
**US-JAPAN ENERGY
COOPERATION
To Help Achieve
Sustainable
Development in Asia**

SEPTEMBER 2000

P o l i c y P a p e r

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Executive Summary

Given the dramatic increases in economic growth, energy use and attendant environmental problems in Asia, it is timely for Japan and the United States to increase their bilateral cooperation and cooperation with other Asian countries in the energy field as an integral part of their efforts to help Asia achieve sustainable development. The magnitude of growth in Asia in energy use is well illustrated, for example, by a projected doubling in China from 1990 to 2020. Projections indicate energy demand in China could triple by 2050, relative to 1990. These increases are not only of great significance to individual Asian economies, but also globally, as projections indicate that most of the growth in energy demand in the next century will occur in Asia (and principally in China and India). Achievement of such growth in energy demand, to improve the living standards of the 3.3 billion Asians that now represent about half of the world's population, is essential from the viewpoint of equity, social development and the economic well-being of people throughout Asia.

There is widespread recognition that, while increases in the economic well-being of Asians is critical, there will be many challenges in supplying the energy to meet their needs and in coping with the environmental problems that will be associated with energy use. Energy supply issues include:

- Security of supply, in particular for imported oil;
- Funds to pay for domestic and imported energy, and to finance energy projects;
- The overall effectiveness, reliability and efficiency of energy systems;
- Pollution associated with energy use; and
- The economic and social impacts of economic, energy and environmental policies, that can result in changes in industrial structures, and in both beneficial and adverse impacts on people.

Taking these points into account, the Committee for Energy Policy Promotion (Japan) and the Atlantic Council of the United States determined that, on the occasion of the 20th anniversary of their ongoing dialogue, they should develop recommendations to increase Japanese-US energy cooperation to help achieve sustainable development in Asia. In developing these recommendations, CEPP and the Council have reviewed the history of Japan-US energy cooperation since 1970.

More importantly, CEPP and the Council have recognized the many efforts now underway at the national level in many Asian countries and through organizations such as the Asia Pacific Economic Cooperation forum (APEC), the Asia Pacific Energy Research Center (APEREC), the South Asia Association for Regional Cooperation (SAARC), the UN Economic and Social Commission for Asia and the Pacific (ESCAP), the International Atomic Energy Agency (IAEA), and the International Energy Agency (IEA), to address the relationships between economic growth, energy use and the environment.

CEPP and the Council are addressing their recommendations to the public and private sectors of Japan and the United States. We welcome comments on these

recommendations from our colleagues in both countries and in particular from colleagues and other interested people in Asian countries and intergovernmental organizations.

The recommendations are highlighted in the chart below and presented in more detail in the full policy paper.

Overview of Recommendations to Increase U.S.-Japanese Energy Cooperation

<i>Issue</i>	<i>Recommendations</i>
Energy Security	▪ Strengthen efforts to develop data systems building on IEA, and APERC work. ▪ Hold conferences involving APERC, SAARC, and IEA to discuss practical development of strategic reserve oil stockpiles.
Diversity of Supply	▪ Hold Asia-wide meetings in support of APEC's goal to foster gas use by addressing regulatory issues, safety and training, and long-term outlook for fuel cells and methane hydrates. ▪ Increase R&D on nuclear reactors (including Generation IV) aimed at improving economics, safety, waste management, and addressing concerns regarding dual-use (civilian-military uses of nuclear technologies). ▪ Increase efforts in the IAEA and WANO (World Association of Nuclear Operators) to emphasize a nuclear-safety culture in Asia. ▪ Carry out multilateral assessments for renewable use.
Energy Efficiency	▪ Conduct seminars and establish enterprise partnerships on practical problems in improving energy efficiency.
Environment	▪ Increase R&D cooperation on carbon sequestration to increase feasibility and affordability.
Restructuring	▪ Form private sector committee to advise Asian governments and enterprises on restructuring in electric power sector. ▪ Hold seminars on regulation of electric utilities in several Asian countries.

US-JAPAN ENERGY COOPERATION To HELP ACHIEVE SUSTAINABLE DEVELOPMENT IN ASIA

I. Sustainable Development

Any discussion of future global and/or Asian development should begin with full consideration of the critical need for approaches compatible with policies and practices supportive of sustainable development.¹

The work of a commission of eminent persons chaired by Gro Harlem Brundtland² stressed the need for concerted long-term action to assure sustainable development for the world. The commission chapter on energy states that:

“Energy is necessary for daily survival. Future development crucially depends on its long-term availability in increasing quantities from sources that are dependable, safe and environmentally sound. At present, no single source or mix of sources is at hand to meet this future need.”

This theme has been recognized widely in the public and private sectors of many nations, intergovernmental organizations and non-governmental organizations. While progress has been made in increasing the effectiveness and efficiency of many energy systems, much remains to be done. This is true in both developed countries and developing countries.

In developing countries, it is especially critical if we are to meet basic needs for food, shelter, and clothing at more acceptable levels. Population in the developing world is expected to grow by more than one billion by 2020, and by an additional two billion by mid-century. Much of this growth will be in Asia. The challenge is therefore not only to meet basic needs for people throughout the world, many of whom are living on the equivalent of

¹ “The reconciliation of society and developmental goals with the planet’s environmental limits is the foundation of an idea known as sustainable development.” *Our Common Journey*, National Research Council, National Academy Press, 1996.

² Brundtland, Gro Harlem, *Our Common Future*, The World Commission on Environment and Development, Oxford University Press, 1987.

one or two dollars a day. It is to increase their living standards while also addressing the needs of additional billions in the coming decades.

Recognizing the critical need for sustainable development, the Atlantic Council, for example, published a policy paper in 1992 presenting recommendations on balancing economic growth, energy use and the environment. The consensus policy paper, which was developed by about 90 experts from developing and developed countries and intergovernmental organizations, stressed the need for overall economic policies that: foster energy efficiency and technology choice; are comprehensive in looking at overall energy systems; involve dedication to managerial and technical training as well as systematic exchange of information³; and targeted financial assistance.

Many other institutions including the World Bank, the International Energy Agency, and countless national institutions, both public and private, have a range of programs which contribute to fostering energy efficiency throughout the world. The website of the World Energy Efficiency Association, for example, lists more than 1,000 institutions in many countries of the world having a particular interest in increasing energy efficiency.

The continuing concern about sustainable development is illustrated by a 1996 Trilateral Commission Report, *Maintaining Energy Security in a Global Context*, which recognizes “three faces of energy security: limiting vulnerability to disruptions given rising dependence on imported oil; provision of adequate supply for rising demand at reasonable prices; and the energy related environmental challenge. The international energy system needs to operate within the constraints of sustainable development.”

