

The Burden Reduction Effects of Importing U.S. LNG for Japan

—Can the shale gas revolution offset the impacts of suspended nuclear power generation?—

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Summary

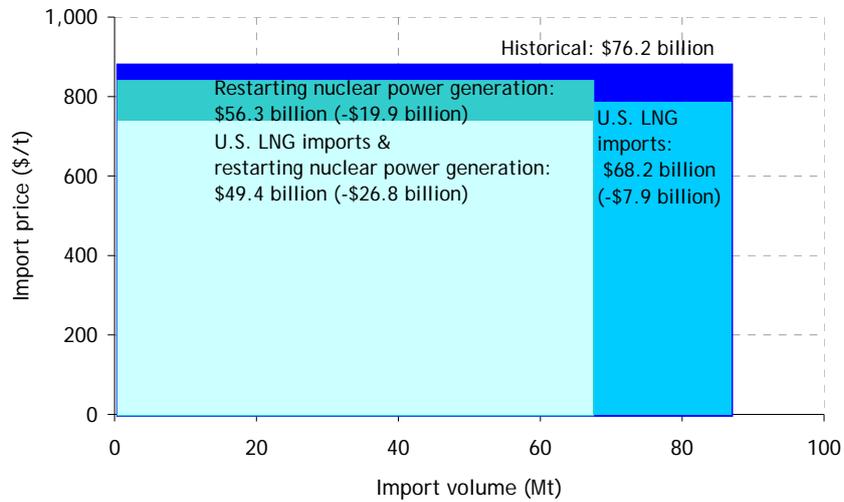
After the Great East Japan Earthquake in March 2011, Japan has increased liquefied natural gas, or LNG, imports to an unprecedented level. Against the backdrop of rapidly expanding demand in Japan, the world's largest LNG consumer, Asian LNG prices are also surging. Accompanied by decreased exports of goods and services owing to the global economic recession, increased LNG import value due to increased import volume and surging prices are major factors of Japan's trade deficits and the downward pressure on Japanese economy. Under these circumstances, plans to import inexpensive U.S. LNG are gathering much attention as a breakthrough to lower LNG import prices.

If Japan can import U.S. LNG for \$9/MBtu, the average import price and value of LNG will drop by \$91/t and by 7.9 billion dollars (0.6 trillion yen), respectively. However, this will not be enough to offset all of the increase in LNG import value after the great earthquake. Japan should maximise its benefits by using U.S. LNG imports as leverage to gain advantageous terms for other LNG imports as well, thereby pushing import prices down.

When nuclear power generation recovers FY2010 levels, the average import price and value will drop by \$35/t and by 19.9 billion dollars (1.6 trillion yen), respectively. The decreased value is 2.5 times the reductions achieved by importing U.S. LNG. Furthermore, carbon dioxide emission reductions will reach 141 Mt and the cost of fossil fuels for power generation will be cut by \$46/MWh (JPY3.7/kWh), thereby having extraordinary effects beyond compare against U.S. LNG imports.

If both U.S. LNG imports and restarting nuclear power generation are achieved, they will lower the average import price by \$138/t collectively. Accompanied by a reduction of imports by 20 Mt, LNG import value will drop by 26.8 billion dollars (2.1 trillion yen).

Changes in Japanese LNG import price, volume and value induced by U.S. LNG imports and restarting nuclear power generation



Note: The area of each rectangle represents import value. Figures in brackets are the difference compared with the historical value.

With the uncertain situation surrounding nuclear power generation in Japan, a roadmap to ensure imports of U.S. LNG should be firmly established. However, acknowledging the uncertainties of whether U.S. LNG can actually be imported at a low price, Japan needs to be well prepared.

