ENVIRONMENTAL DIMENSIONS OF ENERGY POLICIES

An Initial Research Plan

Project on Natural Systems Assessment for Development
East-West Environment and Policy Institute

The East-West Center
1777 East-West Road
Honolulu, Hawaii 96848

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ACKNOWLEDGEMENTS

The Initial Research Plan presented in this paper is based on the valuable input received from many colleagues in Asia, the Pacific, and the United States. Our special thanks are due to the participants at the Planning Workshop from March 25 - April 6, 1979 whose hard work and co-operation before, during, and after the workshop has greatly shaped this document. These include Mario Berbano, Vraluck Chatarupavanich, Ruth Clusen, Wesley Foell, Efrain Friedmann, John Gilbert, Wong Ki Kang, Brij Kishore, Don MacRae, Ir. Andrini Martono, Shuzo Nishioka, Hugh Saddler, Chun Wai Tsang, and Wahjudi Wisaksono. We look forward to their continued co-operation in the research.

Several Research Associates, Research Fellows and Interns at the East-West Environment and Policy Institute also participated actively at the workshop, and have contributed greatly to this document. These include Research Associates Richard Carpenter, Gerald Marten, Choon-Ho Park, Roy Stubbs and Mark Valencia; Research Fellows Herbert Perera, Ata Qureshi, and Terry Rambo; and Research Intern Tomas Jiménez. All of them are expected to be significantly involved in research in this area.

A special acknowledgement should be made of the contribution made by EAPI Director William Matthews, who has been willing to take time off from his management responsibilities to provide valuable ideas and insights on numerous occasions throughout the preceding year.

Colleagues from the East-West Resource Systems Institute have generously given of their time, and made important suggestions. These include RSI Director Harrison Brown and Research Associates John Bardach, Richard Morse, Kirk Smith and Kim Woodward.

The success of the Planning workshop owed a great deal to the Aloha Spirit provided by Fannie Lee Kai. She and Joan Thomas deserve our thanks for the logistical support required to get this document into your hands. Virginia Jamieson provided great help by preventing red tape from appearing. Thanks are also due to Lyn Mukai, Lorraine Hamada and Renee Tanaka for the many hours they enthusiastically spent in getting this report ready for printing.

In conclusion, we would like to express our appreciation to the many colleagues around the world we could not, due to space limitations, mention by name, but whose valuable suggestions find reflection in this Research Plan.

This document is in reality a joint product of all those mentioned above. Only one name has been put on the cover so that readers will know who is to blame for any errors that appear in the subsequent pages.
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1. Objectives and Evolution of Research Program

There is a high degree of awareness worldwide of the important role of energy availability and use in economic development. Simultaneously, there is a growing awareness of the societal costs associated with the production and consumption of energy. Neither energy, nor environmental quality, are sought for their own sake, but as means towards achieving societal goals such as adequate food, shelter, health, and transportation. Energy policies and environmental policies are reflections of the trade-offs involved in meeting a number of these goals at the same time.

The East-West Environment and Policy Institute (EAPI) is initiating a series of activities, in which it expects to undertake collaborative research with institutions in Asia, Pacific, and the United States. The objectives of this research program on the "Environmental Dimensions of Energy Policies" reflect strongly the nature and mandate of EAPI and the East-West Center (EWC). The goal of EAPI is to undertake projects which demonstrate how understanding of the environmental dimensions of different sectoral policies is essential to assess trade-offs when activities designed to meet human needs may be counterproductive among sectors and over time, since they rely on the same environmental resource base. The Institute does not see its role as an advocate for environmental protection, or for other policies, but as an institution which examines the interrelationships between the biophysical environment and policies such as those for energy or economic development.
The major objectives of the research program in this area are:

(i) to provide policymakers with analyses that explore how the natural resource and environment base of the countries affects, and is affected by, the formulation of national and international policies for energy, and

(ii) to assess methodologies, such as computer models and simulations, for examining the major environmental dimensions of energy policies and make recommendations as to their usefulness in various countries and situations.

The research areas selected for initial emphasis are:

a) Environmental Standards and Energy Policies
b) Environmental Implications of Biofuel Plantations
c) Environmental Aspects of Alternative Energy Conservation and Consumption Patterns
d) Energy Production and Shipment in the Ocean Environment

2. Development of the Initial Research Plan

The goal of the EWC is to promote better relations and mutual understanding among nations of Asia and the Pacific, and the U.S.A. through exchange of knowledge and cooperative research containing transnational problems of mutual concern and consequence. Research projects at the East-West Center are planned, as well as carried out, in very close collaboration with persons and institutions in several countries of the region. The areas of emphasis, the research methodologies, and plan for research are thus jointly devised, and a reflection of the interests and priorities perceived by cooperating scientists and policy-analysts in a number of countries.
The Initial Research Plan presented in this document is a result of individual discussions, meetings, and correspondence covering over a year. The staff member responsible for coordinating this effort -- Dr. Toufiq A. Siddiqi -- as well as several other members of the research team travelled to different countries in the region, from India, Pakistan and Sri Lanka in South Asia, to Indonesia, Malaysia, Singapore, Philippines and Thailand in Southeast Asia, as well as Japan and Australia. The resulting exchanges of idea, as well as discussions with visitors to the East-West Center, were supplemented by written suggestions from colleagues in the region. All of these served as an input to a background paper, and a Planning Workshop, held at EAPI from March 26 - April 6, 1979.

Senior policy-makers and scientists from several countries in Asia and the Pacific, the United States, and the World Bank, were invited to the Workshop to assist in the formulation of a research plan for the initial phase (about 2 years) of the program. Participants from outside the East-West Center were:

Berbano, Dr. Mario
Officer-in-Charge
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Metro Manila, PHILIPPINES

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Chatarupavanich, Mr. Vraluck
Special Grade Engineer
Technical Division
National Energy Administration
Bangkok, THAILAND

Friedmann, Dr. Efrain
Assistant Director
Energy and Fuels
Energy, Water & Telecommunications Department
The World Bank
Washington, D.C.

Clusen, Mrs. Ruth
Assistant Secretary for the Environment
Department of Energy
Washington, D.C.

Gilbert, Mr. John
Senior Investigating Officer
Commission for the Environment
Wellington, NEW ZEALAND
Participants from the East-West Environment and Policy Institute included William Matthews (Director of the Institute) and Research Associates Richard Carpenter, Gerald Marten, Toufiq Siddiqi (Workshop Coordinator), Roy Stubbs, and Mark Valencia, and Research Fellows Lawrence Hamilton, Ata Qureshi, and Terry Rambo. The East-West Resource Systems Institute, with which EAPI collaborates in the development of this research program was represented by its Director, Harrison Brown, and Research Associates Richard Morse and Kirk Smith.

An important outcome of the Planning Workshop was the identification of four priority areas to provide the initial focus of the research program:

a) Environmental Standards and Energy Policies

b) Environmental Implications of Biofuel Plantations
c) Environmental Aspects of Alternative Energy Conservation and Consumption Patterns

d) Energy Production and Shipment in the Ocean Environment

These are described in greater detail in Sections 5-9. Several participants indicated their own interest in collaborating in the planned research, or suggested the names of others in the region who would be likely to be interested in such an effort.

3. Resources Available for Implementing the Research Plan

Projects undertaken at the East-West Center are of a collaborative nature, and in most cases the research undertaken in each country is funded by that country. The Center provides a small core of research and support staff, which can also take on the responsibility for coordinating a multi-institutional research program. In addition, EWC provides funding for visiting fellows, research interns, professional associates, and graduate students for periods varying from a few days to several years. Details about this are given in Appendix 4.

The Environment and Policy Institute has two major ongoing projects:

(i) Natural Systems Assessment for Development

(ii) Marine Environment and Extended Maritime Jurisdictions

The research area on the "Environmental Dimensions of Energy Policies" is a major component of the Project on Natural Systems Assessment for Development. It is expected that the Institute will provide resources during each of the next two years to support the following level of participation for research in this area, and that this level could be expanded considerably depending on the potential for collaborative work by other institutions and for external funding: 2-3 person years of core
and visiting research staff effort, a similar amount of effort by research interns and graduate students, and at least one meeting or conference related to the research work each year. Funds for publishing the research findings, and for travel are also expected to be available.

The resources mentioned above do not include the substantial expertise available, in selected areas, from the staff and participants working on the "Marine Environment and Extended Maritime Jurisdictions" project, as well as the energy-oriented projects at the East-West Resource Systems Institute. It is also anticipated that, as the research program outlined here develops, and needs arise, additional funding may be sought from foundations, international organizations, and bilateral assistance agencies.

4. The Policy Context for the Planned Research

The sharp rise in energy prices during 1973-74 provided a substantial incentive for many countries to formulate comprehensive national energy policies. This has turned out to be a much more difficult task than originally anticipated, since the full extent of the interaction between policies for energy, and other sectoral policies, was not fully appreciated. Almost every action which could be taken will benefit some groups at the expense of others. As an example, cutting back on energy imports would help reduce the balance of payments deficits, but could also reduce the output of many industries.

The resources available to societies are finite, and a large part of policy-making involves compromises in which the demands of all the interest groups can only be met partially. It has sometimes been suggested that we can either have sufficient energy, or a good environment, but not both. Fortunately, the situation is rarely that simple. Societies neither want
energy for its own sake, nor a pristine environment where each species can thrive in isolation. Adequate supplies of energy, and a sustainable environment are considered important in so far as they contribute to the material and spiritual well-being of Mankind.

The industrial revolution was based on man's ability to supplement his own physical energy with that derived from coal. The environmental impacts associated with the increased use of energy became apparent fairly early, but were accepted as a price to be paid for the increase in material welfare. Only in the last decade or two have large segments of affluent societies seriously questioned whether the accumulative costs to their own health, and to the long-term sustainability of the resource and environment base, may not be getting too large. Several countries have passed and implemented legislation to protect and enhance environmental quality. In many cases, such legislation led to switching from more polluting fuels such as coal, to relatively cleaner fuels like natural gas and oil.

The dramatic jump in oil prices five years ago, coupled with concern about dependence on imported oil, led to the re-examination of energy policies in most countries. Initial fears that the environmental gains of the preceding years would be sacrificed in the name of energy self-sufficiency have thus far proved to be ill-founded. The goals of energy policy in the more industrialized nations included the need to reconcile it with the aim of attaining acceptable levels of environmental quality. Representative of such concern was, for example, the message sent by President Carter to the U. S. Congress\(^1\), in which he stated:
In countless ways, our environment is affected by the production, distribution, and use of energy. Some of these — for example the need to control oil tanker pollution and the need to restrict plutonium technology — I have already discussed in specific messages to the Congress. Others are implicit in my energy proposals, since the act of reversing our present wasteful energy practices will itself have many beneficial consequences for the environment. The transition to renewable energy sources, particularly solar energy, must be made. But it will take time. Meanwhile, we should satisfy our energy needs from existing sources, both fossil and nuclear, in a safe and environmentally acceptable way .... The decisions we make about energy in the next few years will influence the environment of our country for generations.

In a similar vein, the "Goals and Guidelines" document\(^{(2)}\) issued by the New Zealand Minister of Energy states that a prime goal of the energy sector should be "to ensure a balance between the adverse environmental effects of energy developments and their benefits."

An even stronger expression\(^{(3)}\) of environmental considerations in the formulation of energy policy was made by the Australian delegation at a recent ESCAP meeting in Bangkok. Under the heading of "Overriding National Objectives", their paper states:

Energy goals of course are subservient to national objectives for increased economic and social welfare and for protection of the environment and security of the country. Progress towards energy conservation or energy self reliance is often achieved only at the expense of 'living standards' or environmental quality, and an energy policy which fails to recognize and measure these interactions could be damaging or ineffectual.

The United Nations Conference on the Human Environment, held at Stockholm in 1972, greatly helped to increase awareness in the Developing Countries that environmental problems were not restricted to the more affluent nations. In recent years, expressions of such concern have been frequently included in statements of energy policy in the less-industrialized countries as well. The policy objectives of the Philippine Ten-Year Energy Development Program\(^{(4)}\), for example, are to support national economic and social development by:
- providing adequate and secure energy supplies in the forms that the markets require,
- promoting judicious and efficient consumption of energy, and
- ensuring that levels of supply and utilization activities are environmentally acceptable.

One of the basic objectives of energy planning in India (5) is "to ensure that energy production and utilization do not lead to adverse impact on ecology and to pollution of the environment." Similarly, the conclusions of the Indonesian National Committee to the World Energy Conference (6) state that, "In the implementation of using all forms of energy sources, attention needs to be paid and sufficient steps need to be taken to protect and conserve the soil and the environment."