This concern is further illustrated in the National Research Council publication *Our Common Journey – A Transition Toward Sustainability*, a study with a time horizon of two generations. The report states that the transition towards sustainability will require “significant advances in basic knowledge, in the social capacity and technological capabilities to utilize it, and in the political will to turn this knowledge and know-how into action.” It is important to note that the report looks at several dimensions of sustainability in addition to energy use, including population, urbanization, declines in agricultural production, ecosystems, and water availability. The report notes that “a reasonable goal” would be doubling the historical rate of improvements in energy and materials use, including “the long-term reduction in the amount of carbon produced per unit of energy.”

Japan and the United States have increasingly focused on the role of energy in sustainable development.⁴ In addition to supporting programs in the World Bank, the IEA and APEC, the public and private sectors of both countries have mounted a range of activities relating in particular to increasing energy efficiency and reducing pollution associated with energy use. Examples include the work of Resources for the Future, which has a collaborative undertaking on energy efficiency in China, and the work of the Energy

³ This recommendation led to the formation of the World Energy Efficiency Association which maintains a website receiving about 60,000 hits per month <www.weea.org>.

⁴ Guertin, D.L., Shimoda, K., “A Brief History of US-Japanese Energy Relations and Cooperation,” published on the Atlantic Council website <www.acus.org>, September 2000.

Conservation Center (Japan), which conducts training programs on energy efficiency in developing countries.

Japan and the United States have formalized their mutual interest in contributing to sustainable development by launching the Common Agenda for Cooperation in Global Perspective in July 1993. Particular emphasis has been placed to date on environmental degradation, overpopulation, and disaster relief. The overall program aims at: promoting health and human development; responding to challenges to global stability; protecting the global environment; and advancing science and technology. The Japanese and U.S. governments are now developing specific programs in the energy area.

In this regard, a May 2, 2000 report, *An Agenda for Future U.S. Japan Scientific and Technical Cooperation*⁵ proposes an “Initiative to Accelerate the Global Transition to Cleaner Energy Systems.” The report recommends a formal institutional relationship between the new National Institute of Advanced Industrial Science and Technology (Japan) and the US Department of Energy to foster research on advanced technologies, information exchange, and private sector involvement. It also proposes cooperation to “help identify and implement the best technologies and approaches to provide clean, affordable, and sustainable energy in developing countries.”

This study’s recommendations will, in particular, address how enhanced Japanese-US energy cooperation can help advance basic knowledge and technological capabilities to utilize this knowledge. It will also make some recommendations on how Japanese-US cooperation can assist Asian economies as they restructure their energy sectors to increase the overall effectiveness and efficiency of energy systems.

⁵ Neureiter, Norman P. and Imura, Hiroo, “An Agenda for Future U.S.-Japan Scientific and Technical Cooperation”, May 2, 2000.

II. Energy Outlook

A. World Energy Outlook

In developing recommendations for Japanese-U.S. cooperation to help achieve sustainable development in Asia, it is essential to take into account projections for economic growth and energy use in the coming century. These include projections by APERC to 2010, the IEA outlook to 2020 and a joint International Institute for Applied Systems Analysis/World Energy Council study looking at scenarios to 2050 and 2100. These projections and scenarios are not meant to be taken as absolute forecasts, but rather to be used as tools better to understand possible futures and probable impacts of various policy approaches.⁶

Three cases taken from the IIASA/WEC scenarios illustrate a range of possible global futures in the year 2050.⁷

	<i>High Growth</i>	<i>Middle Growth</i>	<i>Ecologically Driven</i>
World Population, <i>Billion</i>	10.1	10.1	10.1
Primary Energy Demand <i>Gigatons oil equivalent</i> ⁸	25	20	14
Resource Availability: Fossil Non-Fossil	High High	Med. Med.	Low High
GDP Growth %yr 2020-2050	2.6	2.0	2.1

⁶ For additional information see: Lyman, John, *Energy Outlook for Asia*, May 2000 <www.acus.org>, as well as IIASA, EIA and IEA websites: <www.eia.doe.gov/emeu/international/contents> and <www.iiasa.ac.at>, International Energy Agency, *World Energy Outlook 1998*.

⁷ Rolland A. Langley believes that these demand scenarios are understated. He believes that consumption in China could easily exceed tripling the 1990 rate in 2050 when the current overall lack of electricity in a large number of households and the rate of modern industrialization are considered. As a benchmark, one might use 25 to 50 percent of the current European per capita rate.

⁸ Primary energy demand in 1990 was 9 Gigatons oil equivalent (Gtoe); world population was 5.3 billion.

B. Asia Energy Outlook

A comparison of primary energy demand for major regions of Asia relative to global energy demand for the middle growth case is presented below. This chart compares energy consumption in Gigatons oil equivalent (Gtoe) for a number of years from 1990 to 2100.

Region	1990	2000	2020	2050	2100
North America	2.2	2.4	2.8	3.0	3.0
Pacific OECD	0.5	0.6	0.6	0.6	0.6
Centrally Planned Asia*	0.9	1.4	2.1	3.5	5.9
South Asia	0.4	0.6	0.9	2.0	6.0
Other Pacific Asia	0.4	0.6	1.0	1.6	2.5
World	9.0	10.1	13.6	19.8	34.7

* Centrally planned Asia consists of Cambodia, China (PRC), North Korea, Laos, Mongolia, and Vietnam.

These scenarios show a significant increase in energy demand for North America (2.2 Gtoe to 3.0 Gtoe) and limited growth in the Pacific OECD area (0.5 Gtoe to 0.6 Gtoe). Growth in the three Asian areas noted (excluding former Soviet Union and Middle East Asia) is very dramatic. In centrally planned Asia for example, demand is shown as increasing from 1.4 Gtoe in 2000 to 5.9 Gtoe by 2100. This scenario shows energy demand in centrally planned Asia exceeding that of North America by 2050 and double that of North America by 2100. By 2100, in this scenario, centrally planned Asia energy consumption could represent 17 percent of world consumption in comparison to 14 percent of world consumption in 2000.

The IIASA/WEC scenarios also include figures on cumulative investment to meet energy needs globally and by regions in the middle growth case. Globally, the investment scenarios come to trillions of dollars over the period from 1990 to 2100. Investments by area for Asia Pacific (ex. FSU and Asia Middle East) are presented below.