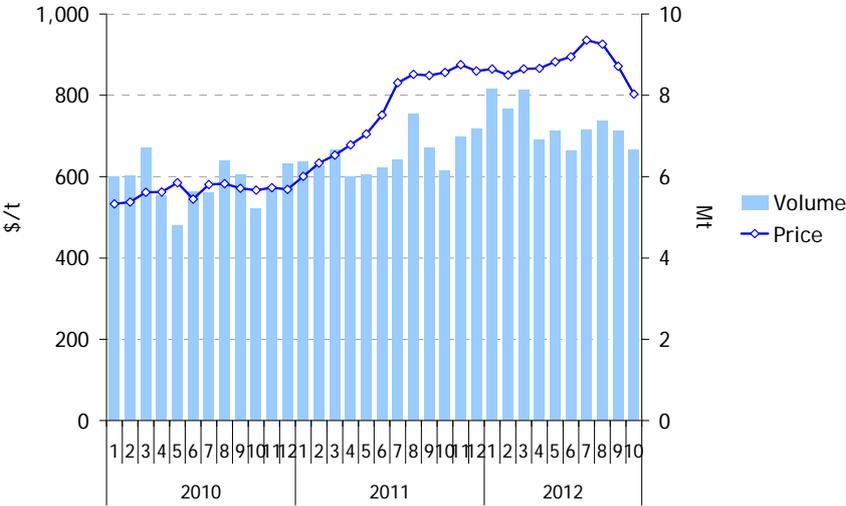
Keywords: shale gas revolution, natural gas, United States, import price, nuclear power

Rising LNG prices

Since the Great East Japan Earthquake in March 2011, most nuclear power plants in Japan that have completed their periodic inspections have remained out of service. The consequential shortage of electricity has been covered by the intensive use of thermal power plants. Therefore, Japan has increased liquefied natural gas, or LNG, imports to an unprecedented level (Figure 1). LNG import volume, which had been an average of 5.8 Mt/month prior to the earthquake, increased to 6.5 Mt/month in 2011 and has leaped to 7.3 Mt/month in 2012¹.

Accounting for one-third of global LNG trade volume, Japan is the world’s largest LNG consumer. With Japanese import volumes increasing rapidly and oil prices, which largely affect Asian LNG prices, on the rise, LNG prices are surging. Japan’s import price² for LNG, which was around \$550/t in 2010, jumped by \$200/t in 2011, and further by more than \$100/t in 2012. As a result of larger LNG import volume and surging prices, LNG import value has increased. This, along with decreasing exports of goods and services owing to the global economic recession, constitutes a major factor of Japan’s trade deficits and the downward pressure on Japanese economy.

Figure 1: LNG import price and volume of Japan



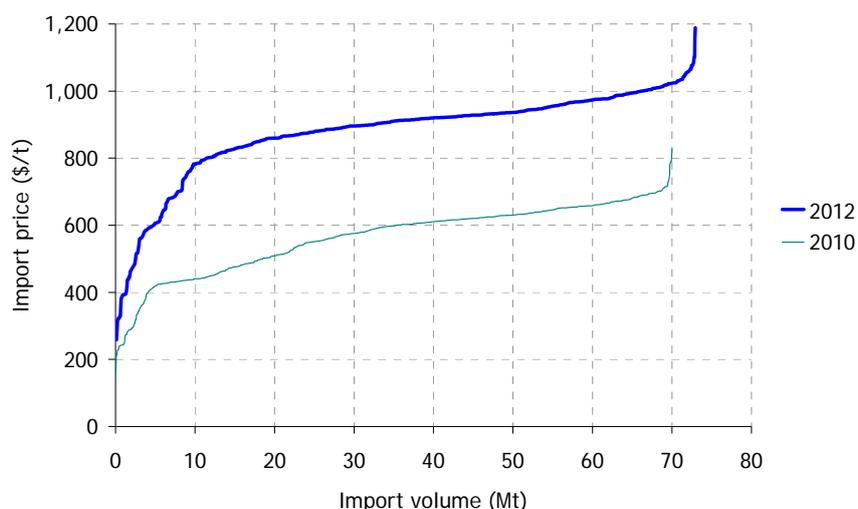
Source: derived from Ministry of Finance “Trade Statistics of Japan”

Figure 2 exhibits a pseudo LNG import cost curve derived by sorting monthly, customs-specific and origin-specific data from Trade Statistics in ascending order according to price.