The policy statements presented here are only a sample of similar views expressed in most countries of the world. It is clear that the concern to assure adequate energy supplies at reasonable cost is a global one, and it is increasingly evident that people in developing as well as developed countries feel that goals of environmental improvement and protection should be simultaneously followed.

5. Initial Areas of Research

The major interactions between environmental concerns and energy policy in each nation are, of course, different, and reflect the circumstances in that country. A number of such interactions are, however, of interest to several countries, as shown in Matrix form in Table 1. Many of these concerns were discussed at considerable length during the Planning Workshop, before the priority areas for initial research were finalized. In addition to the substantive importance of the research areas, some
Table 1: Illustrative Environmental Concerns with Significant Effects on National and Transnational Energy Policies

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>Deforestation</th>
<th>Alternate use of animal and agricultural wastes</th>
<th>Environmental effects of hydroelectric plants</th>
<th>Marine effects of oil production and shipment</th>
<th>Effects of coal mining and combustion</th>
<th>Shipments of LNG Tankers</th>
<th>Disposal of nuclear wastes</th>
<th>Disposal of dissolved solids from geothermal power plants</th>
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additional criteria were also considered in the selection of priorities. It was required that the research

(i) be of interest to several institutions from different countries in the region who would collaborate on it,

(ii) be policy-oriented, rather than technology-oriented, and

(iii) have the potential for providing useful input to decision-makers who will formulate and implement national and transnational policies over the coming 3-4 years.

The areas identified as initial priorities are briefly described here, and discussed in greater detail subsequently.

a) Environmental Standards and Energy Policies

Some countries in the region, e.g., Japan (6) and the U.S.A. (7) have established fairly stringent standards for air and water quality. These have had a substantial impact on energy policies, such as Japan's decision to import large amounts of liquified natural gas, and the decision by several electric utilities in the U.S.A. to opt for nuclear fission reactors rather than coal-fired power plants. As the availability of energy in some forms, e.g. oil, has decreased and the price of energy increased, there is considerable pressure to ease some of the environmental standards.

The collaborative research effort in this area will be directed towards examining for energy-conversion related standards:

(i) the criteria underlying the somewhat different environmental (primarily air-quality) standards set in different countries,

(ii) the approaches to benefit/cost analyses utilized in the setting of such standards, and

(iii) the interaction between environmental standards and energy policy in several countries of the region.
A conference to assess our present state of knowledge regarding the above issues, and defining possible avenues of research, will be held at the East-West Center and is tentatively scheduled for March 9 - 21, 1980.

b) Environmental Implications of Biofuel Plantations

Fuelwood is the largest source of energy in most of the rural areas of the developing countries. Present practices to obtain fuelwood have led to deforestation in many areas, with serious environmental consequences. Attempts are being made in several countries to develop sustainable fuelwood plantations. The results so far, both in terms of meeting energy needs, and their effects on the environment, need to be evaluated. Some of the more affluent countries in the region, such as Australia, New Zealand, and the U.S.A., are interested in converting biomass into liquid fuels.

The focus of the collaborative research will be on the environmental characteristics of different biofuel production systems, including aspects such as alternate uses of land and water, effects on soil fertility and impact on the surrounding ecosystem. The research will be closely coordinated with other ongoing work on tropical forest land use at the EAPI, and with the project on energy and rural development at the Resource Systems Institute (RSI).

The Institute is exploring the possibility of holding a conference in Asia sometime during 1980, to bring together researchers from the different countries where such biofuel plantations exist, and are being assessed.

c) Environmental Aspects of Alternative Energy Conservation and Consumption Patterns

As the availability of oil decreases, and its cost increases, countries are turning to other fuels to meet their energy needs. The particular mix
of energy sources they adopt will have significant implication for environmental quality. Also, some strategies for conserving energy, such as co-generation of heat and electricity, may have significant environmental implications, such as closer location of power plants to the population or industry wishing to use the heat as well as the electricity.

During the last few years, several computer models have been developed, which study various aspects of the energy-environment interaction. EAPI is examining the possible application of suitable models to different regions in Asia and the Pacific. Preliminary discussions have been held with Dr. Wesley Foell of the University of Wisconsin, who led the groups there and at the International Institute for Applied Systems Analysis (IIASA) in developing a model to assess alternative energy/environment futures. The model has been successfully used in Europe and the U.S.A., and is presently being adapted for use in Mexico. A small workshop to explore the initial application of the Model to one or two countries in Asia is tentatively planned for early 1980.

d) Energy Production and Shipment in the Ocean Environment

The role of oil in the economy of the industrialized nations, as well as in the urban areas of less-developed countries, is of great importance. It is also the largest single item in international trade. Increased production of oil and gas in offshore areas, and increased tanker traffic, has raised concern about the possible effects on the environment due to accidents such as that of the Amoco Cadiz. A number of countries have declared safety standards for drilling, production, and shipment of oil and gas in their territorial waters. The extension of these varying standards to the 200 nautical mile Exclusive Economic Zones could lead to possible changes in transportation routes, tanker construction and operating
procedures, and energy policies in nations trading in oil, liquified
natural gas (LNG), or nuclear fuel. Research on some of these implications
will be undertaken, in close consultation with the EAPI project on the
"Marine Environment and Extended Maritime Jurisdictions" (13), whose planned
activities for next year include a workshop on energy policies, marine
transportation of potential pollutants, and environmental policies in the
Exclusive Economic Zones, tentatively scheduled for the summer of 1980.

Each of the four areas of research mentioned above will be discussed in
greater detail on the following pages. Participants at the Planning Workshop
expressed their own personal interest in collaborative research in particular
areas. Their names and areas of research interest are listed below.

Dr. Mario Berbano  (a, d)*
Mr. Vraluck Chatarupavanich  (a, b)
Dr. Wesley Foell  (a, c)
Mr. John Gilbert  (b, d)
Dr. Wong Ki Kang  (a, c)
Mr. Brij Kishore  (b, d)
Dr. Don MacRae  (c, d)
Ir. Andrini Martono  (a, b)
Dr. Shuzo Nishioka  (a, c)
Dr. Hugh Saddler  (b, c)
Dr. Chun Wai Tsang  (a, c)
Dr. Wahjudi Wisaksono  (a, d)

*a - Environmental Standards & Energy Policies
b - Environmental Implications of Biofuel Plantations
c - Environmental Aspects of alternative Energy Conservation
   and Consumption Patterns
d - Energy Production and Shipment in the Ocean Environment
6. Environmental Standards and Energy Policies

General Issues

The deterioration of air and water had become a national issue in many industrialized countries by the late 1960's, and led to the passage of legislation such as Japan's "Basic Law for Environmental Pollution Control" (1967), and the U.S. "National Environmental Policy Act" (1969) and the "Clean Air Act Amendments" (1970). Such laws led to the definition of acceptable air and water quality (ambient standards) as far as particular pollutants were concerned, and to limitation on emissions of pollutants from both stationary sources (e.g., power plants, refineries) and automobiles. They have had a significant impact on energy policy by affecting the choice of sources of energy in different areas, the location of facilities, and changes in international energy trade.

In the case of Japan, for example, the contribution made by coal to total energy use dropped from 50% in 1955 to 3.2% in 1977.\(^{(14)}\) Also, the demand for low-sulfur oil resulted in greatly increased imports from Indonesia, at the expense of imports from Kuwait. Partly as a result of rising demand for its premium oil, Indonesia imports higher sulfur crude for its own use. The need to meet air quality standards in several parts of the U.S. also played an important part in the decision by many electric utilities to order nuclear- rather than coal-fired power plants.

There are, of course, economic costs associated with the efforts to clean up the air and water and these costs are significantly affected by the levels at which the ambient and source emission standards are set. The primary benefits are in terms of human health improvements, supplemented by a
reduction in damage to crops, homes, etc. Various approaches (15), (16) have been tried to assess the benefits and costs associated with pollution control, and each has its strengths and weaknesses. The fact that different countries have come up with somewhat differing environmental standards (Tables 2 and 3) is an indication of the variances in methodology, assumptions made, or the data used.

Several countries in Asia and the Pacific are in the process of setting environmental standards, and interested in examining the process and rationale by which such standards have been set, and the implications for health and economic development which they have had. The Workshop Participants' group on standard-setting felt that, in addition to health and economic factors, the social and organizational context in which technical procedures and carried out also needed to be examined. It was considered likely that administrative procedures covering standard-setting would become more complex, as additional data from social- and economic-oriented agencies was incorporated.

It was suggested that the implications of setting different standards for different parts of the country be investigated, -- a power plant located at the tip of a peninsula, with the prevailing winds such that the pollution will be blown out to sea might not require as stringent emission controls as a power plant located close to a population center.

The whole area of environmental standard-setting was identified as one deserving a very high priority, but the consensus that emerged was to concentrate initially on air quality standards related to energy conversion and thermal discharges into water. These would include ambient standards for Carbon Monoxide, Hydrocarbons, Nitrogen Oxides, Sulfur Oxides, Particulates, and Ozone, as well as emission standards for power plants, oil refineries and automobiles.
<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Japan (7)</th>
<th>Philippines (18)</th>
<th>United States (19)</th>
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<tbody>
<tr>
<td></td>
<td>(primary standards).</td>
<td>(primary standards).</td>
<td></td>
</tr>
<tr>
<td>Particulate Matter</td>
<td>100 μg/m³ (ave in 24 hrs)</td>
<td>180 μg/m³ (24-hr exposure time)</td>
<td>260 μg/m³ (24-hr average)</td>
</tr>
<tr>
<td></td>
<td>200 μg/m³ (any hourly value)</td>
<td>250 μg/m³ (1-hr exposure time)</td>
<td>75 μg/m³ (annual geometric mean)</td>
</tr>
<tr>
<td>Sulfur Oxides</td>
<td>0.04 ppm (daily ave of hourly values)</td>
<td>0.14 ppm (369 μg/m³) (24-hr exposure time)</td>
<td>365 μg/m³ (0.14 ppm) (24-hr average)</td>
</tr>
<tr>
<td></td>
<td>0.1 ppm (any hourly value)</td>
<td>850 μg/m³ (0.3 ppm) (1-hr exposure time)</td>
<td>80 μg/m³ (0.03 ppm) (annual arithmetic mean)</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>20 ppm (ave of 8 consecutive hourly values)</td>
<td>9 ppm (10 mg/m³) (8-hrs exposure time)</td>
<td>10 mg/m³ (9 ppm) (8 hrs averaging time)</td>
</tr>
<tr>
<td></td>
<td>10 ppm (ave of hourly values in 24 hours)</td>
<td>30 ppm (35 mg/m³) (1-hr exposure time)</td>
<td>40 mg/m³ (35 ppm) (1-hr averaging time)</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>0.02 ppm (daily ave of hourly values)</td>
<td>0.10 ppm (190 μg/m³) (1-hr exposure time)</td>
<td>100 μg/m³ (0.05 ppm) (annual arithmetic mean)</td>
</tr>
<tr>
<td>Photochemical Oxidants</td>
<td>0.06 ppm (hourly value)</td>
<td>0.06 ppm (120 μg/m³) (1-hr exposure time)</td>
<td>240 μg/m³ (0.12 ppm) for Ozone (1-hour mean)</td>
</tr>
<tr>
<td>Hydrocarbons (non-methane)</td>
<td>---</td>
<td>---</td>
<td>160 μg/m³ (0.24 ppm) (3 hours averaging time)</td>
</tr>
</tbody>
</table>

(Source: T.D.P. Jimenea, Ref. 17)
Table 3. SELECTED STATIONARY SOURCE EMISSION STANDARDS

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Japan</th>
<th>Korea</th>
<th>Philippines</th>
<th>Singapore</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur Oxides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>q = kx10^-3 He^2</td>
<td>q - hourly volume (in Na^3)</td>
<td>q = hourly volume (in kN)</td>
<td>q - hourly volume (in kN)</td>
<td>q = hourly volume (in kN)</td>
<td>q = hourly volume (in kN)</td>
</tr>
<tr>
<td></td>
<td>1800 ppm (equivalent to 4.7 g/m^3)</td>
<td>1500 mg/scm (as SO2)</td>
<td>Any source excluding sulfuric acid manufacture</td>
<td>0.1 g/Nm^3 (as SO3)</td>
<td>Any source other than sulfuric acid manufacture</td>
</tr>
<tr>
<td>Nitrogen Oxides</td>
<td>Stack gas volume 1a 170 ppm 40,000 Na^3/hr</td>
<td>250 ppm (equivalent to 0.5 g/m^3)</td>
<td>Any source</td>
<td>1.0 g/Nm^3 (as NOx)</td>
<td>Any source not manufacturing nitric acid</td>
</tr>
<tr>
<td></td>
<td>480 ppm 100,000 Na^3/hr 600 ppm</td>
<td>new [gas fuel]</td>
<td>2 g/scm (as NOx)</td>
<td>2.0 g/Nm^3 (as NOx)</td>
<td>86 ng/J (0.20 lb/10^6 BTU) (Gaseous fuels)</td>
</tr>
<tr>
<td></td>
<td>480 ppm 750 ppm 180 ppm 280 ppm</td>
<td>new [solid fuel]</td>
<td>new [solid fuel (low grade coal)]</td>
<td>new [liquid fuel]</td>
<td>Any source not manufacturing nitric acid</td>
</tr>
<tr>
<td></td>
<td>varied values</td>
<td>new [gas fuel]</td>
<td>new [gas fuel]</td>
<td>new [gas fuel]</td>
<td>(b: there are exceptions for special cases)</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>new [gas fuel]</td>
<td>new [gas fuel]</td>
<td>new [gas fuel]</td>
<td>(b: there are exceptions for special cases)</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>400 ppm (equivalent to 457 mg/m^3)</td>
<td>500 mg/scm</td>
<td>Any industrial source</td>
<td>1.0 g/Nm^3</td>
<td>Any industrial source</td>
</tr>
</tbody>
</table>

* Na^3 - Normal cubic meter (amount of dry gas occupying a cubic meter at zero degree Centigrade temperature and at atmospheric pressure).
** scm - Standard cubic meter (equivalent to Na^3).
(Source: T.D.P. Jimenez, Ref. 17)
Participants at the EAPI Planning Workshop identified several research questions which would be of great interest both to countries on the verge of setting standards, as well as those which have had standards for some time, and would like to compare their experience with other nations. The research question identified as having a high priority are listed in the next section.

