 | <u>Solar Demonstrations</u> | | | |
| | | N | | - Solar demonstrations and displays on U.S. installations overseas (embassies, AID missions, etc.) | | | (h) |
| | | L | | - Donor demonstrations to LDC's to show U.S. solar goods and services. | | | |
| * | | L | | - Mobile U.S. solar exhibits in LDC's and other areas (movies, books, handouts, speakers, displays, working models). | | | |

| Most Important | Impact: Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative |
|-------------------|---|--|-------------------|-----------------|----------------------------|
| | | | 1980 Increased | 1980 Maximum | |
| | | a.2.3 <u>Training Foreign Solar Specialists</u> | | | |
| | N | - Solar Fellowships to U.S. Institutions | .4 | .4 | 1.6-2.0 |
| * | N | - Training courses in U.S. industry for foreign government planners, solar managers, engineers, technicians, at U.S.G. expense. (Mainly LDC Trainees: inaudits, systems and components selection, and installation techniques. | .5 | .8 | 1.5-2.0 |
| | | b. <u>ENCOURAGE U.S. INDUSTRY PARTICIPATION IN DEVELOPING INTERNATIONAL SOLAR MARKETS</u> | | | |
| | | b.1 <u>CONTRACTS AND GRANTS</u> | | | |
| 15 * | N | - Allow similar treatment of overseas and domestic market development costs as overhead items. | | | |
| * | N | - Encourage U.S.G. officials/program officers to sponsor small solar RD&D contracts which are export oriented. Expand the NBS/OERI program's export stimulation potential. | -- | -- | -- |
| | | b.2 <u>INDUSTRIAL BASE DEVELOPMENT</u> | | | |
| | L | - On selective basis, actively encourage U.S. industry efforts to form associations with LDC, ADC entrepreneurs which will result in establishment of local solar industry overseas. | .03 | .05 | .30 |

| Most Important | Impact: Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative |
|----------------|---|--|-------------------|-----------------|----------------------------|
| | | | 1980 Increased | 1980 Maximum | |
| | | b.3 <u>INCREASED USE OF EXPORT/FINANCING ASSISTANCE FOR U.S. INDUSTRY</u> | | | |
| | L | - Using the facilities of U.S.G. as appropriate, provide loans, credits, guarantees and insurance to export oriented solar industries. Provide for and encourage loans to exporters under existing U.S.G. programs, designed to encourage solar exports. | | | |
| | N | - Through the Opic (Overseas Private Investment Corporation), provide bilateral loan guarantees to appropriate foreign joint venture partners, to help stimulate local industry. | .10 | .10 | .50 |
| | L | - U.S.G. press for <u>voluntary</u> international standards, warranties. | .01 | .01 | .5 |
| | N | - U.S.G. discourage restrictive practices (tariffs, quotas and dumping) affecting solar trade | -- | -- | -- |
| | N | - U.S.G. review and relax high technology export restrictions related to solar (e.g. photo-voltaics), as appropriate. | -- | -- | -- |

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| Most (f) Important | Impact: Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative |
|-----------------------|---|--------|-------------------|-----------------|----------------------------|
| | | | 1980 Increased | 1980 Maximum | |

| | | | | | |
|--|--|-----------------------|-----|-----|-----------|
| | | GROUP 1 TOTAL (e) (g) | 3.3 | 4.8 | 17.0-23.0 |
|--|--|-----------------------|-----|-----|-----------|

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OPTION GROUP NO. 2, TECHNICAL COOPERATION

| Most Important | Impact: Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative |
|-------------------------------|---|---|-------------------|------------------|----------------------------|
| | | | 1980 Increased | 1980 Maximum | |
| * | N | a. Bilateral, Multi-Level cooperation with DC's | 1.0 ^a | 1.5 ^a | 5.0-10.0 ^a |
| | L | b. Major projects | 1.0 ^b | 1.5 ^a | 7.0-15.0 ^a |
| * | N | c. Industry participation | .1 ^b | .2 ^b | 0.5-1.2 ^b |
| | L | d. Standards | .5 | 1.0 | 5.0-7.0 |
| * | L | e. LDC R&D Program | 5.0 | 10.0 | 50.0-70.0 |
| | N | f. Upper-Tier cooperation | 2.0 | 4.0 | 15.0-25.0 |
| | N | g. Oil Exporters cooperation | 4.5 | 6.5 | 20.0-45.0 |
| | L | h. Regional Centers | 0.5 | 4.0 | 7.5-24.0 |
| | L | i. IEA/LDC cooperation | 0.1 ^b | 0.2 ^b | 0.5-1.2 ^b |
| GROUP 2 TOTALS ^(e) | | | 15.0 | 29.0 | 110.0-200.0 |

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OPTION GROUP 3, COOPERATIVE PROGRAMS

| Most Important | Impact: Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative |
|-------------------|---|---|-------------------|-----------------|----------------------------|
| | | | 1980 Increased | 1980 Maximum | |
| * | N | Analysis of energy needs and resources in some LDC's. | \$7 | \$15 | \$50-80 |
| * | L | Support for expanded LDC indigenous technical capability. | \$15 | \$25 | 75-100 |
| * | L | Field Testing and applied research of solar energy technologies in some LDC's. | 20 | 35 | 100-150 |
| | N | Demonstration and evaluation of proven and applicable solar energy technologies. | 28 | 45 | 125-230 |
| | N | Information dissemination and awareness efforts on the possible applications of solar/renewable energy resources. | 5 | 10 | 25-40 |
| GROUP 3 TOTAL (e) | | | \$75.0 | \$130.0 | 380.0-600.0 |
| GRAND TOTAL (e) | | | \$93.0 | \$160.0 | 500.0-830.0 |

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(u)

- NOTES:
- a) For program planning and integration only. No other additional costs over planned budgets are expected. In some cases, projects costs will decrease due to sharing with other nations.
 - b) For liaison, coordination and planning.
 - c) The 1980 budget would be constrained by staffing considerations. The out-year approximations have been made in the absence of well-defined goals.
 - d) Except for figures noted by a) and b), budget figures are total figures.
 - e) Rounded totals
 - f) Options especially recommended on basis of importance and/or cost effectiveness are indicated by an asterisk.
 - g) Totals exclude those items which have no indicated estimate due to lack of budget impact, probability of implementation by reprogramming or lack of information to estimate. Due to omitted elements and the fact that all are sensitive to the degree of commitment to export promotion, totals could be 2 to 5 times figure indicated.
 - h) FY'79 DOS Authorization incorporated HR 12598 (5247.2) authorizing expenditure of \$4 million to establish solar energy demonstration program for U.S. buildings overseas. Following a survey, the DOS Office of Foreign Buildings identified 146 proposed installations in 56 cities abroad.

3.1 Option Group #1, Commercialization of Solar Technologies

3.1.1 Statement of Need and Opportunity

3.1.1.1 Need

Solar energy is clearly the energy source of the future: it is virtually inexhaustible and will represent an increasing share of the market as the price of nonrenewable fuels rises over time. The U.S. government can facilitate the transition to this long run eventuality by providing better, practical information on the international market for solar technology as a part of a coordinated domestic attempt to accelerate commercialization of solar energy.

The U.S. government can engage in a concerted effort to increase awareness of international applications of solar technologies that are cost effective today and thereby pave the way to more extensive utilization as relevant costs change. This effort should be undertaken in conjunction with programs to encourage the participation of U.S. industry in developing the international solar market.

Increasing awareness of international solar applications can be achieved through two broad categories of initiatives:

- o Improved understanding of the global market for specific solar technologies, through an international market survey.
- o Better information for the potential producers and consumers of solar technologies identifying practical opportunities through educational and demonstration projects.

U.S. industry can be encouraged to develop the international solar market both through this heightened awareness and through programs to support the initial endeavors of an infant industry with high potential. Federal support should be designed to taper off progressively as the private sector establishes itself in the world export market. Long run subsidies are not needed or desired.

In helping to stimulate and develop worldwide solar markets, the U.S. will help to fill a serious international energy need and will:

- o Help other countries to identify and use their indigenous renewable energy sources and in so doing redress adverse balances of trade and achieve more energy independence;
- o Provide technology, systems engineering and specialty hardware that will be of value to energy importing countries, especially the LDC's, and will be a new significant component of international trade;
- o Provide for more efficient worldwide production of solar goods;
- o Stimulate the demand for solar systems (especially in many of the developing countries) that could assume a size that would require an international effort to satisfy the demand. U.S. technology, solar systems engineering and specialized components would be of great value, particularly with respect to the design and installation of onsite energy systems.

3.1.1.2 Opportunity

In achieving a key leadership and competitive position in world solar markets, the U.S. will derive a number of significant benefits:

- o Establishment of the U.S. as a key and competitive leader in international solar activities and trade.
- o R&D to meet the special and immediate needs of foreign solar users, would be of value in meeting our own needs. Such R&D is going to be of critical value to the world. Our nation is one of the leaders in solar energy R&D. If we increase our effort in this area so as to meet a foreign demand today, we will keep this lead and be even more ready to meet our own internal demand tomorrow.
- o The export of solar goods and services will help our own balance of trade situation, a matter of great national urgency.
- o Export demand will enhance the development of the industry, stimulating lower unit costs as producers achieve scale economies and efficient marketing systems. Hence, development of the international market will benefit the U.S. solar industry and consumers abroad.