¹ January to October.; the same shall apply hereinafter
² CIF price; the same hereinafter

The average import price for LNG was about \$880/t in 2012. However, prices apparently vary significantly according to the type of transaction, depending on whether they are long-term contracts or spot contracts, as well as on differences in price formula. Some import prices run as high as almost \$1,200/t. In order to relax the burden inflicted upon Japanese economy, and further on household and corporate budgets, price curbs on LNG in the higher price ranges are called for as well as measures to address the overall upward shift of the cost curve that has been prominent and decreased import volumes of cheaper LNG since the earthquake.

Figure 2: LNG import cost curve of Japan (2010, 2012)



Note: January – October for 2012

Source: derived from Ministry of Finance “Trade Statistics of Japan”

Increasing expectations towards U.S. LNG

Under such circumstances, plans to export LNG produced in the U.S. lower 48 States have gathered much attention as a promising breakthrough to push down LNG import prices. Given the shale gas revolution, unconventional natural gas production has enormously increased in the United States. Domestic natural gas prices are determined according to the supply–demand balance in the country. The prices have significantly dropped, affected by a relaxation of the supply–demand balance. At present, domestic natural gas prices in the United States are as low as one–fifth of Japanese import prices. Focusing on this price gap, many U.S. LNG export projects have been proposed. Three projects, collectively worth 14.7 Mt/year, involve Japanese companies as buyers (Table 1).

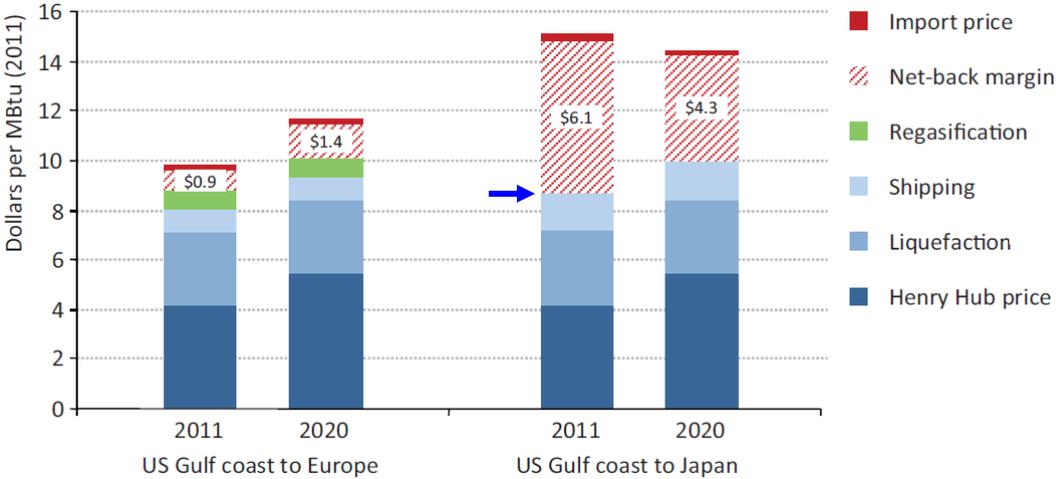
Table 1: U.S. LNG export projects involving Japanese companies

LNG projects	Companies	Mt/year	From
Freeport	Osaka Gas and Chubu Electric Power	4.40	2016
Cameron	Mitsubishi Corporation and Mitsui	8.00	2016
Cove Point	Tokyo Gas and Sumitomo Corporation	2.30	2017
Total		14.70	

Natural gas is considered a strategic product by the U.S. government; and therefore, LNG exports are basically limited to free trade agreement, or FTA, partner countries. This has been a point of domestic controversy in the United States. Commissioned by the government, NERA Economic Consulting published a report, “Macroeconomic Impacts of LNG Exports from the United States,” in December 2012, concluding that LNG exports will invite benefits to the U.S. macro economy. Although the report is not exclusively in support of exports, it referred to Japan’s intentions to seek LNG imports from the United States despite its non-FTA status as optimistic news.