**Research Questions**

- What approaches are being adopted by the different countries in the region for the setting of environmental standards?
- What criteria are being used to assist in the setting of standards? How adequate are the dose-response data available?
- How are the benefits and costs associated with the setting of different standards being calculated? What assumptions are being made?
- To what extent has the establishment of environmental standards affected the fuel mix in the countries setting the standards?
- Has the setting of standards affected the siting decisions of industry?
- Have standards within a country been changed over time? What were the considerations leading to the change?
- What are the difficulties in the implementation of the standards which have been established?
- Are the levels of air pollutants crossing international frontiers already high enough in the region to make it desirable to take a regional approach to the setting of standards, for example, for Sulfur Oxides and Particulates?
- What would be the implications of adopting a regional approach to both air and water quality standards in particular areas, for example around the Straits of Malacca?
Implementation

Participants at the Planning Workshop suggested that a state-of-the-art survey of standard setting in Asia, the Pacific, and U.S.A. be conducted, focusing on the questions listed in the preceding section. They recommended that a co-ordinator be designated at EAPI, to help put together such a survey in a manner which would facilitate comparisons between approaches.

Work in this area has already been initiated at EAPI. The following research staff and participants (See Appendix C for brief biodata) are expected to contribute to this area during 1979-80:

Research Associates: Toufiq A. Siddiqi (Co-ordinator)
                    Richard A. Carpenter
                    Roy C. Stubbs
Research Fellows:    John P. Holdren
                    Maynard Hufschmidt
Research Intern:     Tomas D. Jimenea

In addition, Dr. Kirk Smith, Research Associate and Co-ordinator of the Energy Project at the Resource Systems Institute, is also expected to participate in research in this area.

A Conference on "Environmental Standards and Energy Policies" is tentatively scheduled to be held at the East-West Center in Honolulu from March 9-21, 1980. About 15 participants from Asia, Pacific, and the U.S.A. are expected to present papers covering the questions listed in the previous section, and to identify avenues of further research. The papers, as well as the discussion, are expected to be published, to provide a state-of-the-art survey of those environmental standards which significantly affect energy policies.
EAPI will provide accommodation and a modest daily allowance for invited participants. Cost sharing is encouraged, but travel expenses for participants from the region may also be available in some cases. Researchers or policy-makers interested in presenting a survey of various aspects of environmental standards are requested to write to the conference co-ordinator, Dr. Toufiq Siddiqi, as early as possible. Participation will not be limited to countries which have already set a number of environmental standards. Papers by authors from other countries considering the setting of such standards can focus on the perceived need for the setting of standards, expected benefits and costs associated with them, and likely approaches to implementation.

After the conference, and the expected publication of the survey, it is expected that further collaborative research will focus on the needs identified at the conference.

Readers of this Research Plan, who are interested in collaborative research on environmental standards related to energy policy, are strongly urged to make their interest known to Dr. Toufiq Siddiqi at EAPI. Those working on the administrative and organizational aspects of standard-setting are invited to write to Dr. Roy Stubbs, who is undertaking research in that area.
Biofuel Plantations

General Issues: Fuelwood

Fuelwood was the major source of energy all over the world until about a hundred years ago. Its role in the energy economy of the industrialized nations is very small, but it remains a major source of energy for many of the world's less developed countries. It is estimated that fuelwood supplies about 24% of the total energy consumed in the developing countries, as opposed to about 0.8% in the industrialized nations. In some countries, especially in the rural areas, over 90% of all energy used may be in the form of fuelwood.

The total amount of fuelwood consumed in the developing countries during 1974 was about $1.30 \times 10^9$ cubic meters. In Asia alone, the consumption was about $0.79 \times 10^9$ cubic meters, with an energy content estimated at $7.64 \times 10^{18}$ joules. It would require 1.25 billion barrels of oil per year to provide an equivalent amount of energy. Even if one could assume that the supply of oil could be guaranteed, the cost of this would be about $18$ billion per year for the oil alone. A larger amount would probably be required to provide the furnaces to burn the fuel, and to build the distribution system to the rural areas. Given the capital shortages and the technical difficulties involved, it is unlikely that the rural areas of Asia will switch to an energy source other than fuelwood for meeting most of their energy needs, at least in the next decade or two.

Population growth, as well as rising awareness of the need for better nutrition in the developing countries, are likely to even increase the demand for fuelwood. The implications of this are worthy of serious examination. It has been estimated that current practices are causing about 5 million hectares of forest to be "lost" each year in Asia alone. Even
with no growth in demand, at this rate the remaining tropical forests would be consumed in 60-80 years, and with increased population, in about 40 years. Forests could quite possibly be a self-generating resource if properly managed, but there has been a historical tendency to over-exploit them at too rapid a rate, and this can have serious ecological and social consequences.

The large scale removal of forest cover frequently leads to rapid water run-off, soil erosion, silting, and flooding in the rainy season, followed by reduced down-stream flows in dry weather with its impact on agricultural production. A well-documented example of increased flooding is in the Indus River system, where the incidence of flooding in the last 25 years has been far higher than in the previous 60 years\(^{(24)}\). In a lengthy letter\(^{(25)}\) sent to the Chief Ministers of 23 States, Prime Minister Morarji Desai of India recently wrote:

The main contributing reason for the recent floods were deforestation, shifting cultivation, overgrazing, improper cropping of undulating land, bunding (embankments) without vegetative cover, plugging of natural drains, failure to provide scientific drainage, and the poor soil and water management.

He urged them to "take up tree planting on a massive scale" and to "work out concrete programs for soil and water management, afforestation and other activities to protect and strengthen India's ecological endowment."

As Erik Eckholm\(^{(26)}\) has pointed out, the most severe effect of fire-wood scarcity in the Indian subcontinent may not be the destruction of tree cover itself, but the increased use of dried cowdung as a fuel. The use of dung in amounts estimated to reach up to 400 million tons (wet weight), deprives the agricultural land of desperately needed nutrients and organic matter. The nutrients wasted in this manner in India alone amount to more than a third of the country's use of chemical fertilizers. In addition, organic materials play an important role in preserving soil structure and
fertility. They hold the soil in place, reducing erosion from wind and rain, and the run-off of chemical nutrients. This is especially important in tropical areas, where the topsoils are usually thin and particularly prone to erosion, loss of structure and fertility.

The increased time required to gather firewood in many hillside villages of Nepal is similarly causing farmers to use cowdung as fuel. The fertility of the hills, already declining due to soil erosion, will drop further, since in most cases, no chemical replacement of natural fertilizers is possible in those remote areas. This resulting decline in food output, it is feared, will lead to the clearing of even larger, steeper, tracts of forest -- worsening the erosion and increasing landslide hazards. The National Planning Commission of Nepal feels that, if present trends continue, a "semi-desert type of ecology in the hilly regions" will be created (27).

A similar chain of events is taking place on varying scales all along the Himalayan foothills, extending from Afghanistan through northern Pakistan, India and Nepal to Burma. The impacts are not restricted to the foothills, but spread out for hundreds of miles. The eroded soil carried away by the rivers is filling up dams and reservoirs at a much faster pace than originally expected, reducing the capacity of irrigation channels to carry water, and contributing to the increased frequency of flooding in the subcontinent.

There is some debate on whether the severe environmental effects associated with deforestation along the Himalayan foothills are evident in other parts of Asia and the Pacific. There is some evidence of this happening in Java, where it has been estimated that up to 80 million tons a year of precious topsoil is being washed away (28), as population-, food- and energy pressures drive the inhabitants further up the hills.
During the last few years, there has been a rapid build-up of interest in many countries for introducing "fuelwood plantations" on some type of suitable basis. In addition to national programs, such as those in the Philippines, funding agencies like the World Bank(29) are now giving substantial emphasis to "energy farms." In projects financed or to be financed by the Bank in the period 1976-80, fuelwood components are included in 14 out of 34 forestry projects, and in 11 out of 22 rural development projects with forestry components. The approach in these is to plant species which grow several times faster than local ones, after several trials of different species on local soils. It is estimated that one hectare of such plantations can provide enough fuel for 15-20 people, at a planting cost of $100 per hectare. The largest project of this type is in Korea, which at completion will have 50,000 hectares of trees on denuded hills too steep for agriculture. Part of a multi-purpose agricultural project, 70 per cent of the trees will be used for fuelwood and 30 per cent for timber(30).

The United States is also cooperating with several developing countries in attempting to prevent and mitigate the effects of deforestation. Such programs were given a boost by the passage of the "International Development and Food Assistance Act of 1977" (Public Law 95-88) which authorizes the President of the United States to help strengthen the "capacity of less developed countries to protect and manage their environment and natural resources." The Act places special emphasis on research and development of decentralized, renewable energy sources for rural areas and on energy technologies which are environmentally acceptable, and are simple and inexpensive to use and maintain.

Increased U.S. concern is also shown in the programs of the Agency for International Development, which is now giving high priority to tropical
forest management and restoration activities. The projects proposed by AID for FY 1979 to the Congress include several in this area, including an agri-forestation project in the Philippines for hillside farmers now practicing destructive shifting cultivation (31).

The Department of States' Bureau of Oceans and International Environmental and Scientific Affairs (OES) has also initiated an internationally co-ordinated program to further the protection, management, and rehabilitation of the world's forest resources. The program includes the promotion of more extensive ecological research in tropical forest regeneration, fast growing species, and the role of forests in the CO₂ cycle. (31) The State Department and AID sponsored a "U.S. Strategy Conference on Tropical Deforestation" in June, 1978, to review the status and trends of deforestations, examine present U.S. and international programs, and propose specific steps which can be taken by U.S. organizations, both governmental and nongovernmental.

The environmental implications of introducing biofuel plantations with species usually different from native ones, have not been adequately analyzed. The impact on the ecosystem does not have to be an adverse one -- it is quite likely that the effects of such plantations will be quite beneficial, if the land had previously been denuded or heavily degraded (32). However, if the biofuel plantation is to be raised on existing forested land, on a clear-felling silvicultural system, the implications for water resources, soil erodibility, soil fertility, the effects on wildlife, etc. need to be examined carefully (33).

**Liquid Fuels from Biomass**

Recent increases in the price of oil have enhanced interest in many countries in exploring the possibility of cultivating biomass plantations for the production of liquid fuels. Australia (34), New Zealand (35) and
the U.S.A. are among the countries undertaking research in this area. Among the techniques under investigation are:

(i) The fermentation of carbohydrate-yielding crops to ethanol.
(ii) The conversion of woody materials into ethanol by either acid hydrolysis or enzymatic digestion, followed by fermentation.
(iii) The pyrolysis of biomass to convert it to a fuel gas followed by the catalytic conversion of the gas to methanol.

The ethanol and methanol can be used as transportation fuels. With present-day automobile engines, a blend containing gasoline with up to 15% methanol, or 20% ethanol, can be used. The economics of the processes involved have been such as to make these synthetic fuels non-competitive, unless heavily subsidized as is the case in Brazil.

