Energy Limitations and Environmental Coexistence Policy

Masahide Tanaka

I Philosophy and Realization of COP3

The Kyoto Global Warning Conference (COP3) held in 1997 was expected to increase humanity's exercise of wisdom in protecting the global environment, which is now facing crisis. This conference made it compulsory that advanced countries reduce emissions of global warming gases such as CO_2, and set a target for making such reductions between 2008 and 2012 at approximately 5 percent below those of 1990. By country, the targets were; Japan 6 percent; United States 7 percent; and the European Union 8 percent. Reduction targets for multiple countries included the transfer of emission rights, clean development mechanisms, and inauguration of a new system for joint implementation whose rules will be settled at the Hague Conference (COP6). Protocol is scheduled to be issued in 2002. *(see Table 1).*

Table 1. Assumed Scenario for Protecting Against Global Warming Effects

1997	Adoption of the Kyoto Protocol
2000	Agreement on the methods for reducing global warming gases
2002	Issue of the Kyoto Protocol: ・Implementation of emission-quota transactions by companies ・Providing anti-greenhouse gas-emission technology to developing countries ・Joint project for reducing emissions between advanced countries ・Domestic forestry improvement ・Overseas aforestation plans by companies
2008-2012	Reduction of advanced countries' global warming gases by 5 percent below 1990 levels

Source: *Nihon Kezai Shimbun, Inc.*

Although November 2000 COP6 was held with the expectations described above, minister-level negotiations on November 25 became tangled, no agreement was reached on reduction of greenhouse gases, and a conclusion was sidestepped. The conference ended without agreement on principal issues, due to differences of opinion between Japan and the US, to US confrontation with the EU on plans to meet reduction targets via increased forestry, and to a discontinuity of viewpoints between advanced and developing countries (mainly on funds assistance issues)[1].

1) Environmental Agency homepage, (2000) *Revaluation and Outline of COP6*, November 28.

Ⅱ　Natural Resource Limitations

The new millennium began amidst a mixture of hope and fear about the future. Among the many matters of great concern, the limited supply of natural resources has been exposed, while the global environment has been deteriorated rapidly.

Under the premise that natural resources exist in unlimited supplies, the 20th century saw development and expansion which depending upon mass production, mass consumption, and mass waste, to the degree that the global environment had deteriorated to the point of displaying warning signs concerning the existence of humanity. These signs are seen in the prevalence of ozone layer depletion, acid rain, desertification and erosion, and tropical rain forest destruction, among many others.

Humanity now faces difficult choices in its responses to the deterioration of the global environment, as well as how the living standard of the world's population can be improved without causing further harm. Achievement of sustainable development in the light of limited natural resources—such as petroleum—necessitates the establishment of a society where recycling and natural-resource preservation are implemented to their fullest.

Industrial development and the improvement of living standards reached unprecedented levels in the 20th century, and were achieved in the midst of a rapid increase of populations. The world's population 2000 years ago is estimated to have been approximately 300 million, and had reached only 1 billion by the 19th century. By 1999, however, the world population had reached 6 billion. Although birthrate has recently declined in advanced nations, it is anticipated that the world population will have increased to 8 billion by 2025[2]. According to a United Nations very long term average estimate, the end of the 21st century will see a world population of 11.5 billion, growth which will level off only at the beginning of 22nd century, when the population stabilizes at 12 billion[3]. These people will not be able to eat the large quantities of meat that Americans currently consume, nor freely burn petroleum in large cars, nor live in homes which consume large quantities of energy. The strain on limited natural resources will simply make these things impossible.

After the Industrial Revolution, and especially in the latter half of the 20th century, advanced nations settled upon a system by which nearly all aspects of their high living standards —energy, food, clothing, and shelter—ultimately relied upon fossil fuel resources. For the remaining minable deposits of the various kinds of fossil fuel resources, petroleum (approximately 1 trillion barrels), however, has been commonly recognized as being enough to last only about another 45 years. If including coal (approximately 100 billion minable tons remaining) and

2)　Kono, C. (1998), "Future of World Population", *Movement of Science*, Vol. 3, No. 1 ; Science Council of Japan, pp. 40-45.
Kono, C. (2000), *World Population*, Chapter 1, Tokyo University Publishing Co.
Ehrlich, P. (1994), *Population Will Explode*, Chapter 1. Shinyosha 1994; also discusses this from the standpoint of the environment, natural resources, and economics.