- o U.S. industry's willingness and ability to help stimulate solar and related industries overseas, by joint ventures, technology licensing, etc., will be much increased with resulting benefits flowing in both directions. The development of solar commercial markets abroad will be as important in determining the rate at which solar use increases in the U.S., as will our own domestic solar market development, during the years when our energy prices are significantly lower than those in most of the world.
- o Small businesses, traditionally the largest source of innovations, are particularly involved in the U.S. solar industry. A program to promote the export orientation of such business will support their growth and ability to innovate.
- o U.S. world leadership in energy affairs will be enhanced, thereby increasing our image generally and with it our ability to conduct our foreign affairs and increase our general export trade.

3.1.2 Background

U.S. Government efforts to acquire marketing information or increase awareness of potential international solar applications have been minimal to date.

3.1.2.1 Marketing Data

Available marketing information is very limited and is generally confined to demand through the years 2000 or 2020. However, these estimates, although important for development of future energy policies, reflect a basic lack of knowledge about future international markets.

Many of the factors affecting the market for solar technologies may vary to such an extent that even for the relatively near term (1985), existing estimates can be meaningless if significant changes occur. For example, changes will occur in the price of competing fuels, cost of the solar technologies, capital requirements for conventional plants or transmission networks, environmental considerations, and government subsidies for competing fuels. The

complexity of the market and its uncertainties do not obviate the need for improved analysis. It is important to continually improve the quantity and quality of market data and projections.

3.1.2.2 Consumer and Producer Awareness

The Department of Commerce (DOC) sponsored a solar trade fair in Tehran, which was a success. Some U.S. embassies and consulates abroad have occasionally assisted U.S. industry participants in solar/renewable energy trade fairs and meetings. U.S. officials stationed overseas and DOE officials in the U.S. have informally extended useful assistance to U.S. industry in identifying overseas opportunities. In June and July, 1978, DOE sent teams to various countries to assess the potential and problems of international solar commercialization. Their reports indicate considerable potential for U.S. industry in the solar export field. The International Institute for Education, sponsored by the International Communications Agency, invites foreign solar/renewable energy experts to the U.S. to visit U.S. Government and U.S. industry installations. DOC has a major export stimulation function, but it has been only minimally active in the solar energy field. However, DOC is currently planning for a modest "global market survey" for future solar energy systems.

These activities have been extremely limited in scope but have nevertheless pointed out the need for more extensive, systematic efforts.

3.1.2.3 Encourage U.S. Industry

Generally speaking the U.S. solar industry is oriented to the domestic market and does not aggressively seek to export. The few export arrangements have been random and very few have been the result of concerted efforts. In addition the U.S. does not have, nor does it encourage, close relations between government and industry that mark so many foreign business arrangements. Strong foreign government support, financial and other, is provided to their industrial groups for export market development and sales activities. U.S. encouragement and support of its solar industry will be aimed at assisting U.S. producers to develop the needed international expertise to move more rapidly into international competition. U.S. industries would welcome Federal support that provides greater awareness of international solar applications and encourages industry to develop the market. Such support should provide sufficient opportunities for small business, but should not overly restrict the industry or subsidize inefficient competitors.

The proposed options include development of trade through improved awareness by consumers and producers of the mutual benefits of market exchange. Option Group #1, Commercialization, would facilitate the early efforts of a growing and important industry as it looks abroad for new markets. For example, to assist the U.S. solar industry, the initial purchase of equipment may be underwritten by the U.S. government. Such investment is intended to lead to future contracts at market determined prices.

3.1.3 Proposed Group #1 Options

Presidential Statement:

Commercialization has to be the centerpiece of any effective approach made by the U.S. Government to accelerate the use of solar energy internationally; the viability of the solar promise depends more on successful commercialization than any other factor. To assist this process, the U.S. must shoulder its fair share in a coordinated program with both developed and developing countries. The range of economic and suitable solar applications must be explored and made known. As part of this, the U.S. will assist in establishing a global solar data center which would disseminate both international and U.S. solar information.

On the domestic side, the U.S. must encourage the private sector to develop its international markets if we are to meet the technology and products demand of other nations. To help anticipate this demand, we must conduct a thorough global market survey of solar energy needs and develop a coordinated research and development program aimed at the international solar market. The particular needs of developing countries for durable and economic rural and decentralized energy sources must also be met. We must inform and help U.S. industry to identify and develop these and other overseas opportunities. As a new, potentially quite important industry with a promise of far-reaching benefits, Federal guidance and support should enable the U.S. solar industry to become self-sustaining in the international marketplace by encouraging U.S. solar industry to develop exportable solar systems design, especially components and engineering know-how.

The proposed group of options would: (a) increase solar awareness and understanding in the U.S. and abroad; and (b) encourage U.S. industry participation in developing the international solar market.

In the following list of options those deemed most important (see Recommendations - Section 3.1.8) are indicated by an asterisk.

3.1.3.a Option A: INCREASED SOLAR AWARENESS AND UNDERSTANDING IN U.S. AND ABROAD

A.1 Education of U.S. Industry and State and Local Government

A.1.1 U.S.G. Information Services:

- o Establish a solar overseas markets data bank accessible to U.S. industry.*
- o Global market survey and evaluation to include compilation of long range demand/supply projections, by product, firm, country, export intentions, for data bank.*
- o Establish (in the U.S.) regional solar reading/information services, available to the public.*
- o Establish an international solar opportunities section in the commerce business daily.*

A.1.2 U.S.G. Overseas Market Awareness Program

- o Conduct regional solar seminars for U.S. industry, state and local officials, and the public. Topics include export possibilities/potential, techniques, pitfalls, foreign warranty and standards requirements, spare parts problems, U.S. and other financing programs and loan criteria.*
- o Establish a program of selective U.S.G./industry joint overseas visits at U.S.G expense, to verify/discuss solar commercialization with foreign industry, officials.
- o Arrange for selected U.S. officials stationed overseas to be trained and required to make regular solar market opportunity reports for data bank for U.S. industry use.*
- o Initiate a program of training for U.S. foreign service personnel overseas (Brussels, Tokyo, etc.) and coordination of their activities with DOS/DOC/DOE.

A.1.3 Foreign Products Information Collection and Dissemination

- o Collect and catalog data on foreign patents, tariffs, quotas, standards, etc. for data bank, on continuing basis.
- o Collect and catalog information about foreign solar hardware and technology for data bank for U.S. industry use.*

A.2 Education of Foreign Customers

A.2.1 Trade Fairs, Trade Centers, Meetings

- o Sponsor more U.S. solar trade fairs.*
- o Establish a program to train selected U.S. mission local employees to support U.S. solar export activities.*
- o Provide for partial U.S.G. funding of U.S. small industry participation in international solar fairs, and meetings.
- o Establish regional U.S. solar education/training centers, especially in U.S. trade centers.*

A.2.2 Solar Demonstrations

- o Establish a program of solar demonstrations and displays in U.S. installations overseas (embassies, AIE missions, etc.)
- o Arrange and conduct demonstrations in LDC's, to promote U.S. solar goods and services.
- o Arrange and conduct a series of traveling U.S. solar shows in LDC's and other areas (movies, books, handouts, speakers, displays, working models).*

A.2.3 Training Foreign Solar Energy Specialists

- o Establish a program of solar fellowships for appropriate foreign staff in U.S. institutions.
- o Arrange and conduct training courses in U.S. industry for foreign government planners, managers, engineers, technicians, at U.S.G. expense. (Mainly LDC trainees: in audits, systems and components selection, and installation techniques.)*

3.1.3.b Option B: ENCOURAGE U.S. INDUSTRY PARTICIPATION IN DEVELOPING INTERNATIONAL SOLAR MARKETS

B.1 Contracts and Grants

- o Allow similar treatment of overseas and domestic market development costs as overhead items in contracts.*
- o Encourage U.S.G. officials/program officers to sponsor small solar R&D contracts which are export oriented. Expand the NBS/OERI program's export stimulation potential.*

B.2 Industrial Base Development

- o On a selective basis, actively encourage U.S. industry efforts to form associations with LDC and ADC entrepreneurs which will result in establishment of local solar industry overseas.

B.3 Increased Export/International Trade Assistance for U.S. Industry.

- o Using the facilities of the U.S.G. as appropriate, provide low interest, unsecured loans, credits, guarantees, and insurance for specific export venture costs of export oriented solar industries.
- o Provide bilateral loan guarantees through OPIC (Overseas Private Investment Corp.) to appropriate foreign joint venture partners and help stimulate local industry.*
- o Initiate international development of voluntary international solar standards and warranties.
- o Take active role in discouraging restrictive practices (tariffs, quotas and dumping) affecting solar trade.
- o Undertake review and appropriate relaxation of high technology export restrictions related to solar (e.g., photovoltaics).*

Table 3.1 lists the options and includes an assessment of the potential impact in the near term (N) or the long term (L). Also included are cost estimates to the U.S. Government of each implementation from 1980 to a cumulative figure through 1985 (as compared to the budgetary commitment necessary which is discussed in section 3.3.5.2). It was assumed that due to positive response to the U.S. Government program, Federal outlays would be reduced to a small amount from 1985 onward. For each option, two levels of effort are shown as increased and maximum.