In the United States, one of the options considered economically more attractive is the production of ethanol from sugarcane in appropriate locations. It is estimated that about 10 Tonnes of ethanol could be produced from one hectare of good sugarcane land. About 4 million hectares would be required to obtain $10^{15}$ Btu of energy, or about 5% of the energy used for transportation in the U.S. Hawaii already has substantial sugarcane acreage, and some of the bagasse is being used to fuel a small (20 MW) electric power plant. Florida, Louisiana, and Texas all have the climate and substantial land area that could be converted into sugarcane farms. This would require adjustments to the water supply. Soil conservation would also be a major concern in any such system of intensive agriculture. Studies of mass balance and energy input-output would also need to be undertaken for specific systems. New technologies may be required to minimize
the environmental impacts associated with the run-off of fertilizer and pesticide, as well as to conserve water.

**Research Questions**

Participants at the Planning Workshop considered this an area of high research priority for the region, and recommended that a collaborative research plan be initiated. It was felt that it would be impractical and undesirable to examine the physical and biological implications of energy plantations in isolation from socioeconomic issues, such as the demand for fuelwood, land utilization practices, etc. The questions listed below would provide the focus for initial research:

- What is the actual extent and present status of the natural forest resource in each country, i.e., land which actually has a forest cover, rather than legally defined as forest but with no tree cover?

- How much degraded and denuded land is available for forestry, or rural community woodlot projects?

- Where and to what extent is the use of wood as a fuel responsible for deforestation?

- Could species and provenance trials determine what high-yielding exotic, or even indigenous, fuelwood plantations could be raised on marginal lands?

- What is the location of the lands being considered for biofuel plantations? The tampering of even a few acres of natural forests for fuelwood, in strategic areas such as river catchments could have a substantial impact on thousands of acres in the plains.
What are the current and projected demands for fuelwood and liquid fuels in the different countries? How much of this can be met from biofuel plantations?

What has been the experience with biofuel plantations so far? How sustainable has been the yield? What inputs of energy and minerals have been required under different circumstances? What was the net energy gain? What have been the effects on the surrounding ecosystem? How have the benefits and costs for such plantations been assessed?

What type of research e.g., species and provenance trials was undertaken before a biofuel plantation was started? Were studies made to examine susceptibility to various pests, and the possibility of these pests spreading to other crops? Was the possible introduction of harmful human or domestic animal pathogens examined?

What is the efficiency with which energy from fuelwood is utilized? To what extent could more efficient use, such as pre-drying or better cooking stoves, be paid for by reduced consumption of fuelwood and decreased environmental damage costs?

What is the degree of professional forestry management necessary for cultivation, protection, and harvesting?

What type of ownership and financing arrangements may be most suitable under different conditions?

Implementation

Participants at the recent Planning Workshop suggested that EAPI concentrate its research on those questions which focus on the environmental characteristics of different biofuel production systems, and how these are likely to affect the long-term viability of the projects. In other areas
such as fuelwood demand, and efficiency of energy use, only the compilation of available data would be expected.

It was suggested that a set of papers, or possibly a handbook, be published, which would present the current status in the different countries of the regions focusing on the questions stated in the previous section. It was recommended that the information be grouped under two categories:

a) Production Systems - including:
   - Project size - Plantation, community woodlot, roadside planting, etc.
   - Type of biofuel - possibly differentiated down to the species level, but perhaps only in a broad characterization such as tree/shrub, perennial/annual, leguminous/non leguminous, etc.
   - Harvesting procedure - whole-tree, etc.
   - Site classification - steepness, climate, soil type, etc.

b) Environmental characteristics - the focus to be on those aspects which pose a threat to the viability of the project, and to the longer-term integrity of the ecosystem:
   - Monoculture effects, including pests and diseases of the biofuel system
   - Soil conservation/erosion
   - Soil fertility, including nutrients and such as animal and human wastes
   - Possibility of human, domestic animal, or crop pathogens being introduced or harbored, e.g., mosquitoes
   - Water demand and effect on watershed characteristics
   - Potential land-use conflicts.
The participants at the Planning Workshop recommended that an appropriate person at EAPI be asked to play a co-ordinating role in putting together a survey and arranging a meeting of research workers. It was suggested that such a meeting be held during 1980, where papers dealing with the experience in several countries of the region would be presented. Several participants felt that it would be useful to hold the meeting in Asia, preferably in a location close to existing biofuel plantations. EAPI is exploring the possibility of getting the outside funding which will be required for such an arrangement, as well as identifying potential host institutions in the region.

Work in this area has been initiated at EAPI, and is closely related to ongoing work in Tropical Forest Land Use. The research on biofuel plantations is being undertaken by:

Research Fellows: W.R.H. Perera (Co-ordinator)
Ata Qureshi

Research Associates: Gerald Marten
Terry Rambo
Toufiq Siddiqi

In addition, the project on Energy and Rural Development at the East-West Resource Systems Institute is expected to initiate work dealing with selected aspects of the role of fuelwood in rural energy supplies. The two Institutes plan to co-ordinate their work so that they will have access to each other's results, and avoid duplication of effort.

Scientists or policymakers interested in participating in this collaborative effort are invited to write to Mr. Herbert Perera or Dr. Toufiq Siddiqi at EAPI.
8. Environmental Implications of Energy Conservation and Alternative Consumption Patterns

General Issues

Energy conservation is generally a very effective way to improve the quality of the environment. If the burning of a certain amount of coal in a power plant is reduced, say, by 20%, the volume of pollutants emitted will probably also decrease by a proportional amount. If the reduction in energy can be achieved without any loss of output, through improvements in technology or planning, the goals of industry and of "environmentalists" achieve a rare consensus.

Some approaches to energy conservation may, however, be accompanied by substantial environmental costs as well as benefits. The co-generation of hot water and electricity, for example, will increase the efficiency of energy use, but may require the siting of power plants closer to industry and residential areas. This could increase the concentration of pollutants to which at least some of the population is exposed.

Changes in the sources of energy also result in changes in the emissions of different pollutants. In the U.S.A., for example, the shift during the 1960's and early 1970's from coal to oil and natural gas resulted in a substantial decline in the average $SO_2$ concentration, as shown in Figure 1. Following the escalation in energy prices, which has been more pronounced for oil and gas than for coal, the average $SO_2$ concentrations have levelled off. About 28% of the U.S. population still lives in areas where the annual standard for $SO_x$ is exceeded. Many of the problem areas are along the northern East Coast, the Great Lakes, and southern California. It is no coincidence that these areas have been relying increasingly on nuclear power for their electricity needs.
Figure 1. Trend in Average Annual Levels of Sulfur Dioxide in the U.S.A.  
(Source: U.S.E.P.A. - Ref. 41)
Many countries in Asia and the Pacific, faced with rising prices and tightening supplies of oil, are looking at other alternatives such as coal, nuclear-fission power, hydroelectric generation, and liquified natural gas. Where practical, geothermal energy, as well as solar- and wind-energy are also coming into greater use. These changes will be accompanied by changes in air- and water-quality, as well as have significant impact for land and water use and on public health. As an example, the water requirements for the same amount of energy output from different conversion processes is shown in Figure 2.

### Water Consumption in Energy Systems

![Water Consumption in Energy Systems](image)

**Figure 2.** Water Consumption in Energy Systems. (Source: Ref. 41)
For countries with scarcity of water and land, it is clear that these implications be evaluated before new energy policies are implemented. The same applies to countries which are in the process of setting new standards for air or water quality, as well as those implementing existing standards.

In view of these concerns, participants at the Planning Workshop recommended that a collaborative research effort be launched to apply some of the available simulation modelling techniques to study alternative energy—environment scenarios. The models would attempt to provide a basis for answering some of the questions raised in the next section.

Research Questions

The participants at the Planning Workshop identified several high-priority research questions concerning the environmental implications of energy conservation and of changes in energy production and consumption patterns:

- What are the environmental costs, as well as the benefits, of different energy conservation strategies being pursued in the different countries?

- What are the differences in the environmental implications of adopting varying energy mixes of e.g., coal, nuclear power, and hydroelectricity?

- What would be the environmental implications of changes in the proportion of energy use in different sectors, e.g., transportation and industry? Also, of changes within the same sector, e.g., from public transportation to automobiles?

- How would the implementation of air and water quality standards affect the choice of energy mix a country might wish to adopt?
Implementation

It was generally felt that, in view of the uncertainties and changes in both energy and environmental policies, it was impractical to look at a single scenario for any country. Only those methodologies would be useful, which provided an easy way of changing assumptions in a multiplicity of scenarios.

One such approach, which was discussed at the Planning Workshop, and which some of the participants expressed an interest in possible application to their countries was that developed by Dr. Wesley Foell and colleagues at the University of Wisconsin and the International Institute for Applied Systems Analysis (IIASA). A family of simulation models has been developed to examine energy/environment systems with varying characteristics. These simulate a region's energy system, including energy demand, regional supply systems, and environmental impacts. Different approaches can be taken to model socio-economic developments of different regions.

The models have been successfully applied to applied studies of energy-environment futures for Austria, the Rhones-Alpes area in France, the German Democratic Republic, and Wisconsin, and are being used by policymakers there. A model for a less-industrialized society, Mexico, is under development. The types of results obtained may be illustrated by reproducing in Tables 4-7 some of the different scenarios produced for Austria. Table 4 provides alternative scenarios for alternative end-use energy demands in 1990 and 2015, whereas Table 5 focusses on primary energy demands by source. Table 6 estimates selected environmental impacts associated with the different scenarios, whereas Table 7 compares the effects within and outside of Austria for a particular scenario.
### End-Use Total Energy Demands *

(10^{12} Kcal)

<table>
<thead>
<tr>
<th></th>
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<td>5.2</td>
<td>7.9</td>
<td>10.2</td>
<td>9.6</td>
<td>17.6</td>
<td>7.8</td>
<td>8.8</td>
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<tr>
<td></td>
<td>3.5%</td>
<td>3.5%</td>
<td>3.3%</td>
<td>3.5%</td>
<td>3.6%</td>
<td>3.6%</td>
<td>3.4%</td>
<td>3.4%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Industrial</td>
<td>61.8</td>
<td>98.5</td>
<td>142.3</td>
<td>116.2</td>
<td>231.9</td>
<td>95.7</td>
<td>114.0</td>
<td>81.1</td>
<td>96.2</td>
</tr>
<tr>
<td></td>
<td>41.7%</td>
<td>44.0%</td>
<td>45.8%</td>
<td>42.6%</td>
<td>47.0%</td>
<td>44.3%</td>
<td>44.0%</td>
<td>43.4%</td>
<td>44.2%</td>
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<tr>
<td>Commercial and Service</td>
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<td>34.3</td>
<td>49.4</td>
<td>39.0</td>
<td>69.1</td>
<td>33.8</td>
<td>44.2</td>
<td>27.1</td>
<td>33.5</td>
</tr>
<tr>
<td></td>
<td>11.5%</td>
<td>15.3%</td>
<td>15.9%</td>
<td>14.3%</td>
<td>14.0%</td>
<td>15.6%</td>
<td>17.1%</td>
<td>14.5%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Transportation</td>
<td>31.5</td>
<td>38.1</td>
<td>50.8</td>
<td>50.4</td>
<td>89.4</td>
<td>35.7</td>
<td>43.8</td>
<td>29.7</td>
<td>35.3</td>
</tr>
<tr>
<td></td>
<td>21.2%</td>
<td>17.0%</td>
<td>16.3%</td>
<td>18.5%</td>
<td>18.1%</td>
<td>16.5%</td>
<td>16.9%</td>
<td>15.9%</td>
<td>16.2%</td>
</tr>
<tr>
<td>Residential</td>
<td>32.8</td>
<td>45.2</td>
<td>58.0</td>
<td>57.4</td>
<td>85.2</td>
<td>43.2</td>
<td>48.5</td>
<td>42.7</td>
<td>45.8</td>
</tr>
<tr>
<td></td>
<td>22.1%</td>
<td>20.2%</td>
<td>18.7%</td>
<td>21.1%</td>
<td>17.3%</td>
<td>20.0%</td>
<td>18.7%</td>
<td>22.8%</td>
<td>21.0%</td>
</tr>
</tbody>
</table>

**TOTAL** | 148.3 | 224.0 | 310.8 | 272.5 | 493.2 | 216.2 | 259.2 | 187.0 | 217.8 |

*Columns may not add because of rounding.*

(The numbers in Tables 4-7 are to be considered tentative, and indicative of trends, rather than precise predictions.)