3)　United Nations (1996), *World Population Prospects*, Revision, New York.

natural gas, current fuel resources will last approximately another 100 years. Humanity will have depleted all fossil fuel resources in the 22nd century[4].

Examples of these concerns have already materialized in China, where development has resulted in heavy destruction of the environment. Since more than 70 percent of China's energy supply has depended upon coal, air and water pollution have worsened. China's oil use has accelerated in a rapid conversion from coal to petroleum consumption, reaching a daily average of 4.2 million barrels in the first half of 2000. Since 1993 China has been a net oil importer on a par with Japan, second only to the US in mass consumption; China will certainly outpace Japan in 2001. With the economic development of China and other Asian countries, it will be all but impossible to avoid increases in the consumption of finite petroleum resources. Methods of controlling future consumption effects not only China's environmental problems, but also has a direct and indirect effect upon Japan. It will be vital that issues such as related monetary and technological assistance be resolved. China's energy efficiency is US$ 0.8 in GDP per kilogram, less than one thirteenth of Japan's US$ 10.6[5]. It may be expected that in improving this figure, CO_2 will be controlled, and that global warming will be counteracted.

Ⅲ Challenges to a Sustainable Society

When natural resource limitations become more apparent in 21st century, Japan's role in international environmental protection and coexistence will also become more definite[6], making it urgent business to change Japan's economic society. Under this philosophy, the "Basic Law for Promoting Formation of Recycling Society" was enacted in May 2000. According to the basic policy "recycling society" denotes one in which unnecessary trash is not generated, disposable goods are used for as long as possible, non-reusable goods are recycled, and garbage which cannot be recycled is dealt with appropriately, thereby controlling the consumption of natural resources and reducing the load on the environment[7].

Due to the clear limit to the supply natural resources, it has become increasingly more important to regard waste materials as "circulating resources". To secure the circulation of such materials and reduce the load on the environment, it is necessary to establish comprehensive legal systems which promote measures for waste-material recycling, which was the purpose of the law described above. In the construction of sustainable, recycling societies it has become Japan's responsibility to be a model test case[8]. Resolution of global warming issues are of paramount

4） Kodama, T. (2000), "Until When Will Civilization Depend Upon Fossil Resources?", *Movement of Science*, Vol. 5 No. 11, Science Council of Japan, pp. 46-48. Professor Kodama states that the most effective way to bequeath mankind's common heritage of fossil resources to future generations is the efficient use of biomass energy.

5） UNDP. (2000), *Human Development Report 2000*, research conducted in 1997.

6） Yasunari, T. and Yonemoto, S. eds. (1999) *Global Environment and Asia*, pp. 21-25; Global Environment Study 2; Iwanami Shoten.

7） Kawaguchi, J. (Director General of the Environmental Agency), (2000) "Challenge to the Recycle Type Society", *Movements of the Time*, public service announcement, p. 12.

8） Lee, H. (2000), Climate Change Policy and the Sustainable Future, *International Review for Environmental Strategies;*, IGES, Summer, pp. 17-23.

importance, and should be faced on a worldwide scale within this century, while also seeking to maintain compatibility with economic and lifestyle concerns. To achieve this goal and meet Japan's 6 percent reduction target, it is necessary to study creation of a comprehensive counter-measures package[9].

To attain a sustainable society, it is also vital to resolve the limits of natural energy resources, since economic activities place a load on them at every part of their processes, from supply of raw materials to consumption of finished products. It is therefore necessary to move forward in formulating an energy supply structure which places a small load on the environment, as well as to enhance the overall efficiency of energy consumption. To protect Japan's environment, and also the global environment, it is urgent that plans for this be developed, and that good use is made of new, cleaner energy resources, such as photovoltaic energy generation, wind-power generation, waste material generation, clean energy car, co-generation power plants, fuel batteries, and others which go beyond reliance on fossil fuels[10]. *(see Figure 1)*.

