

JAPAN AND THE GLOBAL ENVIRONMENT

Alan S. Miller and Curtis Moore

ABSTRACT

This paper presents some perspectives on Japanese international environmental policies. The first section reviews domestic factors, including the role of environmental values, the influence of the Japan Environment Agency (JEA), the influence of women on environmental policy, and prospects for a stronger environmental lobby. The second section describes some evolution in Japan's policy toward addressing specific international issues and suggests factors likely to shape future policy development in this area. Finally, the concluding section focuses on the relationship between Japan's energy and environmental policies, noting in particular the remarkable technological innovation of Japanese industry in response to domestic pressures to control air pollution and improve energy efficiency.

INTRODUCTION

In many areas, the word most often used to describe Japanese policy is "enigma." In some ways, Japan's record on environmental policy also has elements of mystery and contradiction. On the one hand, Japan's history and culture often are associated with a reverence for nature. Indeed, Japan does lead the world in certain environmental areas, such as reduction of conventional air pollutants and compensation of air pollution victims. On the other hand, Japan has been widely criticized for its poor record in preserving its domestic environment, contribution to tropical deforestation, and unwillingness to protect endangered species.

Today, the international community clamors for Japan to take its share of responsibility, as an economic superpower, for the global environment. To secure its place in world affairs, Japan slowly has begun to respond to this pressure on issues ranging from Ivory importation to reduction of CFC emissions. There is some hope that the government's particular willingness to ad-

dress global warming may be a sign of significant changes to come in Japanese environmental policy. However, international pressure remains on the many environmental issues Japan has yet to resolve, including tropical deforestation and financing of Third World development projects that harm the environment.

Japan's environmental policy is most effective when government and industry cooperate to find technical solutions to environmental problems. Although in recent years Japan's energy consumption has risen sharply, the Japanese have developed numerous technologies to reduce pollution and increase economic growth by improving energy efficiency. It is in these technologies that Japan has made the greatest strides and has the most to offer the global environment.

I. AN OVERVIEW OF ENVIRONMENTAL POLICY IN JAPAN

A. Environmental Values in Japan

It is generally thought that the Japanese, because of their religious beliefs, value nature much more than Westerners, a cultural stereotype that has some historical basis. Joseph Kitagawa notes in his book *On Understanding Japanese Religion*:

Japanese Buddhism affirms the sacrality [sic] of the world of nature. This feature is probably the most basic to the Japanese Buddhist understanding of reality.¹

ALAN S. MILLER is the Executive Director of the Center for Global Change, University of Maryland at College Park.

CURTIS MOORE is an environmental attorney, analyst and writer based in McLean, Virginia. He served for eleven years as a consultant to the United States Senate Committee on the Environment and Public Works.

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Edwin Reischauer adds in *The Japanese*:

Early Shinto centered around the animistic worship of natural phenomenon—the sun, mountains, trees, water, rocks, and the whole process of fertility.²

In the Judeo-Christian tradition, man was placed above and apart from the rest of nature at creation.³ In contrast, Shinto and Buddhist beliefs maintain a reverence for natural things and view the entire universe—animate and inanimate—as one.⁴

Japan and the United States begin with different views of nature, which has had profound effects on their respective environmental policies. Localized opposition movements protested against continued pollution in Japan at least as far back as the late nineteenth century, but pollution only became a national issue with the mercury poisoning at Minamata and air pollution lawsuits against major industries in the 1960s.⁵ In the United States, however, environmentalists have focused on conservation of the wilderness since the nineteenth century; Americans assign strong symbolic and cultural significance to their national parks. The Japanese hold more utilitarian views, considering nature a resource for humanity to enjoy.⁶ The management of Japanese national parks generally is oriented toward facilitating maximum visitation and recreational activity, possibly including resort development. The Shiga Heights area, home for tribes of mountain monkeys, had one hotel before designation as a national park. As of 1987, "[i]t now has twenty-two ski resorts and 101 hotels."⁷

In the United States there is a great deal of public support for protecting even the remote parks of Alaska, although few Americans expect to go there and the land may contain substantial oil reserves. In contrast, threats to the forests of Hokkaido and the coral reefs in Okinawa, both of which the average Japanese is likely to visit, evoke much less concern in Japan. Perhaps the most glaring example of this lack of concern is Mount Fuji, revered for centuries in Japanese paintings and poetry. The landscape of the mountain today reveals a different attitude among the Japanese toward nature:

There is a huge parking area with shops, restaurants, horses to ride and photographers. Coachloads arrive, crowds emerge and immediately line up to have their photographs taken [W]hen the sun lights Fujisan it reveals the tin cans and other rubbish left behind by the visitors who had come to see Japan's symbol of ultimate purity.⁸

In a 1989 fourteen-nation survey commissioned by the United Nations Environment Programme ("UNEP"), only 44% of the Japanese public polled expressed a willingness to contribute money or labor to improving their environment. Other nations in the survey expressed a 60% to 100% willingness to contribute to betterment of the environment. Although they expressed great apprehension about global climate change, Japanese respondents cited polluted drinking water as their foremost environmental concern, followed by the pollution of lakes and rivers.⁹ However, in a country where pollution has had devastating effects on human health, the Japanese believe far less often than respondents from other nations that environmental deterioration threatens public health.

B. Lack of a Strong Citizen's Lobby

The modern Japanese environmental movement began in the early 1960s with anti-pollution citizen movements that opposed crippling and even lethal industrial pollution. These anti-pollution movements had a significant impact on the government's overall environmental policies. The government tightened environmental regulations significantly and in some areas, particularly control of traditional air pollutants, Japan became a world leader. However, in contrast to experiences in the United States and Europe, Japanese environmentalists have failed so far to build a strong national movement able to influence the national political agenda. The UNEP poll showed that most Japanese do not believe voluntary agencies or community organizations in Japan play an important part in resolving environmental problems, which they view as the responsibility of the government. Only 26% of Japanese respondents, compared to 80% to 90% of other respondents, expressed support for leaders of such organizations.¹⁰ Eugene Linden of *Time Magazine* notes,

[i]f anything will hold back progress [on environmental issues], it will be Japan's lack of environmental activists and experts. Only about 15,000 Japanese—most of them bird watchers—belong to conservation groups, and the country does not have an extensive network of environmentalists, like those who monitor policies in the United States and Western Europe.¹¹

A brief examination of the Japanese environmental movement's evolution will elucidate its current status and prospects for change. The first environmental activists were pollution victims and their families, and others who lived in contaminated areas.¹² They organized in response to local problems, which were often health or nuisance related (for example, noise levels). While these efforts often provided relief, they did not lead to larger coalitions of similarly affected parties or provide the basis for a national environmental movement.¹³ Indeed, as Frank Upham argues, the creation of dispute resolution procedures and an administrative system for compensating victims effectively preserved bureaucratic control.¹⁴

Environmental groups became notably less active and influential after the early 1970s as public attention shifted toward the oil shocks of 1973 and national political scandals in the Tanaka administration.¹⁵ The environmental movement was unable to establish an effective bureaucratic foothold despite the creation in 1971 of an environmental agency with its own minister (see section D). For example, neither the citizen's movements nor JEA could persuade the Diet to pass a general environmental impact assessment bill. The courts, which had provided environmentalists with a series of important victories in the 1960s, also retreated in several major cases that could have provided an avenue for environmental litigation on a wide range of issues.¹⁶ Although the outcome of the pollution trials of the 1970s generally favored plaintiffs, court decisions of the 1980s tended to favor government and industry defendants.¹⁷ The movement continues to face opposition from industry, government, and the ruling Liberal Democratic Party (LDP).

