

Energy Conditions in Japan and the Challenge of Global Warming

By Dr. Matsuo Naoki

The method used to combat global warming differs from country to country. It is affected by the characteristics of each country, specifically, the peculiarities of the energy situation. Here, we will take an overall look at the peculiarities of the energy situation in Japan, which has achieved considerable success in saving energy, and examine the present situation and future challenges. Japanese experience may be able to offer valuable insights to developing countries which are pursuing a course of rapid economic growth in shaping their energy policies for the future.

Energy situation in Japan and its policies

The first peculiarity of the energy situation in Japan is the country's low self-sufficiency rate. In the case of petroleum, which represents 56% of the total primary energy supply, Japan almost wholly depends on imports. Even if nuclear energy, which accounts for 12% of the nation's energy consumption and is considered to be semi-domestic energy, is included, Japan's self-sufficiency rate for energy is less than 20%. Among the members of the OECD, Japan is one of the countries that has the most fragile energy supply structure.

For this reason, since the two oil crises, the first in 1973, when petroleum represented 77% of the primary energy supply in Japan, and the second in 1979, Japan's energy policy gave top priority to energy security. Energy consumption, which had been skyrocketing due to the high growth-rate of the economy, was cut considerably as voluntary endeavors in the private sector, centering on industry, were combined with various institutional measures taken by the government, such as the enactment of energy-saving related laws. The energy

Figure 1: Long-Term Trends of Energy-Related Indicators in Japan

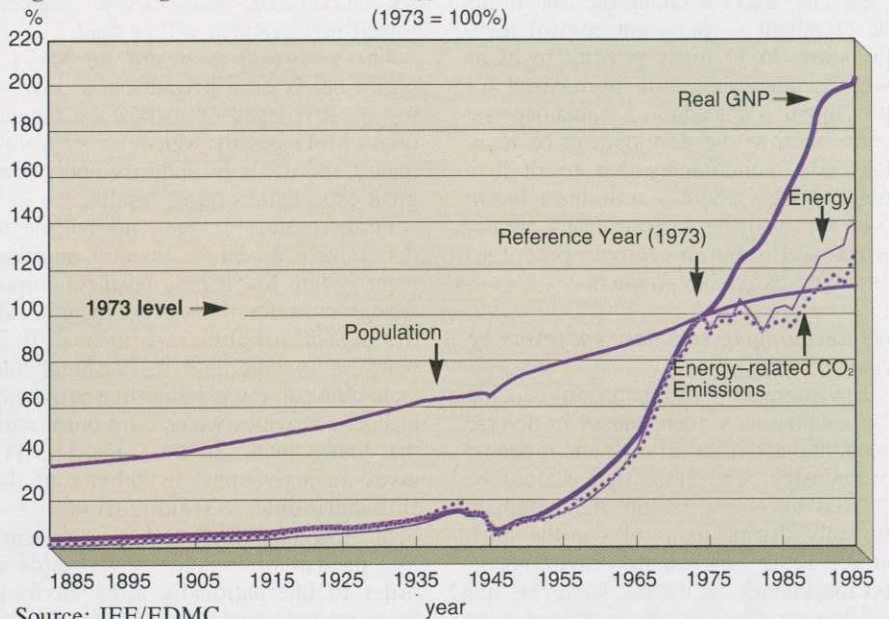
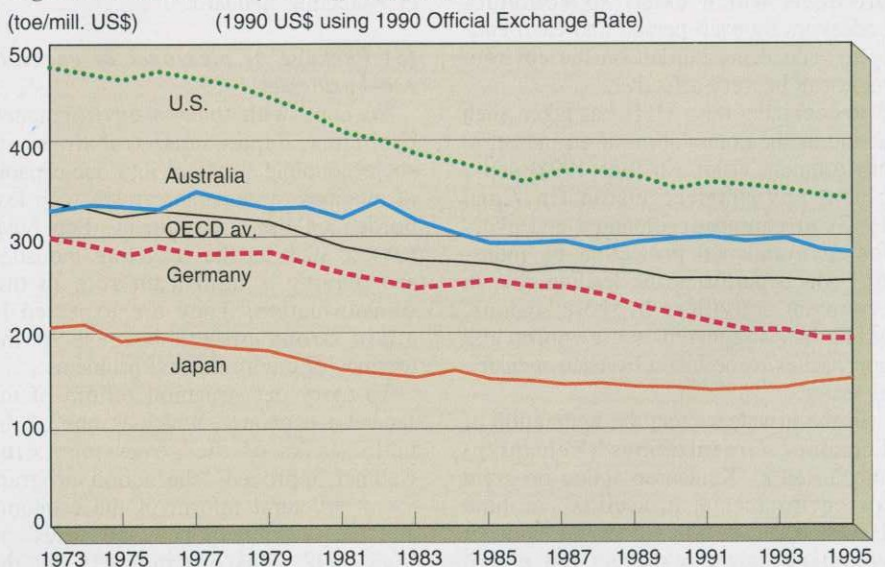