TABLE 3.1

OPTION GROUP NO. 1, COMMERCIALIZATION
Estimated Cost (\$ Millions)

| Impact Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative | Peak Effort Year | Agencies With Related Ongoing Programs |
|--|---|-------------------|-----------------|----------------------------|------------------------|--|
| | | 1980 Increased | 1980 Maximum | | | |
| | a. <u>INCREASED SOLAR AWARENESS AND UNDER- STANDING IN U.S. AND ABROAD</u> | | | | | |
| | a.1 <u>EDUCATION OF U.S. INDUSTRY AND STATE</u> | | | | | |
| | a.1.1 <u>U.S.G. Information Services:</u> | | | | | |
| 30 N | - Incorporate Solar Overseas Markets Information into a Bank accessible to U.S. industry | .30 | .50 | .55-.75 | Constant | DOC, DOE, DOS, Treas. |
| L | - Global market survey and evaluation to include compilation of Long range Demand/Supply Projections, by product, firm, country, export intentions, for Data Bank. | 1.00 | 1.00 | 2.00 | '80 | DOC, SBA, DOE, Treas., OPIC/ EXIM |
| N | - Establish (in the U.S.) Regional Solar Reading/Info Services available to the public | | | | Constant | DOC |
| N | - Establish an International Solar Oppor- tunities Section in the Commerce Business Daily | | | | Constant | DOC |
| | - Survey all Federal Agencies to iden- tify existing programs which can be modified to assist international solar commercialization and disseminate information as appropriate. | .02 | .02 | .02 | '80 | DOC, DOE, Treas. |

| Impact Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative | Peak Effort Year | Agencies With Related Ongoing Programs |
|--|---|-------------------|-----------------|----------------------------|------------------------|--|
| | | 1980 Increased | 1980 Maximum | | | |
| | <u>a.1.2 U.S.G. Overseas Market Awareness Program</u> | | | | | |
| L | - Regional solar seminars for U.S., industry, state and local officials, and the public. Topics include export possibilities/potential, techniques, pitfalls, foreign warranty standards requirements, spare parts problems, U.S. and other financing programs and loan criteria. | .30 | .50 | 4.0-5.0 | '83 | DOC, DOE, EXIM, DOS, Treas. SBI |
| L | - Selective U.S.G./Industry joint overseas visits at U.S.G. expense, to verify/discuss Solar Commercialization with Foreign Industry, officials. | .20 | .40 | 1.6-3.2 | '83 | -- |
| | - Encourage industry-organized, Government approved (IOGA) overseas solar trade missions. | | | | | |
| N | - Selected U.S. officials stationed overseas to be trained and required to make regular solar market opportunity reports for Data/Bank U.S. Industry. | .05 | .10 | .40-.80 | Constant | DOS |
| N | - Training for U.S. foreign service personnel overseas (Brussels, Tokyo, etc.), and coordination of their activities with DCS/DOC/DOE. | .03 | .05 | .9-1.5 | '81 | DOS |
| | <u>a.1.3 Foreign Products Information Collection and Dissemination</u> | | | | | |
| N | - Data on foreign patents, tariffs, quotas, standards, catalogued for Data Bank, on continuing basis. | -- | -- | -- | '80 | DOC |
| N | - Foreign solar hardware and technology catalogued for Data Bank/Industry. | .01 | .02 | .04 | '81 | DOE |

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| Impact Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative | Peak Effort Year | Agencies With Related Ongoing Programs |
|--|--|-------------------|-----------------|----------------------------|------------------------|--|
| | | 1980 Increased | 1980 Maximum | | | |
| | a.2 <u>EDUCATION OF FOREIGN CUSTOMERS</u> | | | | | |
| | a.2.1 <u>Trade Fairs, Trade Centers, Meetings</u> | | | | | |
| N | - Sponsor more U.S. solar trade fairs | .40 | .80 | 3.2-4.8 | Constant | DOC |
| N | - Train selected U.S. mission local employees to support U.S. solar export activities. | -- | -- | -- | Constant | DOC, DOE, DOS |
| N 32 | - U.S.G. provide assistance for U.S. small industry participation in international solar fairs, meetings. | | | | '81 | DOC |
| L | - Establish Regional U.S. Solar Education/ Training Centers in U.S. Trade Centers. | | | | '81 | DOC |
| | a.2.2 <u>Solar Demonstrations</u> | | | | | |
| N | - Solar Demonstrations and displays on U.S. installations overseas (embassies, AID missions, etc.) | | | | '82 | -- |
| L | - Donor demonstrations to LDC's to show U.S. solar goods and services. | | | | '85 | AID, ACTION |
| L | - Mobile U.S. solar exhibits in LDC's and other areas (movies, books, handouts, speakers, displays, working models). | | | | '85 | ICA |

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| Impact: Near (N) or Long (L) Term | Option | Level of Effort | | 1980 to 1985 Cumulative | Peak Effort Year | Agencies With Related Ongoing Programs |
|---|--|-------------------|-----------------|----------------------------|------------------------|--|
| | | 1980 Increased | 1980 Maximum | | | |
| | a.2.3 <u>Training Foreign Solar Specialists</u> | | | | | |
| N | - Solar Fellowships to U.S. Institutions | .4 | .4 | 1.6-2.0 | '83 | -- |
| N | - Training courses in U.S. industry for foreign government planners, solar managers, engineers, technicians, at U.S.G expense. (Mainly LDC Trainees: in audits systems and components selection, and installation techniques.) | .5 | .8 | 1.5-2.0 | '81 | DOC-TEMPS |
| | b. <u>ENCOURAGE U.S. INDUSTRY PARTICIPATION IN DEVELOPING INTERNATIONAL SOLAR MARKETS</u> | | | | | |
| | b.1 <u>CONTRACTS AND GRANTS</u> | | | | | |
| N | - Allow similar treatment of overseas and domestic market development costs as overhead items. | | | | '83 | |
| N | - Encourage U.S.G. officials/program officers to sponsor small RD&D contracts which are export oriented. Expand the NBS/OERI program's export stimulation potential. | -- | -- | -- | Constant | |

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N

N

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| Impact: Near (N) or Long (L) Term | Option | Level of Effort | | | Peak Effort Year | Agencies With Related Ongoing Programs |
|---|--|-------------------|-----------------|----------------------------|------------------------|--|
| | | 1980 Increased | 1980 Maximum | 1980 to 1985 Cumulative | | |
| | b.2 <u>INDUSTRIAL BASE DEVELOPMENT</u> | | | | | |
| L | - On selective basis, actively encourage U.S. industry efforts to form associations with LDC, ADC entrepreneurs which will result in establishment of local solar industry overseas. | .03 | .05 | .30 | '85 | DOC |
| | b.3 <u>INCREASED USE OF EXPORT FINANCING ASSISTANCE FOR U.S. INDUSTRY</u> | | | | | |
| 34 L | - Using the facilities of U.S.G. as appropriate, provide loans, credits, guarantees and insurance to export-oriented solar industries. | | | | '81 | OPIC, EXIM |
| N | - Provide limited export credit arrangements through the SBA, for low-interest loans for industry R&D and prototype development, overseas oriented. (Possibly repayable from profits, secured by product.) | | | | | SBA, EXIM, OPIC, etc. |
| N | - Through the OPIC (Overseas Private Investment Corporation), provide bilateral loan guarantees to appropriate foreign joint venture partners, to help stimulate local industry. | .0 | .10 | .50 | Constant | OPIC |
| L | - U.S.G. press for <u>voluntary</u> international standards, warranties. | .01 | .01 | .5 | '85 | ISO |
| N | - U.S.G. discouragement of restrictive practices (tariffs, quotas and dumping) affecting solar trade. | -- | -- | -- | Constant | GATT |

| Impact: Near (N) or Long (L) Term | Option | Level of Effort | | | Peak Effort Year | Agencies With Related Ongoing Programs |
|---|--|-------------------|-----------------|----------------------------|------------------------|--|
| | | 1980 Increased | 1980 Maximum | 1980 to 1985 Cumulative | | |
| N | - U.S.G. review and relax high technology restrictions related to solar (e.g. photo-voltaics), as appropriate. | -- | -- | -- | '80 | DOS |
| | TOTAL | 3.3 | 4.8 | 17.0-23.0 | | |

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3.1.4 Consistency With Other Federal Programs

The option described is consistent with other federal programs. It can be interpreted as a logical extension of the Bonn summit meeting as well as several ongoing efforts (DOE, State, AID, Commerce, Treasury) in the public sector. Coordination of these efforts will be strengthened through the information generated by this option.

3.1.5 Legislative and Budgetary Requirements

3.1.5.1 Legislative

The legislative actions which created DOE (PL 93-438), and which govern many of the agencies that will play a part in international solar commercialization, do not specifically include support for such commercialization. Only Treasury and the Department of Commerce are enjoined to further U.S. exports; the Department of State has a legislative responsibility to assist U.S. industry overseas but is not yet very active in providing such support to the solar industry.

PL 93-473 (1974 Solar RD&D Act) could be amended to include unilateral development and export of viable equipment (see Section 2 of the Act). The Department of Energy Authorization Act of 1978--Civilian Applications could be amended to provide for commercial cooperation between industries as well as countries. The Nuclear Non-Proliferation Act of 1978 (PL 45-242) currently has language which generally covers such cooperation. Specific authorization for selected activities and any necessary clarification could be provided through appropriate language in the annual authorization legislation for the agencies involved.