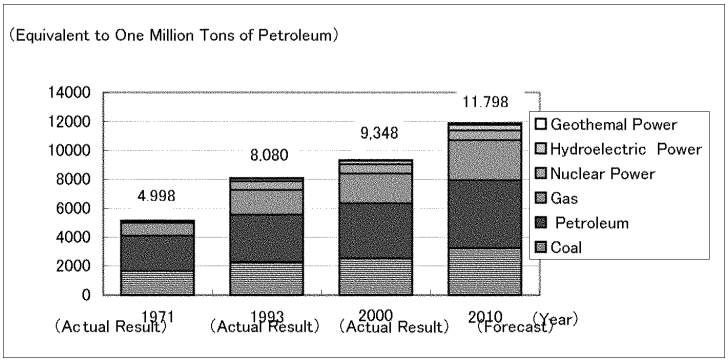

Figure 1. Global Energy Consumption and Outlook, by Resource

Sources: *OECD/IEA's "World Energy Outlook 1996 Edition"; "Environmental White Paper 2000 Edition", Environmental Agency, ed.*

Note: *There are some figures in parentheses (indicating composition ratio) which do not equal 100 percent, due to the rounding of fractions.*

Ⅳ　Comparison of Energy-Conservation Policy With Major Countries

If humanity, and all other life, is to continue to live in this planet indefinitely, it is essential to seek coexistence with the global environment.

(1)　Comparison of Energy Consumption Rates:

Below are comparisons of energy consumption rates of major countries and Japan, in the industrial sector's unit consumption against GDP, and in the household/transportation sector's per-person consumption. Figures for Japan are low in both cases. *(see Figure 2 and 3.)*

9)　Report by Basic Policy Subcommittee, (2000), *Global Environment of Industrial Structure Council*, November 16.

10)　Environmental Agency, eds. (2000), *White Paper on Environment, Details*, pp. 347.

When making comparison according to unit consumption against GDP, Japan's overall energy consumption will be small, but it should be noted that major countries' energy consumption rates rapidly improved after the oil crisis of 1973, narrowing differences from Japan. This is made clear based on figures for 1997 Japan, and by comparing improvements in unit consumption against GDP for the industrial sector and individual energy consumption for the private/transportation sector.

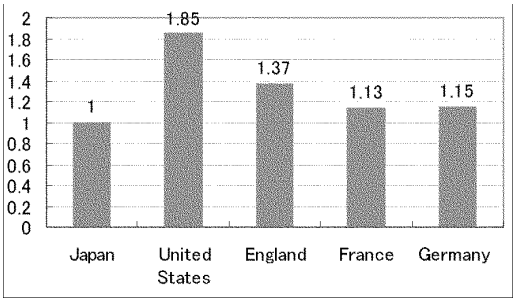

Figure 2. Comparison of Energy Consumption in the Industrial Sector, in Units Against GDP
Source: *Ministry of International Trade and Industry, Agency of Natural Resources and Energy; 1998 data.*

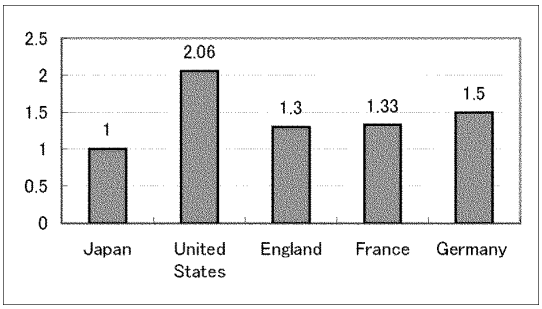

Figure 3. Comparison of Energy Consumption in the Household Sector, in Units Against GDP
Source: *Ministry of International Trade and Industry, Agency of Natural Resources and Energy; 1998 data.*

When comparing unit consumption against GDP, in all countries improvement in the industrial sector has progressed, and differences between countries have tended to narrow. Defining energy consumption from 1970 to 1995 as 1, the US shows a reduction from 3.5 to 3.0, England from 2.3 to 2.1, Germany from 1.8 to 1.5, and France from 1.5 to 1.6; many countries achieved reductions (according to materials prepared by the Agency of National Resources and Energy).