The feeling that the government is too big to fight contributes to the prevailing public apathy about the environment,¹⁸ and the inaccessibility of important government documents reinforces this perception. The national government has no Freedom Of Information ("FOI") Act. Some towns and prefectures do have FOI ordinances, but these often unduly limit access to information. According to the *Japan Times*, "[p]oliticians have begun to define as public documents only those papers that have been officially stamped by a set number of officials. Bureaucrats have learned to avoid stamping sensitive documents to keep them out of public hands." An environmental protection committee in the town of Oiso that opposed the construction of a chemical research laboratory by the Showa Denko company was refused access to municipal and prefectural data on the project. The committee also was denied the town mayor's letter to the company, urging Showa Denko to approve the project quickly, presumably to head off local opposition. In another case, the Japanese Citizen's Movement for a Freedom of Information Law finally obtained data on Japanese nuclear reactors through the United States Freedom of Information Act, having been denied the information from the Japanese government. The government provides such information to the United States Nuclear Regulatory Commission but not to Japanese citizens. Fortunately, some LDP members are pushing for an FOI law. Several factors, including United States pressure and support from the Japan Committee for Economic Development, work in favor of the legislation's passage.¹⁹

As discussed in Section E, there are some signs of change in the public's attitude toward the environment.

C. The Influence of Japanese Women on Environmental Policy

Women composed the largest numbers in the anti-pollution movements of the 1960s and 1970s and have provided much of the leadership for the anti-nuclear movement of the 1970s and 1980s.²⁰ It may be that women are accepted in Japanese society as environmental activists because they generally are viewed as caretakers of family and community.

Housewives belong in large numbers to the neighborhood women's associations, called Fujinkai, to the larger Shufuren, the Housewives' Association, and to the Japanese League of Women Voters. Chifuren, the largest women's organization, is an umbrella organization that channels volunteer work to women through the Fujinkai. Chifuren members frequently have addressed environmental issues on the local level.²¹ Today's women's groups focus less on pollution and more on dangerous and overpriced consumer goods. Chifuren successfully fought against dangerous food additives, for consumer labeling on fruit juices, and for lower-priced televisions and cosmetics in the 1960s and 1970s.²² Having met some of its initial goals, the organization has been noticeably less active in the 1980s.²³

Today, because of advances in time-saving goods for the home, housewives have even more leisure time to devote to community service and political activity. Karl van Wolferen, author of *The Enigma of Japanese Power*, calls Japanese housewives "a potentially important political presence."²⁴ Their recent political history indicates that if women's roles change in Japan, they are likely to have greater influence over environmental policy.

Today, however, Japanese women "have a lower political profile than in almost any other democratic country."²⁵ It is unclear whether women are gaining greater status; their environmental impact may be minimal for some time to come. In 1989, Prime Minister Kaifu appointed two women—an unprecedented number—to his Cabinet at a time when the LDP was least popular with female voters. One appointment was Mayumi Moriyama, a leading Diet member elevated to chief cabinet secretary. Following his successful reelection in 1990, however, Kaifu replaced both women with men. Mrs. Moriyama protested that she had been used to attract the female vote and dropped when the election was over.²⁶

Surprisingly, there are fewer women in the Japanese Diet today than in the 1950s. (It should be noted, however, that there are far more women per capita in the Japanese Diet than in the United States Congress.) Although more women than men vote in Japan, "... few women run for election and still fewer win, in spite of the fact that women

constitute a majority of the electorate."²⁷ It may be that widespread opposition to the LDP in 1989 spurred the election of several women to the Diet. However, it is likely that Japanese women will continue to wield their greatest political influence in the voting booth. Exit polls from 1989 show that women overwhelmingly joined men to express their dissatisfaction with Prime Minister Uno, linked to a sex scandal, and the LDP's 1989 consumer tax.²⁸ Some observers conclude that the influence of Japanese women on politics is on the rise, but as one Japanologist said, "When you start low, there's only one way to go."²⁹

D. The Role of the Environment Agency

The Japanese Diet established the Japanese Environment Agency (JEA) in 1971, largely in response to pollution victims' demands that the government take a more responsible approach toward the environment. The agency's mandate is to coordinate and administer programs to prevent environmental pollution and to protect nature.³⁰ JEA has limited authority over a wide range of environmental law, including pollution control for individual factories, toxic wastes, and the regulation of sewage, waste disposal, marine pollution, and agricultural chemicals.³¹ JEA also manages Japan's national parks.

Although JEA provides an important focal point for environmental advocates and analysis, the agency has much less power than the Ministry of International Trade and Industry (MITI) and other established agencies with missions to bolster economic growth.³² Some scholars include JEA among the "relatively ignored structures of Japanese politics,"³³ and many believe that JEA cannot afford to offend industry.³⁴

By the early 1980s, paralleling developments in United States environmental politics, the environmental agenda lost some of the political support it had attained in the previous decade. The government successfully campaigned to reduce public concern over pollution, noting reductions in the levels of sulfur dioxide, nitrogen dioxide and photochemical smog, but downplayed problems with toxic wastes and chemicals, including dioxin, water pollution and contamination of drinking water.³⁵ Japanese participation in international environmental ne-

gotiations was, and continues to be, dominated by economic ministries.

The environmental budget grew steadily during the 1970s, but MITI and the Ministry of Construction, rather than JEA, received much of this funding. Industrial pressure forced JEA to reduce some emission control standards³⁶ and cut certain programs instituted in the 1970s to strengthen environmental administrations in cities and prefectures.³⁷ Due to opposition from industry and other ministries, JEA most notably failed to persuade the Diet to pass environmental impact legislation, a priority for the agency since the early 1970s. JEA proposed but failed to pass environmental impact laws five times by 1980.³⁸ A cabinet resolution finally implemented a weaker impact requirement in 1984.

Despite its weaknesses, JEA is gradually becoming a more established and accepted part of the government. Until the 1980s, former members of MITI and the Ministry of Finance composed most of the agency's senior directors. Many JEA officials retained their old allegiances, anticipating that they would return to their previous agencies.³⁹ Today, however, many JEA officials expect to finish their careers there. Moreover, in the annual contest among government agencies to recruit top graduates from Tokyo University, a growing number have made JEA their first choice.

Absent a shift in national values toward environmental protection, JEA's biggest problem may be the lack of an organized environmental movement that forcefully can counter the tightly organized industrial lobby. In the mid-1980s, industry argued that Japan had reduced air pollution so effectively that emissions no longer significantly contributed to health problems. Industry successfully lobbied the government to amend its pollution compensation system to halt all new designations of air pollution "victims." This system, which compensates people suffering health problems from air pollution, is unique to Japan.⁴⁰ Environmental opposition was too weak and the amendments were enacted in September 1987.