3.1.5.2 Budgetary

The program's options and implementations have cost estimates for the fiscal years 1980 and cumulative through 1985. However, these are cost estimates and differ from budgetary requirements. It is estimated that the entire program as stipulated herein, could entail incremental budgetary allocations as follows:

Table 3.2 Option Group #1, Commercialization
 Estimated Funding (\$ millions) for Total Option Group #1

| <u>Level of Effort</u> | <u>FY 80</u> | <u>FY 80-85 Cumulative</u> |
|------------------------|--------------|--------------------------------|
| Increased: | 3.3 | 17.0 |
| Maximum: | 5.0 | 23.0 |

The cost estimates include both reallocated and incremental funds. Loan or insurance costs are aggregates of borrower principal assignments, drawn on current lending institution operating capital and provided on a case-by-case, relative merit basis.

There is presently very little commitment on the part of government agencies directed toward furthering the commercialization of solar technologies; hence nearly all the above budgeting implications are incremental, to be provided by either reprogramming or supplemental funding.

Current program commitments related to the options in Table 3.3 are:

Table 3.3 Option Group #1, Commercialization

| <u>Agency</u> | <u>Estimated FY 78 funding level (\$ millions)</u> | <u>Options #</u> |
|---------------|--|------------------|
| DOE | .11 | a.1.1 |
| DOC | .06 | a.2.1 |
| SBA | <u>.02</u> | b.1 |
| TOTAL | .19 | |

3.1.6 Implementation Requirements and Organization Roles

3.1.6.1 Implementation Requirements

Interagency coordination is the single main implementation requirement of this initiative. On the program side, agency activities should be coordinated to avoid duplication. In this context the effectiveness of agency activities with respect to initiative goals should be regularly reviewed and evaluated in reports to the President. Agencies having mandates to review and monitor the financial aspects of the program's work should lead this endeavor.

3.1.6.2 Roles of Government and Industry

In the commercialization program, the U.S. Government plays a large role at first but diminishes its role as the solar industry in the U.S. and overseas matures and develops. As this occurs, the commercialization responsibilities shift to industry with those segments that can stand alone doing so as rapidly as possible.

No coordination yet exists, except informally, between agencies with responsibilities in the realm of international solar commercialization. Such coordination will be a key to the success of any Federal endeavor.

3.1.7 Probable Impacts/Timetables

3.1.7.1 Energy Impact

The international market survey will develop better, technology-specific estimates of the demand and energy impacts of solar applications, by area or country. This improved qualification and quantification will be a major contribution to the U.S. effort to enhance solar commercialization in the U.S. and abroad.

Having previously cited the pitfalls associated with using currently available estimates, 1.5 quads might be provided by 1985 in the international solar market, excluding the U.S. The limitations of this estimate have already been pointed out.

The U.S. domestic solar commercialization timetable might also be accelerated as a result of the development of solar markets overseas. There are so many variables in this related impact that numerical estimates could be misleading. The range however, might be from a moderately favorable impact of 2 to 3 percent on solar commercialization in the U.S. due to world commercialization, up to a 10 percent impact by 1985; and the figures for the year 2000 might well be double those for 1985.

3.1.7.2 Effects on International Competition

U.S. entry into the international solar market will stiffen competition. If U.S. industry follows a route similar to the one it took with its automobile designs, market opportunities may be lost by having technology unsuited to the needs of individual markets overseas. A domestic R&D program, which takes into account the nature of international applications, and the export of responsive and relevant goods and services, should help to avoid this problem.

3.1.7.3 Economic and Employment Impacts

Economic impacts can be roughly quantified, as above, for dollars that should flow into the U.S. from the overseas market. This would have a favorable impact on the balance of trade. The secondary impact, that of increasing U.S. solar production (due to exports) and thus increased U.S. employment, is not readily quantifiable, but is expected to be beneficial. It is estimated that 40-50,000 jobs may be created for each \$1 billion of sales.

3.1.7.4 Social Impacts

Significant social impacts, particularly those which improve quality of life, will occur as we move toward the global use of solar/renewable energies. Here again the impacts cannot be quantified satisfactorily, but will be beneficial.

3.1.7.5 Environmental, Health and Safety Impacts

As noted above, most solar/renewable energy conversion systems are relatively benign environmentally and safer than conventional energy conversion systems. To do more than make this statement, each of the various solar/renewable energy conversion system will have to be described and examined in detail. Each will have to be compared against the safety/health/environmental records of competing energy conversion systems. Adequate data is not yet available in the U.S. or abroad for these comparisons to be described in a systematic and accurate manner.

3.1.7.6 Regional Impacts

Market survey information is required. Impacts will vary widely and depend on climate, degree of industrialization, agricultural methods, and the range of priorities in national plans for each area.

3.1.7.7 Other Impacts

A controversial issue is whether certain solar components and systems produce more energy in their useful lifetimes than was used to manufacture them. Studies of this issue are necessary.

3.1.8 Recommendations

The basic theme of the proposed options is to help bring U.S. industry to the forefront as an internationally accepted and competitive leader in a new and developing international solar energy market, for the benefit of the U.S. and the world in general. The U.S. will more rapidly acquire and securely maintain a position of being the best source and repository of data, technology, innovations, systems engineering, advanced components, and forward-looking associations with foreign firms in the solar usage field.

To implement the proposed options as cost-effectively as possible for the U.S. Government, in a manner that reduces government assistance promptly as the U.S. solar industry is strengthened, we have suggested two main categories of options. We have also suggested several legislative changes and studies that need to be undertaken, and that a carefully developed and integrated intergovernmental overall strategy is required.

Of the above options, the following have the greatest potential for being cost-effective and stimulating U.S. industry to move into international solar commercialization.

3.1.8.1 Program Options

- o Market Survey and Data Bank (Option a.1.1.)*

The major share of the activities presented in this option should be provided for in the context of existing programs and agency

* See Table 3.3.

activities. The initial step in a solar commercialization initiative is necessarily the completion of a global market survey. Information from this survey would provide the core of a data bank requiring continuous updating and review. While the survey would indicate existing markets, their size, and areas of U.S. competitive advantage, an implied benefit would be knowledge in areas in which further R&D needs to be undertaken in order to diversify the solar exports. With this information, the U.S. Government can guide public investment to encourage the introduction of solar technology. Cost-effective solar applications would be identified.

With a market survey and cost-effectiveness data in hand, companies and their customers can reasonably expect to obtain venture financing, without need for solar-specific preferences from lending institutions. Hence, no solar financing "earmarking" is recommended.

Market survey source materials can be used in U.S. solar information reading rooms at DOC and DOE regional offices, should such facilities be established for domestic purposes.

Summarizing initial market survey findings (e.g., country or technology specific reports), it is recommended that the Commerce Business Daily institute and maintain a "Solar Exports" Section.

o Overseas Market Awareness (Option a.1.2)

It is recommended that major efforts in this area be planned in detail on the basis of market survey results. However, certain "awareness" activities--regional seminars, meetings between U.S. industry overseas and foreign officials, training of U.S. overseas officials--might be initiated as part of the survey process to enhance country report generation on the one hand, and reporting on the status of the "universe" of U.S. exporters on the other.

o Foreign Product Information (Option a.1.3)

A thorough market survey will necessarily include technology characterizations and the status of foreign solar industries. It should also discuss patent and tariff considerations.

It is recommended that the global market survey provide for a systematic evaluation of the prospects for U.S. export industries. This must be undertaken on the basis of demand/supply projections done by product and country with respect to the capacities of U.S. and foreign firms.

o Trade Fairs, Centers, Meetings (Option a.2.1)

While the market survey may indicate future benefits in expanding trade promotion activities of this type, in the near term it is recommended that U.S. industry be encouraged, and supported initially, if necessary, to participate in international fairs scheduled in the normal course of events. Commercial as well as public information media should be fully utilized by the U.S. Government to notify industry of coming events.

o Solar Demonstrations (Option a.2.2)

U.S. installations overseas could be fully included in whatever government facility solar and conservation programs are initiated as a result of this program. Market survey results should aid in the identification of priority sites for new installations or retrofits.

Similarly, market survey results may indicate fruitful opportunities for other types of demonstration.

o Training (Option a.2.3)

Training of solar "fellows"--both U.S. and foreign--should be rapidly and fully expanded to receive currently interested individuals. Initial programs should be directed at relatively high

level individuals, their curriculum encompassing decision making in energy sector and industry development subjects. While this orientation may be maintained over time, as the program matures it should gear toward training of a lower level technician/engineer student body, at educational, research and U.S. industry installations. Initially, this should be done within the context of existing cultural exchange or foreign student training programs to the extent possible. If this initial effort proves to be productive, consideration should be given to expanding it with the U.S. providing temporary facilities at a solar research institution. Later the program could be moved to industry as appropriate. Under an expanding program, student fees could be paid from a fellowship fund, with costs to be shared by industry and government.

o Product and Venture Financing (Options b.1; b.2; b.3)

The effort should identify, broaden and publicize financing sources and the potential for initiating industry ventures. Under the current participation or involvement terms of the EximBank, IBRD, OPIC, etc., many opportunities for industry development may be found. Also on the basis of the survey, the benefits of specific incentives or support programs will be more readily quantifiable. Weighed against incentive costs these may be implemented.

The survey process itself may identify opportunities for joint ventures or associations between U.S. industry and LDC/ADC procedures. Contacts made to assess the market might be followed, in their own right, with ad hoc initiatives.