(Source: W.K. Foell et al; Reference 51)
Table 5

Primary Energy Demands by Fuel *

(10^{12} \text{ Kcal})

<table>
<thead>
<tr>
<th></th>
<th>All Scenarios</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Coal**</td>
<td>20.9</td>
<td>20.2</td>
<td>25.2</td>
<td>23.9</td>
<td>37.7</td>
</tr>
<tr>
<td></td>
<td>11.5%</td>
<td>7.6%</td>
<td>6.6%</td>
<td>7.5%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Brown Coal</td>
<td>19.2</td>
<td>11.5</td>
<td>11.9</td>
<td>15.6</td>
<td>19.1</td>
</tr>
<tr>
<td></td>
<td>10.6%</td>
<td>4.3%</td>
<td>3.1%</td>
<td>4.9%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Petroleum</td>
<td>89.4</td>
<td>129.3</td>
<td>170.5</td>
<td>161.2</td>
<td>271.2</td>
</tr>
<tr>
<td></td>
<td>49.3%</td>
<td>48.4%</td>
<td>44.8%</td>
<td>50.2%</td>
<td>43.3%</td>
</tr>
<tr>
<td>Gases</td>
<td>31.7</td>
<td>58.4</td>
<td>77.4</td>
<td>67.1</td>
<td>126.0</td>
</tr>
<tr>
<td></td>
<td>17.5%</td>
<td>21.8%</td>
<td>20.3%</td>
<td>20.9%</td>
<td>20.1%</td>
</tr>
<tr>
<td>Hydropower ***</td>
<td>13.0</td>
<td>27.7</td>
<td>43.0</td>
<td>29.9</td>
<td>47.6</td>
</tr>
<tr>
<td></td>
<td>7.2%</td>
<td>10.4%</td>
<td>11.3%</td>
<td>9.3%</td>
<td>7.6%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>-</td>
<td>11.0</td>
<td>42.1</td>
<td>11.0</td>
<td>105.2</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>4.1%</td>
<td>11.0%</td>
<td>3.4%</td>
<td>16.8%</td>
</tr>
<tr>
<td>Waste Products</td>
<td>7.0</td>
<td>9.3</td>
<td>10.9</td>
<td>12.1</td>
<td>19.3</td>
</tr>
<tr>
<td></td>
<td>3.9%</td>
<td>3.5%</td>
<td>2.9%</td>
<td>3.8%</td>
<td>3.1%</td>
</tr>
</tbody>
</table>

TOTAL         | 181.2 | 267.4 | 381.0 | 320.8 | 626.1 | 257.2 | 304.2 | 215.0 | 246.3 |

* Columns may not add because of rounding.

** Including coke.

*** Conversion factor: 1 GWH = 1.08 Tcal

(Source: W.K. Foell et al; Reference 51)
Table 6

SCENARIO RESULTS OF SELECTED ENVIRONMENTAL IMPACTS

<table>
<thead>
<tr>
<th></th>
<th>1971</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatalities within Austria (Deaths/year)</td>
<td>18</td>
<td>2.4</td>
<td>3.9</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Total PDL within Austria (10^3 PDL/year)</td>
<td>290</td>
<td>130</td>
<td>200</td>
<td>100</td>
<td>85</td>
</tr>
<tr>
<td>Land Use for Resource Extraction (km^2/year)</td>
<td>16</td>
<td>23</td>
<td>36</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>Land Use for Facilities (km^2)</td>
<td>110</td>
<td>320</td>
<td>380</td>
<td>290</td>
<td>280</td>
</tr>
<tr>
<td>Radioactive Waste (Tons/year)</td>
<td>0.0</td>
<td>6.9</td>
<td>17</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>SO₂ Emissions (Tons/year)</td>
<td>300</td>
<td>200</td>
<td>280</td>
<td>190</td>
<td>150</td>
</tr>
</tbody>
</table>

Table 7

HUMAN HEALTH AND SAFETY INSIDE AND OUTSIDE AUSTRIA*

<table>
<thead>
<tr>
<th></th>
<th>Inside</th>
<th>Outside</th>
<th>Total</th>
<th>Inside</th>
<th>Outside</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatalities (Deaths/year)</td>
<td>18</td>
<td>23</td>
<td>41</td>
<td>2.4</td>
<td>40</td>
<td>43</td>
</tr>
<tr>
<td>Occ. Accidents (10^3 PDL/year)</td>
<td>100</td>
<td>140</td>
<td>230</td>
<td>18</td>
<td>240</td>
<td>260</td>
</tr>
<tr>
<td>Public Accidents (10^3 PDL/year)</td>
<td>3.9</td>
<td>23</td>
<td>27</td>
<td>4.8</td>
<td>32</td>
<td>37</td>
</tr>
<tr>
<td>Occ. Health (10^3 PDL/year)</td>
<td>60</td>
<td>82</td>
<td>140</td>
<td>3.7</td>
<td>140</td>
<td>150</td>
</tr>
<tr>
<td>Public Health (10^3 PDL/year)</td>
<td>120</td>
<td>0.6</td>
<td>120</td>
<td>100</td>
<td>0.7</td>
<td>100</td>
</tr>
<tr>
<td>TOTAL PDL (10^3 PDL/year)</td>
<td>290</td>
<td>240</td>
<td>530</td>
<td>130</td>
<td>420</td>
<td>540</td>
</tr>
</tbody>
</table>

* Columns may not add because of rounding.

(Source for both tables: W.K. Foell et al; Reference 51)
scenario. As with all such simulations, the numbers given in the tables are to be interpreted as indicative of trends, rather than precise predictions.

EAPI has held preliminary discussions with Dr. Foell about the possibility of applying the approach described above to simulate alternative energy-environment futures for one or two countries in Asia. A small Workshop is tentatively planned for late January - early February 1980, to assess data requirements, and the availability of data-processing equipment in various countries. We are in the process of identifying scientists and policymakers interested in participating in such a workshop, and of institutions in Asia interested in hosting it. Readers of this report who would like to explore these possibilities are strongly urged to write to Dr. Toufiq Siddiqi at EAPI as early as possible.

A Global/Regional economic model is also being developed in Australia and may be used for environment-energy policy analysis in the Pacific region. Dr. Don MacRae has kindly offered to provide additional information to those interested. His address is given on page 4.

EAPI staff presently involved in this activity are Dr. William Matthews and Dr. Toufiq Siddiqi. Related work at the East-West Center is planned by the Resource Systems Institute's energy project, co-ordinated by Dr. Kirk Smith.

Opportunities presently exist at EAPI for a Research Fellow or a Research Intern to work in this area. Information about these types of awards is given in Appendix D.
9. Energy Production and Shipment in the Ocean Environment

General Issues

Oil and gas play a crucial role in the economies of both industrialized and less-industrialized nations. The aspects EAPI will be concerned with are related to the increased exploration and production of oil and gas in the offshore region, and the shipments of oil, liquified natural gas, nuclear reactor fuels and associated radioactive wastes across the Pacific Ocean and adjacent areas.

Some of the newer oil-producing areas such as offshore Palawan in the Philippines overlap important fishing grounds where the effects of a large oil spill could be substantial. Also, the rapid increase in the global shipments of oil have resulted in large numbers of tankers passing through rich fishing areas, e.g., offshore Indonesia, Japan, and the U.S. New England coast. Tanker accidents, such as those of the "Showa Maru" in the Straits of Malacca, the Argo Merchant off Massachusetts, and the Amoco Cadiz off the Brittany coast of France have raised great concern amongst the fishing and tourism industries.

Several nations have, of course, established guidelines for drilling on their claimed continental shelves. In the United States, environmental impact assessments are made before drilling can commence in an offshore area. Precautionary measures against oil-well "blowouts" are also required. The U.S. Environmental Protection Agency (EPA) requires that best practicable technology be applied to treat effluents from extraction of oil and natural gas, and a further tightening of the standards will specify that, by 1983, the "best achievable technology economically available" be used. A study undertaken for the EPA by the Committee on Energy and Environment of the National Research Council's Commission on Natural Resources concluded:
that the current regulatory policy is motivated by technology capability rather than by proven environmental necessity. (The Agency is now considering changes to the OCS Oil and Gas Effluent Guidelines, which have been remanded to EPA by the courts.) The regulations are generally not cost-effective or even necessary. There is little evidence to justify zero-discharge technology except for particularly susceptible areas near shoreline and estuarine boundary grounds (though even this need has not been conclusively validated).

When best practicable technologies are used, the residuals from offshore oil production seem harmless and trivial in comparison with other sources of oil contamination of coastal waters, such as runoff containing waste oil from automotive and non-marine industrial operations and tanker spills.

The offshore pollution control issue is a good example of a situation in which a better balance should be established between considerations involving the economy, energy, and the environment.

International organizations, which had previously stayed away from development of hydrocarbon resources, are now financing such projects. The World Bank made its first large such loan amounting to $150 million, in 1977, to India, for the development of the Bombay High Offshore field. By 1981, the Bank expects to be lending about $500 million dollars in this sector each year. About that time, the annual funding of the Asian Development Bank in this category will amount to $120-140 million a year.

The World Bank, as well as the U.S. Agency for International Development, require that an "Environmental Assessment" of proposed projects be made before the granting of a loan. This provides strong encouragement to recipient countries to establish environmental standards, and in some cases standards are being adopted from the industrialized countries without much change. It is thus important that the criteria and rationale underlying requirements for offshore oil production be analyzed critically.
Transportation of Energy-Related Materials

Oil spills from tanker accidents have been a source of concern for over a decade. The concern has increased recently because of increases in the size of the tankers and the declaration of 200 nautical-mile "Exclusive Economic Zones" by an increasing number of states. During the late 1970's, shipments of liquified natural gas (LNG) from Indonesia to Japan, and of spent nuclear reactor fuels and associated radioactive wastes through the Asia-Pacific region, have added additional dimensions to issues arising from the transportation of energy-related materials.

International agreement on controlling pollution from ships has been difficult due to the differing interests of the maritime nations vis-a-vis the coastal states, and of the industrialized nations when compared to the developing nations. As Pearson and Pryer (16) have pointed out, the task of negotiating reasonable environmental controls in the UN Conference on the Law of the Seas (UNCLOS) has been made even more difficult by the three-way division of ocean space:

(i) by function or economic activity -- e.g., fishing, navigation, and offshore minerals
(ii) by distance from shore -- i.e., territorial waters, economic zones and high seas
(iii) Vertically -- i.e., seabed floor, water column, surface, and superadjacent air space

Threats to the environment can originate in any one of these divisions and be physically transported across the boundaries which divide them. Where, then, should the powers for standard-setting and enforcement reside?

In the Law of the Sea negotiations, developing countries have generally sought to protect their coastline from environmental damage by reserving
the right to set their own standards. The maritime nations, concerned with the possibility of arbitrary harassment of commercial shipping, have advocated standard setting authority by international organizations such as the International Maritime Consultative Organization, with the standards to be enforced by the Flag State.

These issues have been discussed by the Third Committee at UNCLOS III. Part XII of the Informal Composite Negotiating Text contains several Articles dealing with the "Protection and Preservation of the Marine Environment." These articles define the rights and obligations of sovereign states, and measures to prevent, reduce and control pollution of the marine environment.

Many of these articles, if adopted and enforced could have substantial implications for international trade and sea transportation. The adoption of varying standards by different states could add to the cost of imported products and exports, and possibly result in changes in transit routes through the oceans. For example, fourteen countries have already declared 200 nautical mile territorial seas, and one of these, Peru, has stated that no nuclear-powered vessel, or one carrying radioactive material may enter its territorial waters. The Malacca Straits Safe Navigation Scheme is already leading Japan to consider a shift to alternative routes for Very Large Cargo Carriers, and some archipelagic states are designating sea-lanes which may not be the most economical for the transportation of cargo.

Environmental policies for EEZs may influence transportation routes of energy sources or byproducts — e.g., oil, LNG, uranium, nuclear spent fuel, and, eventually, hydrogen. Altered routing of energy materials may have an impact on energy policies themselves. Also, energy needs and policies will determine energy material transport needs and policies and thus influence
environmental policies regarding transport of energy material in EEZs. There is thus developing the prospect of a dynamic interaction between national energy policies and environmental policies in EEZs with transportation requirements, routes, and standards of transport as the link. This area of research will examine the implications of policy alternatives in regards to potential conflicts between environmental policies and energy policies in the marine sphere, with a focus on energy material transport as the link.

Research Questions

A number of important questions in this area were identified by the participants at the Planning Workshop. Some of the questions dealing with environmental standards could also be looked at in the context discussed in Section 6 of this report, i.e., Environmental Standards and Energy Policies. We have included them here because of the possible extension of the standards beyond territorial limits to the Exclusive Economic Zones. The research questions identified as having a high priority are:

- What are the present, proposed, or potential environmental standards in each nation's internal waters, territorial seas and in the Exclusive Economic Zones (EEZ's). What is the basis for variations in such standards?

- To what extent does each nation have the equipment and manpower required to enforce these standards in the huge areas which might be involved?

- How are differences in standards and enforcement likely to affect global trade and ocean transportation routes?

- How are the energy policies of countries likely to affect, or be affected by the environmental standards set by other nations or the shipment of oil, LNG, or radioactive materials, through waters under their jurisdiction?
What methodologies exist for assessing the possible impact of oil spills, or accidents to ships carrying LNG or radioactive materials? Which of these would be useful in different parts of Asia and the Pacific?