Figure 2: Total Primary Energy Supply per Unit of GDP



saving rate accomplished by Japan during the period from 1973 to 1986 was unmatched by any other country in the world. As shown by Figure 1, this is clear from the gap between GDP and primary energy supply. Progress was made in the development of non-oil energy sources through legislation and by setting up a specific fund, and as a result, the present energy consumption mix reveals a very well-balanced picture based on diverse energy sources.

From a macroeconomic viewpoint, among the OECD members, Japan is one of the countries that consumes the smallest amount of energy in producing one economic unit,¹ as shown in Figure 2.

The success of this policy was primarily due to concerted endeavors to save energy, on the part of the government, industry and private citizens, based on a shared sense of crisis. The entire energy of the nation, which had hitherto been directed to the emergence of Japan as a developing country to a highly industrialized country during the high economic growth-period of the 1960s, was now redirected to building a low energy consumption and low environmental pollution nation. The energy-saving industrial production processes implemented during the period of energy-saving endeavors by industry, which was at the heart of this national transformation, later proved to be a considerable advantage for it in international competition. This is particularly striking in basic materials industries (Figure 3).

At present, securing a supply of energy sources sufficient to support economic growth and measures to protect the global environment—specifically, measures to prevent global warming, as well as energy security (collectively called “3E”), are the three main elements of Japan’s energy policy.

Present condition of CO₂ emission and problems

Since 1986, the CIF price of crude

oil imports to Japan has been at the same low level as prior to the first oil crisis, because of the combined effects of the crash in the international crude oil market, stagnation of global oil demand, and appreciation of the yen (Figure 4). Moreover, as a result of the speculative bubble economy caused by such factors as land speculation, the energy-saving endeavors in Japan are at a stalemate even today, long after the bubble economy fizzled out.

Here, we will analyze the upward trend in energy consumption in Japan. By sector, energy consumption by industry has been almost flat since 1973, though a slight increase was seen recently. However, the growth of energy consumption in the transport and household sectors has been fairly brisk (Figure 5 and Figure 6). In every industrialized country, energy consumption in the transport sector has been growing, but consumption in the household sector has scarcely increased in the U. S. and Europe.

This indicates that the level of awareness of the Japanese in the household sector, closely related to their