With respect to tax deferrals, it is recommended that the DISC system, as it is presently in force, be continued. Any expansion of deferral benefits should be short term. It is recommended, though, that the needs and benefits of a deferral be identified and specified

and that, in general, programs addressed to specific needs be generated within functional U.S.G. agencies.

3.1.8.2 Legislative Recommendations

- o The global market survey should be mandated and funded by legislation.
- o A solar fellowship fund, for U.S.G. and industry contribution could be established through legislation.

3.1.8.3 Recommended Studies

- o An extensive global solar market survey.
- o A study of other international energy education programs (e.g., Atoms for Peace).
- o A study of the energy cost/payback of solar equipment.

3.2 Option Group #2, Technical Cooperation

3.2.1 Statement of Need and Opportunity

The U.S. can both contribute to and learn from technology development efforts abroad. An expanded and coordinated international effort could accelerate the development and implementation of new energy technologies, especially those involving solar/renewable energy sources.

The capabilities of industrialized and developing countries to utilize and develop solar resources vary widely and thus, while the needs and the opportunities for fruitful technical cooperation exist, the nature of the cooperation will vary with the specific situation.

3.2.2 Background

The U.S. currently participates in both multilateral and bilateral international solar cooperative agreements. The multilateral cooperation takes place primarily under sponsorship of the International Energy Agency (IEA) and the NATO Committee on the Challenges of Modern Society (CCMS). The U.S. currently has bilateral agreements with France, Saudi Arabia, Spain, and the U.S.S.R. and anticipates arrangements soon with Japan, India, Italy, and Brazil. Energy assessment and planning activities with Egypt and Peru including consideration of the solar energy potential occur under the U.S. International Energy Development Program (IEDP).

IEA agreements provide for information exchange on national programs, exchange of test results, cooperation in design studies, as well as some joint construction and operation of hardware. Joint efforts are currently underway in:

- o Solar Heating and Cooling,
- o Small Solar Power Systems,
- o Wind Energy Conversion Systems,
- o Large Scale Wind Energy Conversion Systems,
- o Forestry Energy,--Growth, Production, Harvesting, & Conversion,
- o Biomass Energy,
- o Wave Power.

The CCMS initiated a pilot study on solar heating and cooling in 1973. Beginning in 1976, the groups exchanged information on each nation's progress in the field of solar energy and exchanged data using a common reporting format for solar heating and cooling system performance. In addition, two subgroups are coordinating efforts on zero energy houses and Mediterranean solar applications. Except for information exchange activities, most CCMS solar projects are slated to be phased out or transferred to the IEA.

U.S. agreements with the U.S.S.R. and the anticipated arrangement with Japan involve, in the near future, exchange visits of government-sponsored experts. The agreement with France enabled the U.S. to test

a power tower boiler at the French solar test facility in Odeillo and to begin assessing risks associated with heliostat fields. The Spanish Treaty provides for joint testing of a 1 MWe central receiver system, and to conduct further research on and demonstrate a variety of solar technologies. The Saudi agreement is planned to involve cooperative solar RD&D in a number of areas including thermal processes, solar thermal and photovoltaic electricity generation, and storage and fuel production.

3.2.3 Proposed Group #2 Options

Presidential Statement:

As a leading country in solar technology and recognizing its particular responsibility in the energy field, the U.S. will develop a coordinated program for international technical cooperation in solar energy. Such agreements are essential to the timely development of solar technologies and systems which are durable, reliable, easy to operate and economical. This option group would expand research, development and demonstration efforts with industrialized and certain developing countries to accelerate the development of solar technologies.

These initiatives stress the need to share the cost of research with other countries and to exchange information with other nations who have relevant experience and technical know-how. Through bilateral and multilateral technical agreements and joint programs with the industrialized nations, with OPEC and other "upper tier" developing countries, and with the Third World nations, the U.S. can promote mutually beneficial programs to stimulate solar energy utilization. Such agreements will build on present existing relationships within the International Energy Agency, with our bilateral agreement with Saudi Arabia and other interested OPEC countries and with the developing countries.

The U.S. and other nations can benefit from an expansion of the joint RD&D efforts of the industrialized countries. In addition, cooperation with selected developing countries can also hasten the utilization of solar/renewable energy resources.

This option group comprises joint or cooperative RD&D efforts aimed at meeting the solar technology needs of both industrialized and

developing countries, and accelerating the rate at which solar technologies will be utilized worldwide. These activities will materially assist in maintaining or achieving U.S. technological leadership and determining mid- and long-term commercial prospects for various solar technologies.

3.2.3.a Option a: U.S. - Industrialized Countries Cooperation

International collaboration in RD&D serves to reduce the costs of advancing technology and its application to any one nation. Such RD&D activities accelerate the needed work, widen the intellectual base for new ideas and meeting broader needs, and avoid unnecessary duplication and overlap. They also serve to substantiate and verify experimental data and approaches.

3.2.3.a.1 Bilateral, Multilateral Cooperation With Industrialized Countries

The U.S. should enter into new and expanded bilateral and multilateral cooperative agreements in areas of solar technology being actively pursued in national programs, but not covered by existing joint efforts. Such joint efforts could be fruitful in the areas of: desalinization, water pumping, water heating, space heating and cooling, agricultural and industrial process heat, photovoltaics, ocean thermal, wind, solar thermal, and biomass.

In addition to new or expanded R&D cooperation, design information and performance data from solar demonstration projects can be exchanged, thus reducing time and cost of RD&D.

3.2.3.a.2 Major Projects

The U.S. should encourage international participation in major, high-cost projects, thereby reducing the cost to each country. Any such cooperation should be consistent with U.S. commercialization and technical leadership goals. Major projects such as solar-thermal power systems or ocean thermal utilizing advanced technological concepts could lend themselves to such joint efforts.

3.2.3.a.3 Industry Participation

U.S. industry should play a significant role in international joint projects, participating early in the planning stage.

Since industry plays an important role in U.S. government-sponsored RD&D, and makes the products to meet market demands, it is essential that they (a) actively provide advice on the international projects which should be undertaken and (b) participate in the conduct of the projects. Such participation will also provide additional market exposure for U.S. industry and provide additional opportunities for test and demonstration of U.S. developed technology.

3.2.3.a.4 Standards

Efforts should be expanded to develop international performance standards and standardized measurement procedures for various kinds of renewable-energy technologies, processes, and equipment.

International standards are essential for the development of international trade in solar energy products, technology, and services and for meaningful comparison of data generated in various countries. These efforts could best be carried out through existing international organizations for example, the International Standards Organization (ISO).

3.2.3.b Option b: U.S. Cooperation with Developing Countries*

The developing countries span a broad spectrum of technical, financial, and institutional capabilities as well as a range of geographic, demographic, climatic, and other factors. Our interaction with these countries must take all these factors into account. Programs could range from cooperative technical activities (proposed below) to purely assistance activities (set forth in Section 3.3). Of primary importance for the application of solar/renewable technologies in the developing countries is the accommodation of approaches, hardware, and systems which are suitable for their specific socio-economic needs.

3.2.3.b.1 LDC R&D Programs

The DOE solar/renewable R&D program should devote a specified portion of its budget to developing technology, components, and systems designed to meet the specific needs in developing countries.

Such programs must develop systems which have a low capital cost, are readily maintainable, and are suitable to the available skills, materials and social needs of the LDC's. While the DOE program currently pursues many technology areas appropriate to LDC application, the specific hardware and systems are being developed for U.S. conditions.

It is proposed that an RD&D program for LDC's be planned, because the LDC market is expected to be a significant fraction of the total world solar market. Such a program is justifiable on political,

*See also Option Group #3.

economic, and foreign-policy grounds. Such planning cannot be done unilaterally. Rather, countries which intend to participate in the program would be invited to do so. Industry representatives and government laboratories such as SERI would also be invited to assist in developing a program.

3.2.3.b.2 Upper Tier Cooperation

Initiate cooperative R&D activities with the "upper-tier" developing countries having adequate technical capabilities or financial resources to conduct joint efforts of mutual programmatic benefit. For example, as mentioned previously, Brazil has initiated an alcohol-from-biomass-production program which forms the basis for useful cooperation; India is developing flat-plate collector solar-thermal devices; and Mexico has undertaken efforts in photovoltaics.

3.2.3.b.3 Major Oil Exporting Country Cooperation

We should seek additional opportunities to conduct solar RD&D projects jointly financed by the U.S. and oil exporting countries.

The first such agreement with Saudi Arabia has been initiated. Other oil exporting countries, such as Iran, have both the financial capability and the interest to support solar technology development and utilization.

3.2.3.b.4 International Energy Centers

International energy centers, with emphasis on solar/renewable technologies, should be established, financed by the U.S., or in cooperation with other industrialized countries or oil exporters, or

through multilateral mechanisms such as the IEA, CCMS, or UN. Such centers can serve the dual function of technical cooperation as well as technical assistance (mentioned elsewhere). Research, development, demonstration, and testing of regionally suitable equipment may be accomplished there.

The careful planning of the location of the regional energy centers and their functions should be accomplished by the USG with appropriate inputs from industry and the cooperating countries intending to participate. (It should be noted that this concept was earlier proposed in connection with a Caribbean Center and the White House reaction was negative until such time as a global energy strategy is developed to encourage development of indigenous national energy planning capabilities.)

3.2.3.b.5 IEA/LDC Cooperation

We should encourage cooperation between the IEA-sponsored solar/renewable energy research and development program and appropriate oil exporting and "upper-tier" developing countries.