E. Recent Developments in Environmental Activism in Japan

Important indicators of new interest in conservation and wildlife protection may be recent environmental protests opposing several dams, an airport project in Okinawa that threatens a coral reef, and housing for United States military personnel in the Ikego forest.

During 1989, campaigns were mounted to halt construction of dams on the Kamo River in Kyoto, the Shimanto River in Shikoku, and the Nagara River, running from the Japanese Alps to Ise Bay.^{41,42} The battle for protection of the Nagara in particular has become a major organizing issue.⁴³ The proposed dam will kill most of the river's sixty species of fish, including a species of trout called ayu, a delicacy for which the river is known. The Nagara is the only river where enough ayu exist for cormorant fishing, a unique sport under the patronage of the Imperial Household Agency since the Meiji Restoration.^{44,45} "Tradition still holds that part of the first catch each season lands on the Emperor's table. Because of this legacy, the Nagara River is one of the cleanest rivers running through a major urban area in Japan today, and one of the last major rivers not to be dammed."⁴⁶

Despite vehement public opposition, dam construction began in July 1989. Several critics submit that the government has an unstated reason for continuing with the project. The dam, they charge, would help alleviate international (primarily United States) pressure on Japan to increase its spending on domestic projects and employ more foreign goods and services.⁴⁷

When local issues did not attract much national attention, environmental groups found it easier and more effective to solicit help from abroad than rely on Japanese support to protest government policies. In these cases, foreign pressure has benefited the environmental movement. For example, Japanese conservationists solicited help from foreign scientists and international environmental organizations to protect a rare coral reef off the Island of Ishigaki in Okinawa where an airport was planned.⁴⁸ The government later moved the construction site to a nearby location.

In another instance, environmentalists entreated American officials and environmental groups to oppose a Japanese government plan allowing the United States military to build housing for its personnel in the Ikego forest near the town of Zushi. The Natural Resources Defense Council made efforts on their behalf. The issue even generated a letter from the head of the Smithsonian to the Secretary of Defense asking why the United States government was building housing in an environmentally sensitive area.⁴⁹ Ikego shelters a number of endangered species and is one of the few forests still standing in the Tokyo area. Support for the forest's preservation was so strong that a head of the opposition movement defeated Zushi's pro-housing mayor in the latter's 1986 bid for reelection.⁵⁰

There are indications of growing public and corporate interest in global environmental issues. A new environmental fad has flourished favoring sprays that do not contain chlorofluorocarbons, biodegradable plastic shopping bags, a new brand of beer called "Suntory is Thinking About the Earth," and clothing with wildlife pictures on them.⁵¹ In Osaka and Tokyo in 1989, citizen conferences on the international environment attracted considerable public interest and media coverage. A government-sponsored conference on the environment that was closed to the public provided the impetus for these citizen meetings. Over a thousand people, many of them students and housewives, attended the Osaka meeting. Similar meetings have been held in the past, including several on tropical rain-forest issues, but none have been nearly so large.

On the corporate level, a 1990 *Japan Economic Journal* survey found that sixty of 113 major companies had established or planned to establish environmental committees or sections. In response to increasing pressure from American and European environmentalists, most of Japan's largest trading companies have created environmental sections. They apprise the firm of tighter domestic and international environmental standards, help improve its image, and find business opportunities for new environmental technologies and products.⁵²

In the remainder of this report, we focus in more detail on the strengths and weak-

nesses of Japan's environmental record and suggest indications of change that give hope of a broader and more forward-looking environmental policy in the future.

II. THE EVOLUTION OF JAPANESE POLICY TOWARD INTERNATIONAL ENVIRONMENTAL AGREEMENTS

With few exceptions, Japan has been slow to recognize and respond to international environmental problems and agreements.⁵³ Local concerns historically have taken precedence over international environmental issues. This is due in part to the history of the anti-pollution movements. Pollution victims had a war to wage at home and had neither energy nor resources to address international issues as well. However, a July 1990 poll conducted by the Prime Minister's office found that almost 60% of respondents believe that the government's first priority should be preservation of the global environment, particularly protection of the ozone layer and tropical forests, and reduction of CO₂ emissions.⁵⁴ These results contrast with a previous poll released by the same office in February 1989, in which only one-fifth of respondents indicated a strong personal interest in global environmental issues.⁵⁵ Growing domestic concern for the global environment, combined with pressure from abroad, has forced the Japanese government to reconsider its position on many environmental issues, including driftnets, endangered species, and global atmospheric pollution.⁵⁶

A. Driftnets

Of all nations, Japan has the largest driftnet operation for fishing.⁵⁷ Squid and tuna fishermen cast these huge nylon nets that cover an area of ocean up to 40 miles wide and 40 miles deep. Environmentalists have called driftnet fishing "aquatic strip mining"⁵⁸ because the nets, set out overnight, randomly kill porpoises, seals, sea turtles, sea birds, and other marine animals. United States, Soviet and Canadian fishing industries also complain of the massive loss of sea trout and salmon.⁵⁹ In 1989, Japan agreed to have American and Canadian observers aboard some of the 460 Japanese squid boats to determine the number of sea animals being killed.⁶⁰

In 1989, fifteen countries in the South Pacific called for a total ban on driftnet use. Japan subsequently implied that the move might jeopardize Japanese aid and trade to these countries, a form of "checkbook diplomacy" that provoked an immediate negative response.⁶¹ On September 19, a subcommittee of the United States House of Representatives approved legislation to ban driftnets worldwide. Japan then announced its intention to reduce the number of ships permitted to use driftnets by two-thirds.⁶² In July 1990, the Foreign Ministry announced that the government would suspend drift net fishing in the South Pacific for the 1990-91 season. The suspension, beginning in November, will last until "regulatory measures for drift net fishing are established."⁶³

B. Endangered Species

Japan has been the largest ivory importer, accounting for 38% of the world's total. In June 1989, MITI announced an ivory import ban from September 20 through the end of 1989. The move followed bans by several European countries and the United States to save the African elephant from extinction and preceded the probable signing of a worldwide agreement.⁶⁴ On October 30, 1989, the Japanese government announced a total ban on ivory trade.⁶⁵

The ivory ban is suggestive of the gradual change in Japan's attitude toward endangered species. In 1980, Japan signed the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora, but had more exemptions to the agreement than any other signatory.⁶⁶ Some of those exemptions, particularly on whales, remain the subject of severe international criticism. However, in 1987, Japan enacted a law on the domestic trade of endangered species to enforce the Convention within the country.⁶⁷ Also since 1987, Japan has agreed to prohibit imports of the green sea turtle, the musk deer and the desert monitor lizard. Japan has responded so slowly to halting this trade in part because MITI, the ministry most interested in economic development, has delayed limiting the imports of some endangered species.⁶⁸

C. Global Atmospheric Pollution

In September 1987, more than twenty countries signed the Montreal Protocol on Substances that Deplete the Ozone Layer, agreeing to reduce CFC emissions by 50% over the next decade. Japan, which consumes more than 10% of the world's CFCs, opposed the treaty until only a few months before its conclusion. Japanese industry was skeptical, environmentalists were largely uninvolved, and government research was limited.