How much will the import price be in the event that U.S. LNG exports to Japan are approved? Although many uncertainties exist at present, the International Energy Agency (IEA)’s “World Energy Outlook 2012” estimates that if domestic U.S. natural gas prices maintain the current level of \$4/MBtu, the Japanese import price will be slightly under \$9/MBtu, excluding excess margin (Figure 3).

Figure 3: Indicative economics of LNG exports from the United States



Source: International Energy Agency, “World Energy Outlook 2012”

U.S. LNG imports to reduce average LNG import price and value by \$91/t and by \$7.9 billion, respectively

To what extent will Japan’s expanding LNG import burdens be alleviated by importing U.S. LNG? Despite expectations that average import price will be pushed down, there is actually little quantitative analyses of the macro impacts. Therefore, simple analyses have been conducted based on the presumption that U.S. LNG imports were approved under current circumstances acknowledging that various conditions and restrictions, including take-or-pay agreements, exist in the real world. Estimations have utilised the LNG import cost curve provided above. The premises for analysis are provided below:

- 1/ The LNG import cost curve has been calculated based on the most recent annual data from the “Trade Statistics of Japan” (November 2011 – October 2012).
- 2/ The U.S. LNG import price is \$466/t based on the aforementioned IEA estimates of “slightly under \$9/MBtu.”
- 3/ The import volume of U.S. LNG is 14.7 Mt³, derived from the aforementioned projects in which Japanese companies are involved.
- 4/ The prices of other LNG will not be affected by U.S. LNG imports, which will replace these LNG in descending order according to price.

Figure 4: Changes in LNG import cost curve induced by U.S. LNG imports

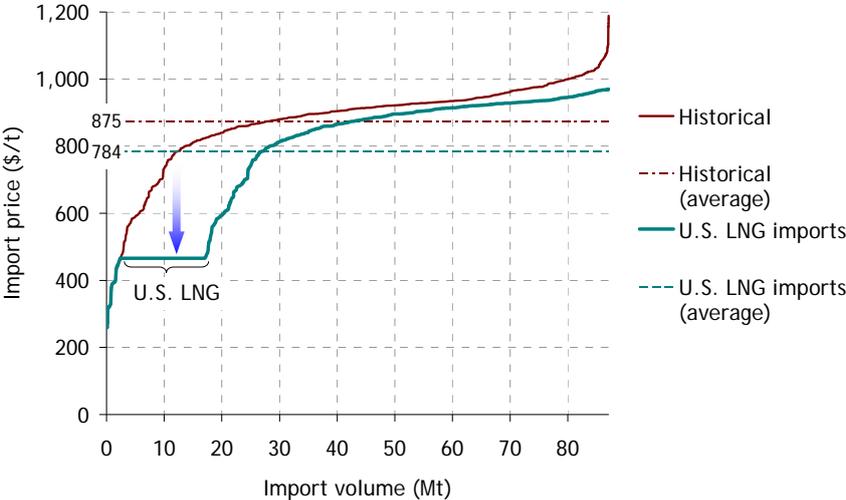


Figure 4 presents the LNG import cost curve estimated for the case in which U.S. LNG imports become possible. The average import price will be pushed down by \$91/t from the historical price of \$875/t to \$784/t, just slightly higher than that of 2011. With LNG import

³ Actual imports are projected to start beyond 2016.

value projected to amount to 7.9 billion dollars (0.6 trillion yen⁴), due effects can be expected.