Experience already exists in the NATO/CCMS effort regarding cooperation in energy technology programs between the NATO countries and interested developing countries. Several of these countries have expressed interest in associating with or joining IEA R&D projects. These interests should be encouraged when adequate mutual benefit can result.

3.2.3.c Possible Variations

The two main thrusts of this option, cooperation with other industrialized nations and similar efforts with selected LDC's can be treated somewhat independently.

It is essential that we broaden cooperation with our industrialized partners for the reasons stated in 3.1.3.a. This cooperation can be carried out at any degree of intensity desired and thus can be varied by the number of countries and the number of technology areas we choose for cooperation.

Our efforts in technology development can also be varied in expenditure over a wide range, depending on the priorities assigned.

3.2.4 Consistency With Other Federal Programs

The options on Standards (3.2.3.a.4), LDC R&D (3.2.3.b.1) and International Energy Centers (3.2.3.b.4), are new options. The remaining options discussed above are extensions and expansions of the existing solar international programs and logical modifications suggested by experience with existing programs. Hence, the options are consistent with other Federal programs.

3.2.5 Legislative and Budgetary Requirements

3.2.5.1 Legislation

No new legislative authority is required for the options outlined above. Additional legislation may be required to provide necessary budgetary support and sufficient authority to the agencies to assure a fully coordinated USG approach. These requirements can probably be met through appropriate language in the annual authorizing legislation for agencies involved.

3.2.5.2 Budgetary

During FY 78 the annualized funding rates were: Bilateral, Multilateral Cooperation with Developing Countries, \$488.5 thousand (3.2.3.a.1); Major Projects, \$220 thousand (3.2.3.a.2); Oil exporter Cooperation, \$7.5 million (FY 79) (3.2.3.b.3).

Budget requirements are given below:

Table 3.4 Option Group #2, Technical Cooperation

Estimated Funding Requirements (\$ million)

| Option | Level of Effort | | | |
|--|-----------------|----------------|----------------|----------------|
| | Increased | | Maximum | |
| | 1980(c) | 1980-5 | 1980 | 1980-5 |
| 3.2.3.a.1 Bilateral, Multi-lateral Cooperation with DC's | 1.0 (a) | 5.0 (a) | 1.5 (a) | 10.0 (a) |
| 3.2.3.a.2 Major Projects | 1.0 (a) | 7.0 (a) | 1.5 (a) | 15.0 (a) |
| 3.2.3.a.3 Industry Participation | 0.1 (b) | 0.5(b) | 0.2 (b) | 1.2 (b) |
| 3.2.3.a.4 Standards | 0.5 | 5.0 | 1.0 | 7.0 |
| 3.2.3.b.1 LDC R&D Program | 5.0 | 50.0 | 10.0 | 70.0 |
| 3.2.3.b.2 Upper-Tier Cooperation | 2.0 | 15.0 | 4.0 | 25.0 |
| 3.2.3.b.3 Oil exporter Cooperation | 4.5 | 20.0 | 6.5 | 45.0 |
| 3.2.3.b.4 Regional Centers | 0.5 | 7.5 | 4.0 | 24.0 |
| 3.2.3.b.5 IEA/LDC Cooperation | <u>0.1 (b)</u> | <u>0.5 (b)</u> | <u>0.2 (b)</u> | <u>1.2 (b)</u> |
| TOTALS | 14.7 | 110.5 | 28.9 | 198.4 |

(a) For program planning and integration only. No other additional costs over planned budgets are expected. In some cases project costs may decrease due to sharing with other nations.

(b) For liaison, coordination, and planning.

(c) The 1980 budget would be constrained by staffing considerations. The out-year approximations have been made in the absence of well-defined goals and would normally be refined as these goals are set.

(d) Except for figures noted by (a) and (b), budget figures are total figures.

3.2.5.3 Budget Justification

The current bilateral and multilateral cooperative efforts are budgeted at approximately \$500 thousand for FY 78. This cooperation would expand in both the moderate and maximum cases to include additional technologies and provide increased linkages with the domestic U.S. efforts.

Major projects now consist of two cooperative hardware projects in the design phase. These solar thermal projects are expected to enter the hardware phases and will need increased funds. Should the projects be discontinued, replacement hardware projects are anticipated.

Industry participation in the overall program planning is to be encouraged in order to ensure they will gain the benefits of the cooperative activities. The budget provides for a series of workshops to develop plans and other interactions with industry.

International standards are to be developed to ensure that all manufactured products move easily into the global market. Standards will remove one nontariff barrier that has at times been utilized to restrict imports from specific sources.

The U.S. Government expects to join with the LDC's in solar research and development efforts. The increased level of effort in 1980 permits pilot efforts addressing applications suggested by 2-3 countries and expansion to other applications or additional countries in future years. The maximum level is believed to be a reasonable fraction in relation to U.S. domestic program interests.

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Cooperation with upper-tier LDC's permits initiation of meaningful cooperation with 2 or 3 countries. Cooperation with oil exporting countries was begun with Saudia Arabia and is jointly funded as a 5-year \$100 million bilateral RD&D program. Other OPEC countries have indicated interest in similar bilateral arrangements. This fact is reflected in the budget.

Where suitable, regional cooperation can avoid duplication of effort and reduce overall costs. The increased level FY 1980 allows initiation of plans for the first center. The maximum level anticipates two or three centers and a heavier commitment.

Efforts will be made to interest and promote IEA cooperation with LDC's. Initially, it is expected that these countries would join in relevant ongoing projects.

3.2.6 Implementation Requirements and Organization Roles

The DOE will play the major role with regard to RD&D and, in many cases, commercialization of solar concepts, components, and systems. Close coordination with state, AID, the International Financing Institutions (IFI's) and other development assistance groups (government and private) will be essential.

With the number of systems and components being developed and put into service under the terms of the proposed options, the early involvement of the U.S. private sector is essential.

3.2.7 Probable Impacts and Timetables

3.2.7.1 Energy Impacts

A major impact of the proposed options would be on the developing countries. Significant effects might not be felt until equipment (solar or other renewable) could be installed in large quantities. In general, solar energy applications would be economically viable in LDC's earlier than in industrialized countries.

3.2.7.2 Effects on Competition

These effects are difficult to assess because solar is a fledgling industry. A larger market could lower the per unit production costs in the U.S. for some technologies, and permit U.S. firms to compete more effectively with firms in other countries.

To the extent the U.S. R&D program is successfully aimed at technology for export, the U.S. should have a competitive advantage in world markets.

3.2.7.3 Economic/Employment

Economic benefits to the U.S. could come from increased sales of solar products, technology, and services by U.S. firms to other countries. Benefits may also accrue to the U.S. market in terms of lower manufacturing costs (which may translate into lower solar prices) due to economies of scale. These manufacturing activities are expected to produce increased opportunities for employment in the U.S. General economic benefits through the use of solar products could occur in other nations, especially developing countries.

3.2.7.4 Social Impacts

The social impacts would be most significant in the LDC's. The appropriate applications of renewable-energy-technologies can have the effect of gradually raising the standard of living.

3.2.7.5 Environmental/Health and Safety Impacts

The negative environmental/health and safety impacts should be minimal for technologies like wind, low-head hydro and solar heating and cooling. Such impacts for each of the technologies are being addressed.

3.2.7.6 Regional Impacts

Large regional impacts in the U.S. are not expected in the early years of the application of the above options. As manufacturing of solar and solar-related goods increases, however, the regions involved in this activity should benefit through increased employment. Development and manufacturing of solar technology will be diffused throughout most of the U.S.

In addition, regional impacts in LDC's will be significant as a possible result of solar energy application on migration to urban areas.

3.2.7.7 Other Impacts

Technology cooperation provides an opportunity for the U.S. to lead and initiate in an area of its technical competence, where it has already gained much experience. The opportunities to provide

assistance and conduct research are in line with this experience and technical cooperation generally assists in other bilateral and multilateral forms of international cooperation.

3.2.8 Recommendations

All components of this option group should be approved for initiation. None of them is expensive in the context of overall domestic program costs and some include agreements now in force between the U.S. and other countries. Most of the front-end costs are small and downstream decisions regarding increased commitment are possible.

To the extent that these activities result in making the U.S. developed technology available earlier in the U.S. and foreign markets and contribute to increasing the U.S. share of the total future solar technology market, they could well be the most cost-effective expenditure in the solar budget.

Among the proposed options presented, the following are the most important:

- o Option 3.2.3.b.1 LDC R&D Programs
- o Option 3.2.3.a.3 Industry Participation
- o Option 3.2.3.a.1 Expanded Cooperation with Industrialized Countries

3.3 Option Group #3, Cooperation with Developing Countries

3.3.1 Statement of Need and Opportunity

Most developing countries face a continuing financial crisis caused by oil imports which have widespread impact on development efforts. A U.S. foreign policy objective is to contribute to the social as well as economic advancement of developing countries. The U.S. has the opportunity to help these nations in overcoming energy-related constraints to continued progress. A cooperative assistance effort will:

- o Provide viable alternatives to imported oil and contribute to the appropriate use of other energy sources by better matching energy sources to end use;
- o Reduce financial burdens imposed by oil imports;
- o Support development goals consistent with basic human needs;
- o Slow environmental degradation created by exploitation without replacement of forest resources for fuel use;
- o Stimulate the development and use of energy technologies which may have significant domestic as well as international applications.