Ultimately, Japan took action largely because the United States and Europe had agreed to do so, and because non-signatories risked adverse trade consequences designated in the Protocol and in several bills pending in the United States Congress.⁶⁹ Once Japan did agree, however, it moved quickly to implement the agreement. MITI requested several million dollars for FY 1990 to develop CFC substitutes.⁷⁰ Several Japanese automakers promised to phase-out CFCs in automobile air conditioners by 1993.⁷¹ Japan supported an accelerated and complete international phase-out of CFCs adopted in June 1990.

Unlike its response to most other environmental issues, Japan has shown relatively quick progress in supporting measures to prevent global warming. Japan announced in June 1990 that it will stabilize its CO₂ emissions by the year 2000 "at the lowest possible level." The government's announcement also included proposals for increased research and monitoring of climate change and the development of technologies transferable to other countries to facilitate global reductions in greenhouse gasses.⁷²

The June proposal triggered a debate between MITI and the Environment Agency concerning implementation of the "lowest possible level" target. MITI had projected a 16% increase in CO₂ emissions by 2000, despite rather optimistic assumptions about the availability of additional nuclear power. Japanese utility companies expressed concern about the technical feasibility of CO₂ limitations in the face of rapid growth in demand and limited supply alternatives.⁷³

On October 23, 1990, the Japanese government approved an "Action Plan to Ar-

rest Global Warming," setting the target of stabilizing carbon dioxide emissions at the 1990 level by the year 2000. The announcement was accompanied by a detailed list of measures to achieve the target including improving energy efficiency, promoting tree planting, and educating the public. The targets, however, are not binding or enforceable should the programs prove to be inadequate.⁷⁴

Several American environmental groups have expressed concern that Japan's greenhouse gas emissions will increase in response to the United States-Japanese Structural Impediments Initiative ("SII"). The initiative, intended to reduce trade friction between the two countries, calls for infrastructural improvements and promotion of leisure activities in Japan that will lead to greater general consumption, and therefore may increase greenhouse gas emissions.⁷⁵

Japan accounts for about 5% of the world's CO₂ emissions, following the United States, the Soviet Union and China.⁷⁶ Japan has been well-represented and active at the principle governmental meetings on climate change. With the support of the Prime Minister's office, the Japanese government hosted a major international meeting on the global environment in September 1989 in Tokyo. MITI, the Ministry of Transportation, the Science and Technology Agency and others have made large funding requests for global warming research. Industry is well-informed about global warming. Manufacturers see potential market opportunities in environmental regulation, such as increased sales of fuel cells.

A 1989 JEA report described climate change as a serious threat to Japan's import supply and suggests some understandable self-interest motivating Japan's growing attention to global warming. Japan is highly dependent on foreign oil, timber and some food staples such as soybeans. Thus the impact of climate change on foreign markets greatly concerns Japan. For example, the 1973 drought in the Soviet Union led that country to increase its imports of United States wheat, which resulted in higher prices on the world market. Also in 1973, a poor harvest of sunflowers in the Soviet Union and of peanuts in India led to panic in the Japanese soybean market. Since economic

activity in coastal areas results in approximately 90% of Japan's GNP, a sea-level rise due to global warming could have serious consequences for Japan.⁷⁷

D. Foreign Aid

Growing international pressure has forced Japan to assume more responsibility for the global environment. With nine of the world's ten largest banks in 1989, and 53 of the world's 100 largest companies,⁷⁸ Japan is now the leading financial contributor to developing countries.⁷⁹ However, much of Japan's aid is tied, devoted to infrastructure projects, such as mining operations, intended to benefit Japan.

The Ministry of Foreign Affairs states that the Japanese government has made "contributions to the globe a national goal." Further, "Japan should take initiatives in the development of international strategies and systems to support remedial efforts in ... protection of the ozone layer, global warming, protection of tropical forests, prevention of desertification, elimination of acid rain, [and] protection of endangered wildlife species."⁸⁰ To combat its image as being internationally irresponsible, the Japanese government aimed to double its giving in United States dollars between 1986 and 1990.⁸¹ It met this goal by 1989, and also reached its five-year target of providing \$40 billion (United States) in development assistance.⁸²

The Official Development Assistance ("ODA") budget recently has grown considerably—6.5% between 1987 and 1988 and an additional 7.8% between 1988 and 1989. The 1989 budget totalled \$11 billion, \$2 billion more than the United States budget.⁸³ In 1989, Japan planned to allocate approximately \$2.25 billion in environmental aid alone over the next three years.⁸⁴ Japan will give Mexico \$1 billion in credits over three years to fight air pollution.⁸⁵

Despite these increases, a 1989 World Wildlife Fund report (*Timber from the South Seas*) charges that Japan's percentage of aid still lags behind that provided by most members of the Development Assistance Committee ("DAC") of the Organization for Economic Cooperation and Development ("OECD"). Japan ranks fifteenth among the eighteen member nations. DAC countries

aim to contribute 0.7% of their Gross Domestic Product ("GDP"), while Japan donated only 0.31% of its GDP in 1988. However, for 1988-1998, Japan plans to increase the proportion of aid as a percentage of GDP to 0.35% and to increase giving to \$50 billion.⁸⁶

According to *Timber from the South Seas*, a central problem with Japanese development aid is that no single administrative body has the experience or the authority to supervise all of the development programs.⁸⁷ Moreover, there is no general law on foreign aid that would help the many aid institutions coordinate their efforts.⁸⁸ While the Ministry of Foreign Affairs is the official coordinating body, numerous ministries and agencies are involved in the decision making process. Japan International Co-operation Agency, the Overseas Economic Cooperation Fund, the Ministry of Agriculture, Forestry, and Fisheries, and the Ministry of Finance each participate in some aspect of project selection, definition, appraisal, monitoring or funding. As a result, implementation, appraisal and monitoring of on-going projects and evaluation of finished projects is poor.⁸⁹

Because many development offices are new or growing, they often are inexperienced and have yet to gain the stature of other long-time administrations.⁹⁰ Many aid agencies are severely understaffed. Richard Forrest of the National Wildlife Federation notes that although the Japanese government prides itself on the small size of its bureaucracy, this "... would not seem to be an asset for the world's largest and fastest growing development financing program, which needs careful control and monitoring. There are reports that Japan cannot even disburse all of its promised ODA budget every year, much less study in detail the effects of the funding, due of a [sic] lack of staff."⁹¹ Moreover, Japanese officials and ministers are not always apprised of how ODA funds will be used—further evidence that Japan's aid programs are inadequately supervised. The government also does not require environmental impact assessments of its own programs or those of the private sector.⁹² ODA only recently initiated environmental policy guidelines for its assistance. Environmentalists fear that inadequate supervision and evaluation will lead the government

to finance Japanese corporations intending to gain a foothold in markets abroad.⁹³

For example, JATAN, the Development and Cooperation Program, has subsidized the clearing of roads for logging by Japanese companies in developing countries. On the island of Sarawak, those companies used the roads for timber exploitation, which destroyed the centuries-old habitat of the Penan people.⁹⁴