(2) Comparison of Energy Policies:

The following is a comparison of the energy conservation policies of major countries and Japan, according to materials issued by each sectors' environment-related advisory councils.

1) The Industrial Sector

- Germany has set mandatory standards which regulate maximum heat loss and other waste by small combustion plants. There are no other countries where energy-saving measures are in place which obligate energy control by factories and office units in the same way as Japan's energy conservation law.
- Germany, a voluntary agreement has been reached between the government and industrial circles, effecting more than 70 percent of overall industrial energy consumption (monitoring has been conducted by a private organization). In France and England, a few industries have made similar agreements with the government, the number is limited. No such agreements have been concluded in the US.
- ll major countries have provided information service programs to their industrial

sectors.

2） ***The Household Sector***

- In the US and England, minimum energy efficiency standards have been set for general household electrical appliances. Other than Japan, however, no countries have set energy efficiency standards which are based on the performance level of the best appliances.
- The US, England, France, and Germany require labeling of appliances' energy efficiency levels.
- Energy-saving standards have been established for new building construction in Japan, placing the responsibility upon building owners. In the US, England, France, and Germany, compulsory standards relating to enhancement of energy efficiency under building standards or regulations are placed upon building contractors. Additionally, in Germany equipment for measuring heat consumption is required for each room of a residence. In Japan, more than 90 percent of illegal dumping of industrial waste is related to building construction, revealing that energy-saving measures must be specifically included in environmental policy.

3） ***The Transportation Sector***

- Energy consumption in transportation sector increased by approximately 23 percent between 1990 and 1998, 80 percent of which was due to increases in private automobile ownership.
- Between 1990 and 1998, car ownership per household increased at a pace exceeding 23 percent, and their resulting increased use has become a factor in energy consumption. The number of private automobile was 35.15 million in 1990, and is estimated to reach 59.73 million by 2010. By 2020, this number will exceed 60 million. Since car ownership will increase simultaneously with a decrease in Japan's population, a drastic control plan will be required in addition to with energy-efficiency regulations.

V　New Energy Sources

（1） Development:

While it has become clear that existing energy sources will not meet demand in the 21st century, it is also expected that population growth will continue at the same as in the 20th century, if not more. Such a rise in the population will be directly connected with increased energy consumption[11]. *(see Figure 4.)*

Global energy consumption in 1996 was equivalent to 9.3 billion tons in petroleum, 60 percent of which (5.5 billion tons) was expended by advanced regions (whose populations are 20 percent of the world total), and 40 percent of which (3.8 billion tons) was expended by developing

11） Global Industry and Culture Research Institute, ed. (2000) *Global Environment 2001 to 2001; from CO_2 to Environmental Hormones*, pp. 27-34. Million Shuppan.

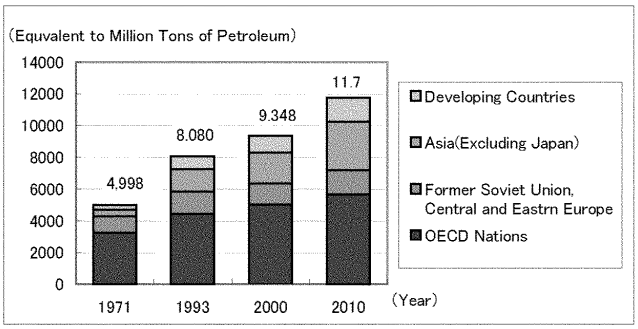

Figure 4. Transition and Outlook for Global Energy Expenditure, by Region

Sources: *OECD/IEA's "World Energy Outlook 1996 Edition"; "Environmental White Paper 2000 Edition", Environmental Agency, ed.*