To what extent are the known effects of oil different in tropical and temperate ecosystems? Do they provide a basis for substantial differences in standards affecting offshore oil production and shipment?

What are the economic benefits and costs of emphasizing the control of oil pollution offshore, as opposed to controlling it on land? (e.g., in the U.S., most of the oil pollution of the oceans has its origin on land).

Implementation

The participants at the Planning Workshop suggested that a useful first step would be to produce a handbook covering the environmental guidelines and standards presently in existence within the territorial waters of the countries in Asia and the Pacific, dealing both with the offshore production of oil and gas, as well as the transportation of oil, LNG, and other energy-related materials, e.g., radioactive spent fuel and wastes from nuclear power plants. Where available, legislation and procedures for implementation in the Exclusive Economic Zones would also be included. It was suggested that substantial information might be available from international organizations such as IMCO, UNEP, OECD, as well as from the Law of the Sea conferences. The participants recommended that the putting together of the handbook be co-ordinated by a staff member or Research Fellow at EAPI and be reviewed by a working committee in mid-1980. In addition to this, the work in this area would focus on the likely implications of varying environmental
standards and implementation procedures on energy policies in the region. In terms of methodologies, it was suggested that an analysis be undertaken of existing models such as those developed by the U.S. Geological Survey and the Ministry of International Trade and Industry (MITI) in Japan to assess the impacts of oil spills, with a view towards identifying those which might be employed in different regions of Asia and the Pacific.

The work in this area undertaken at EAPI will be very closely co-ordinated with the Institute's project on Marine Environment and Extended Maritime Jurisdictions. The following EAPI staff members are currently involved in research on "Energy Production and Shipment in the Ocean Environment":

Research Associates: Dr. Mark Valencia (Marine Environment Project Co-ordinator)
Dr. Choon-Ho Park
Dr. Toufiq Siddiqi

Additional opportunities are presently available for a Research Fellow, and Research Interns to undertake research at EAPI on issues discussed in this section.

The Conference on "Environmental Standards and Energy Policies" planned for March 1980, mentioned in Section 7 of this report, will also cover some of the areas related to offshore oil and gas production in the oceans. Another conference, focusing on the transportation link between energy policies and environmental concerns is likely to be held around May 1980, possibly in collaboration with an Institution in Asia.

Policymakers and scientists interested in collaborative work on offshore oil production and shipment in the ocean environment are requested to make their interest known to Dr. Toufiq Siddiqi or Dr. Mark Valencia at EAPI.
CONCLUSION

The collaborative activities described in this initial research plan were started during this year, and are likely to be modified as the research progresses. At the risk of repetition, we would like to emphasize once again the word collaborative to indicate the nature of activities at the East-West Center. From the conceptual phase to the publication and dissemination of research, the effort will be one in which scholars and policymakers from diverse nations in Asia and the Pacific, as well as the U.S.A., will have continuous input. This document is a reflection of the collaboration which has taken place so far. Readers of this report are urged to send their comments and suggestions, be they on research areas, methodologies, or suitable products of research, since such inputs will play an important role in shaping the nature of our activities. These may be sent to Dr. Toufiq Siddiqi, or any of the other staff members or Fellows at EAPI mentioned in the individual research areas. EAPI will try to keep informed of developing and planned activities all those who have expressed an interest in the collaboratively planned research effort described here.
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Appendix A. The East-West Center

The East-West Center was established in 1960 by United States Congressional legislation. Our purpose is to promote better relations and understanding among the peoples of Asia, the Pacific and the United States. The legislation prescribes the method of carrying out this purpose as "cooperative study, training, and research," and the means as "the establishment and operation in Hawaii of an educational institution to be known as the Center for Cultural and Technical Interchange Between East and West."

The Center's programs focus on major world problems, especially those which are potential or actual sources of difference, misunderstanding, and conflict among cultures and nations, East and West. We seek to generate and share knowledge about alternative approaches and solutions to problems; to produce, share, and test policy aids and materials; and to educate people to reconcile differences, clarify misunderstandings, and avoid or resolve conflict. In order to plan research and to disseminate knowledge generated by the Center's programs, we hold workshops, seminars, and conferences throughout the year.

The style of each program is cooperative, bringing together from different countries, cultures, disciplines, and professions, older and younger scholars, practitioners, and policy makers to seek solutions to the problems being tackled. Thus, the problem provides a focus around which people from East and West can interact as they study, give and receive training, exchange ideas and views, and conduct cooperative activities.

The Center's programs are organized into five institutes, Open Grants, and special projects. The institutes focus on the following problem areas: communication, culture learning, environment and policy, population, and resource systems.

The Communication Institute investigates the various patterns of communication that bind individual societies together and analyzes how these different patterns facilitate or retard better relations and understanding among nations.

The Culture Learning Institute focuses on the special set of problems that arise when different cultures come into contact; specifically when people of Asia, the Pacific, and the United States interact.

The Environment and Policy Institute explores ways to integrate environmental factors into a broad range of policy considerations so that activities designed to meet human needs will not be counterproductive among different sectors of society and over time.

The Population Institute contributes to the knowledge and understanding of the facts of rapid demographic change, its causes and effects, and policy alternatives.

The Resource Systems Institute concentrates on the interrelationship of food, energy, and raw materials which influence the lives of people and relations among nations.
Truly international, the Center has international staffing, participants, and teamwork; international financial support; and an international Board of Governors.

Our staff includes more than 250 men and women of numerous nationalities, of diverse academic backgrounds, and with wide practical experience.

Our “participants” number more than 1,000 men and women each year and include scholars, leaders, public officials, professionals, and graduate students. They come to the Center from the United States and more than 40 countries and territories ranging from Korea to Iran on the Asian continent and from Japan to Australia in the Pacific. For each participant selected from the United States, two are selected from the Asia-Pacific area.

Participants, chosen in relation to Center objectives, are invited to join Center projects. They bring with them varying degrees of knowledge and awareness about a problem area. They begin working with Center staff and with each other—in teams—joining in the production, testing, and dissemination of knowledge and in applying skills to respond to problems. In the process, they develop bonds of friendship, collegiality, and trust that serve to promote better relations and understanding.

The Center, itself, is supported not only by appropriations from the United States Congress ($13,500,000 in 1979) but also by contributions from 21 governments of Asia and the Pacific. Such international support creates a true sense of partnership, the essential foundation for mutual understanding and better relations.

Since 1975, the Center has been operated by a quasi-public, educational, non-profit corporation with an independent, international Board of Governors. Board members come from the United States, Fiji, India, Japan, the Philippines, and Singapore.

We maintain close and cooperative relationships with the University of Hawaii. Our staff and participants have access to its libraries, computer center, and other resources. We provide reciprocal access for University of Hawaii faculty and students to our facilities and resources.

Our own 21-acre campus is adjacent to the University. We have three residence halls, housing 500 participants. One hall has self-contained apartments; the other halls are dormitories. In addition, we have a 300-office program building, a conference building with a cafeteria, a half-dozen temporary buildings, and garden, recreation, and performance areas. A Thai Pavilion, a Japanese Teahouse, and a Japanese Garden are among facilities contributed by governments, organizations, and businessmen in Asian countries.

Among Center services available to staff and participants are data support and media production.
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and Department of Racial
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Gilbert White
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University of Colorado

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Alice Stone Ilchman
Associate Director for
   Educational and Cultural Affairs
   International Communication Agency
   Washington, D.C.

Fujio Matsuda
President, University of Hawaii
One of the most urgent challenges facing mankind is to fully utilize the enormous potential of the environment for meeting needs while maintaining an environment conducive to human survival and development. All organisms, including humans, can only be understood in the context of their environment; for example, survival of the fittest is a statement about organisms and the environment upon which they depend. An organism that changes or destroys its environment changes or destroys itself.

In the last several decades we have become aware of the dramatic impact of human activity upon our environment, especially as more and more people consume greater and greater quantities of resources with increasingly sophisticated technologies. Human activities depending upon or impinging on the environment are in large part directed by policies laid down by government officials, industrial leaders, and other policy makers. It is, therefore, an absolute necessity that we come to understand more clearly the relationship both between organisms and their environment and between the environment and policies that affect it.

The East-West Environment and Policy Institute was organized in October, 1977, to increase understanding about the vital relationship between the policies that direct a society's activities and the physical environment within which these activities take place and upon which they depend. Without such understanding, policies developed within one sector of a society can have unanticipated, undesirable impacts in other sectors of the society: for example, a policy designed to increase foreign exchange through the export of timber products may adversely affect the society's agricultural productivity through erosion resulting from deforestation. Further, a policy designed to fill a critical short-range need may inadvertently create even more critical problems in the longer-term future.

To assure that activities designed to meet human needs are not counterproductive among various sectors and over time, consideration of environmental and natural resource factors must be integrated into the formulation and implementation of a broad range of policies. This must be achieved on an international basis when a common environment is involved or when interdependencies such as finance or resource flows link nations.

The Environment and Policy Institute (EAPI) addresses these problems through a program of research and training based on the following premises:

- Societies are increasingly concerned with meeting the basic needs of all persons. This concern is expressed through policies that guide the management of the day-to-day activities through which societies attempt to achieve their goals.
- These activities involve interaction between social behavior and a physical environment that is governed by natural laws. The structure and functions of this environment must be understood so that policies can more easily achieve their objectives by being compatible with, rather than thwarted by, these natural laws.
- Tensions arise within and among nations when environmental factors are dissociated from technical, economic, and political factors in policy planning and decision-making.
- Scientists and decision-makers in all societies must make special efforts to integrate environmental understanding into policy formulation and management.
EAPI contributes to the required international understanding of these issues through the study and synthesis of environmental knowledge from a perspective of policy concerns. Its efforts are undertaken through the cooperation of competent and experienced scholars and professionals from many societies in the independent institutional setting provided by the East-West Center.

Institute activities include staff studies, awards to scholars, experts, and advanced degree students in relevant fields, workshops, and conferences that bring together professionals from different sectors and many countries to identify and examine important problems and to work toward their solutions. The products of these activities include issue papers, research reports, state-of-the-art surveys, policy aids, and instructional materials.

Project 1: NATURAL SYSTEMS ASSESSMENT FOR DEVELOPMENT

Coordinator: Richard A. Carpenter

Policies for economic growth in the developing countries are based on utilization of their natural resources and environment with the assistance of capital and technology from industrialized nations. Successful development policy must meet immediate basic human needs and also sustain the productivity and carrying capacity of natural systems for the welfare of future generations. Scientific understanding of the resource base and ecosystems is an essential ingredient of development planning and management. Natural resource and environmental assessment is both a process and product to aid decision makers in improved allocation of funds and choice among alternative development activities.

Assessments are now mandated by the U.S. Agency for International Development, the World Bank, and many host countries. Assessments are suspected by some development officials of causing delays in urgent projects and in imposing foreign cultural values. However, there is considerable evidence that planners must have more complete and timely information if they are to generate and carry out effective development projects, preserve long term options, and balance the conflicting needs of their society. Assessment should not advocate exploitation, conservation, or pollution control, but, rather, it should forecast the consequences of development so as to enable more rational decision making. Adapting assessment methods so that they are appropriate and demonstrably useful in specific developing country situations is a major task for multinational collaboration.

Since early 1978, EAPI has conducted a set of studies with the objective of enhancing the performance and use of assessments in the economic development context. This five-year project will produce adaptive assessment methods, training and educational materials on natural resource and environmental assessment, and increased understanding among participants from the United States, Asia, and the Pacific of the role of natural systems in economic development in different national and cultural contexts.

Following a planning conference in May, 1978, attended by experts from nine nations, the project initiated the following collaborative research activities dealing generally with the assessment process:

1) A cross-country comparison of assessment with respect to policies, legislation, regulations, institutions, organizations, methods, and implementation of assessment results. Following an empirical assembling of data, a critical analysis will be undertaken to identify preferred administrative patterns and critical points in the dynamic sequence of establishing assessment activities in governments;
2) Extension of economic benefit/cost analysis to include more off-site and long-term aspects of natural resources and the environment, to deal with inter-generational issues and the validity of using market-derived discount rates, to evaluate common property resources and the environmental services provided by natural systems, and to measure the economic justification of ecological and health-based constraints on development; and

3) Assembly, comparison, and synthesis of various methods for performing assessments in order to enable adaptation to developing-country situations and to assist managers in choosing the most appropriate approach for each particular development activity.