Cumulative Investment in Trillions of US dollars

Region	1990-2020	2020-2050	2050-2100
Centrally Planned Asia	1.17	3.42	15.21
South Asia	0.54	1.50	9.70

Other Pacific Asia	0.60	1.49	5.24
Pacific OECD	0.74	0.97	2.47

These estimates demonstrate the magnitude of the efforts needed to meet Asian energy needs in the next century, and demonstrate that efforts to improve the effectiveness and efficiency of energy systems can make a significant contribution to reducing capital requirements to meet energy needs for the rapidly growing populations of Asia.

These projections and those of the IEA and others indicate that even by 2020, developing countries' growth rate in GDP will be faster than that of industrialized countries and will be concentrated in Asia.

Developing countries' total consumption of primary energy in the middle growth case will be greater than that of industrialized countries, reflecting economic and population growth. Fuel use patterns in the middle growth case are expected to be about the same as today with the exception that natural gas demand will increase in the long run. In Asia, coal is expected to continue to play a major role (China and India are heavily dependent on coal). Nuclear power is now a significant energy source in some countries in Asia, in particular, Japan and South Korea. It grew 18 percent annually between 1971 and 1993, and is now projected to increase at a more moderate rate in the period to 2010 (about four percent per year).

Looking out to 2050-2100, IIASA and WEC scenarios show continuing heavy dependence on fossil fuels in centrally planned Asia (mainly China) and South Asia (mainly India). Other Pacific areas show significant growth in use of renewables.

A higher economic growth scenario for Asia (2.6 percent per year in 2020-2050 and 2.3 percent per year in 2050-2100 versus 2.0 percent per year in the medium growth case) results in an almost 30 percent increase in energy demand in 2100 (45 Gtoe versus 35 Gtoe).

In this higher growth scenario prepared by the IIASA/WEC, there is a greater shift to reliance on nuclear power and other new energy resources as a percentage of fuel for centrally planned Asia. There is also a very significant gain in the use of solar energy in South Asia.

As the latter part of this paper and the outlook above illustrate, meeting energy needs in a sustainable context for Asia in the coming century poses many challenges.

1. All energy resources are expected to have a role to play in meeting Asian and global energy needs.
2. Efforts to increase the effectiveness and efficiency of energy systems can have a critical impact on energy demand.
3. Energy resource choices, technologies to reduce pollution – including carbon emissions – and higher efficiency can have a dramatic environmental impact.

Given these projections, it is important to know where Asian economies now stand in managing energy systems in their countries. This is discussed in the next section of this paper.

III. An Overview of the Structure of the Energy Sector and Energy Policies in Asia

A. Present Situation

As noted in the previous section on the energy outlook, Asian energy demand would drive global energy demand in the coming century under a variety of energy future scenarios. This will occur because of dramatic increases in population projected for Asia, the need for significant increases in economic growth to meet the aspirations of people throughout Asia, and the economic dynamics evident in Asian economies.⁹

In this regard, the energy outlooks for China and India, whose populations are now over two billion, are especially critical. The energy consumption per capita in both countries is now a small fraction of that in the United States or Japan (for example, China's energy use per capita is about four percent that in the United States). The low levels of energy consumption per capita dramatize the major challenges which must be addressed by China, India and other Asian nations as their economies develop and living standards are improved.

1. Issues Arising From the Outlook

While addressing these challenges, it will also be desirable to balance economic growth, energy use and environmental impacts (the 3 Es) to help ensure the sustainability of development in Asia. In balancing the 3 Es, Asian economies must take into account several significant points:

1. While there are oil reserves in the region, in particular in China, Indonesia and Malaysia, the region is now dependent on imports from the Middle East and this dependence will grow in coming decades, resulting in concerns about energy security.

2. Although natural gas and LNG only provide a small percentage of overall energy supply in Asia at present, their use is expected to grow. Meeting this demand will require additional development of Asian gas fields, especially in Russia and the Central Asian republics, pipeline infrastructure and facilities for handling LNG.

3. China and India are now heavily dependent on coal, and given their coal resources, are expected to rely heavily on coal in the future. This will require significant increases in the deployment of clean coal technologies to contribute to decreased environmental pollution as well as increased R & D efforts on carbon sequestration.

4. Nuclear power is now an important source of electric power in Japan, South Korea, Taiwan, and to a lesser extent India and Pakistan. It is expected to increase in importance in China. Some other Asian countries are expressing interest in nuclear power in

⁹ IIASA-WEC scenarios note population increases for Asia (ex former Soviet Union and OECD Asia) from 3.3 billion in 2000 to 5.0 billion in 2050, <www.iiasa.ac.at/cgi-bin/ecs/book_dyn/bookcnt.py>

the long term. The overall management of existing and expanded facilities is critically important.

5. The effectiveness and efficiency of electric power generation and use could be greatly improved. Such improvements can moderate the need for ever increasing supply necessary to meet the growing economic aspirations of Asian populations.

6. While some countries, in particular Japan, have excellent records on the efficient use of energy, and China has made significant strides in increasing energy efficiency, the region overall has vast potential to use energy more efficiently.

7. Commercial renewable energy use is expected to grow in the region, in particular in remote villages. However, the overall impact of renewable use in Asia is unlikely to increase significantly, at least without substantial technological and policy efforts.¹⁰

8. There is a growing awareness of the need to address environmental impacts of energy use, necessitating increased investment over time in improving environmental performance.

Governments throughout Asia are recognizing these challenges by developing new institutions, increasing regional cooperation,¹¹ taking initial steps to restructure their energy sectors, in particular their electric utility sectors, and in some cases taking actions to improve the basic financial viability of their energy sectors by moving to raise prices to cover costs and reducing broad-based subsidies. Some of these actions are illustrated below.

2. Energy Security/Diversity of Supply

The growing interest in energy security¹² is discussed in a 1999 article by Dr. Fereidun Fesharaki,¹³ which reviews Asian thinking about energy security since the 1970s. Fesharaki concludes that many Asian countries have learned that market forces can contribute to energy security and as a result are placing increased emphasis on economic reform, deregulation and privatization.

While, as noted, there is an increasing movement towards recognition of market forces, there is a continuing interest in diversification of supply options and energy efficiency to decrease overall energy needs, in particular for imports. There are efforts underway, notably in APEC, to develop information systems and address questions on oil reserves.

¹⁰ The IIASA/WEC middle growth scenario shows significant growth in use of renewables in some Pacific areas beyond 2050. Renewables also show a significant increase in the higher growth scenario in South Asia. India, for example, has made a commitment to meet 10 percent of capacity additions by renewables by 2010.

¹¹ See Annex A for brief description of some regional cooperation efforts.

¹² Energy security and diversity of supply are viewed as synonymous in Japan.

¹³ Fesharaki, Fereidun, "Energy and the Asian Security Nexus," *Journal of International Affairs*, Fall 1999.