Few of the problems the Japanese development program faces are unique. No one body coordinates environmental policy or provides overarching environmental guidelines for the United States government either. The United States Agency for International Development (AID) also has contributed billions of dollars to environmentally destructive programs, like the early 1980s AID program to construct dams in Sri Lanka, which later inundated forests and tea farms. AID began to assess the environmental impacts of its projects after several such environmental catastrophes. However, other United States Executive Branch agencies involved in development assistance do not yet require environmental impact assessments. Agencies like the United States Treasury Department that administer United States lending to the World Bank and other international lending institutions only have begun this process.⁹⁵

As discussed above, Japan's aid policies will evolve as it establishes a position in international affairs commensurate with its new economic power. By some accounts, "Tokyo's hesitation to act has less to do with an insider's lack of concern for the outsider's problem and more to do with never before being faced with a leadership role in these areas."⁹⁶

E. Tropical Deforestation: A Case Study of Evolving Japanese Policy

Tropical deforestation is one of the international environmental issues of greatest relevance to Japan. In 1987, forests covered 25 million hectares, or 66%, of its land surface, which means that Japan is still among those countries with considerable forestry resources.⁹⁷ However, the Japanese timber industry logs relatively little domestic timber. Officials assert that most of Japan's forests are on mountainous terrain

(and therefore expensive to harvest) and do not provide the hardwoods most wanted to meet the growing demand for building materials and furniture. However, some foreign authorities challenge these arguments, noting that some of the tropical forests Japan logs are equally mountainous.

Unlike most other international environmental issues, tropical deforestation has attracted modest public interest in Japan, and an active citizen organization addresses the issue. The Japanese government also has taken a more active role than it has toward other international environmental issues, providing a secretariat for the International Tropical Timber Organization (ITTO) in Yokohama.

Japan has been the world's leading tropical timber importer since the 1960s. Economic growth has fueled much of this enormous timber and paper consumption. The high price of indigenous timber, easy access to inexpensive Southeast Asian wood, and the high quality of tropical hardwoods makes them especially attractive. As the World Wildlife Fund argues, however, "[a]lternative materials exist, are already in use, and are assuming a growing importance."⁹⁸

A September 1989 report by the Ministry of Foreign Affairs downplays Japan's role in tropical deforestation, asserting that Japan imported only 1% to 2% of tropical hardwoods in 1986 from Central and South America and Africa, and only 2% of its tropical timber from other Asian countries. The report argues that exports contribute very little to the total deforestation problem: "The main cause of deforestation is the destructive slash-and-burn method of agriculture that poor farmers in developing nations use to maintain their lives."⁹⁹

While the government may be correct when viewing the problem globally, it does not effectively respond to concerns about the impacts of extensive logging in particular areas. Commercial stands are being depleted worldwide: currently, thirty-three developing nations are net exporters of forest products; by the year 2000, fewer than ten such nations may exist.¹⁰⁰ The more difficult issue may be what role Japanese firms, and indirectly the Japanese government, should take in demanding better management by

exporting nations, particularly since they are increasingly taking control of harvests and processing in order to export more high-value wood products and fewer logs.

There are some indications that the Japanese government is becoming more sensitive to tropical deforestation. In response to White House inquiries, Japan aggressively denied official support for construction of a highway in the western Amazon, but the possibility of unofficial private support remains. Deforestation issues also were highlighted in the Environment Agency's 1988 White Paper on the international environment and at the September 1989 Tokyo conference on environment and sustainable development.

The Japanese Environment Agency claims that its international efforts will include "protection of the environment in developing countries," and particularly the protection of tropical forests and the ozone layer.¹⁰¹ Prime Minister Kaifu has pledged part of Japan's three-year \$2.1 billion environmental aid package to tropical rainforest preservation.¹⁰² Responding to accusations that grants sometimes have supported environmentally destructive activities (for example, logging roads have reportedly been built with foreign aid funds), Japan recently took steps to apply environmental requirements to foreign aid programs.¹⁰³ The Foreign Ministry has also requested about \$30 million in aid funds for ITTO programs on forest preservation and technical assistance.¹⁰⁴

These financial contributions may be part of a policy designed to promote tropical forest preservation while allowing growing hardwood imports. While seemingly inconsistent, this approach is similar to that of many developing countries which assert some commercial logging is essential to economic growth and consistent with "reasonable" conservation goals.¹⁰⁵ As developing countries increasingly seek to control the use of their resources, technical assistance and multilateral pressure for structural reforms may be the most effective levers industrialized countries can use to promote tropical forest protection.¹⁰⁶

Some Japanese industrialists and traders realize that they cannot count on tropical timber imports indefinitely and ac-

cordingly have begun to prepare for the future. The government and forestry industry have sponsored research on technologies and products based on greater use of softwoods for some time. The logging traders also have given token amounts (\$71,000) to help protect the rain forests.

III. ENERGY AND ENVIRONMENTAL POLICY

Although weak concerning conservation of nature, Japanese environmental policy excels in an area the United States does not—pollution reduction and energy efficiency technologies. Government cooperation with industry to promote these technologies has reduced air pollution and increased energy efficiency tremendously. Japan, one of the worst polluters in the 1960s, became the world leader in clean air and now exports large quantities of pollution control technology. From 1973 to 1986, Japan also cut energy consumption 50% per unit of GNP. However, Japanese energy consumption has increased significantly since 1986 due to declining energy prices, strong economic growth, new government policies, and changing attitudes toward conservation.

A. Energy Efficiency

Japan's economy is one of the most efficient in the world, clearly demonstrating that efficiency goes hand in hand with economic growth. (See Table 1) However, although Japan still uses half as much energy as the United States to produce one unit of gross domestic product,¹⁰⁷ differing lifestyles, climate, population patterns, and other factors make comparisons between the absolute energy consumption of Japan and other nations risky. The Japanese use less central heating, live in a much smaller area, and rely significantly more on rail and subway systems for commuting than Americans do. Thus, differences in energy consumption are not as great as they first appear. Even so, Japan's continued progress in efficiency during a period of rapid economic growth is impressive and a model for all nations.

Japan achieved its greatest energy savings between 1979 and 1986, when it cut energy consumption 20%. The government proudly notes that from FY 1973 to FY 1986,

GNP grew 63% while energy demand grew only 6.4%.¹⁰⁸ In addition to a high tax on gasoline, incentives for specified conservation investments included accelerated depreciation or tax credits, reduced property taxes, and loans. Small businesspersons can obtain energy audits at no charge, and all factories above a minimum size must have a licensed energy engineer on site to promote energy efficiency. Minimum efficiency standards also apply to some industrial processes, buildings, automobiles and appliances, supported by consumer labeling.¹⁰⁹

How and why did the Japanese achieve this progress? In a recent study,¹¹⁰ the Association for the Conservation of Energy suggests several reasons for Japan's success in attaining energy efficiency and economic growth, which provide lessons for other OECD nations. First, the Japanese government provides financial incentives, regulations, standards, information and education to help companies reach the highest possible energy efficiency standards. Second, a single government agency, MITI, administers a comprehensive national program for energy efficiency and has the power to ensure that all sectors adopt its conservation measures. Third, all companies larger than a minimum size must have licensed energy managers who supervise the firm to ensure maintenance of the highest energy efficiency standards. Fourth, to preserve efficiency gains, the Japanese upgrade energy efficiency standards for appliances and buildings periodically. Finally, the government has a long-term plan to obtain significant increases in national energy efficiency.