The following specific development sectors are being studied to bring actual project data and case studies into the general research areas and to gain insights into the practical usefulness of assessment:

1) Tropical forests and forest lands are important to all nations as a continuing source of lumber and other products, plant genetic materials, wildlife habitat, watershed and soil protection, and climate stabilization. Forest management practice has long been based on technical information. However, the consideration of products and services other than lumber has generated the need for a much broader information base and analysis of trade-offs. Fundamental to planning the future use of forest lands is an ecologically based land classification and assessment system designed for the tropical and subtropical regions. As part of its work in this area, EAPI will conduct a meeting of experts in classification methods in June, 1979. In addition, case studies of representative forest development sites will be prepared to illustrate the usefulness of assessments to the forest manager and to provide a real-world context for the research on extended economic benefit/cost analysis.

2) There are environmental dimensions of energy policies which have major implications for trade-offs involved in meeting diverse goals at the same time. This EAPI research area explores how present or potential impacts of energy activities on the environment affect and are affected by the formulation of national and international policies for energy and other sectors; and assesses methodologies for examining the major environmental dimensions of energy policies with respect to their usefulness in various countries and situations. These areas are presently being explored and others may be added: Fuelwood Plantations: environmental consequences of traditional forestry practices and of experiments to grow fuelwood on a sustainable basis; oil production and shipment in the ocean environment: implications for energy policy and for transportation routes of varying environmental standards in territorial waters and Exclusive Economic Zones; and environmental standards and the choices of electricity sources: effects of differing environmental standards on the cost of producing electricity from different sources, particularly coal and nuclear fission reactors. These topics are closely related to the forestry area mentioned above, the oceans project discussed in the next section, and the energy projects at the Resource Systems Institute.

Project 2: MARINE ENVIRONMENT AND EXTENDED MARITIME JURISDICTIONS: ENVIRONMENT AND RESOURCE MANAGEMENT ISSUES

Coordinator: Mark J. Valencia

The ocean is a natural geopolitical link for nations East and West through their interactions and interdependent policies concerning the management and use of its resources and environment. Changing national perceptions of the
ocean are resulting in the unilateral extension of national jurisdictions to 200 nautical miles from shore. This world sea enclosure movement is transferring a majority of the present "high seas" area and most ocean resources and activities to the control of individual states.

However, extended national jurisdiction does not alter the facts that: 1) marine resources are often transnational in distribution; 2) the ocean, a continuous, fluid system, transmits environmental pollutants and impacts; and 3) many maritime activities transcend the new national marine jurisdictional boundaries. Thus, there may be an increase in potential and actual tensions, misunderstandings, and conflicts concerning management of marine activities, resources, and the environment.

There are three central questions of ocean management:
- What is to be managed?
- How is it to be managed?
- Who will manage or be affected by who manages it?

There are numerous transnational issues that must be addressed in answering these questions. Management options and their implications must be considered from many perspectives, including national interests (among them, security and development priorities), international relations, and historical cultural perspectives.

This project is being undertaken in collaboration with the Resource Systems and Culture Learning Institutes, which also have related activities in other projects. The goals of the project are to provide an independent, informal forum for the specific identification and exchange of views on evolving East-West ocean management issues, and to undertake subsequent research designed to provide a knowledge base to aid in their international resolution. The project's specific objectives are to:
- Provide a broad perspective on present and future trends of marine interests and marine use in the Southeast Asian Seas, and of the implications of extended maritime jurisdictions for marine use management.
- Identify, anticipate, and characterize transnational ocean management issues of mutual concern and consequence to nations of East and West using the Southeast Asian Seas.
- Delineate for subnational, national, and international policy makers the range of policy options with respect to the issues and their potential problems and opportunities.

Initially, the project will focus on a particular geographic area, the South China Sea, and will undertake to delineate potential problems and opportunities which have relevance to many EWC participating nations in this and other regions. The timeframe for the focus of research will depend on the issue but will generally be of medium range, i.e., 1985 to 2000.

Project research is concentrated on three fundamental areas: the natural environment, jurisdictional regimes and issues, and the interests of states in various aspects of the marine environment. Specific studies are presently being undertaken on two topics. One is country specific but sectorally broad—national marine interests of the Philippines as they relate to foreign policy. The other is sector specific—transnational effort on transboundary stocks—and includes significant resource owners and exploiters in many countries.

Planned products include an atlas of marine policy and use in the South China Sea, a companion volume of policy analysis, and white papers and educational programs for policy makers.
Appendix C. Staff and Participants working on
"The Environmental Dimensions of Energy Policies"

Director

MATTHEWS, William H., Ph.D., Socio-Technological Engineering, Massachusetts Institute of Technology, 1970. Came to the Institute in October, 1977, from post as senior research scholar at the Austrian-based International Institute for Applied Systems Analysis. Prior to this he was closely associated with the United Nations Environment Programme and was Arthur D. Little Associate Professor of Environmental Sciences and Engineering at Massachusetts Institute of Technology and Visiting Faculty Member in Environmental Management at the Center for Education in International Management in Geneva, Switzerland.

Research Associates

CARPENTER, Richard A. Came to EAPI from the National Academy of Sciences/National Research Council where he was Executive Director of the Commission on Natural Resources. Prior to establishing that office in 1972, was Chief of the Environmental Policy Division of the Congressional Research Service, Library of Congress. Has contributed to the passage and implementation of legislation including the National Environmental Policy Act and the Technology Assessment Act and has been responsible for a variety of studies interpreting and transferring technical information for decision-making. Began his career as a chemist and has obtained patents in the field.

MARTEN, Gerald G., Ph.D., Zoology, University of California at Berkeley, 1970. Has conducted research on systems ecology and renewable natural resource management in Canada, East Africa, and Mexico. Most recently was Senior Research Scientist at the Instituto de Investigaciones Sobre Recursos Bioticos in Veracruz, where he headed an interdisciplinary team studying the environmental dimensions of land use planning in the Mexican highlands and tropics. Earlier research included fisheries management and mathematical modelling of lake and forest ecosystems.


RAMBO, A. Terry (United States) Fellow, 3/1/79–5/30/79. Ph.D., University of Hawaii. Has been Lecturer at the University of Malaya since 1975 and Consultant on Resources and the Environment to the Ford Foundation, responsible for monitoring environmental developments in Malaysia and encouraging cooperative ecological research with neighboring countries. Special interests: human ecology; development and cultural change in peasant societies; and the ethnology and cultural history of Southeast Asia.

SIDDIQI, Toufig A., Ph.D., Experimental Nuclear Physics, University of Frankfurt-am-Main, West Germany, 1966; B.A. and M.A., University of Cambridge, England; primary and secondary education in India and Pakistan. Was Associate Professor of Public and Environmental Affairs at Indiana University prior to joining EAPI. Has written extensively and developed courses in the areas of science, technology, and public policy; energy and the environment; technology assessment; and environmental systems.

STUBBS, Roy C., Ph.D., Public Administration, University of Southern California, 1974; B.S. in Geology/Geophysics. Was previously the Management Scientist for the Task Force on Human Environment, a United Nations project providing assistance to governments of Asia and the Pacific in environmental institution-building. Has been a consultant in management information systems to the United Nations Environment Programme in Nairobi and has done extensive teaching, research, and consulting in management in Latin America. Was involved for several years in the research and development of mineral and petroleum resources in Australia, the United States, Europe, and the Middle East.

VALENCIA, Mark J., Ph.D., Oceanography, University of Hawaii, 1972; M.A., Geology, University of Texas; Master of Marine Affairs, University of Rhode Island. Served for two years as a Lecturer (Assistant Professor) with the Universities Sains Malaysia in Penang, followed by a year with the United Nations Development Program Regional Project on Offshore Prospecting in Bangkok, Thailand. Professional activities have concentrated on regional marine policy issues, including problems of national and transnational marine pollution in Southeast Asia.
Research Fellows and Intern


HUFSCHMIDT, Maynard (United States) Fellow, 6/1/79-7/31/81. Is Professor of Planning and Environmental Sciences and Engineering at the University of North Carolina, where he conducts research on and teaches public investment and environmental, water resource, and regional planning. Has worked with, and advised on, natural resource programs at the national, regional, and local level since 1949, and was for 10 years Director of Research for the Harvard Water Program.

JIMENEA, Tomas Daniel P. (Philippines) Intern, 2/13/79-7/29/79. Has studied Electronics Engineering at St. Louis University and is working on a Master's in Electrical Engineering at University of the Philippines. Is Technical Assistant in the Environmental Unit of the Philippines' Ministry of Energy. Special interests: nuclear reactor technology, particularly in nuclear siting and safety considerations, and the use of computers in engineering analysis.

PERERA, William Ryan Herbert (Sri Lanka) Fellow, 4/7/79-4/7/81. Diploma in Forestry, Dehra Dun, and graduate courses in Forestry from Oxford University. Is Conservator of Forests for Sri Lanka and Director of both the Water Resources Board and the State Timber Corporation. Has a combined experience of 30 years in administration, policy making, and research and development in the Sri Lankan Forest Service where he planned, organized, and implemented a comprehensive development program for watershed management, shaping of the environment, and production of lumber, fuel-wood and plywood, with the goal of meeting long fibre pulp requirements of the existing and planned paper industries in the country.

QURESHI, Ata (Pakistan) Fellow, 6/1/79-11/30/79. Doctorate, Forest Soils, University of Hawaii while on award from the East-West Center. Earlier was Divisional Forest Officer, Forestry and Wildlife Department, in Pakistan. Has worked extensively in the areas of soil conservation and watershed management. Special interests: forest resource management, soil and land surveys and productivity evaluations, fast growing forest species for biomass production, and agro-forestry.

Resource Systems Institute Staff Co-ordinating Related Work

BARDACH, John, Ph.D., Zoology, University of Wisconsin. Served as Director of Hawaii Institute of Marine Biology, is now also Adjunct Professor at University of Hawaii. Has chaired aquatic food sources as part of the World Food and Nutrition Study of the National Research Council/National Academy of Sciences. Is executive council member of the Pacific Science Association and board member of the Law of the Sea Institute. Was faculty member at University of Michigan. Research interest: relationships of applied ecology to economics especially energy in food production and resources management aspects of extended maritime jurisdiction.


Appendix D. Types of Awards Available for Work at the East-West Center

TYPES OF AWARDS

The Center provides awards for various categories of participants to join its staff in problem-oriented programs. Asian and Pacific participants come to the United States on the Exchange Visitor (J-1) visa and are subject to all provisions of the Exchange Visitor Program. Listed below are the various categories and general conditions for Center awards. Specific conditions and objectives for awards vary among the different institutes and projects. Final decisions on all awards, regardless of type or source of funds, are made by the individual East-West Center institutes.

Fellows. Scholars and authorities who have engaged in research and development activities on problems of interest to the Center are invited from research organizations, universities, government administration, private enterprise, and the arts for periods ranging from one week to three years to participate in specific Center projects. Visiting Fellow awards are generally for those involved for less than one month in the planning and design of projects. Research Fellow awards are generally for those involved from one to 36 months in the full range of research and development activities. Ninety to 120 such awards are made yearly.

Research and Professional Interns. Research Intern awards are provided to researchers in various stages of their careers for supervised practical experience in specific Center projects. Professional Intern awards are provided to potential leaders seeking to develop managerial and practical skills for supervised practical experience in specific Center projects. In addition to research and professional involvement in Center projects, interns may be expected to provide other types of assistance for project teams. Sixty to 90 such awards are made yearly, by invitation, nomination or application.

Professional Associates. Participants in this category include policy makers, public officials, scholars, and managers from business, government, and education. They share knowledge and experiences in specific Center projects designed to apply research results to practical problems; develop and demonstrate policy aids, curricula, and other educational materials; and explore policy applications of new knowledge. Activities include seminars, workshops, conferences, and planning meetings for periods ranging from one week to one year, averaging about one month. Approximately 800 to 1,000 awards are made yearly by either invitation, nomination, or application.

Graduate Degree Students. Graduate students participate in research and development projects in the Center's problem-oriented institutes or in Open Grants activities, while also studying for advanced degrees in a wide variety of disciplines offered at the University of Hawaii. The amount of time and the nature of student participation in Center projects vary among the institutes. The specific objectives for project involvement are worked out in consultation with the Center program advisor and the University of Hawaii department. Degree research interests at the University of Hawaii must be coordinated with a Center institute problem focus or Open Grants requirements. About 100 to 120 new awards are made yearly and, depending on degree level and prior study, are for 17 to 48 months duration.

Degree students are involved in project work at the East-West Center as well as advanced degree work at the University of Hawaii, and therefore have obligations to both institutions. Because of this dual obligation, the Center has specified the following conditions which are intended to facilitate meaningful involvement of students in Center projects and degree study at the University of Hawaii.
1. The academic work of each student is expected to be closely coordinated among the relevant Center program, the relevant University of Hawaii department, and the respective student. To the greatest extent possible, the student's academic work with the University of Hawaii department and the Center project should be mutually complementary.
   a. Center research staff members are assigned to advise students on institute work and to serve as liaison with University of Hawaii departmental advisors.
   b. The Center institute advisor and the student are expected to work closely with the faculty of the University of Hawaii so that to the greatest extent possible the dissertation or thesis is related to the student's work in the institute project.

