

An Analysis on Clean Energy Introduction and Price Affordability

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Use and consumption of energy as an indispensable good for economic activities and citizens' daily life increases on economic and population growth. In that process, the most economically efficient, available, cheap and convenient energy sources have been selected, though the selection differs greatly depending on national or regional conditions, as shown by history. However, the selection may not necessarily be the best from the viewpoint of externalities including energy security and environmental conservation. Rather, energy sources or energy mixes selected only from the viewpoint of economic efficiency frequently create vulnerability to externalities. Policies to counter the vulnerability have been constituted as energy and environmental policies.

Regarding environmental conservation, for example, clean energy sources must be introduced and diffused politically and strategically to resolve or overcome problems with energy sources or mixes selected from the viewpoint of economic efficiency. Such measure may cost more than business-as-usual ones. It may be important to accept and overcome such additional cost.

The year 2019 marks the 50th anniversary of Japan's liquefied natural gas (LNG) introduction. Japan introduced LNG as Tokyo Gas Co. and Tokyo Electric Power Co. imported LNG from Alaska of the United States in 1969. In the 1960s, energy demand was expanding rapidly amid high economic growth in Japan. Major energy supply switched from coal to oil, leading oil to continue increasing its share of primary energy supply and the power generation sector's energy consumption toward a peak. Rapid growth in energy demand and in dependence on oil deteriorated air pollution in major urban and industrial regions such as Tokyo and Osaka.

Then, tough regulations were introduced to require oil-fired power plants as the then leading electricity generation source to use ultra-low sulfur crude oil in major urban regions. City gas production depended on oil-based naphtha and coal. In such situation, it was significant to introduce natural gas featuring much less sulfur and nitrogen oxide emissions. This clean energy source had to be liquefied at very low temperatures for transportation using special tankers, making LNG "a premium fuel" costing more than other fuels. In the face of the serious air pollution, however, Japan introduced and diffused LNG under a strategic decision to balance economic growth with environmental conservation.

Later, LNG was promoted from the viewpoint of not only environmental conservation but also energy security enhancement through the diversification of energy sources and the reduction of dependence on oil and on the Middle East following the oil crises in the 1970s. Since the 1990s, LNG was further promoted as a fossil fuel emitting less carbon dioxide from the viewpoint of global warming prevention. In this way, the introduction and diffusion of LNG was designed to address the externalities such as environmental conservation and energy security.

An important point in this respect is how seriously the government, industry and citizens considered such externalities. In Japan, a view has been shared that the externalities would be very serious and urgent challenges/threats and should quickly be addressed with large-scale countermeasures. Another important point is that Japan has had economic capacity to implement responses to externalities even at some cost. For example, Japan's per capita real gross domestic product (GDP) in 1971 was \$19,328 in 2010 dollars. Compared with the global average of \$5,323 and the non-OECD average of \$1,433 then, the Japanese per capita real GDP indicates that Japan as one of the industrial countries then had economic capacity to pay for environmental conservation and energy security measures. As a matter of course, any energy cost increase is a macroeconomic burden for Japan as a major energy consumer and net energy importer. However, Japan has viewed externalities as clear and present problems and introduced and diffused the key clean energy source of LNG as a country with economic capacity to address the problems.

A half century after Japan became the first Asian country to introduce LNG, Japan is still the world's largest LNG importer. In the future, however, LNG demand is expected to expand mainly in emerging Asian countries such as China, India and Southeast Asian nations. As seen in Japan a half century ago, serious air pollution has become a grave matter of social concern and loomed as an urgent problem to be tackled by governments in China, India, South Korea and Southeast Asian countries. In this respect, natural gas or LNG as a clean energy source is expected to play a major role. Some countries, including China, have taken regulatory measures to ban the use of coal and expand natural gas or LNG in response to the deterioration of air pollution. As seen typically in China and India, Asian countries have used coal as a major energy source and introduced the clean energy source to reduce their dependence on coal.

The problems here are the cost of clean energy introduction and its affordability. The extent to which additional costs are accepted for environmental conservation widely differs from country to country depending on national conditions and economic development stages. China's per capital real GDP in 2016 was only \$6,894. However, the number represents a nationwide average. Given the Japanese experience, large coastal Chinese cities with per capita GDP far exceeding \$10,000 can apparently withstand some cost burden. In this sense, China could promote the introduction of clean energy sources and accelerate their diffusion with strong government incentives. In India and Southeast Asia as growth markets after China, however, affordability could become a tougher constraint. For example, India's per capita real GDP in 2016 was limited to \$1,856 or less than one-third of the Chinese level. This is also a nationwide average, indicating that some regions could have far higher per capita GDP. However, affordability will become a key factor behind energy choices. It is important to employ policy initiatives and incentives and restrict supply costs for competitive supply to overcome the affordability constraint and take advantage of LNG or natural gas as a clean energy source.

Regarding the introduction of clean energy sources, I have taken up LNG and pointed out the seriousness of the problem awareness and the significance of countermeasures and economic capacity to pay for them. This point may be common to all clean energy sources that are not limited to LNG. As for renewable energy, consideration must be given to the cost for overcoming the intermittency of supply. The development and utilization of innovative energy sources such as hydrogen should be tackled from the long-term viewpoint of climate change and energy security. We must acknowledge energy as an indispensable good again, keep the viewpoint of affordability in mind and consider the reduction of costs and the enhancement of competitiveness as indispensable.

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