Japan's experience shows that economic growth does not depend on growth in energy supply. Indeed, improved energy efficiency improves a nation's competitiveness in the international marketplace. Another important lesson is that Japan did not rely solely on higher prices to spur efficiency improvements.

However, lower oil prices, the strength of the economy since 1986, and the stability of the yen have led to a declining interest in energy efficiency in Japan in recent years.¹¹¹ OECD data indicates that the national energy efficiency index for Japan has not risen since 1986 and that demand for energy has been increasing since 1987.¹¹² Japan's current increased energy use

typifies the response of most industrialized nations experiencing declining energy prices. These policies may now change in response to the war in Kuwait and renewed concern about oil security.

Although official government policy touts energy conservation as a primary goal, the Japanese government has cut several energy initiatives and relaxed some conservation laws. Moreover, growth in personal income and the declining real price of oil has led to growing demand for automobiles, particularly larger automobiles, while the average fuel efficiency of new cars has declined steadily since 1982. The government has not attempted to combat this trend with higher gasoline taxes, and it removed a commodity tax on larger cars in 1988 as part of recent tax "reform" legislation. Electricity prices, among the highest of any industrialized country, also have been reduced to reflect the declining cost of fuel.¹¹³ Japan could make significant energy savings in appliances, automobiles, lighting and buildings, where efficiency either has declined or increased little. However, until fuel prices rise, or until the government upgrades its energy policies, it is likely that demand will continue to increase while efficiency lessens.¹¹⁴

The government and private companies have taken some limited measures to stem energy consumption since Iraq invaded Kuwait in August, 1990. They are encouraging citizens and employees to turn air conditioners up to 80°, turn off one-third of the lights in offices, and adhere to an 80 km/hr speed limit on highways. Even some corporations are "reexamining investment blueprints with an eye toward energy efficiency." However, these measures are not expected to yield large energy savings. The government seems to be relying on years of energy planning to help the economy through the crisis.¹¹⁵

The government's campaign to reduce the personal savings rate and increase consumption—a policy designed partly to appease the United States government—also has contributed to growing energy use. With the recent conclusion of the United States-Japan SII talks promoting domestic measures to increase consumption, this trend may only worsen.¹¹⁶ The campaign comes at a time when the Japanese have

decided to enjoy the benefits of economic growth. Energy intensive luxury items and home appliances, such as electric bread makers, full-size refrigerators, and microwave ovens, have become fashionable. The Japanese use more disposable goods today, such as wooden chopsticks and paper towels. More choose to drive rather than ride the subway and buy bigger houses that cost more to heat in winter and cool in summer. Increasingly vain Japanese youngsters are now taking "asa-shan"—morning showers to shampoo their hair—in addition to the traditional evening bath.

According to Osamu Maeda, a Rikkyo University sociologist, "in the process of economic growth, the people have gotten used to their modern amenities and have grown more distant from nature.... They have lost some of their sensitivity to the environment."¹¹⁷ A Japan Economic Institute report adds, "there appears to be no place for a public campaign to promote energy conservation in this new consumer environment."¹¹⁸ If anything, new government policies that relax restrictions on building large retail stores in urban areas will accelerate this trend.

The growth in energy use may be due to government miscalculation rather than intention. MITI assumed that with a stronger yen/dollar ratio, Japan's economy would shift from energy intensive industries to increased consumption of imports and less energy intensive consumer goods. This has not occurred, and the growth in energy use accelerated from 0.4% in FY 1986 to almost 5% in FY 1987¹¹⁹ and rose another 5.4% in FY 1988.¹²⁰ Industrial growth and increased consumer spending on cars and durable goods has resulted in greater electricity production and consumption.¹²¹ (See Chart 1.) The sharp increases in energy consumption in 1988 and the beginning of 1989 have forced MITI to address energy issues more seriously.

MITI's latest energy plan (1990) focuses heavily on energy conservation. MITI intends to use various energy conservation measures to improve the GNP Base Unit (primary energy supply quantity/GNP) by 2.0% annually, with a total improvement of 36% by the year 2010, and to cut the energy GNP elasticity ratio (growth rate of primary energy supply/growth rate of the economy)

for energy demand by 0.58%. To attain these two goals, MITI aims to reduce energy use by government and industry 11.2% from what it would be in the year 2010 given current trends.¹²² This target is consistent with a reduction in the energy used per unit of GNP of 2% per year. The plan requires a substantial improvement in cooling and heating efficiency in residential use, vehicle fuel efficiency and improved efficiency in power generation facilities.

MITI projected a growth rate in energy consumption between 1988 and 2000 of 1% for the industrial sector, 0.9% for the manufacturing sector, 2.7% for the residential and commercial sector, and 1.9% for the transportation sector. Between the years 2000 and 2010, however, the annual growth rate in energy consumption for each of these sectors is predicted to drop to 0.6% for the industrial sector, 0.6% for the manufacturing sector, 2.0% for the residential and commercial sector, and 1.3% for the transportation sector.

To combat global warming and to reduce its dependence on foreign energy imports, thereby improving Japan's energy security, MITI plans to promote increased use of new energies, and hydro, geothermal and nuclear power to 27% of the energy supply by 2010. (See Chart 2.) In 1988, these non-fossil energies provided 15% of Japan's energy supply. MITI will encourage research and development of alternative energy from methanol and solar power with the aim of dramatically cutting solar facility costs, and will install new facilities for generating power from liquefied natural gas (LNG). MITI plans to increase the share of LNG in gasoline used in motor vehicles in urban areas from 71% to 85% by encouraging small- and medium-sized gas companies to convert to natural gas.¹²³

The government views coal as a stable resource and a major oil alternative. In the wake of the 1973 and 1978 oil crises, the Japanese government adopted an aggressive policy to develop alternatives to oil. The attraction of coal is clear: there are abundant world reserves located in countries such as Australia, China, and the United States which can supply Japan conveniently via sea routes. Many of Japan's suppliers also have stable governments, and some allow foreign ownership of coal fields or the companies

that control them. Thus, coal ensures Japan a relatively secure fuel supply. However, MITI believes it will be difficult to increase Japan's coal use in the mid- to long-term, given the CO₂ emissions that arise from coal burning.¹²⁴ To combat these emissions, the ministry proposes for FY 1991 to cut the budget for coal liquefaction and gasification substantially, from 24,901 million yen to 16,296 million yen.¹²⁵

MITI also hopes to increase the share of power generated from nuclear power plants from 27% to 43% by the year 2010.¹²⁶ Japan has maintained an enviable nuclear safety and reliability record, ironically using United States reactor technology. However, Japan still is searching for a final solution to disposal of its waste. Growing public opposition may make it difficult to obtain new sites for reactors, which will force utilities to move further away from demand centers and thereby increase costs. Such factors as TMI, Chernobyl, the increasing influence of women (who tend to oppose nuclear power) and an awareness of public opposition to nuclear power in the United States and Europe, have helped fuel anti-nuclear sentiments in Japan.¹²⁷

B. Japanese Energy Technology and the Environment¹²⁸

Sustained by low oil prices, Japanese industry grew rapidly during the 1960s. Then, shocked by the oil crisis of 1973 when prices rocketed upwards, government and industry undertook massive conservation efforts that reduced energy use sharply and quickly.