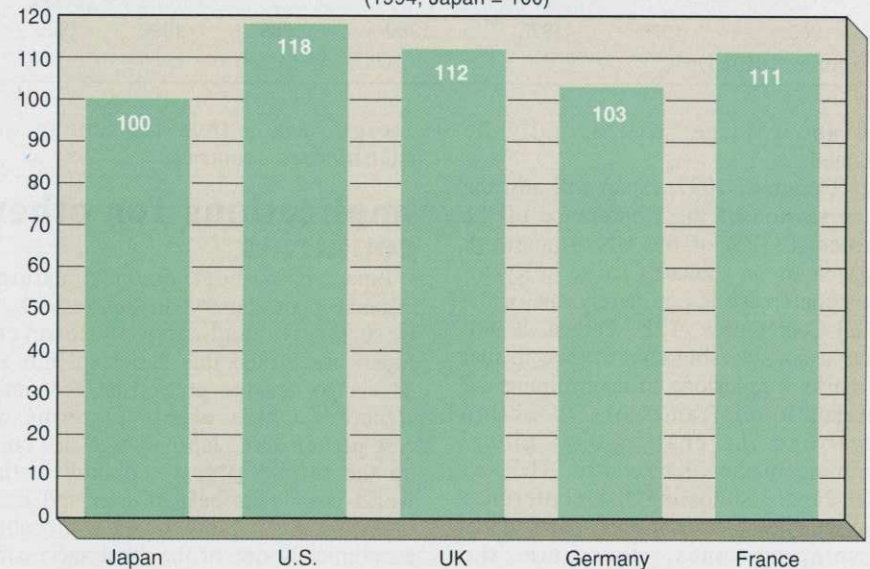
daily life, is still at the “developing stage.” Certainly, the absolute level of energy consumption in Japan is considerably lower than in both the U.S. and Germany and will increase for some more years until it reaches some saturation point.

The amount of CO₂ emissions, the main cause of global warming, has been tracing a curve similar to that of energy consumption, as shown in Figure 1. The slightly gentler curve than that of energy consumption is due to the shift to non-carbon or low-carbon energy sources, such as nuclear energy and natural gas. This shift has been prompted by the energy security policy, as well as by growing awareness of the economic advantages of such energy sources.

Japan’s target for cutting CO₂ emissions calls for “reducing the amount of per capita emissions to the 1990 level by 2000.” The amount of per capita emissions in Japan is less than 50% of the U.S. level and is about 20% lower than the OECD average. However, it rose about 8% from 1990 to 1995, and it is thus doubtful whether

Figure 3: Energy Intensity for Steel Production

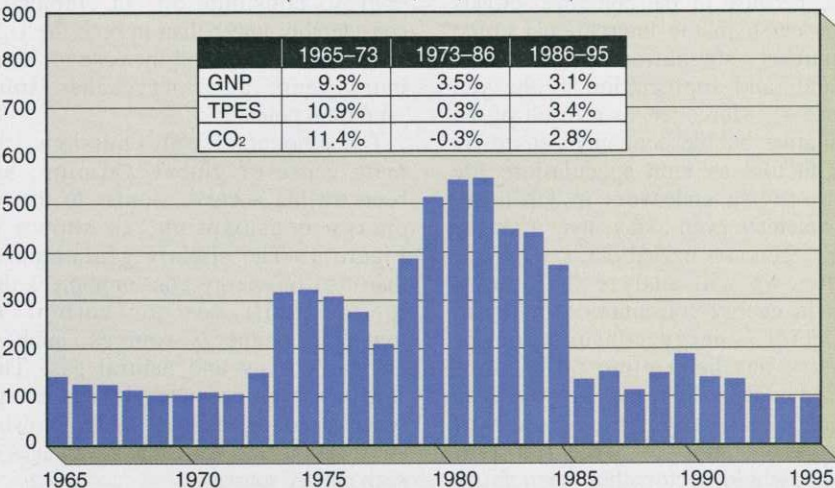
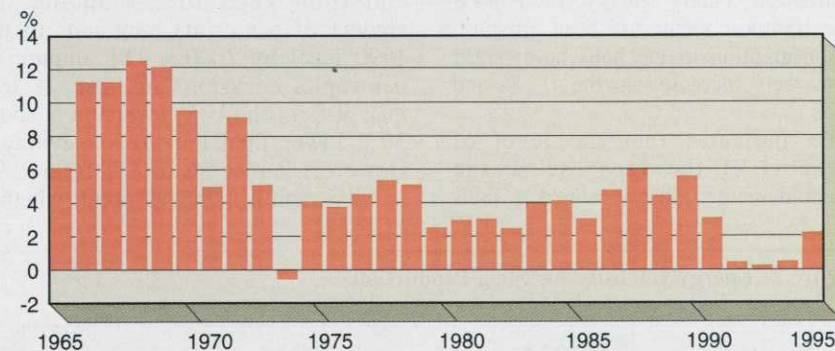
(1994; Japan = 100)



Source: Calculation by Japan Iron and Steel Federation based on Statistics on Energy in the Steel Industry

Figure 4: Crude Oil Import Price in Japan

(1972 = 100%; CIF; Real Value)

**Annual GDP Growth Rate**

Source: IEE/EDMC

the above target will actually be attained.