2. Students are expected to meet satisfactorily Center guidelines for completing University of Hawaii degrees as well as all relevant academic requirements of the University of Hawaii as specified in the University of Hawaii catalog.
   a. During regular semesters (and summer sessions as appropriate), a full-time course load at the University of Hawaii is required of Center students on active award status in residence. If not enrolled full-time during the summer session, full-time involvement in an institute project is expected.
   b. Appropriate enrollment during field work must also be maintained.
   c. Minimum academic performance as specified in Center guidelines and as required for continued University of Hawaii registration must be maintained.
   d. Failure to meet the relevant academic standards of the Center and the University of Hawaii may result in early termination of the Center award.

Joint Doctoral Research Interns. Doctoral students who have completed all course requirements at institutions in the United States, Asia or the Pacific gain supervised practical research experience in specific Center projects directed toward completion of their dissertation. The specific conditions for these awards are spelled out in an agreement among the Center, the doctoral candidate, and the degree-granting institution. Twenty to 25 such awards are made yearly, by invitation, nomination, or application, for durations of 12 to 24 months. In addition to professional involvement in the Center project, interns may be expected to provide other types of assistance to project teams.

COST SHARING
A limited number of fully funded awards for participants in East-West Center programs is available each year to qualified candidates in each country working with the Center. Cost-shared awards are encouraged through arrangements with cooperating governments, institutions, foundations, or private organizations. The Center also may admit some participants on externally funded awards which cover the full cost of their participation.

ADDITIONAL AWARD PROVISIONS
East-West Center awards include provisions for round-trip air transportation, stipends, on-campus housing, health insurance, and other allowances.

Round-Trip Air Travel. The Center provides economical round-trip air travel for fully funded participants via the most direct route from the airport nearest the participant's home to the location of the Center activity. The Center does not pay other travel costs incurred while en route or the travel costs for spouses or dependents. All tickets are issued to the participant by name and are non-refundable and non-transferable.

Stipends. Stipend levels vary by participant category and are based on the level of knowledge and experience which participants can contribute to Center projects as well as the amount of responsibility participants have for carrying out Center projects.

Fellows. The monthly stipends for fellows are based upon the appropriate rank and step of the East-West Center salary schedule for Center employees. The specific stipend level is determined by the relevant Center institute.
Professional Associates and Interns. Professional associates attending East-West Center workshops, seminars, or conferences, as well as research and professional interns, receive a per diem or monthly stipend in addition to on-campus housing.

Graduate Degree Students and Joint Doctoral Research Interns. Degree students and joint doctoral research interns receive a monthly stipend for basic living expenses in addition to on-campus housing.

Health Insurance. All participants and accompanying spouses and dependents are covered by the East-West Center’s comprehensive health insurance plan (or the Center contributes toward the cost of an equivalent plan held by the participant) during the entire award period.

Housing. The Center has three resident halls: 1) Hale Manoa is a high-rise dormitory with units each including four small single rooms, three double rooms, one common lounge, and one common bathroom. Hale Manoa generally houses students, professional associates, and interns. 2) Hale Kuahine is a small dormitory divided into units each including four small single rooms, three double rooms, one common lounge, and one common bathroom. Hale Kuahine generally houses students, professional associates, and interns. 3) Lincoln Hall has individual studio and one-bedroom apartments with baths, including some with kitchenettes. Lincoln Hall houses visiting scholars and officials including fellows and short-term senior professional associates who attend conferences and workshops.

During the first year on award, students, professional associates, and interns (including those with spouses, but without dependent children) reside on campus. After the first year, these participants may choose to reside off campus at their own expense. In exceptional cases where students, professional associates, or interns have accompanying minor dependent children (under 18) or have documented health problems that cannot be accommodated in on-campus facilities, such participants may reside off campus, and a limited off-campus housing allowance is provided. Fellows (without accompanying dependent children) have the option of residing on campus for up to one year (normally in Lincoln Hall). If fellows choose to reside on campus, costs of on-campus housing are deducted from the stipend payment.

The Center provides participants with the opportunity of residing in all-female, all-male, or mixed floors or areas within the residence halls.

Other Allowances. As noted under the Housing section, the Center provides a limited off-campus housing allowance to those students, professional associates, and interns who have accompanying minor dependent children or documented health problems which cannot be accommodated in Center facilities. The amount varies according to the number of dependents and is based upon current East-West Center rates. This allowance continues throughout the active period of the award, including field work or project related travel, so long as the spouse and dependent minor children remain in Hawaii.

The Center also pays tuition and other fees of participants who undertake a course of study outside the East-West Center when this is stipulated in the award agreement or authorized by the institute director.

For work contributory to a project activity prior to actual participation (such as preparation of a major conference paper) an honorarium may be paid to some short-term professional associates or fellows.

The Center provides an allowance for books and materials or the books and materials themselves when necessary for accomplishment of the award objectives.

Field Work. Field work is a planned, budgeted component of a program project. Detailed provisions for field work vary among the institutes. If the participant's project has a field work component, the following Center-wide provisions apply:

a. Time spent in field work is limited and in no case exceeds 49 per cent of the award time available. Unless part of a specific project activity design, no field work should be the terminal experience of a participant. Generally, a minimum of one month of award time will remain after return from the field work to the Center.

b. In determining costs of field work, in-transit payments are uniform for all categories of participants. Stipends provided while in residence in the field are related to variations in stipends provided to the various categories of participants while in residence at the Center.
Spouses and Dependents. The Center does not accept the financial responsibility for dependents of participants and makes no differential stipend payments on the basis of marital status. Therefore, participants who plan to bring spouses or dependents to Honolulu should be fully aware of the high cost of living in Honolulu, the limited availability and high cost of off-campus housing, and the difficulty in finding employment opportunities for spouses.

The Center does, however, provide certain limited financial assistance as follows:

a. During the period of active award status, the Center makes available residence hall space for spouses of participants and provides a limited off-campus housing allowance for students, professional associates, and interns accompanied by dependent children.

b. The Center provides health insurance for all participants, accompanying spouses, and dependent children, and requires health insurance for other accompanying dependents.

The Center also provides appropriate opportunities for the spouses and dependents of participants to be involved in informal and social activities at the Center.

APPLICATION PROCEDURES FOR AWARDS

All awards are for participation in specific projects and activities of the Institute programs and Open Grants. No awards are offered for pursuits that are not part of the programs of the Center.

Graduate Degree Student Awards. Persons interested in these specific awards should be aware of two basic characteristics of the award: (1) Applications for award normally follow a process of national competition administered in-country by Center program representatives listed below. Only Americans and individuals from countries without EWC Program Representatives or without provisions for handling degree student applications (see next section) may apply directly to the Center for graduate degree awards.

Awards are made only on the basis of open competition. National competition application deadlines vary, by country, between March and October of each year, and all national slates of applicants must be received at the East-West Center by the international deadline of Dec. 1 for any given year. Awards are announced on April 1, for study to begin in August of that same year.

Fellow Awards and All Intern Awards. Application for these awards are made at the project level. Persons interested in these categories of participant awards should contact the office listed in the relevant EWC institute section of this catalog or the in-country program representative for more information. Normally, Fellows are selected for their expertise in a particular area relevant to an Institute project and are invited to participate by the Institute academic staff. Interns are often nominated by cooperating institutions, but in some instances, individuals may apply.

Professional Associate Awards. These comprise the great majority of award opportunities for participation in Center programs. Contact the office listed in the relevant EWC institute section of this catalog or in-country program representative for information on which activities will be held during the year and which are open for applications. In some cases, participation is limited to those of a particular position; in others, participation is limited to those nominated by cooperating institutions; and in others, awards are available to applicants who meet prestated selection criteria.
PROGRAM REPRESENTATIVES

The East-West Center works under cooperative arrangements with countries and territories within the United States, Asia, and the Pacific region. In-country program representatives assist the Center in recruiting, advising, and selecting participants. Identify your program representative by your citizenship or legal permanent residency regardless of the country you are currently residing in (e.g., Singaporeans in the United States would apply through the Singapore program representative). Citizens or legal residents of the United States and those countries or territories which are not included in the following list, may correspond directly with the Awards Coordinator, East-West Center, 1777 East-West Road, Honolulu, Hawaii 96848.

AFGHANISTAN
Executive Director
Afghan-American Educational Commission
P.O. Box 3124
Kabul, Afghanistan

AMERICAN SAMOA
Degree student awards only:
Special Assistant for Public Affairs
Department of Education
Pago Pago, American Samoa 96799

All other awards:
Assistant Director
Training Division
Governor's Office
CETA Administration
Pago Pago, American Samoa 96799

AUSTRALIA
Executive Officer
Australian-American Educational Foundation
Churchill House
218 Northbourne Avenue
Canberra, A.C.T. 2601, Australia

BANGLADESH
Cultural Affairs Officer
American Cultural Center
House #8, Road #9, Dhanmondi R.A.
Dacca, Bangladesh

BHUTAN
First Secretary
Royal Bhutan Mission to India
Chitra Gupta Marg
Chanakyapuri
New Delhi 110021, India

BURMA
Cultural Affairs Officer
American Embassy
581 Merchant Street
Rangoon, Burma

COOK ISLANDS
Staff Training Officer
Manpower Training Unit
Public Service Commission
P.O. Box 24
Rarotonga, Cook Islands

FIJI
Degree student awards only:
Assistant Registrar (Academic)
University of the South Pacific
P.O. Box 1168
Suva, Fiji

All other awards:
Cultural Affairs Specialist
American Embassy
P.O. Box 218
Suva, Fiji
Regional representative
Assistant Research Officer
South Pacific Bureau for Economic Co-operation
G.P.O. Box 856
Suva, Fiji

GUAM
Dean
Graduate School & Research
University of Guam
P.O. Box EK
Agana, Guam 96910

HONG KONG
Assistant to the Director
Institute of International Education
Southeastern Asia Regional Office
The Hong Kong Arts Centre,
12th Fl.
Harbour Road, Wanchai
Hong Kong

INDIA
Program Officer
U.S. Educational Foundation in India
Fullbright House
12 Hailey Road
New Delhi 110001, India

INDONESIA
The East-West Center
c/o American Embassy
International Communication Agency
Jl. Medan Merdeka Selatan 4
Jakarta, Indonesia

IRAN
Executive Director
U.S. Commission for Cultural Exchange Between Iran and the United States
Vozara Avenue
Iran America Society
P.O. Box 41-3145
Tehran, Iran

JAPAN
Degree student awards only:
Awards Coordinator, East-West Center
All other awards:
Liaison Officer
East-West Center, Japan Office
Room 207, Sanno Grand Building
14-2, Nagata-cho, 2-chome
Chiyoda-ku, Tokyo 100, Japan

KOREA, REPUBLIC OF
Executive Secretary
Korean-American Educational Commission
Garden Tower #1801
98-78 Wooni-dong, Chongro-ku
Seoul 110, Korea

MALAYSIA
Program Officer
Malaysian-American Commission on Educational Exchange
198 Jalan Ampang
Kuala Lumpur 04-07, Malaysia

NEPAL
Program Officer
U.S. Educational Foundation in Nepal
Post Box 380
Kathmandu, Nepal

NEW ZEALAND
Programme Officer
New Zealand-United States Educational Foundation
P.O. Box 3465
Wellington, New Zealand

PAKISTAN
Program Officer
U.S. Educational Foundation in Pakistan
2-84th Street, Ataturk Avenue
Ramna 6/4
Islamabad, Pakistan

PAPUA NEW GUINEA
Public Affairs Officer
International Communication Agency
American Embassy
P.O. Box 3492
Port Moresby, Papua New Guinea

PHILIPPINES
Executive Director
Philippine-American Educational Foundation
R-301, Teodorica Apartments
1148 Roxas Boulevard
Manila 2801, Philippines

SINGAPORE
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TONGA
Degree student awards only:
Scholarship Officer
Ministry of Education
Nuku’Alofa, Tonga

All other awards:
Principal Training Officer
Secretary to Government
Prime Minister’s Office
Nuku’Alofa, Tonga

TRUST TERRITORY
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Saipan, Mariana Islands 96950

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P.O. Box 193
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Citizens or permanent legal residents of the following countries and territories should contact:

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Each year more than 1,500 men and women from many nations and cultures participate in Center programs that seek cooperative solutions to problems of mutual consequence to East and West. Working with the Center's multidisciplinary and multicultural staff, participants include visiting scholars and researchers; leaders and professionals from the academic, government, and business communities; and graduate degree students, most of whom are enrolled at the University of Hawaii. For each Center participant from the United States, two participants are sought from the Asian and Pacific area.

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