Current U.S. domestic natural gas prices have hit extremely low levels and run even below production costs for unconventional natural gas, which are estimated to fall between \$4–6/MBtu. U.S. domestic prices may be following an upward trend after having bottomed out in spring 2012; and therefore, it is not clear whether U.S. LNG can actually be imported for the presumed price of \$9/MBtu. If U.S. domestic prices rise to \$10/MBtu (equivalent to the average price for the six months prior to the Lehman Shock), U.S. LNG import prices may reach as high as \$15/MBtu. In this case, the average import price will only decrease by \$39/t instead of \$91/t, and the impact on LNG import value will be halved, dropping by only 3.4 billion dollars (0.3 trillion yen).

Restarting of nuclear power generation to decrease average LNG import price by \$35/t and import value by \$19.9 billion

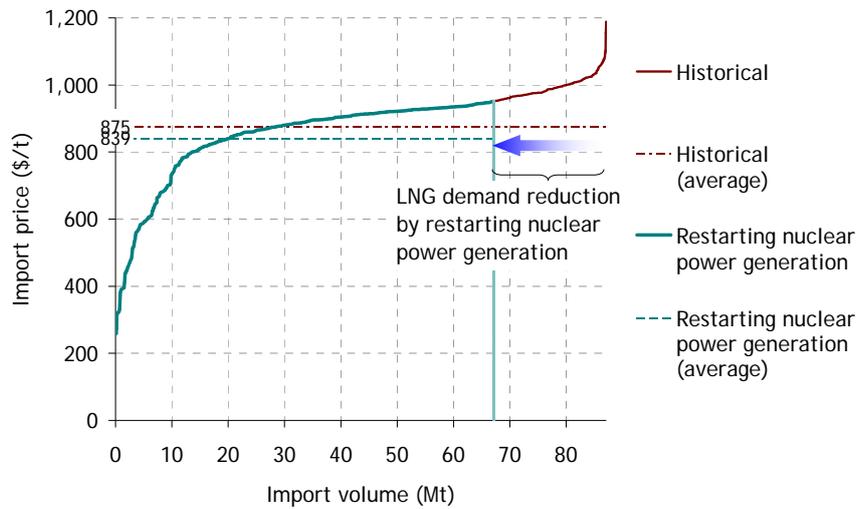
The volume of LNG imports has marked a record high level due to delays in the restarting of nuclear power generation. Nuclear power generation has been substituted by increased operation of natural gas-fired and oil-fired thermal power plants, thereby boosting LNG demand. The impacts that restarting nuclear power generation will have on LNG imports has been estimated employing the same method used above. Additional premises are provided below:

- 1/ Nuclear power generation, which amounted to 27 TWh (November 2011 – October 2012), will have resumed its previous (FY2010) level of 288 TWh.
- 2/ 261 TWh of electricity generated by thermal power can be saved by restarting nuclear power generation; and therefore, in respect of the current situation of increased utilisation of thermal power plants, natural gas-fired plants and oil-fired plants are evenly replaced.
- 3/ The power generation efficiency of natural gas-fired thermal plants is 43%.

When nuclear power plants resume operations, the LNG import cost curve will be as exhibited in Figure 5. The average import price will drop by \$35/t. Compared to importing U.S. LNG, the price reduction effect will be small because imports of LNG in the highest price range will be avoided but highly priced LNG will not be replaced with cheaper LNG. However, the reduction of 20 Mt of import volume will have a large impact on import value, which will decrease by 19.9 billion dollars (1.6 trillion yen), or 2.5 times the reductions achieved by importing U.S. LNG.

