

Trends in Energy Conservation Measures in the Household Sector

By Nakagami Hidetoshi

Introduction

The prevention of global warming, one of the major challenges of the 21st century, compels us to reexamine the patterns that have been adopted in every field, including those in society, in the economy and in our personal lives. As the term itself suggests, global warming is a global-scale problem that is of great significance not only for Japan, but also for other developed nations, as well as for developing nations. If the goal of the developing nations in this century is, in some sense, to catch up with the developed nations, then it appears that a dramatic increase in energy demand, which is the leading cause of global warming, will be a path they cannot avoid. With a view to alleviating this problem to the greatest extent possible, the dissemination and promotion of highly energy-efficient technologies in developed nations like Japan would surely play an effective role as a model.

This essay will discuss recent trends in energy conservation measures in Japan's household sector and will look

at trends in energy conservation policies.

Energy Demand Trends in the Household Sector

Before discussing trends in energy conservation measures, let us examine trends in energy demand in Japan's household sector.

Household energy demand in Japan has shown a consistent increase. From 1990 to 1998, Japan's household energy consumption rose 3.1% annually. Because the rate of increase in the number of households during this period was 1.3%, we can estimate a 1.8% rate of increase in energy consumption per household.

Consider the energy consumption trends in households of two or more people over the past 30 years. In 1970, 26,617 MJ per household were consumed annually, while by 1999 that figure had multiplied 1.8 times to 47,011 MJ. During this time the average annual growth rate was 2.0%. A breakdown of the types of energy consumed by households in 1970 shows that kerosene was used most, accounting for

30.4% of consumption, while city gas accounted for 21.2%, electricity for 18.8%, liquefied petroleum gas (LPG) for 12.1%, and solid fuels like coal for 17.5%. In 1999, most energy was consumed in the form of electricity, at 36.2%, while kerosene accounted for 25.1%, city gas for 24.8%, and LPG for 13.9%. Solid fuels have been completely eliminated as a fuel for household use. (Figure 1)

What does a breakdown by type of use reveal? In 1970, heating accounted for the largest share of energy use at 44.1%, followed by hot water at 23.4%, cooking at 16.3%, lighting and home electronics at 16.0%, and cooling at 0.2%. In 1999, however, there were some major changes. The largest share of energy was accounted for by hot water at 33.8%, followed by lighting and home electronics at 28.0%, heating at 27.5%, cooking at 8.3%, and cooling at 2.4%. (Figure 2)

As shown above, Japan's household energy demand has continued to rise in spite of very different trends in the developed nations of Europe and in the United States. In some countries, such

