U.S. and Japanese Manufacturing Energy Costs

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Over recent years, United States natural gas and crude oil production has continued expanding under the shale revolution in which the development of unconventional fossil energy resources has made progress. The U.S. natural gas and crude oil output expansion is expected to contribute to reducing net energy imports, improving the energy self-sufficiency rate, cutting the trade deficit, lowering industrial energy costs and enhancing industrial competitiveness.

In Japan, meanwhile, manufacturing industries have been put in a disadvantageous position in terms of energy costs due to the Asian premium problem that represents higher liquefied natural gas prices than in Europe and the United States, as well as an electricity price hike resulting from greater fossil fuel consumption for power generation amid the shutdown of nuclear power plants.

I here would like to compare manufacturing energy cost changes in the United States and Japan and analyze their differences.

■ Major Japanese and U.S. energy prices

Figures 1 and 2 indicate changes in major industrial energy prices in the United States and Japan.

Changes in U.S. and Japanese petrochemical product prices linked to crude oil prices in the global market are similar. Petrochemical product prices in both countries rose rapidly from 2002 and peaked in 2008 before plunging on the Lehman Shock. But they turned up again in 2009 and recovered to the 2008 average levels around 2012. Due to a tax rate gap and other factors, however, the U.S. diesel oil price is relatively lower than the Japanese price. Based on the 2012 exchange rate (83 yen per dollar), the U.S. diesel oil price was about 40% lower than the Japanese level. In the meantime, Japanese and U.S. liquefied petroleum gas prices moved in tandem with other petroleum product prices until 2011. From 2012, however, the U.S. LPG price plunged due to an oversupply. In the year, the U.S. LPG price was more than 60% lower than the Japanese price.

Natural gas prices are formed on a region-by-region basis, differing between North America, Europe, Asia and other regions. Until 2008, Japanese and U.S. natural gas prices showed similar upward trends. While the Japanese LNG price turned up from 2009 after plunging in the wake of the Lehman Shock, the U.S. natural gas price continued declining on progress in shale gas development. There has been a gap between Japanese and U.S. natural gas prices due to differences between pipeline gas and LNG liquefaction and transportation costs. The shale revolution has worked to expand the gap further.

Both U.S. and Japanese coal prices retained a moderate upward trend until 2011. From 2012, however, the Japanese coal price turned down.

The U.S. industrial electricity price is less than half the Japanese level. The U.S. electricity price continued a moderate upward trend in line with fuel price hikes from 2002 before leveling off due to a natural gas price drop from 2008. The Japanese electricity price continued declining due to growing shares for relatively cheaper coal and nuclear power generation as well as electricity market deregulation until 2007. After a temporary rise attributable to a rapid fuel price increase in 2008, the Japanese electricity price returned to a downward trend in 2009 and 2010. Since 2011, the Japanese electricity price has soared remarkably because of the Great East Japan Earthquake, the shutdown of nuclear power plants and rising fuel costs for power generation.