These conservation programs addressed virtually every aspect of Japanese activity, ranging from home refrigerators to steel mills. Conservation began with simple acts, such as greater use of insulation, and it progressed to complex and expensive undertakings including the development of alternative energy technologies. Japan now consumes less energy per unit of GNP than any other nation. This results from a concerted effort by Japanese industry, spurred by government demands and cooperation.

Japanese government and industry have developed a menu of technologies and practices that demonstrate that pollution—even carbon dioxide—can be cut sub-

stantially in ways that increase efficiency and lower costs. This experience challenges the conventional wisdom among scientists, engineers and politicians that pollution is the inevitable consequence of industrial productivity. The reverse may be true: the path to true productivity may be one that leads to zero pollution and 100% efficiency.

Japanese industry has succeeded in reducing energy consumption in three fundamental ways. First, improved measurement and control devices, such as exhaust gas analyzers with information feedback mechanisms that automatically adjust boiler air-fuel ratios, have been installed to minimized energy consumption. Second, waste heat collection systems are being used to capture and reuse heat that otherwise would be vented into the atmosphere. The Japanese use a variety of devices ranging from heat exchangers to automatic frequency controls for electric pumps and blowers.

Finally, the Japanese have reduced energy consumption dramatically by changing the production process itself. For example, steel can be rolled into a product as it comes from the blast furnace without being cooled, or it can be allowed to cool, inspected for defects, then re-heated for rolling. The former process, now used at nearly all Japanese steel mills, reduces energy consumption enormously.

Following is a discussion of certain Japanese innovations in energy efficiency and pollution reduction. From the demand side, we review advances made at Nippon Steel and Toyota Motor companies, whose new technologies reduce pollution and energy consumption significantly. From the supply side, we discuss innovations in fuel cells, nuclear reactors, combined cycle power plants and coal combustion technologies that reduce pollution and provide energy more efficiently, thus reducing the country's dependence on imports and improving its energy security.

C. The Demand Side

1. Nippon Steel, Keihin Works

When it began operations in 1976, Nippon Steel's Keihin Works was arguably the most efficient steel mill in the world. Yet during the next decade, the plant reduced

energy consumption by another 30%, enabling the complex to produce more steel plate and tubing with less energy and pollution than any mill in history. The highly computerized and automated plant, located on an island in Tokyo Bay, turns out six million tons of steel per year.

Each ton of steel from the Keihin Works requires 5.7 million kilocalories of energy, substantially less than the average at mills in the United States and Western Europe. Stringent pollution controls cut SO₂ emissions from the plant by more than 90% and NO_x by 80%, with comparable controls on the superfine and frequently toxic dust and soot that characterize steel production. Nippon Steel officials estimate that the Keihin Works is the third or fourth most efficient mill in Japan. Without the pollution control devices, it likely would be Japan's most efficient.

2. Automotive Efficiency

Automotive fuel efficiency has increased by about 30% since the 1973 oil crisis. The bulk of this improvement has been attributed to decreases in bodyweight, adoption of aerodynamically superior designs, and improvements in engine technology.

Toyota, the world's largest auto manufacturer, is working on several pollution reduction and efficiency enhancement technologies. One is improvement of the lean burn engine, which simultaneously reduces NO_x emissions while increasing fuel economy. Toyota has the reputation among automotive experts of offering the best of the lean burn engines. With current technology, the company can meet Japanese and European standards, but its engines fall under the more stringent United States requirements. Toyota is presently developing ways for lean burn engines to meet some governments' stricter NO_x requirements while preserving fuel economy gains.

As discussed above, fleet efficiency has been declining since 1982 due to growing demand for larger cars, declining oil prices, and the elimination of some incentives for small cars. This led Toyota to drop production of its smallest car due to lack of demand.

D. The Supply Side

1. Fuel Cells

Fuel reacts with itself in a fuel cell to generate electricity. Producing virtually no sulphur dioxide (SO₂) or oxides of nitrogen (NO_x), this technology holds extraordinary potential for reducing air pollution. Fuel cells can run on currently available fossil fuels and their derivatives such as natural gas and methanol, or on hydrogen, which might be produced through the use of solar or nuclear-generated electricity. Because fuel cells also are more efficient than conventional energy technologies, they have the potential to significantly reduce CO₂ emissions by minimizing fossil fuel consumption. Unlike most other energy technologies, fuel cells may be versatile enough for small, medium or large-scale applications, ranging from automobiles to central power plants. They make almost no noise, as there are no noisy pistons or controlled explosions of the sort that make gas and diesel engines run. It may be possible to locate smaller scale units, ranging from ten to fifty megawatts, in or near city centers, eliminating the need for transmission lines and minimizing the cost of land.

Fuji Electric is the largest fuel cell producer in Japan. As of January 1989, Fuji had 11,000 kilowatts of fuel cell projects underway in Japan and thirteen projects in the United States and Europe. These projects include commercial electricity generation, production of a fuel cell-powered forklift and development of a fuel cell-powered bus for Georgetown University in Washington, D.C.

Fuji has completed construction and testing of a one megawatt power plant and plans to undertake a five megawatt demonstration plant. Fuji believes it can cut production costs enough to compete with coal-fired plants (whose conventional cost is \$2,000 per kilowatt) by mass production of standardized components. Fuji has made enormous progress toward commercializing fuel cell technology for generating electricity from natural gas since winning a four company competition supported by the Japanese government. They now have a semi-automated production facility for the manufacture of fifty megawatt fuel cells for use in medium-size commercial and residential buildings. These will be turn-key units with error detection systems built in to minimize

maintenance and service requirements. Tokyo Gas Company has made a substantial contribution to the development cost in return for a guarantee that they will receive fifty kilowatt fuel cells with a minimum five-year operating life at \$1,800/kw by 1995. The company benefits by selling gas to Fuji.

2. Nuclear Power

An experimental 2.8 megawatt demonstration breeder reactor, the "Monju," is under construction and expected to achieve criticality in 1992. Officials expect three progressively more powerful demonstration reactors to follow Monju, culminating in 1500 megawatt scale commercial plants sometime between 2010 and 2030. Nuclear power is already Japan's leading source of power, accounting for more than one-fourth the nation's electricity output.

As of June 1989, thirty-seven nuclear power plants were running in Japan, producing 26.6% of the country's energy.¹²⁹ As discussed previously, growing questions about the political future of nuclear power in Japan may jeopardize proposals for additional plants. Japan now imports the fuel to supply these reactors. However, if plans for the development of fast breeder reactors proceed on schedule, the nation will become an exporter of fuel within a generation—possibly becoming the first nation in history to bootstrap itself from energy buyer to energy seller.