Figure 1

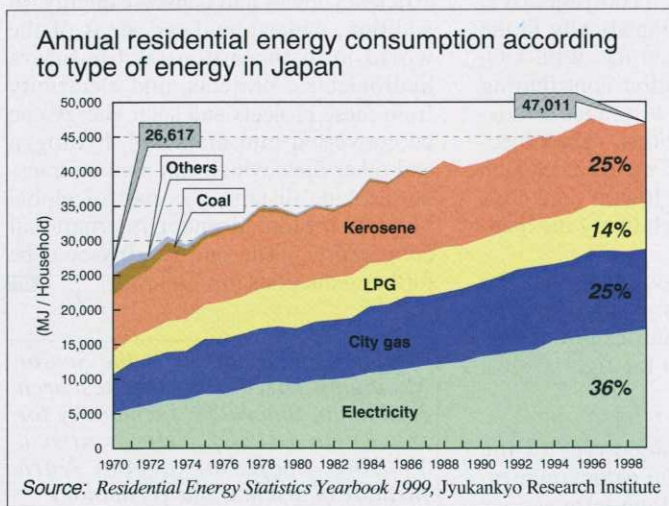


Figure 2

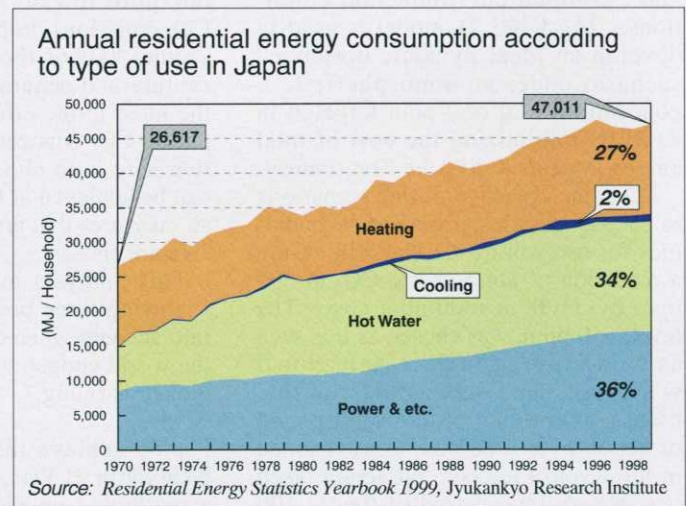
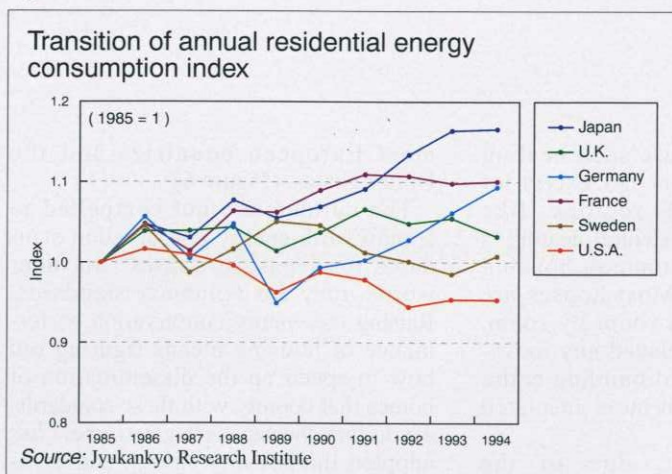


Figure 3



as the United Kingdom, France and Germany, demand has remained at about the same level, while in others, such as the United States and Sweden, demand has actually fallen. (Figure 3) This suggests that it is indeed possible to halt the increasing trend in household energy demand once it has reached a certain level (level of sufficiency) and to reduce it by upgrading to more efficient appliances and improving the insulation structure of homes. Still, Japan's household energy consumption continues to rise. In this sense, Japan resembles a developing country. Let's compare the composition of household energy demand in Japan and other developed nations.

A comparison of energy consumption per household in 1994 reveals that the United States has the highest energy consumption at 114.2 GJ per household per year, or 2.5 times that of Japan. Following the United States are Sweden with a consumption of 87.7 GJ per household per year (1.95 times Japan), France with 85.2 GJ (1.9 times Japan), Germany with 84.5 GJ (1.88 times Japan), and the United Kingdom with 79.6 GJ (1.77 times Japan). Demand in all of these countries is clearly much higher than in Japan. Breakdowns by use reveal interesting differences in climate and lifestyle.

The most significant, indeed, overwhelmingly significant, difference between other countries and Japan is in the area of energy used for heating. If Japan is given a value of 1.0 in the index, the United States is 5.6, Sweden is 4.7, France is 5.5, Germany is 5.6, and the United Kingdom is 4.0. Even if adjustments are made for the fact that

winter in Japan is much warmer than in some of these European countries, the difference still remains large. This difference does not indicate that Japanese houses are built to be more energy-efficient than houses in Europe. Instead the difference lies in the level of heating. In Japan, homes are still heated room by room, while in the other advanced nations, homes are generally fully heated, and even hallways and bathrooms are kept warm. For Japanese homes to reach the heating level of European and American homes, at a conservative estimate, more than double the current energy consumption for heating would be required.