APERC for example, published a report on energy demand and supply in 1998.¹⁴ More recently in March 2000, APERC¹⁵ published a report on emergency oil stocks and energy security. This reported several policy issues for further study including:

- oil pricing policies to cover costs of stockpiles
- minimum stockpiles equal to 30 days of net imports, which might be held on a joint basis.

Most of the above activities are designed to address short-term disruptions or disruptions to particular countries or regions. If there were to be either an extended disruption or a more widespread significant supply disruption, it would also be important to have contingency plans available to deal with shortages that could not be adequately covered by stock drawdowns. Such plans should incorporate an understanding of demand price elasticity and fuel switching capabilities in various countries. Most countries, including the United States, do not appear to be addressing the allocation and pricing issues which would arise from a major worldwide supply disruption.

China, for example, recognizes its increased dependence on oil imports from the Middle East and is committed to optimizing domestic energy resource development and diversifying sources of supply.¹⁶ China is therefore reviewing importing LNG and gas products via pipelines from Russia and/or Central Asia. According to a paper by Xiaojie Xu,¹⁷ feasibility studies are now underway on possible Russia-China natural gas pipelines. Investment requirements could total more than \$20 billion and require at least ten years for completion. Since 1990, China has also become somewhat more open to foreign investment. Foreign investments in oil exploration and development for example, totaled about \$580 million by the end of 1999. The value of overall contracts is \$1.12 billion.¹⁸

The Indian government has also announced significant policy initiatives to attract foreign investors. Oil and gas exploration projects are open to the private sector and for foreign participation under production-sharing agreements. Up to 100 percent foreign investment is also allowed in production, import, marketing and import terminals for LNG, and pipelines for natural gas.

More effective utilization of coal reserves in China, India, Indonesia, and other Asian countries can also contribute significantly to energy security. Coal reserves in Asia, for example, represent about 21 percent of world coal reserves.¹⁹ About 75 percent of primary energy in China is supplied by coal, and future scenarios show coal continuing to play a very significant role.

¹⁴ APERC, *APEC Energy and Supply Outlook*, July 10, 1998. <www.iecee.or.jp/aperc/executiv.htm>

¹⁵ APERC, *Emerging Oil Stocks and Energy Security in the APEC Region*, March 2000, APEC #00-RE-01.2.

¹⁶ Julian Steyn also notes that India shows these same concerns.

¹⁷ Xiaojie Xu, *Sino-Russian Gas Connections and Impacts*, The James A. Baker III Institute for Public Policy, Rice University, May 2000.

¹⁸ Mehmet Ögütcü, *Foreign Direct Investment in China's Energy Sector*, May 2000.

¹⁹ "BP Statistical Review of World Energy," June 1998

A number of countries (Japan, South Korea, Taiwan, India, Pakistan and China) use nuclear power to contribute to energy security and diversification of supply. (Nuclear power provides 36 percent of electricity in Japan and 43 percent of electricity in South Korea.) Other countries, in particular Vietnam, have indicated interest in nuclear power to meet future needs. The paper, *An Appropriate Role for Nuclear Energy in Asia's Power Sector*, provides an in-depth discussion of the challenges facing the region in fulfilling its nuclear plans. The paper includes recommendations on: reactor safety; regulation; waste management; economics; financing; R&D; public attitudes; non-proliferation; and regional and international cooperation.

There is also interest in the expanded use of renewable energy resources to provide electricity cost-effectively in rural areas, to diversify supply, contribute to energy security and reduce pollution. In this regard, the National Research Council has published an overview of renewable energy resources.²⁰ While focussing on a review of the United States Department of Energy's renewable energy program, the report includes extensive discussion on research challenges, commercial prospects and barriers, and the timeline for deployment of technologies. In a section on photovoltaic programs to produce electricity, the report provides comments on the changing prices for power generated by photovoltaics and a forecast on prices and systems costs for the period from 2010 to 2030.

G-8 leaders at their meeting in Okinawa in June 2000 also proposed an initiative to greatly expand the use of renewable energy, in particular in developing countries. A task force has been formed to report back to G-8 leaders next year on concrete steps which should be undertaken in this regard.

India is the fourth largest wind energy producer in 2000, and a significant market for photovoltaic technology.²¹ India began work on wind energy in the 1980s. The Indian Renewable Energy Development Agency began making loans for wind power development in 1989. After a slow period, interest has again developed in this power sector. The Indian government is now discussing a proposal for a \$2.3 billion hydroelectric power project. In terms of capacity, this project could be larger than the Three Gorges project in China.

Any review of diversity of energy supply and energy efficiency should take into account the report of a panel of the President's Committee of Advisors on Science and Technology issued in June 1999.²² This report focuses on the need for international cooperation on energy R & D and includes brief overviews of energy R & D in China and India, as well as a number of OECD countries. While China does not yet have major energy R & D programs, the report states that the National Power Corporation announced a three year moratorium on new conventional thermal power projects and concentrates on improving the power grid and developing renewable and clean coal technologies.

²⁰ National Research Council, "Renewable Power Pathways," 2000.

²¹ Thwaites, L., *China and India, Greenhouse Gas on the Rise*, Source Book, May 2000.

²² President's Committee of Advisors on Science and Technology, *Powerful Partnerships, The Federal Role in International Cooperation on Energy Innovation*, Office of the President, June 1999.

3. Restructuring of the Utility Sector

In recent years India,²³ recognizing the need to increase the availability of electric power, undertook to strengthen the state electricity boards, privatize the sector, separate generation from transmission and distribution of power and restructure the regulatory system. Private participation is now permitted in the sector, including 100 percent equity ownership by foreign investors. According to the Shukla paper, regulations in India previously focused on creating regulatory institutions and developing rules for investment. In 1998 a Central Electricity Regulatory Commission (CERC) was created to rationalize or adjust tariffs and to develop subsidy policies which are transparent and promote “benign” environmental policies. The CERC can also: suggest tariffs to companies selling power in more than one state; regulate transmission between states; advise the central government on tariffs; and arbitrate disputes. These represent significant steps in reforming the sector.

Changes are also underway in other countries, such as Malaysia and Indonesia. Malaysia’s electric power generation is now dominated by three state-owned enterprises. Since 1994, fifteen independent power producers have been licensed, and consideration is being given to restructuring the sector to reduce costs and make it more competitive.

Indonesia had taken steps to open the electric power generation sector to independent power producers (IPP) prior to the Asian financial crisis. Decreased energy demand following this crisis has resulted in a reduction in IPP interest and in financial difficulties for the state utility, which in turn had difficulty in paying IPPs for contracted power. As a result, some foreign investors are abandoning projects and are renegotiating contracts with the state utility.