3. Combined Cycle Power Plants

Tokyo Electric Power Corporation ("TEPCO") began construction of the world's first large scale combined cycle power plant in April, 1982. Perched on the edge of Tokyo Bay, Futsu is today one of the world's largest power plants and almost certainly the cleanest. It produces 2000 megawatts of gas-fired electricity but emits almost no SO₂ and less than one-sixth of the nitrogen-based pollution allowed from new plants in the United States

Three factors account for the extraordinary performance of the Futsu plant. First, it burns liquefied natural gas, one of the cleanest fuels available. Second, it uses a combined cycle system, burning the gas in one turbine, then using the exhaust gases to power a second turbine run by steam.

Third, selective catalytic reduction, an add-on device for pollution control, cleanses the exhaust gases of NO_x . Although other power plants have employed one or two of these approaches, Futsu is the first to use all three. The combination makes the plant a model of simultaneous pollution reduction and increased efficiency.

4. Technologies to Reduce Pollution from Coal Combustion

To increase efficiency and reduce air pollution, Japan's Electric Power Development Company ("EPDC")¹³⁰ is investing in fluidized bed combustion ("FBC"), an inherently cleaner combustion process for coal. A finely powdered mixture of coal and limestone is suspended in mid-air by blowing air through it at tremendous velocities. The cooler and more complete combustion which results not only lowers levels of both NO_x and SO_2 but allows the use of a wide range of different fuels. FBC can be coupled with highly efficient turbines to reduce air pollution still further.

Since 1980, EPDC has been testing a process to powder coal, then mix it with water to form a combustible slurry. As a liquid, coal could be more easily transported, loaded, and stored. The company also is attempting to develop methods of dewatering low-quality, sub-bituminous and brown coals, which contain too much water to be transported or burned efficiently. The reserves of this fuel are believed to be practically inexhaustible. Its use would increase CO_2 emissions, but this increase would be potentially much less than existing coal combustion technologies because of its greater efficiency. The reduction in CO_2 is proportional to the improvement in efficiency; improvements of 10-20% or more are technically feasible.

E. Discussion

Japan has much to offer the world in the development of innovative technologies that clean the environment and bolster economic growth. The prospect of future international environmental accords could have economic benefits for Japan because of its position of technological leadership. A global warming agreement, for example, might help promote markets for high-efficiency appliances and industrial systems.

Pressuring developing countries to control their pollution similarly could increase orders for Japanese pollution control systems. At a March 1990 presentation in Washington, a MITI official described plans to develop somewhat less effective but much less expensive pollution control technology for sale to developing countries. Already, discussion of a "green industry" has begun to appear in the Japanese press, but so far these considerations seem to be less politically salient than the possible costs of environmental controls on the Japanese economy.¹³¹ Indeed, Japan could do much more to publicize its activities to provide a model for newly industrializing countries.

CONCLUSION

Japan's environmental policy is weakest in conservation of nature and protection of the global environment and strongest in pollution reduction and energy efficiency technologies. It is with these technologies that Japan can make important contributions to resolving global environmental problems. However, lack of domestic support for conservation and NGO activities remains a serious limitation on Japan's involvement in domestic and international environmental issues. Japanese technology can benefit the world significantly, but it cannot address all environmental issues. Since World War II, Japanese politics have been oriented towards increasing the wealth of the country. Today, how Japan addresses environmental issues may relate to its need to find a moral basis for involvement in international affairs that transcends the single-minded pursuit of economic wealth.

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TABLE 1
International Comparison of CO₂, SO_x, NO_x, Energy and Background Data

	JAPAN	CANADA	U.S.	FRANCE	U.K.	NL.	SWEDEN	FRG
Population '87 10 ⁶	122.1	25.9	243.8	55.6	56.9	14.7	8.4	61.2
Area 10 ³ Km ²	378	9,976	9,373	547	245	37	450	249
GDP '87 US\$ (in thousands)	2,376	373	4,497	873	575	214	137	1,117
GNP/Capita '87	15,760	15,160	18,530	12,790	10,420	11,860	15,550	14,400
Avg. Growth Rate/y. GDP—'65-'87	4.2%	2.7%	1.5%	2.7%	1.7%	2.1%	1.8%	2.5%
Commercial Energy Consumption/Capita '87 Eq. Kg. Petroleum	3,232	9,156	7,265	3,729	3,805	5,198	6,453	4,531
Annual Growth Rate of Energy Consumption '80-'87	1.7%	0.9%	0.1%	9.6%	1.1%	1.3%	2.3%	0.2%
Energy Saving Index 1975 = 100 '87	71	85	77	94	86	88	99	86
Total Primary Energy Requirement (TPER) '87 Mtoe	371	240	1,865	206	484	65	56	271
TPER/GDP	0.2624	0.6435	0.4409	0.3788	0.4311	0.5058	0.5448	0.4198
TPER/Population	3.0442	9.3536	7.6490	3.7113	3.6654	4.4932	6.7210	4.4399
CO ₂ /TPER	0.734	0.507	0.741	0.544	0.809	0.738	0.311	0.761
CO ₂ /Population '85	1.91	4.14	4.98	1.78	2.63	3.32	2.09	3.00
Total CO ₂ Emission 10 ⁶ t	230	106	1,138	97	146	49	18	183
SO ₂ Emission 10 ³ t	1,079	3,938	20,700	1,845	3,580	230	284	2,640
SO ₂ /Population '85	8.93	15.29	85.5	33.42	63.63	15.86	31.34	43.27 (x10 ⁻³)
SO ₂ /TPER '86	0.35	16.89	11.49	9.19	17.38	3.57	4.77	9.75 (x10 ⁻³)
NO _x Emission 10 ³ t	1,339	1,940	19,300	1,652	1,965	537	300	2,976 (x10 ⁻³)
NO _x /GDP	1.04	5.61	4.89	3.24	4.33	4.30	3.00	4.75 (x10 ⁻³)
NO _x /Population '85	11.07	75.48	80.75	29.93	34.78	37.03	35.71	48.67 (x10 ⁻³)
NO _x /TPER '85	3.57	8.22	10.71	9.23	9.54	8.44	5.42	10.97 (x10 ⁻³)

Sources: Japan Environment Agency, 1989.

Chart 1

Japan's Total Electricity Output			
Thermal, Nuclear and Hydro-electric (in billions of kilowatt hours)			
1980	1985	1987	1988
514.05	603.93	640.16	663.40

Japan's Total Electricity Consumption			
(in billions of kilowatt hours)			
1980	1985	1987	1988
464.25	541.39	570.64	592.91

(Japanese industry and households contributed equally to the rise in total consumption in 1988.)

Source: Jon Choy, *Japan's Energy Policy: 1988 Update*, JEI Report No 40A, 6 (October 20, 1989).

Chart 2

Japan's Energy Supply (1986)
Oil - 55.2%
Solid fuels - 18.4%
Nuclear - 11%
Gas - 9.6%
Hydro and geothermal - 5.7%

Dependence on Energy Imports
Japan - 80.1%
United States - 12.3%

Sources: Energy Conservation Center in Japan, 1988; *Nuclear Power Development and Use in Japan*, Science and Technology in Japan 8 (March 1990).

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