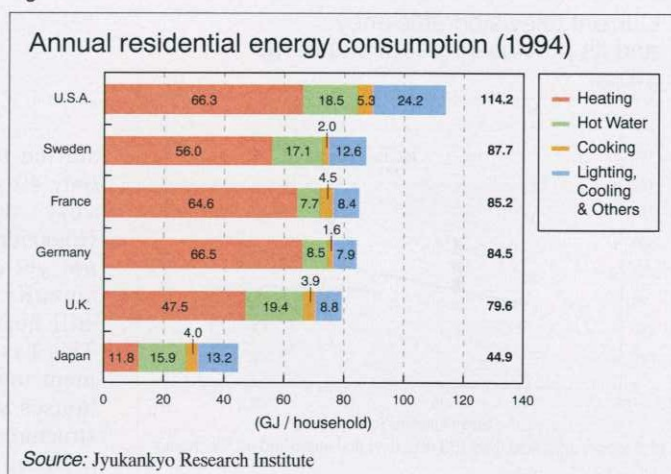
There are no other areas of energy use in which Japan and Europe show as significant a difference as that seen in the area of heating. In fact, for many uses Japan's energy consumption is higher than in other countries. Energy consumption for hot water, for example, can be explained by differences in

Table 1 Energy savings of the revised standards

Category	Energy saving effect	Indices	Target fiscal year
Air conditioner			
Heat pump type	63.0%	COP	2004(cooling year)
Cooling - only	14.0%	COP	2007(cooling year)
Fluorescent lights	16.6%	lm/W	2005
Television	16.4%	kWh/year	2003
VCR (stand-by power use)	58.7%	W	2003
Refrigerators and / or Freezers	22.5%	kWh/year	2004
Computers	56.0%	W/MTOPS	2005

COP: Coefficient of Performance. MTOPS: Millions of Theoretical Operations Per Second.

Figure 4



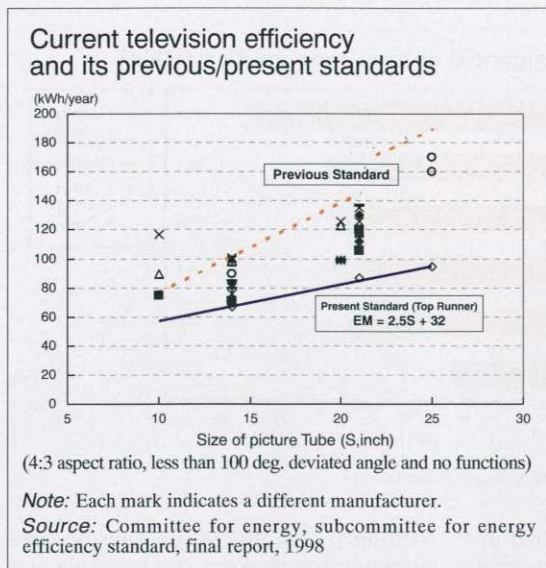
bathing traditions, while energy consumption for cooking can be explained by differences in eating habits and customs. One could argue that energy consumed by lighting and home electronics is pushed upward in Japan by the dissemination of a diverse array of home electronics not available in Europe. (Figure 4)

Trends in Energy Conservation Measures

Appliance Policies

The appliance policy winning special attention around the world is the "top runner method" to set standards for various energy-consuming household appliances stipulated in the revised Energy Conservation Law of 1998. Energy conservation standards had been established for these kinds of appliances prior to this legal revision, but attempts to improve efficiency

Figure 5



merely stipulated that the energy consumption efficiency of home appliances had to be improved by a certain percentage over the average. Under the "top runner method," by contrast, the energy consumption efficiency of home appliances must be kept equal to or above that of the most energy-efficient product currently available on the market. For example, a 63% energy efficiency improvement has been set as the new standard for household heating and cooling air conditioners. The efficiency improvement values that have been adopted are 16.6% for fluorescent lights, 58.7% for videocassette recorders (VCRs; stand-by power use), 22.5% for refrigerator-freezers, and 16.4% for TVs (Table 1, Figure 5).

Also, strengthening energy conservation measures has meant expanding the target products to include oil and gas appliances (instant water heaters, room heaters, water heaters, bath heaters, gas burners and fan heaters) and toilets with warm-water washing functions. Investigations of new standards are just now getting underway.