Solar technologies have strong potential for meeting many of these needs. For many developing countries, the cost of conventional energy sources is such that solar technologies may already represent an economically viable alternative, in certain locations, and in many other areas it appears that at least some of the energy requirements could be met effectively through these technologies. Such possibilities need more testing in real situations to determine whether solar alternatives can in fact be economically practical in developing countries.

3.3.2 Background

At the Bonn Economic Summit meeting July 16-17, 1978 the participants agreed to intensify their respective development assistance programs in the energy field and to develop a coordinated effort to bring into use renewable energy technologies. As developed during Summit preparations, this initiative will entail a commitment by the Summit nations--and other nations interested in doing so--to:

- o Expand their domestic R&D on renewable energy resource technologies;
- o Increase the field testing and adaptation of these technologies in developing, as well as developed, countries;
- o Support the demonstration and introduction of proven renewable energy resource technologies in developing countries;
- o Expand information exchange and coordination of bilateral programs with developing countries in renewable energy technologies.

3.3.3 Proposed Group #2 Options

PRESIDENTIAL STATEMENT:

The U.S. will undertake a comprehensive program in cooperation with developing countries to support the development and utilization of solar technologies in the Third World. The program would fulfill the U.S. commitments at the recent Bonn Economic Summit meeting to help developing countries overcome their current energy constraints. The developing countries have been particularly affected by the sharp rise of world oil prices and have a great need for indigenous energy sources to help them meet their development goals.

The cooperative program consists of: (1) an enhanced U.S. research and development effort focused on solar technologies that would have application in developing countries; (2) analysis of energy needs and uses of developing countries carried out in conjunction with each country; (3) support for expansion of indigenous technical capability in the developing countries; (4) testing and adaptation of solar technologies in developing countries; (5) demonstration and evaluation of proven solar technologies; and (6) an international program to increase awareness and disseminate information about solar technologies and applications.

It is essential that the U.S. coordinate its efforts closely with other concerned developed nations, particularly through the OECD, and the major international organizations to achieve a well thought-out and integrated program with the Third World. In addition, the U.S. plans to assist LDC solar energy development by encouraging increased funding through the international financial institutions and would improve the capacities of export-oriented solar industries to use the facilities of these organizations. To the extent that commercially viable solar options emerge at this stage, the services of the U.S. export assistance agencies will also be available.

The summit agreement outlined above provides the framework for Option Group #3; Cooperation with Developing Countries. The Option Group consists of:

- a. U.S. research and development efforts in decentralized, renewable energy technologies which would have LDC applications, as described under the technical cooperation option.
- b. Analysis of energy need and resources in LDC's.
- c. Support for expanded LDC indigenous technical capability.
- d. Field testing and adaptation of solar energy technologies in LDC's.
- e. Demonstration and evaluation of proven and applicable solar energy technologies.
- f. Information dissemination and awareness efforts on the possible applications and benefits of solar/renewable energy resources.

The Option Group described above consists of an interrelated package of components, which when taken together comprise a unified approach that the U.S. can pursue in promoting the use of solar technology to meet LDC energy requirements. The option group contemplates variations in emphasis in the mix of discrete initiatives

and funding of each component, but initiatives from each component are desirable to form the package. The program would be closely coordinated with other bilateral and multilateral programs. The coordination could be under an international framework or limited to bilateral exchanges, depending upon the receptivity of other countries to this approach and further USG analysis of this initiative.

In connection with the Summit initiative, the World Bank will be invited to explore ways in which its activities in the energy area can be made more effective and increasingly responsive to the needs of the developing countries. Along with the bilateral program outlined above, the U.S. could also consider various degrees of increased support for the International Bank for Reconstruction and Development (IBRD) and other international financial institution programs supporting solar energy. Policy recommendations and/or expanded funding offered to multilateral institutions for solar activities should be designed to obtain greatest overall benefits.

Set forth below are individual initiatives that support each of the above components of the Option.

3.3.3.a Option a: Domestic R&D for LDC Applications

- o LDC/U.S. institutions and industry in exchanges of personnel;
- o USG research institutions (SERI and others) review U.S. domestic research for applicability in LDC's;
- o DOE solar program to undertake research specifically oriented to LDC applications.

The U.S. has been expanding its solar energy R&D programs with the focus entirely on domestic applications. Many energy problems, how-

ever, might be approached through a somewhat different technology or configuration than for the high-technology inputs generally used in the U.S. U.S. R&D on specific LDC problems can provide direct results for application in LDC's as well as potential applications in the U.S. SERI, as a new and evolving U.S. solar research institution, could play an important, positive role. Presently, U.S. R&D efforts concentrated in decentralized solar energy technologies are still of limited suitability for most LDC applications. An emphasis on low capital costs, easy maintenance, high reliability, and effective installation with respect to LDC applications would also have a positive impact on U.S. domestic solar research.

3.3.3.b Option b: Analysis of Energy Needs and Resources in LDC's

- o Assessment of national energy options for use of available energy resources for meeting current and future needs;
- o Assistance in integrating national energy strategies into overall plans and programs;
- o Participation of or coordination with other nations in carrying out assessments.

The U.S. would expand its present effort to assist developing countries to undertake comprehensive analyses of their energy needs and resources, an effort now in progress in Egypt and Peru. The expanded effort could be implemented by increasing the number of analyses to be undertaken per year, refining the methodology used on the basis of experience and possibly coordinating our program with similar activities undertaken by others, including IFI's, or developing joint approaches where appropriate. The analyses are designed to lay out alternative energy strategies for each country to meet its development goals and would include (1) emphasis on the joint

analysis of renewable energy technologies applicable in these countries, and (2) a closer look at noncommercial energy demand and sources of supply. The analyses would include examining domestic energy resource potential and manufacturing capabilities which might provide the recipient country as much energy self-sufficiency as would be economically sensible. In order to be credible, the analyses must be absolutely objective vis-a-vis various energy alternatives.

3.3.3.c Option c: Support for Expanding Indigenous Technical Capability

- o USG support for LDC educational and research institutions including regional institutions among countries, national institutions, and institutions addressing localized problems;
- o Training for technology and technology support skills at
 - LDC institutions, existing or to be supported
 - USG institutions, to be identified
 - International training center(s), existing or to be established;
- o Provide for an International Renewable Energy Manpower Survey from among participating countries;
- o Encouragement and support for international financial institution programs and projects which emphasize renewable energy technologies and related technical, institutional, and manufacturing capabilities.
- o Encouragement for U.S. industry involvement overseas in selected technical areas to provide new markets for industry and to reduce USG burden of LDC technical build-up.

The implementation of Solar Energy Technology in LDC's is critically dependent upon indigenous technical, institutional, and manufacturing capabilities as well as available resources. The variety of applications and the matching of technologies and end-use needs requires people intimately familiar not only with the

technologies involved but also with local environment, customs, and economy. The lack of indigenous capability is one of the key constraints to utilization of solar energy technologies.

3.3.3.d Option d: Testing and Adaptation of Solar Energy Technologies in LDC's

- o Establishment of common criteria to evaluate renewable energy technologies which would facilitate technology transfer;
- o Provide for gathering and assessment of renewable energy data and identification of elements needed for the systematic installation of applicable solar technology;
- o Increased USG funding of testing and adaptation in LDC's for renewable technologies;
- o IFI and other donor financing of testing and adaption in LDC's;
- o Establishment of international renewable resource center(s).

Solar technologies for domestic applications almost invariably have some application in LDC environments. It is essential that testing in the LDC environment, and adaptation of technology to specific LDC conditions be undertaken. The initiative for Research Center(s) would increase LDC capability to do this, and also provide a technical resource with which U.S. researchers can interact.

3.3.3.e Option e: Demonstration and Evaluation of Proven Solar Energy Technologies

- o Use solar energy technology in U.S. facilities abroad--e.g., International Communication Agency (ICA), State (overseas embassies), AID, DOD--to demonstrate state of the art technology and assist local governments in understanding the benefits of such technology;
- o Assist LDC's in projects demonstrating technology and promoting efforts for importation or local manufacture and installation of hardware;
- o Provide for coordination of efforts by donor countries and other international energy agencies to undertake renewable energy demonstrations in developing countries.

Demonstration and evaluation are key elements of the LDC solar energy option, and at an accelerated implementation decision level, could require sizable funding. The principal constraints to widespread utilization of solar energy technologies in the LDC's are (1) cost effectiveness, (2) knowledge and applicability of solar technologies, and (3) capabilities for accelerated implementation and continued maintenance. Once systems prove cost effective in LDC's, as they already are in certain cases, there will be a substantial increase in demand for these products, which will increase LDC flexibility in making development investment decisions and lessen their demand for conventional energy sources. Technical performance must be proven for the LDC application before sizable solar energy investment can be made, and this requires the demonstration and evaluation effort discussed herein. Such an effort carries with it LDC institution building capability as the LDC's work with as yet unfamiliar technologies.