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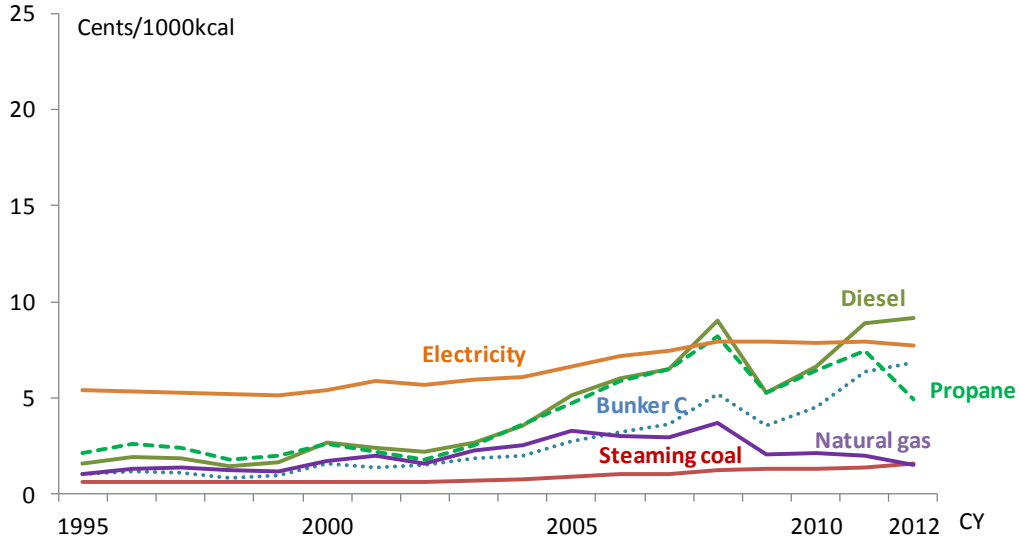
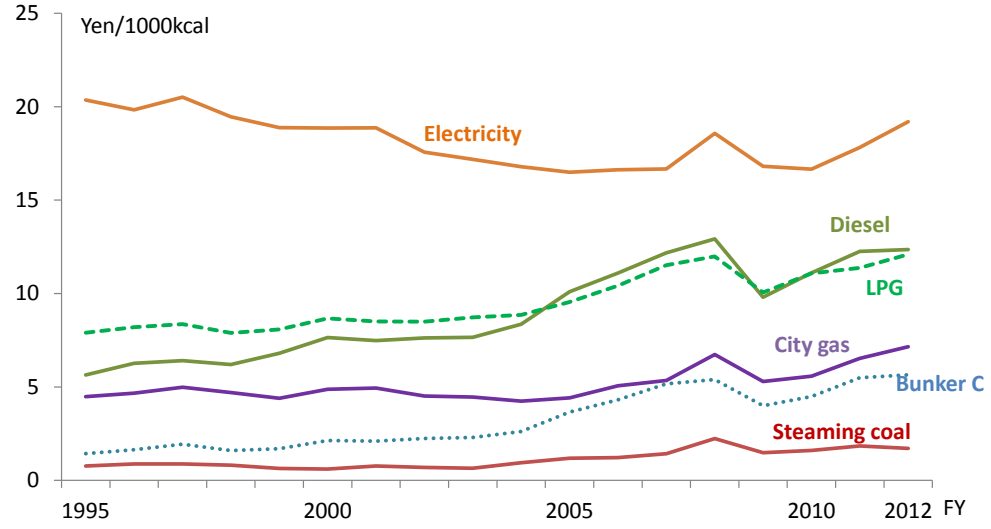
Figure 1 Major U.S. Industrial Energy Prices



Note: Diesel, propane and bunker C prices are sales prices to end users, electricity and natural gas prices are sales prices to industrial users, and the coal price is a steaming coal sales price to industrial users.

Sources: Prepared from "Annual Energy Review" by the U.S. Energy Information Administration and "Energy Prices & Taxes" by the International Energy Agency

Figure 2 Major Japanese Industrial Energy Prices



Note: Diesel, LPG and bunker C prices are wholesale prices. The city gas price represents three major gas companies' industrial and commercial gas prices. The electricity price is an average unit price of power services. The coal price is on a CIF import basis.

Source: "Handbook of Energy & Economic Statistics in Japan" by the IEEJ Energy Data and Modelling Center

■ Final energy consumption mix

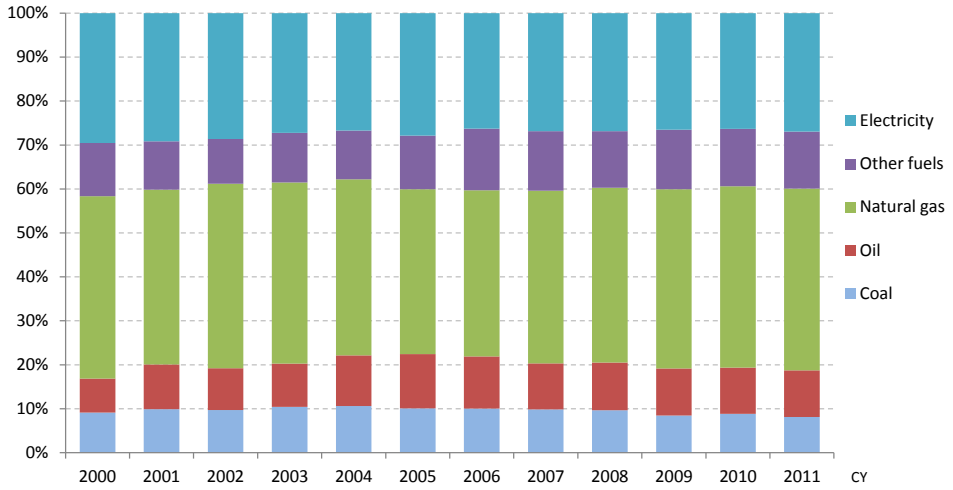
Among energy sources, natural gas has accounted for the largest share of final energy consumption[1] in the U.S. industrial sector. The share continued expanding from 2005 and reached 41% in 2011. Electricity's share stood at less than 30% then. Coal's share remained at some 10% until 2008 and turned down later, falling to 8% in 2011. In the

[1] The consumption covers only fuels and electricity, excluding energy sources used as raw materials and for private power generation.

year, oil accounted for some 11% of final industrial energy consumption, and biofuels and wastes for about 13%.