Improving the Energy Conservation Performance of Housing

After looking at housing in Tokyo, a close friend of mine from France once asked, "Why isn't double-paned glass used in houses here?" I remember being at a loss for an answer. As mentioned earlier in the section on Japan's energy consumption trends, this is because of the fact that the use of indoor heating in Japan has a fairly short history. People

started to use such heating only 40 years ago, except for very cold regions like Hokkaido. Central heating is not yet a common housing amenity. Most houses are still heated room by room. This has delayed any movement toward building entire houses with more insulated structures.

However, due to the stricter energy conservation standards that were introduced in 1999 for housing, greater housing insulation

performance standards had to be promoted. The standards were revised twice, and energy conservation standards that were more than 20% higher than the previous standards were established. Double-paned glass was thus added to the standard features of new houses in Tokyo. This brought energy conservation standards for Japanese houses closer to values established in

most European countries and the United States. (Figure 6)

The builders are not compelled to comply with energy conservation standards for Japanese houses. In other words, they are voluntary standards. Raising the energy conservation performance of housing means figuring out how to speed up the dissemination of homes that comply with these standards. To do this, the Japanese government has adopted the housing energy conservation performance indicator system.

New Energy Conservation System

The Japanese government and the private sector are working to promote the development and dissemination of a Home Energy Management System. This system does not stop at regulating the energy-saving performance of individual appliances, but controls the energy-saving performance of all the appliances in a household, thus eliminates the waste of energy consumption. The