Steps are also being undertaken to lay plans for the Indonesian restructuring of Pertamina, the state oil company. Earlier efforts to pass legislation to restructure the company have not been acted upon by the parliament. Malaysia and Indonesia have long histories of foreign investment in the oil and gas sectors. An early review of production sharing agreements in these countries was published in 1984.²⁴

As discussed in “A Brief History of U.S.-Japanese Energy Relations and Cooperation,” the United States and Japan have established an activity to discuss deregulation and competition policy. The “Brief History” lists deregulation and other measures undertaken by the governments under this initiative.

4. Energy Efficiency

A comprehensive overview of energy use in developing countries and the potential for energy savings is presented in a 1992 study by the Office of Technology Assessment.²⁵ The report notes, for example, that at that time steel plants in China and India used about twice as much energy to produce a ton of steel as United States and Japanese plants. The

²³ Shukla, P.R., Ghosh, Debyani, Chandler, William and Logan, Jeffrey, *Electric Power Options in India*, Pew Center on Global Climate Change, October 1999.

²⁴ Mikesell, Raymond F., *Petroleum Company Operations and Agreements*, Resources for the Future, 1984.

report discusses policies to increase efficiency in the industrial, agricultural, and other sectors.

A 1993 book on energy technology cooperation for sustainable development includes a chapter on end-use energy efficiency. The authors of that chapter note that power plants in developing countries consume 20 to 40 percent more fuel per unit of electricity than plants in developed countries.²⁶

In the past decade the recognition of the need for increased energy efficiency has led to the formation of institutions dedicated to fostering energy efficiency in countries ranging from the Philippines to India. A directory²⁷ of energy efficiency institutions lists organizations in a number of Asian countries which can provide information on best practices and run training programs in this field.

A June 2000 paper by Alimala Dutta Ray and V. Raghuraman (published on the WEEA website), for example, presents information on energy efficiency programs in the Confederation of Indian Industry (CII). They include an Energy Efficiency Forum to highlight significant achievements, provide networking opportunities and exchange information. CII has also recently formed a working group on energy efficiency labeling.

The Republic of Korea has created the Korea Energy Management Company (KEMCO) to promote energy efficiency in industry, the building sector, and transportation. KEMCO publishes *Energy Management* on a continuing basis and individual reports on conservation and energy technology trends.

While energy consumption per unit of GDP in China is much more than in the United States or Japan (five times U.S. levels, twelve times Japanese levels), it is important to recognize that over the period 1981-1995 commercial energy intensity declined 5.6 percent per year. In contrast, India had an increase of 1.4 percent per year over the same period. China's improvements are attributed to conservation actions, some reduction in subsidies, improving end-use efficiency, and fuel switching.²⁸

A March 2000 APERC report on energy pricing discusses implications for energy efficiency, the environment, and supply infrastructure.²⁹ The report states that, "Although in most cases the subsidies and tariffs on energy products are not high, the overall effect is significant and results in lower economic efficiency and welfare."

²⁵ OTA, *Funding Development*, United States Congress, Office of Technology Assessment, OTA-E-516, April 1992.

²⁶ Guertin, D. L., Gray, J. E. and Bailly, H-C, *Energy Technology Cooperation for Sustainable Economic Development*, University Press, 1993.

²⁷ <www.weea.org>

²⁸ IEA, *China's Worldwide Quest for Energy Security*, OECD / IEA 2000, ISBN 92-64-17648-9.

²⁹ APERC, *APEC Energy Pricing Practices*, March 2000.

5. Environmental Impacts

Increasing concern about environmental issues in Asia is evidenced by the discussions at the Ministerial Conference on Environment and Development in Asia and the Pacific, held August 31 to September 2, 2000 in Kitakyushu, Japan. A background note prepared by the secretariat³⁰ for the conference states that the region's urban population is expected to increase to 2.2 billion (from 1.4 billion) by 2020. This growth could have further deleterious effects on air quality unless major actions are taken. At the present time, twelve of the world's fifteen cities having the highest levels of suspended particulate matter are in Asia. Levels are three to four times the levels of particulates recommended by the World Health Organization. SO₂ levels are also high by world standards (six of the fifteen highest levels being in Asia).

A Declaration by the Ministers³¹ addresses these concerns, stressing the need to balance economic growth and the use of natural resources. It also states the need for commitment to "nationally determined policies," integrating environmental protection and management into the development process and "greater regional and sub-regional cooperation." The Declaration notes the need for further commitment to international legal instruments and agreements. The Declaration further emphasizes the need for adequate financial resources and technology transfer and the important role of official development assistance.

As noted earlier, China and India are now heavily dependent on coal, and given their coal resources, are expected to rely heavily on coal in the future for sustainable economic development. It is projected that China and India alone will account for 40 percent of world coal use by 2010.

Two major problems both countries face in using coal are environmental pollution and inefficient use of coal. Principal concerns include: adverse health effects from high ambient levels of particulate and sulphur dioxide; major land disturbances and solid waste disposal problems; nitrogen oxides; and global effects of increased carbon dioxide and methane emissions. Efforts are underway to increase the use of clean coal technologies and the feasibility of carbon sequestration. Examples of clean coal technologies include: the use of gas made from coal; the use of coal-water slurry fuels; and the introduction of integrated gasification combined-cycle facilities.³²

Carbon sequestration (carbon capture) as well as reduced carbon content of fuels and energy efficiency must play an important role in utilizing fossil fuels. Research and development is underway in the United States and Japan to develop cost-effective sequestration, which will provide stable long-term storage of carbon and be environmentally benign.

³⁰ Note by the Secretariat, "Review of the State of the Environment in Asia and the Pacific." <www.unescap.org/mced2000/so1.htm>

³¹ Note by the Secretariat, "Regional Message for the 'Rio+10' Review of Agenda 21, and the Kitakyushu Initiative for a Clean Environment," <www.unescap.org/mced2000/so7.htm>

³² In this process, coal gasification is used to fuel a gas combustion turbine generator, whose exhaust is integrated with a heat-recovery steam generator and a steam turbine generator.

The government of China has taken a number of steps which illustrate a response to environmental problems associated with energy use.³³ The Chinese government has developed extensive environmental protection legislation, but local enforcement, especially outside major cities, is a problem. Funding and staffing are not adequate to meet enforcement goals. In 1995 the State Council approved *Agenda 21*, a comprehensive plan for sustainable development. This plan was in line with the guidelines of the U.N. Rio meeting held in 1992. The government has undertaken plans to reduce pollution associated with coal use. These plans include: reduction of particulate matter; installation of flue gas desulphurisers; and increased overall efficiency. All of these plans will be implemented over a number of years and will be greatly influenced by the availability of finance. Areas for further cooperation noted by the Coal Industry Advisory Board include: efficient coal mining practices; coal washing; coal bed methane; thermal efficiency of new plants and addition of equipment to reduce sulphur dioxide, oxides of nitrogen, and particulates.