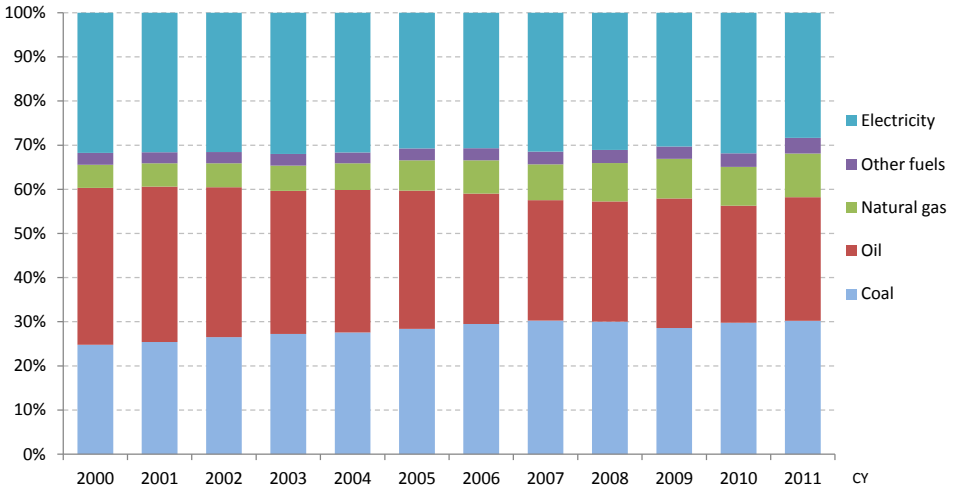
Electricity's share of final industrial energy consumption in Japan has been slightly higher than in the United States, remaining above 30% until 2010. The natural gas share in Japan, though continuing to expand, has still been far lower than in the United States, standing at 10% in 2011. Among fuels, coal has accounted for the largest share of final industrial energy consumption in Japan. The share has remained around 30% over recent years. The oil share has continued a downward trend, falling from 36% in 2000 to 28% in 2011.

Figure 3 U.S. Industrial Sector Final Energy Consumption Mix



Note: Excluding energy consumption for non-energy purposes
Source: "Energy Balances of OECD Countries" by the International Energy Agency

Figure 4 Japanese Industrial Sector Final Energy Consumption Mix



Note: Excluding energy consumption for non-energy purposes
Source: "Energy Balances of OECD Countries" by the International Energy Agency

■ Manufacturing energy costs

Figures 5 and 6 indicate the ratios of fuel and electricity costs to manufacturing industry shipments in the United States and Japan.

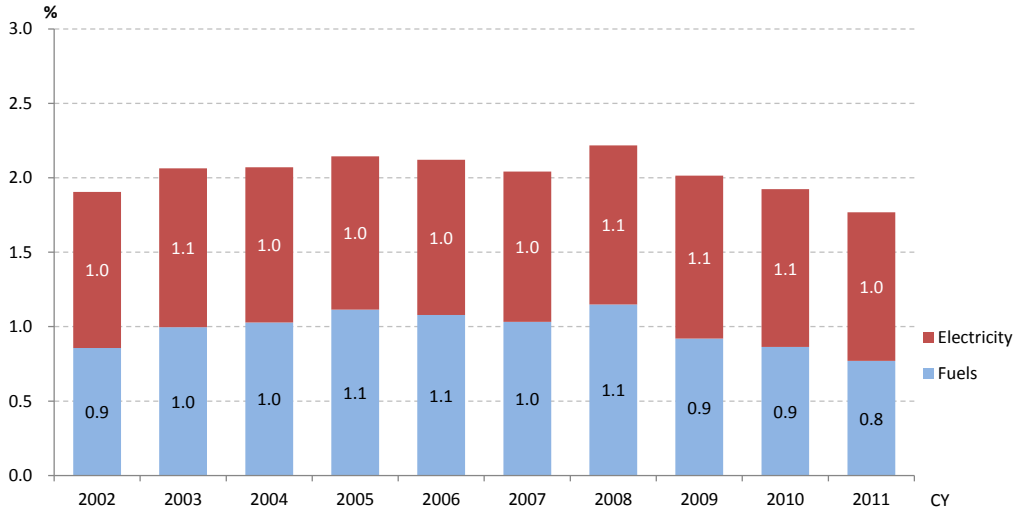
From 2002 to 2011, the ratio of electricity costs to manufacturing shipments in the United States remained in a 1.0-1.1% range. In Japan, the ratio of electricity costs to manufacturing shipments stayed in a 1.2-1.3% range, 0.1-0.2 percent points lower than in the United States, until 2007, despite the fact that the Japanese electricity price was more than double the