Figure 6

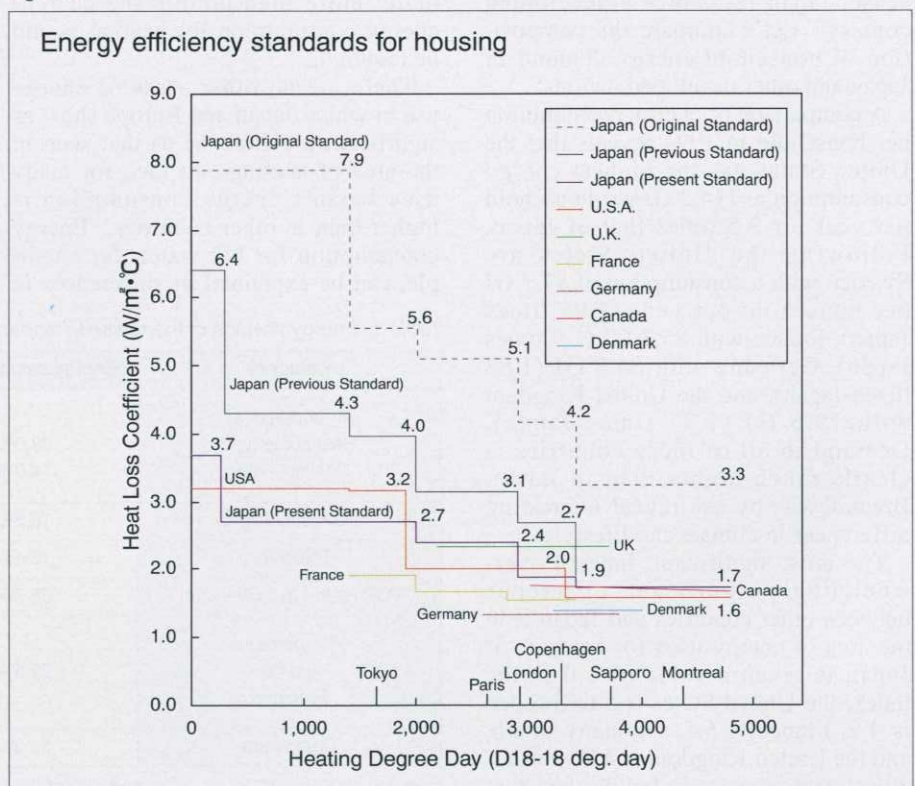
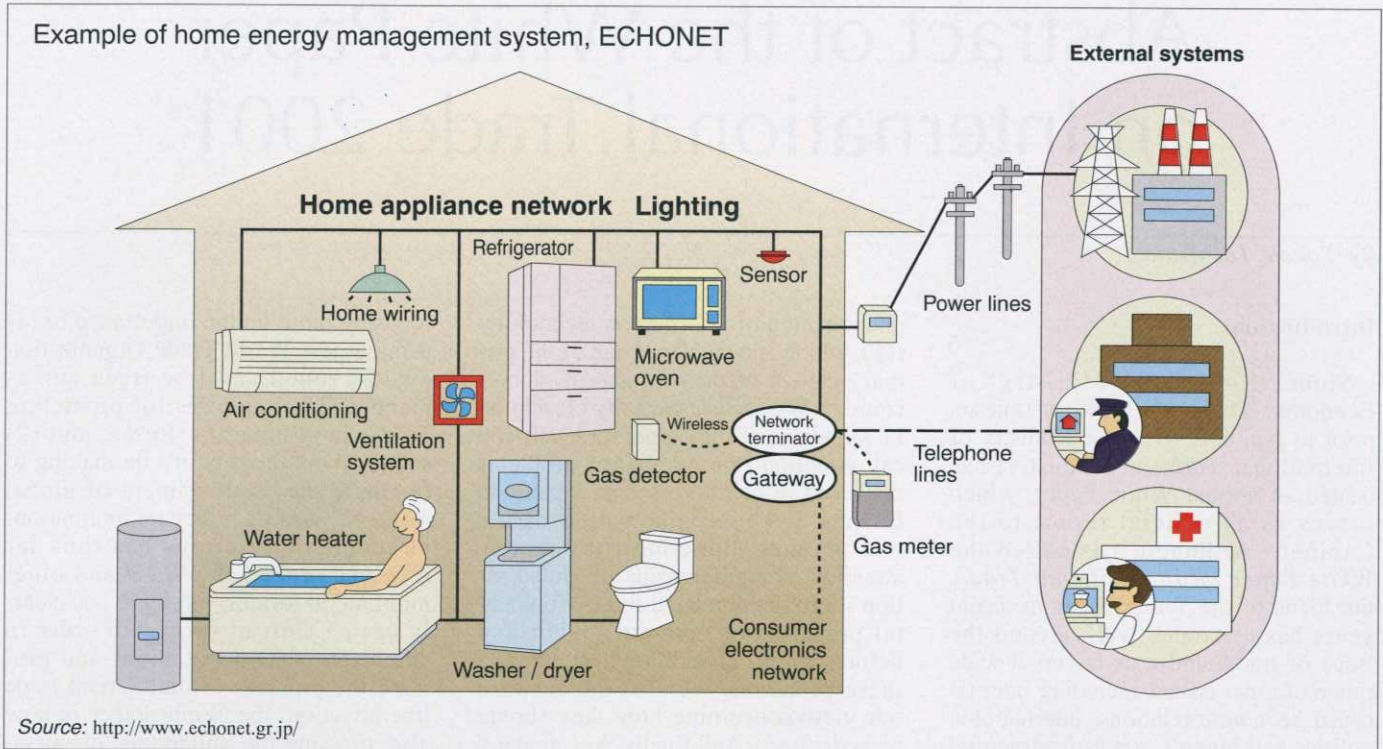


Figure 7



use of IT will make it possible to save energy automatically without any extra trouble to the consumer. For example, it may be possible to make consumers more aware of their consumption by putting their energy use into visual form in real time, and showing them how that use affects their energy costs.

Field tests in this area are being planned. Preliminary surveys have measured energy-saving effects of 10-20%. (Figure 7, 8)

Conclusion

Energy conservation is the most basic

problem we need to address in efforts to stop global warming. As described here, steady progress seems to have been made in the development of energy-saving technologies. Information technologies, which are also expected to play a leading role in the development of 21st-century technology, are also quickly appearing in the energy conservation market. However, no matter how much technologies are developed, they will be of little use if they are not applied. This is where the role of the individual consumer comes into play. In many cases, adopting these new technologies and new energy conservation standards involves bearing some increased costs, but we need to consider these as a necessary price to be paid for the sake of future generations. The goal of bringing a halt to global warming must surely compel us to undertake a basic paradigm shift. **UJI**

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Figure 8