India is also a major user of coal. Most of the coal power plants have low efficiency resulting in high energy consumption per unit of output. In recognition of the need for more efficient and less polluting power plants, the government has eased rules related to foreign investment in the sector. For example, private Indian companies setting up operating power projects or coal mines for captive combustion are allowed up to 100 percent foreign direct investment. The government is also taking steps to foster increased use of hydropower and renewables such as wind power.³⁴

In contrast to China and India, the Philippines rely heavily on geothermal power and hydropower to generate electricity. Particular emphasis is now being placed on development of natural gas-fuel plants to reduce reliance on imported oil.

The Atlantic Council, in cooperation with the Committee for Energy Policy Promotion (Japan), the Confederation of Indian Industry, and the South-North Institute for Sustainable Development (Beijing) is now undertaking a quadripartite project to promote clear air in China and India. The objective is to develop, on a collegial basis, consensus recommendations for economic and energy policies to promote clear air associated with energy use in China and India. Recommendations will include proposals to the public and private sectors of the four participating countries. Given this on-going project, recommendations in the present report will only address the area of carbon sequestration, an area in which both Japan and the United States are now active.

6. Financial Viability of the Sector

It is especially difficult for a number of Asian countries to take steps to ensure the independent financial viability of their energy sectors. Many of these countries have a history of government ownership of significant segments of their national energy sectors. This is especially true of the electric power sector, which is viewed as a natural monopoly.

³³ Coal Industry Advisory Board, International Energy Agency, *Coal in the Energy Supply of China*, OECD/IEA, 1999.

³⁴ During a March 2000 meeting in Agra, India, new Indian-U.S. initiatives to protect the environment, promote clean energy development, and combat global warming were proposed.

The utility sector has in many cases received investment funds and subsidies from governments, and tariffs for electricity have been kept low to minimize costs to industrial and individual consumers. There have, however, been some significant cases, particular in the oil, gas, and coal sectors, where financial viability has been a goal of government policy.

The APERC report on pricing practices referred to earlier presents a great deal of information on the varying pricing policies in APEC member economies. An overview of selected findings in the report is presented below.

Pricing Policy in Selected Countries

<i>Economy</i>	<i>Coal</i>	<i>Petroleum Products</i>	<i>Electricity</i>
China	Market	Controlled	Regulated
Indonesia	Market	Controlled/ Subsidized	Regulated
Japan	Regulated Market*	Market	Regulated**
Korea	Regulated Market*	Market	Regulated
Malaysia	Market	---	Regulated
Philippines	Market	---	Regulated
Chinese Taipei	Regulated Market*	Transition to Market	Regulated
Thailand	Market	Transition to Market	Regulated
Vietnam	Market	Controlled	Regulated

**Regulated domestic price*

***Since March 21, 2000 partial liberalization has occurred.*

Malaysia and Indonesia present interesting examples as their oil and gas sectors are financially viable. Both have extensive foreign and direct investment in their oil and gas sectors and are significant exporters. Nevertheless, prices of petroleum products are still controlled in these two economies, although some actions are being taken to raise prices to cover costs.

A number of other Asian countries, for example China and India, are now net importers of oil. This has been the case for China for only a few years. Given the need for funds to pay for imports, to foster domestic investment, and to provide investment funds for further development of domestic resources, China's leaders are moving toward market pricing in the energy sector. Since 1980, the government has reduced controls on oil pricing. This was initially done through a two-tier system – controlled prices within the state plan and freer prices for direct sales beyond the plan output. Through subsequent reforms in the

1990s, further steps were taken to develop market prices for refined products to increase revenue to oil companies. Reforms being undertaken in the coal sector to balance demand and supply should contribute to firmer prices for coal companies over time. In the power sector, the State Power Corporation of China is both a regulator and holding company. It is beginning to close small, less efficient, polluting plants.

As noted previously, India is also taking steps in the electric power sector to improve financial viability. In Indonesia, consideration is being given to the reduction and long-term elimination of subsidies on domestic oil consumption in Indonesia.

B. Conclusions

After reviewing current developments in the energy sector of Asia, and the history³⁵ of United States–Japanese cooperation in the energy sector, the working group agreed on the following conclusions to guide development of recommendations.

These conclusions are meant to provide an overall perspective on policy issues to be addressed to foster US-Japanese cooperation:

1. Energy security is of critical importance globally as well as in Asia. Any actions to contribute to energy security in Asia are therefore of universal benefit.

2. Diversification of supplies through the development of a range of energy resources must receive increased attention.

3. Increasing energy efficiency is attractive both to reduce demands on energy supply and contribute to reducing pollution. There are significant opportunities to increase efficiency in a number of Asian economies. The electric power sector is of particular importance.

4. There are many opportunities, in particular in the use of coal, which is a key fuel in China and India, to reduce pollution in Asia. Increased use of natural gas and LNG, nuclear power and renewables are viewed as significant approaches to reducing pollution associated with energy use. Deployment of technologies which reduce air pollution is of great importance, as are efforts to lower levels of carbon dioxide through sequestration.

5. Restructuring of the utility sectors may provide opportunities to increase the overall effectiveness of the electric power sector, thereby increasing efficiency and reducing pollution. Asian economies should carefully study the experience of economies which are now engaged in a range of restructuring/deregulatory actions, in particular in the electric power sector.

Recommendations concerning the financial viability of the energy sectors of Asian economies raise a number of economic, social, and equity issues that are best addressed at the national level.

³⁵ Guertin, D. L., Shimoda, K., *Ibid.*

IV. United States-Japan Energy Cooperation: Recommendations

1. Energy Security

As noted earlier, many Asian countries recognize that market forces can contribute to energy security and are placing increased emphasis on economic reform, deregulation, and privatization. Given the diversity of policies and practices in various Asian economies, two areas stand out for US-Japanese energy cooperation in the energy security area: availability of data and oil stockpiles.

➤ Japan and the United States should recommend that the region, including India, a non-APEC member which does participate in APERC activities, **develop, maintain, and update a shared database on energy supply and demand.** Existing collaboration by the IEA, APERC and EUROSTAT is laying a foundation for such a system. If the present institutions are unable or unwilling to develop such a database, consideration should be given to creating a new institution. As part of their work, APERC and the IEA might hold regional conferences in conjunction with the South Asian Association for Regional Cooperation. Japan and the United States should cooperate actively in these efforts. Such an effort could be part of a broader program involving oil producing and consuming countries, and focus on transparent data on oil supply, inventories, and demand worldwide.³⁶

➤ Japan and the United States should recommend **a joint conference of APERC, SAARC and the IEA** to discuss the practical issues involved in developing oil stockpiles for the region, including financing requirements and criteria for release of stocks in an emergency or other circumstances. This conference might hold several meetings over a period of two to three years.