U.S. level. Factors behind the small gap between the Japanese and U.S. ratios of electricity costs to manufacturing shipments might have included Japan's high energy efficiency as well as differences in product prices, industrial structure and value added mixes.

Since 2008, however, the ratio of electricity costs to manufacturing shipments in Japan has risen sharply reflecting an electricity price hike. It reached 1.4% in 2011, 0.4 points higher than in the United States, indicating a widening gap between Japanese and U.S. manufacturing industry electricity costs.

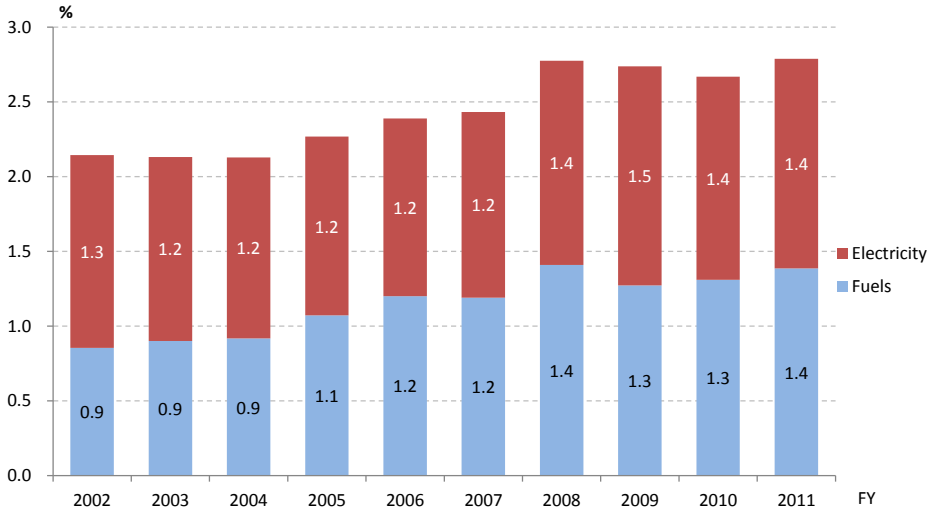
Changes in the ratio of fuel costs to manufacturing shipments in Japan have differed far more from those in the United States. In 2002, both the Japanese and U.S. ratios of fuel costs to manufacturing shipments stood at 0.9%. Through 2008, both ratios rose due to price hikes for oil and other fossil fuels. But the rise in Japan where oil's share of final energy consumption is higher than in the United States was faster than in the United States. Since 2008, U.S. fuel costs have continued declining sharply due to natural gas price drops. In contrast, Japanese fuel costs turned up after a decline amid a drop in oil prices in 2009 and remained high. Fuel costs' ratio to manufacturing shipments in Japan reached 1.4% in 2011, 0.6 percentage points or 80% higher than in the United States.

Figure 5 Ratios of Fuel and Electricity Costs to U.S. Manufacturing Shipments



Source: Prepared from "Annual Survey of Manufacturers (ASM)" by the Census Bureau

Figure 6 Ratios of Fuel and Electricity Costs to Japanese Manufacturing Shipments



Source: Prepared from "Census of Manufacturers" by the Ministry of Economy, Trade and Industry

Priority challenges to lower energy costs in Japan include restarting nuclear plants and other measures to diversify electricity sources, restraining electricity price hikes through fuel cost cuts, and utilizing a wide variety of fuels to avoid overdependence on oil. In terms of economic efficiency, expanding coal consumption can be conceived as one of the measures to cut energy costs. But clean coal technology must be developed and spread to tackle environmental problems. In the meantime, natural gas supply is expected to increase globally thanks to progress in unconventional natural gas development in the United States and other countries. Japan should take advantage of the trend to eliminate the Asian premium on natural gas prices and expand cheaper natural gas consumption.

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