In December 1997, Japan will host the third session of the Conference of the Parties (COP3) of the UN Framework Convention on Climate Change in Kyoto. This conference is not merely one of the usual Conferences of the Parties. It will have a considerable significance in that it marks a milestone in determining the international framework of action regarding the challenge of global warming in the 21st century. The fact that Japan is hosting the conference may enable other countries, particularly developing ones, to share the experience of Japan, which is one of the greatest economic success stories and has accomplished the greatest

energy saving thus far among all industrialized countries.

Implications for other countries

Japan is without doubt a natural resource-poor country. In this respect, it is seriously handicapped. However, Japan has turned this handicap into an advantage and has created an economic structure which excels in terms of cost-performance. Japan, which has built up the second largest economy in the world despite its belated start and now ranks top in per capita GDP, is probably economically one of the most successful cases among OECD members. In not a small measure, this success is due to the restructuring of the economy into an

energy-saving and low-pollution type.

One of the methods used to accomplish this was the establishment of a unique energy policy and tax system. In pursuance of the energy policy, the Japanese Government imposed a light but widespread tax on energy, particularly oil, and the tax revenue from that has been appropriated to the implementation of energy policy, specifically the development of non-oil energy (gasoline and diesel oil are taxed separately). In particular, a considerable amount of public funds has been invested for the research and development of nuclear energy and nuclear plant safety, since the government considers nuclear energy to be a very important energy source from the viewpoint of energy security and also the prevention of global warming. As a result, the safety of nuclear energy in Japan at present ranks at a high level internationally. Such participation by the government is considered to be a catalyst in bringing about this success, as it counteracts the distortion and short-sighted movements of the market and stimulates the development of renewable energy sources.

The cost of energy in Japan is the highest of all the OECD member countries. The electric power charge for industry and the price of natural gas are two or three times higher than other OECD countries. This is due to the fact that the greater part of energy sources are imported from distant countries and that various domestic costs are very high. Ironically, however, the high cost of energy has urged and stimulated the restructuring of industry into an energy-saving type.

Japan, which learned a bitter lesson from the considerable pollution generated during the high economic growth period of the 1960s, curbed harmful emissions of pollutants into the environment by setting stringent environmental criteria from fairly early on. Electric rates which are the highest in the world are partly due to the fact that Japanese electric utilities practice a desulfurization process of the highest level in the world. This is a concrete example of "the internalization of external costs" in economics. Sulfur dioxide emissions from power plants are

being countered by imposing a sulfur tax in Europe and by "SO₂ allowance trading" in the U.S. (each method has been successful in its own way). As regards environmental performance, however, Japan is a notable example. Japan's success is based on the lesson learned from experience that preventing pollution is far more cost-effective than recovering a polluted environment. This lesson was not learned without paying a high price.

The system of appointing an "energy supervisor" and an "environment super-

visor" at each factory is often mentioned as a successful institutional approach to implementing energy-saving measures and environment protection policies at plants and factories. In Japan, such engineers often occupy quite high positions in corporate organizations, and so they have been able to contribute greatly to the success of energy-saving and environmental protection endeavors.

Saving energy and protecting the environment can be compatible with economic growth. This has been proven

by the example of Japan, which scored success at a high international level in all three areas. Certainly, it can be pointed out that in the case of Japan, external factors were a major stimulus and that environmental protection measures were taken after, not before, pollution occurred. A considerable part of what Japan has accomplished, however, can be generalized as a lesson for other countries who wish to enjoy the benefits of latecomers.