2. Energy Diversity of Supply

Diversity of supply has long been of concern to some Asian countries, in particular Japan and Korea, and is of growing interest throughout Asia. The paper addresses subjects relating to diversity of supply: natural gas and LNG utilization; nuclear power; and renewables.

➤ The Japanese and the U.S. public and private sectors should sponsor a series of Asia-wide fora in support of APEC's goal of **fostering the development of gas grids in urban areas.** Topics might include:

³⁶ In January 2000, the U.S. Department of Energy organized an international forum to discuss how the quality, timeliness, and availability of oil production and stock data might be affecting volatility in oil markets. The forum was followed by an international conference in Madrid attended by 23 oil producing and consuming nations. At that time, it was proposed that the IEA initiate an effort to gather and disseminate such data. A follow-up meeting is being developed.

- strengthening of regulatory bodies by increasing their independence, competence, and the predictability of regulatory regimes, and by making provision for effective public participation.
 - equitable access to gas pipelines and LNG facilities.
 - gas safety and training.
 - long-term outlook for gas use in fuel cells and the rise of methane hydrates.
- The Japanese and U.S. governments should **increase R & D cooperation on nuclear reactors** (including Generation IV reactors) to increase safety, improve economic performance, reduce waste management issues, and address dual-use concerns.
- The Japanese and U.S. public and private sectors should cooperate to strengthen IAEA and WANO efforts in establishing and maintaining **a safety culture in nuclear power operations** throughout Asia. Consideration might be given to establishing a management and training institute to facilitate such efforts, following a review of the effectiveness of the initial efforts.
- The Japanese and U.S. governments, in conjunction with Asian governments, should carry out **multilateral assessments of the expanded use of renewable energy** in Asia, taking into account economics, environmental impacts, and capabilities to establish and maintain these technologies. They should coordinate their efforts with those of the task force created by the G-8 leaders to develop concrete steps to increase the use of renewables in developing countries.

3. Energy Efficiency

The benefits of increased energy efficiency have long been recognized in most Asian countries. Given the potential savings in energy use and reductions in environmental pollution as demand grows, this is an area of potentially dramatic payoff. Increasing energy efficiency is however very difficult given existing infrastructures, the lack of economic motivations in some cases, and the long time frame sometimes required to attain results. The paper therefore recommends discussions to focus on practical problems in increasing efficiency.

- The Japanese and U.S. private sectors, with government funding, should sponsor a series of seminars and enterprise partnerships focusing on the practical problems in **increasing energy efficiency in Asian economies**. This should be done taking into account APEC's current efforts.³⁷

³⁷ Wilfrid Kohl comments that it might also be useful to set up energy efficiency centers in other Asian countries using the models developed by the Battelle Pacific Northwest National Laboratory in China, Russia, and various Eastern European countries.

4. Environment

A great deal of work is now underway on a range of approaches to reducing pollution associated with energy use, including for example, clean coal technologies and sequestration of carbon. Moreover, there is now a mechanism in place for the Japanese and United States governments to cooperate on coal R & D. In addition, the Atlantic Council and CEPP are, as noted previously, now undertaking a cooperative project with China and India to promote clean air associated with energy use. This report does not, therefore, attempt to address the whole range of environmental issues associated with increasing Asian energy use. Rather, it focuses more narrowly on two key recommendations on carbon sequestration and deployment of cleaner technologies.

- The Japanese and U.S. governments should increase cooperative R & D on **carbon sequestration** with the goals of increasing feasibility and affordability. Such work should involve Asian institutions, in particular in China and India, and include both research and demonstrations of appropriate technologies.
- The Japanese and U.S. governments should work with the World Bank and other inter-governmental agencies to foster the **deployment of energy technologies which decrease pollution**. Particular attention should be given to technologies used for power generation.³⁸

5. Restructuring

Restructuring of the energy sector is occurring globally as a result of government and private sector actions. Restructuring of the electric utility sector is receiving particular attention in Asia. As restructuring takes place, many lessons are being learned regarding benefits and pitfalls. This paper recommends that efforts should be strengthened to discuss these lessons in Asia.

- The Japanese and U.S. private sectors should form a committee in conjunction with the private sectors of representative Asian countries to advise Asian governments and enterprises on **the role of markets, regulation**, and different approaches to meeting their electric power needs.
- The Japanese and U.S. public and private sectors should hold **seminars on regulation of electric utilities** in Asian countries to discuss:
 - independence and competence of regulation
 - transparency
 - dispute settlement
 - pricing and subsidies, and
 - the role of governments and markets.

³⁸ Wilfrid Kohl suggests that thought be given to making World Bank financing conditional on use of fluidized-bed combustion or combined cycle gas turbines. He also notes that need to deploy lower-emission vehicles in Asia.

Annex A

Institutions

A number of institutions have been created to foster increased cooperation among Asian countries in the energy sector. The work of the U.N. Economic and Social Commission for Asia and the Pacific (ESCAP) has already been noted. Other institutions include the Energy Working Group of APEC (Asia Pacific Economic Cooperation), APERC (Asia Pacific Energy Research Center), and SAARC (South Asian Association for Regional Cooperation). The latter group has the prospect of an inter-regional electricity grid as a cornerstone of its agenda. Brief descriptions of APEC and APERC cooperative efforts are presented below.

The APEC Energy Working Group

APEC created the Energy Working Group in November 1990. Membership of APEC includes Japan, 26 other Asian economies and the United States. Russia became a member in 1997. The Energy Working Group is responsible for promoting regional energy security. The Working Group has activities relating to data collection and dissemination, standards for energy goods, review of energy efficiency standards and regulations, encouragement of the use of renewables and other energy issues of common interest. The Asia Pacific Energy Research Center conducts research on APEC energy issues including preparation of energy supply/demand outlooks. The Energy Working Group also created a business network in 1998 to foster business government interaction.

A significant initiative aimed at enhancing the use of natural gas in the APEC region was launched at the APEC Energy Minister Meeting in 1998. Japan and the United States have particular interest in this initiative. Japan is funding projects on the use of coal bed methane in China and mine mouth coal upgrading in Indonesia.