Note: *There are some figures in parentheses (indicating composition ratio) which do not equal 100 percent, due to the rounding of fractions.*

regions (whose populations are 80 percent of the world total). Although the average energy expenditure per person was 1.6 tons overall, individuals in advance regions accounted for 4.8 tons each, while in developing regions per-person use was only 0.8 tons, which is 17 percent of the figure for advanced regions[12]. *(see Table 2.)*

Table 2. 1996 Global Energy Consumption Figures

	Total Consumption (petrol tons)	Consumption Per Person (petrol tons)
Advanced Countries	55.22	4.83
Developing Countries	37.95	0.82
World	93.17	1.62

Source: *World Bank, World Development Indicators, 1999.*

Population growth in developing regions will sharply increase energy expenditures, especially in areas where there is a rapid explosion of urban populations. Consequently, restraining concentration of populations into urban areas, reduction of natural resource and energy use, and development of energy sources which have a small environmental load have become urgent issues to be resolved.

(2) Creation of New Energy:

Simultaneous achievement of "3E" will be required in natural-resource and energy policies, including: economic growth, energy security, and environmental protection.

Advanced countries have gradually moved to resolve these three issues in a step-by-step manner, but developing countries must resolve them all at once. Accordingly, global warming

12) World Bank (1999), *World Development Indicators*.

control, natural resource conservation, and energy policy cannot be addressed without a global strategy for coexistence with the environment, and will require cooperation between advanced and developing countries. An international environmental coexistence policy is required, in which Japan's role will be especially important.

Although Japan generated an annual 320 million tons of CO_2 as of 1998, the global total reaches 6.5 billion tons. With the economic development of populous countries such as China and India, CO_2 emissions can also be expected to increase rapidly. Providing Japan's cleaner technologies (such as the CO_2 Global Recycle System) to developing countries will be vital to the destiny of the global environment.

Currently, the majority of energy sources used throughout the world are fossil fuels such as petroleum, coal, and natural gas, all of which emit CO_2 when burned. Excluding coal, it is also estimated that supplies of these fuels will be depleted in another 40 to 50 years. Electrical power faces similar circumstances, and even the supplies of uranium used in nuclear power generation are expected to be gone by the latter half of the 21st century. Depending upon the tempo of Asian development, exhaustion of global natural resources may be further accelerated. The fate of human existence will therefore largely rely upon development of new energy sources within the next 50 years. Such new energy sources are divided roughly into three categories: redeemable energy such as photovoltaic batteries and solar thermal conversion; recycled energy, such as waste-generated electricity; and new utilization of existing energy sources, such as clean energy cars, co-generation plants, and fuel cells. The greatest problem concerning these new energies is cost. *(A comparison between existing energy sources and generation unit costs is showed in Table 3.)*

Table 3. Generation Units of New and Existing Energy　　（*Yen-kWh*）

Photovoltaic Generation	70-100
Wind Power Generation	16-25
Geothemal Generation	20-15
Electric Power Generation from Waste Materials	9-15
Thermal Power Generation	10（petroleum）4-6（LNG）
Water Power Generation	13
Nuclear Power Generation	9*

Expense of handling radioactive waste not included.
Source: *Nihon Keizai Shimbum, November 20, 2000*

To attain a 6 percent reduction in greenhouse gases, Japan has set a target for increasing the percentage of new energy use, from 1.1 percent in 1996, to 3.1 percent by 2010. Germany, the Netherlands, and the US have given priority to wind power generation, and Japan has also set a target for increasing its use by a factor of 20, from the current 14,000 kilowatts, to 300,000 kilowatts. Although wind power's potential worldwide capacity is more than 10 million kilowatts, Japan currently generates no more than 406 kilowatts. Since wind power requires an annual average of more than 5 meters of wind speed, Japan's regional facilities must be limited to

seacoasts of its Hokkaido and Tohoku districts. There are also many problems to be resolved, in that maintenance equipment is costly and the noise that wind generators makes them unacceptable neighbors. Nonetheless, mainly in Hokkaido, recent programs have progress such as creation of large wind farms[13].