As mentioned above, the path of economic growth with energy-saving which Japan has achieved must be attractive and informative to other countries, particularly developing ones. Developing countries will be responsible for a considerable portion of CO₂ emissions in the future, so it is no exaggeration to say that the policy of energy-saving type economic growth may become a key to solving the global warming problem.

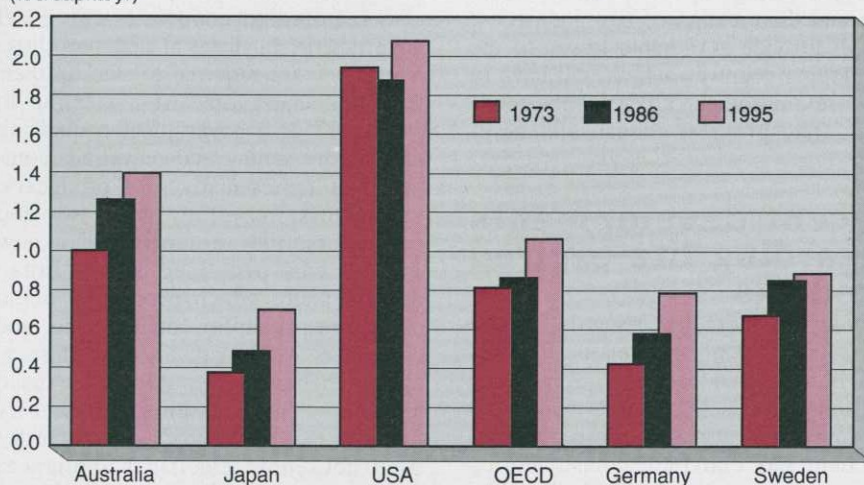
To this end, a global framework that encourages developing countries, as well as the countries of the former Soviet Union and Eastern Europe, to choose the path of energy-saving economic growth should be structured. Multiple channels should be set up by means of which many countries can share the experience of a country like Japan in these fields. The international emissions trading system for greenhouse gases (GHGs), which the COP3 in Kyoto is expected to include in the Protocol, appears to be a system of high potential which utilizes the market mechanism. Joint implementation with crediting, too, will prove to be a system that brings benefit to both parties and the global environment as a whole if introduced.

Note: Japan's position in this respect worsens slightly if it is based on purchasing power parity. ■

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Figure 5: Energy Consumption in the Transportation Sector per Capita

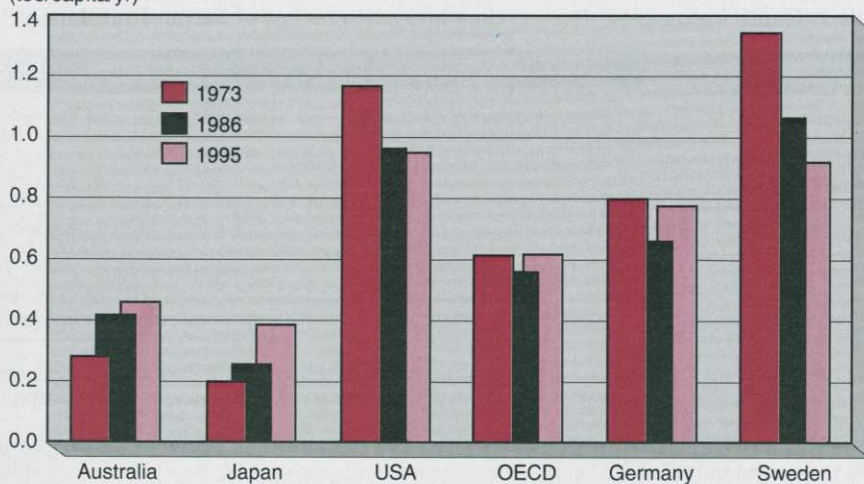
(toe/capita/yr)



Source: OECD/IEA, "Energy Balances of OECD Countries"

Figure 6: Energy Consumption in the Residential Sector per Capita

(toe/capita/yr)



Source: OECD/IEA, "Energy Balances of OECD Countries"