APERC (Asia Pacific Energy Research Center)

The Asia Pacific Energy Research Center was established in 1996 in response to the Action Agenda adopted by the APEC Economic Leaders in Osaka, in November 1995.³⁹ It is an affiliate of the Institute of Energy Economics, Japan. APERC was created to foster a greater understanding of energy supply/demand trends and policy implications among member economies. In addition to supply/demand outlooks, the Center is carrying out research on: energy pricing and implications for energy efficiency; the environment and energy supply infrastructure; energy efficiency indicators for industry; natural gas resource development; feasibility of regional power networks; deregulation and privatization of the electric power sector; and the value of oil stocks for energy security.

³⁹ www.ieej.ORG.jp/

Annex B

Comments by Working Group Members

Katsutoshi Chikudate

Director, Deputy Executive General Manager of Nuclear Power Division
Tokyo Electric Power Company

At present the reduction of SO_x, NO_x and SPM emissions must be the major issues for the Asian environment. Also the facilitation of more efficient use of energy must be strongly linked with environmental measures. So transfer of these relevant technologies to Asian region is required to solve these issues.

Although nuclear power would be a strong option for a balanced achievement of what is referred to as the '3Es' in the Asian region, the recommendations should also refer to the fact that there are various difficulties in introducing nuclear power, i.e., nonproliferation and back-end issues. International cooperation to cope with these issues is important.

Concerns about nuclear nonproliferation:

- In pursuit of the peaceful use of nuclear power, it is necessary/indispensable to set forth the position of respecting IAEA activities and to secure transparency by the participation of countries/regions in the international framework for nuclear safety and nonproliferation.
- It is regrettable that, at this moment, all Asian countries/regions do not join in the framework, therefore, schemes are required to deepen dialogue and to call for their participation in the international framework.
- The back-end (nuclear waste and spent fuel) issue which inevitable arises from nuclear power utilization is also associated with nonproliferation. It is necessary to promote political and technological cooperation in the Asian region from an early stage in the introduction of nuclear power and to work to get rid of future uncertainty regarding nuclear waste and spent fuel.

Martha Caldwell Harris

Senior Fellow, Atlantic Council of the United States

Developing and using Asian energy resources more efficiently should be seen as a major way to address energy security concerns. Although the paper touches on this subject, more needs to be said about it and about experience to date with multilateral cooperation—including both successes and problems—if the U.S. and Japan are to initiate new and deeper forms of cooperation in the energy and environmental fields. Some joint efforts are under way, but progress has been slower than expected in a number of gas projects in Northeast Asia, despite the assessment by APERC that there is sufficient demand to justify a natural gas pipeline project in this part of the region. China is promoting a new East-West gas pipeline project, and a variety of other projects are under consideration. How will priorities

be set and will the outcomes address the energy and environmental needs of all the countries involved?

In order to develop realistic and feasible expectations, it will be increasingly important to think beyond and across the traditional energy policy “issue” areas, as defined in this report. For example, impediments to development and effective use of resources include not only regulatory regimes in host countries, but also energy market restructuring policies in potential markets, as well as the absence of shared understandings of environmental risks—not to mention economic uncertainties relating to projected demand and alternative fuel prices in the future. This synergy needs further attention and requires thinking about new partnerships among countries, organizations, and individuals.

The paper does not delve into clean coal, a very important subject for Asia. The reason is apparently that a framework for cooperation has been established. However, the reality is a set of demonstration projects that are likely to remain isolated and disconnected from the mainstream of power generation unless new initiatives are taken. The governments of Japan, the United States and China have all highlighted clean coal as a priority, but much more needs to be done to set priorities, identify areas for joint action, and ensure implementation.

Finally, it would have been useful to say more specifically what governments, private firms and NGOs can contribute to addressing the issues highlighted in general terms in the report. It would also have been useful for the Working Group to prioritize recommendations and suggest required levels of effort or cost.

David Jhirad
U.S. Department of Energy

As regards energy security, I would propose that the effort to develop data systems include transparent data on oil supply, inventories and demand worldwide, as part of a broader initiative involving oil producing and consuming countries. Some background may be helpful here.

Last January, the Department of Energy organized an international forum to discuss how the quality, timeliness and availability of oil production and stock data might be affecting volatility in oil markets. This forum was followed by an international conference in Madrid attended by 23 oil producing and consuming nations where Secretary Richardson proposed that the IEA initiate an effort to gather and disseminate such data. I have been working with William Ramsey at the IEA to organize a follow-up meeting and to initiate a process to collect and distribute “transparent” data. We can make this an important part of the United States-Japan agenda.

The United States and Japan could use the meetings on oil stockpiles to elucidate a broader, more realistic concept of energy security that emphasizes interdependence of nations and relies on both a well-functioning market and strategic stockpiles.

The G-8 leaders at their meeting in Okinawa in June 2000 proposed an initiative to greatly expand the use of renewable energy, particularly in developing countries, and directed that a task force be formed to report back to the leaders next year on concrete steps to be taken. (This is a Tony Blair initiative.) Mark Moody-Stuart, CEO of Shell will co-chair the task force with a senior Italian official. The United States and Japan should play a leadership role in this task force. It is also worth stressing that private sector and non-profit groups should play a key role in this cooperation.

Rolland A. Langley
Former President, BNFL Inc.

I believe the following recommendations should have been presented in the report:

- Establishment of joint working groups on sustainability of nuclear energy through breeder reactors and the thorium fuel cycle.
- Establishment of mechanisms for exchange of efficiency technologies now being applied in the United States and Japan.
- Exchange of technologies on super-conducting high kVA transmission systems.

Shunji Shimoyama
Senior Advisor, Japan Power Company

There may be little agreement in Japan regarding the establishment of a management and training institute. It is quite difficult to establish such new international organizations in Asia; moreover, we already have the organization WANO, whose biggest advantage is its non-governmental nature and China, Taiwan (Chinese Taipei), and even such non-NPT member countries as India and Pakistan are joining it. Therefore, we should think first of utilizing WANO and should propose that, for example, "the Japanese and U.S. public and private sectors should cooperate to strengthen the function of WANO and to expand its scope of activities," if we find the activities limited or insufficient.

There is an urgent need to establish a nuclear liability scheme relating to its safety on other problems including the international transportation of nuclear materials and supply of nuclear facilities to Asia countries. In order to encourage Asian countries' national schemes to address nuclear liability, it would be worth recommending that Japan and the United States should review these international and/or regional liability actions, including joint participation in existing international conventions, and should make efforts to strengthen liability schemes.

Thomas J. Wilbanks
Oak Ridge National Laboratory

I strongly recommend that the United States and Japan sponsor seminars to explore paths for sustainable development that avoid conflicts between economic and environmental goals.