Additionally, although many people still remember the Chernobyl nuclear accident, for economic reasons former Soviet states have continued depending upon nuclear power (Ukraine targeted 40 percent, and Russia more than 14 percent). European Union nations like Germany plan to eliminate reliance upon nuclear power, and some local European governments have even planned to use only natural energy. Programs for meeting energy demands only by use of natural energies, such as wind and solar power, have recently multiplied[14], and eleven local governments in Sweden, Denmark, and Germany have reported 100 percent natural energy programs to the EU (including partial utilization, this would include 30 local governments). These programs do not to rely upon fossil fuels, include cities which will not emit global warming gases, and will exclude nuclear power. Denmark's government has supplied an investment fixed-ratio subsidy to these local governments, and policy support has been issued by other central governments.

These local-level energy programs do not require large-scale, centralized planning, and according to the future trend that individual regions acquires their own energy, there has been movement toward also generating electricity from waste materials. This type electric power generation creates steam to generate electricity by using the heat produced when burning trash, aiding attainment of the so-called 3R principle of reuse, reduce, and recycle. Although issues remain to be resolved, such as in enhancing the efficiency of waste-generated electricity, an increase of such facilities can be expected. In constructing such facilities, the agreement of nearby residents will be essential, which will require more assistance than ever in environmental improvement by governments.

For other new energy sources, improved performance of photovoltaic generation and fuel cells is also expected.

Ⅵ Introduction of an Environment Tax

If unchanged, complete compliance with the philosophy of COP3 will be quite difficult. Along with issues of how developing countries, such as China, intend to coexist with the environment, Japan and US environmental controls will have an influence on implementation of COP3. The responsibility of Japan, where the meetings were held, is heavy.

Although Japanese environmental protection has greatly improved, mainly through corporate efforts, it may not yet be considered sufficient. In the transportation and household sectors, no improvement was found; the situation has worsened. If COP3 is left as it is now, there is

13） Nishimori, K. (2000), Urgent Necessity for Fostering New Energy, *Creation of New Industrial Power;* Nihon Keizai Shimbun, Inc;. This chapter is highly suggestive.

14） Nihon Keizai Shimbun, Inc, (2000) December 3.

concern that Japan's 6 percent reduction plans will become mere lip service, since there are limitations to past environmental policies of voluntary control.

Introduction of an "environmental tax", as in effect in countries which are eager in environmental policy (such as Scandinavian countries, Germany, and the Netherlands) is expected to raise public concern, mainly in Japan and the US. In the US, industrial circles have a strong opposition to an environmental tax, based on the reasoning that international competitiveness will suffer due to cost increases. In Japan, however, the time has come to immediately introduce an environmental tax, and it is necessary that pressure be applied concerning introducing it in the US.

Although a clear definition has not yet been established, Japanese environmental taxes will be performed via a wide range of means. In recent polls which included businesses, support for introduction of an environmental tax has increased. According to recommendations by the Governmental Tax Commission in summer of 2000, a time for studying introduction of an environmental tax was designated.

It may be considered policy that, at first, an environmental tax is introduced, followed by a carrot-and-stick policy of providing subsidies to companies that have achieved environmental targets. Japanese businesses have the potential ability to internalize the environmental tax burden, and to not pass it on to consumers. Although the business environment in Japan is severe, technical and product development capacity which will be internationally competitive must be maintained. Along with careful assistance by the government, consumer behavior will favor products produced by companies that have made efforts to protect the environment. Furthermore, Japan should not only grow out of excessive car ownership, but also should take on the role of environmental power by paying greater attention to waste disposal.

Ⅶ　Summary

It has become clear that the natural resources which have supported development in the 20 th century will be depleted by the latter half of the 21st century. Accordingly, development of environmentally friendly new energy has become vital. Although currently considered costly, new energy sources will be of great use in increasing people's awareness about environmental problems and energy consumption. Promotion of development and implementation of new, low-cost energy technologies which may substitute for existing energy sources is a worldwide requirement. In this, the role and responsibility of Japan, which has economic power and technical development capacity, and which has enacted appropriate environmental policy, has been greatly increasing.

(Part-Time Lecture, Graduate Course of University of Tsukuba)