⁴ Converted at 80 yen/dollar.; the same hereinafter

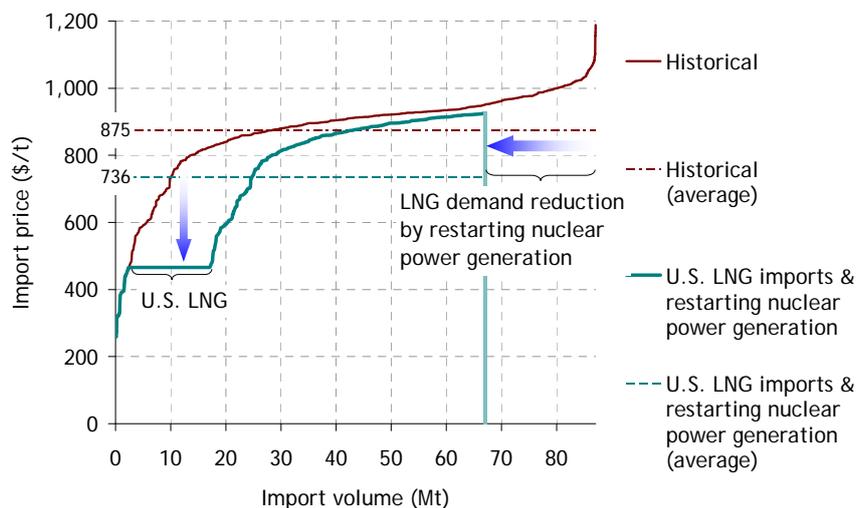
Figure 5: Changes in LNG import cost curve induced by restarting nuclear power generation



U.S. LNG imports and restarting nuclear power generation to collectively reduce average LNG import price by \$138/t and import value by \$26.8 billion

Finally, an analysis of simultaneously importing U.S. LNG and restarting nuclear power generation has been conducted. Figure 6 exhibits the LNG import cost curve for this case.

Figure 6: Changes in LNG import cost curve collectively induced by U.S. LNG imports and restarting nuclear power generation



The introduction of inexpensive LNG and avoided imports of high price range LNG as a result of decreased demand will lower the average import price by \$138/t collectively. The reduction is more than the simple sum of the two measures which would amount to \$126/t. Accompanied by a decrease in imports by 20 Mt, LNG import value will drop by 26.8 billion

dollars (2.1 trillion yen). This will offset three–fourths of the total increment in LNG import value since 2010.

U.S. LNG imports alone are insufficient

The abovementioned conclusions are summarised in Table 2. Importing U.S. LNG will lower the average import price – and likely import value – by 10%, but will not be enough to offset all increased LNG import value since the great earthquake. Japan should maximise its benefits by using U.S. LNG imports as leverage to gain advantageous terms for other LNG imports as well, thereby pushing import prices down.

On the other hand, while the average import price will only be lowered by 4% by restarting nuclear power generation, from the perspective of reducing import value – or, reducing Japan’s economic burden – the effect to be achieved is more than twice that of importing U.S. LNG. There is no controversy over the conclusion that the maximum effect can be derived by simultaneously importing U.S. LNG and restarting nuclear power generation.

Table 2: Changes in LNG import price, volume and value induced by U.S. LNG imports and restarting nuclear power generation

	Prices (\$/t)	Volume (Mt)	Values	
			(\$billion)	(JPY trillion)
Historical (Nov. 2011 - Oct. 2012)	875	87.1	76.2	
U.S. LNG imports	784	87.1	68.2	
(Changes from the historical)	-91	-	-7.9	-0.6
Restarting nuclear power generation	839	67.1	56.3	
(Changes from the historical)	-35	-20.0	-19.9	-1.6
U.S. LNG & restarting nuclear power gen.	736	67.1	49.4	
(Changes from the historical)	-138	-20.0	-26.8	-2.1
[Memo.] 2010	564	70.0	39.5	
(Changes from the historical)	-311	-17.1	-36.7	