3.3.3.f Option f: Information Dissemination and Solar Awareness Program

- o Establish a mechanism for regular information exchange among bilateral and multilateral programs and LDC centers. The mechanism could be through either an international center or through bilateral coordination, and preferably should be within an existing institution.
- o Launch a major ICA program to disseminate information about solar energy technologies and energy management. The thrust of the program would address technologies which would be applicable in LDC's, and would include publicity on domestic and international solar energy developments. (See also the corresponding discussion within the technical cooperation option.)
- o Undertake actions in broad international forums to give wide visibility to and gain further support for the solar and renewable energy effort. In particular, two upcoming United Nations activities could provide opportunities to emphasize new or intensified solar energy programs:

- The UN Conference on Science and Technology for Development (UNCSTD), scheduled for Vienna in August, 1979. In preparation for or connection with this Conference, the U.S. should:
 - Make energy one of the priority areas, along with food and health, for U.S. developmental and technical assistance;
 - Make alternative energy technology, particularly solar technology (to the maximum technically warranted extent), a major area for technology transfer initiatives and programs aimed at improving the developing country capabilities in, and increasing their access to, industrial technology;

- The UN conference on New and Renewable Sources of Energy, to occur in 1981 if approved by the UN Economic and Social Council. The U.S. has already supported ECOSOC approval of the Conference. If approved by ECOSOC, the U.S. could:
 - Participate in a leading or major fashion on the panels of experts proposed to deal with the following topics: solar, wind power, biomass (remaining panels will deal with geothermal, oil shale, and tar sands; tidal and wave power, micro-hydropower will not as presently conceived require separate panels);
 - Mobilize a major U.S. effort in both private and public sector to support the Conference and its goals.

Today, many possible cost-effective solar applications are not being used. Increased knowledge about the potential capability of solar energy systems will assist in solving the long-term world energy problem.

3.3.4 Consistency with Other Federal Programs

In general, the above programs would be an extension of existing efforts and are within the mandate of participating agencies. The programs would also assist our domestic efforts because they would provide for cooperative programs, sharing of data, and broader use of renewable energy resources.

Each energy technology and resource must be evaluated in terms of its potential economic and technical application with no particular technology receiving technically or economically unwarranted emphasis. Integration of current and future solar/renewable energy efforts under the aegis of a coherent development strategy for solar energy may involve problems in coordinating technical cooperation programs (primarily between and among industrialized countries) with energy resource assessment and development (primarily involving developing countries). It will be necessary to avoid creating the impression of an "advanced" technology effort for industrialized countries and a separate "appropriate" technology effort for developing countries. Careful crafting of the overall technical strategy can prevent this by making clear the technological connections among all solar energy projects, and by stressing the uniform application of the principle of matching energy source to intended end use. Moreover, to the extent technically justifiable, the U.S. and other industrialized countries should learn about and from indigenous energy technology and resource development activities in developing countries which may have a bearing on potential applications in industrialized countries (especially in decentralized or onsite uses).

In developing country programs, attention must be devoted to integrating assistance in energy resource development into an overall country development strategy. Energy is an important resource which must be available to achieve other purposes.

3.3.5 Legislative and Budgetary Requirements

3.3.5.1 Legislative

The basic mandate to carry out activities described in options 3.3.3.a through 3.3.3.f above is contained in existing legislation. Additional legislation may be required to provide necessary budgetary support and sufficient authority to the agencies to assure a fully coordinated USG approach. These requirements can probably be met through appropriate language in the annual authorizing legislation for agencies involved.

3.3.5.2 Budgetary

FY 78 funding consists of AID's obligations under the Section 119 program at \$19.7 million, the DOE IEDP program at \$3.5 million and an additional \$1.5 million in foreign currency, and other efforts in various USG agencies. For FY 80, the size of already planned USG efforts will expand substantially resulting from shared executive and legislative branch interest in the importance of solar energy. The preliminary estimates of required funding levels described below as the increased level reflect much of the already planned expansion in this area.

The funding at \$75 million for FY 80 will finance an interrelated package of components, all of which are essential to achieving the program objectives. Thus it is exceptionally difficult to disaggregate items in terms of priority. Over the long term, the

success in helping developing countries expand their use of solar technologies will depend on building their own indigenous capability, an effort which should be reinforced as soon as possible. Analysis of needs and resources, and field testing must also move forward soon to set a basis for more widespread utilization of solar technologies.

The internal breakdown of the estimates is as follows:

Table 3.5, Option Group #3 Cooperative Programs

Estimated Funding Requirements(\$ million)

| Option | <u>Level of Effort</u> | | | |
|---|------------------------|-----------------|---|-----------------|
| | <u>Increased</u> | | <u>Maximum</u> | |
| | <u>FY 80</u> | <u>FY 81-85</u> | <u>FY 80</u> | <u>FY 81-85</u> |
| 3.3.3.a U.S. research and development efforts in decentralized renewable energy technologies which would have LDC applications. | | | see Option Group #2 Technical Cooperation | |
| 3.3.3.b Analysis of energy needs and resources in some LDC's. | \$ 7 | \$ 50 | \$ 15 | \$ 80 |
| 3.3.3.c Support for expanded LDC indigenous technical capability | \$15 | \$ 75 | \$ 25 | \$100 |
| 3.3.3.d Field testing and applied research of solar energy technologies in some LDC's | \$20 | \$100 | \$ 35 | \$150 |
| 3.3.3.e Demonstration and evaluation of proven and applicable solar energy technologies | \$28 | \$125 | \$ 45 | \$230 |
| 3.3.3.f Information dissemination and awareness efforts on the possible applications of solar/renewable energy resources. | \$ 5 | \$ 25 | \$ 10 | \$ 40 |
| TOTAL | \$75 | \$375 | \$130 | \$600 |

3.3.6 Implementation Requirements and Organization Roles

The primary agencies involved with this effort are AID, DOE, and State, with participation by ICA, DOC, Peace Corps, and other USG entities. AID, as the agency of the USG for foreign assistance, has the major role in formulating program and project directions in consultation with multilateral donors and in countries where it has a presence. AID should increase its capability to meet proposed energy projects over the period ahead. The DOE is the technical agency of the USG to support this program and its capability will need to be reviewed in terms of applicability to LDC's. State Department's role would be to provide general policy and strategy guidance including coordination with broader political and economic foreign policy input on LDC energy issues. ICA, DOC, Peace Corps and other agencies will carry out programs within their respective areas of responsibility. The USG should enlist the cooperation of private voluntary organizations (PVO's), other donors, the private sector, and the ongoing efforts in LDC's themselves to assure a maximum worldwide effort at solar energy technology development and utilization.

Detailed specification of the roles and responsibilities of departments and agencies requires extensive interagency coordination. This coordination will be addressed in part during the review and evaluation of the IEDP pilot program now in process. The executive branch should prepare an analysis and recommendations for an appropriate organizational structure and responsibility to integrate the U.S. overseas solar effort, leading to a formal organizational and jurisdictional decision.

3.3.7 Probable Impacts and Timetables

The proposed option groups would have the following impacts:

3.3.7.1 Energy Impacts

The impact of the option implementation would depend on future costs and utilization of solar energy, fossil fuels, and nuclear technology. It is likely that solar energy will prove to be cost effective immediately with respect to certain LDC energy uses. Over time with increasing costs of traditional fuels, solar will almost certainly become cost effective for an increasing number of applications in the LDC's as well as industrialized countries.

3.3.7.2 Effects on Competition

The program will encourage the use of renewable energy resources and increase demand for related technology, equipment and engineering. This will contribute to a competitive environment both domestically and internationally which should result in lower costs. It should be noted that much future solar energy equipment will be manufactured by developing countries themselves, and competition for exports from industrialized countries will largely be in the areas of know-how by means of license agreements. The exception will probably be high technologies such as photovoltaics.

In the effort to encourage industrial participation in and contributions to new energy technology demonstration projects, the U.S. government must be aware of and assist the private sector's proprietary commercial interests, both on the part of U.S. firms as well as their foreign counterparts. Joint venture arrangements may be able to overcome some of the problems in this area and should be encouraged.

3.3.7.3 Economics and Employment Impacts

New industries will be developed in the LDC's resulting in greater and more efficient use of labor. Energy efficiency should also increase and there should especially be a beneficial impact on the economic and personal output of areas utilizing the lower cost and more available solar energy. This should also increase GNP of the individual country, lower import costs of oil and thus contribute to the achievement of other development oriented goals.

For the industrialized countries the widespread use of solar energy in LDC's can mean more exports and larger markets than might otherwise develop.

3.3.7.4 Social Impacts

In the developing countries, safe and lower cost energy for rural areas should increase productivity, improve rural life and decrease the continuing problem of urban migration. Also it should increase crop yields and provide more food with resulting better nutrition and health. New industry should also decrease unemployment and result in higher living standards for those directly affected. In addition educational television and improved communication can be brought into the remotest areas via photovoltaics, with potential long-term benefits.

3.3.7.5 Environmental/Health and Safety Impacts

Use of renewable solar energy could decrease the need for nuclear power and associated waste management problems, decrease the use of oil and/or coal and their effects on the environment. For certain developing countries it may slow down deforestation and the resultant

soil erosion and desertification. This will have an indirect benefit on management of water resources. To the extent that climate is being affected by deforestation, an hypothesis suggested but not proven, development and utilization of solar technology, will provide an alternative which could help alleviate the problem.

3.3.7.6 Regional Impacts

These will differ widely. In some areas it will mean use of less firewood, in others more biomass. Some areas richer in solar power will become more desirable for settlement than they had been previously.

3.3.7.7 Other Impacts

To the degree that the developing countries are encouraged to adopt renewable energy technologies to meet their energy requirements, new approaches to overall development planning will probably emerge which may have broad implications for related U.S. policies and programs.

3.3.8 Recommendations

The USG commit itself to pursuing the LDC energy initiative at the maximum funding level.