Note: converted in yen/dollar at JPY80

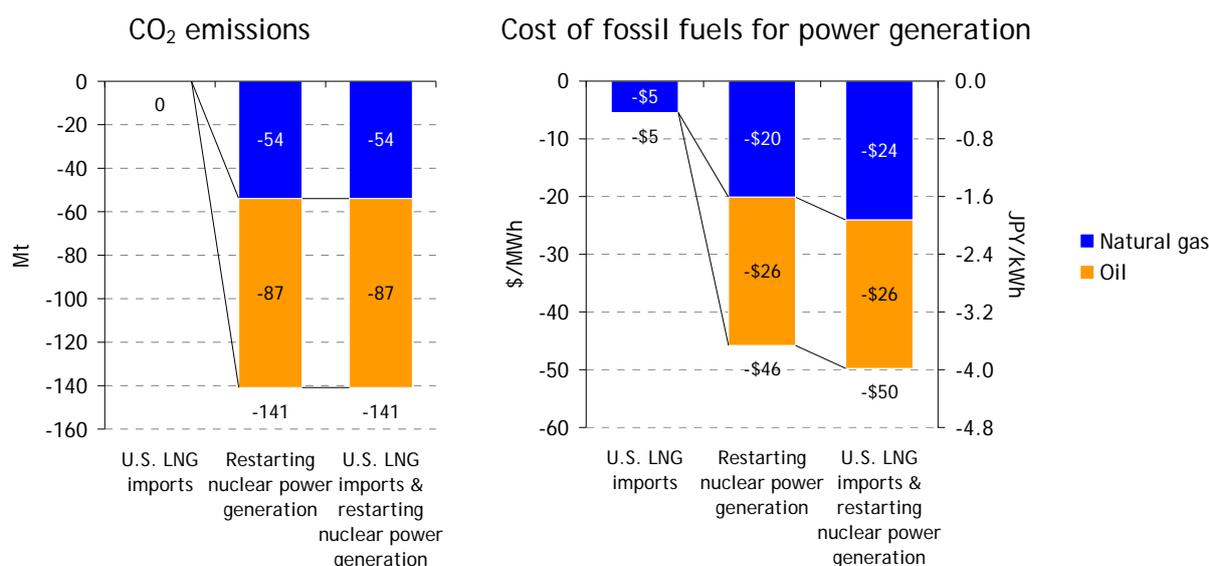
Furthermore, restarting nuclear power generation will have large advantages, which can be expected only slightly or not at all from introducing U.S. LNG imports. These include reductions in carbon dioxide emissions and spending in fossils fuel for power generation. By restarting nuclear power generation, increased operations of not only natural gas–fired thermal power plants but also oil–fired thermal power plants will be curbed, thereby having

extraordinary effects beyond compare against U.S. LNG imports^{5, 6}.

Carbon dioxide emission reductions resulting from restarting nuclear power generation will reach 141 Mt (Figure 7). This is equivalent to 11% of emissions for the base year under the Kyoto Protocol⁷ which amounted to 1,261 Mt. U.S. LNG imports will not reduce the electricity generated at thermal power plants and therefore will not reduce carbon dioxide emissions at all.

Also, in terms of electricity tariffs, the rising of which are currently a target of concern, cost reduction effects greatly differ between importing U.S. LNG and restarting nuclear power generation. Fossil fuel costs per volume of electricity generated and purchased by the General Electricity Utilities⁸ will be reduced only by \$5/MWh (JPY0.4/kWh) as a result of U.S. LNG imports, whereas \$46/MWh (JPY3.7/kWh), or eight times the costs, will be cut by restarting nuclear power generation.

Figure 7: Changes in CO₂ emissions and cost of fossil fuels for power generation induced by U.S. LNG imports and restarting nuclear power generation



Note: per volume of electricity generated and purchased by the General Electricity Utilities, excluding fuel costs for purchased electricity generated by autoproducers. Converted in yen/dollar at JPY80.

⁵ Note that aforementioned analyses focused only on LNG.

⁶ Additional premises: 1/ The CIF price for oil imports is \$115/bbl; 2/ The power generation efficiency of oil-fired thermal power plants is 37%.

⁷ The greenhouse-gas reduction target of Japan in the first commitment period of the Kyoto Protocol is 6%.

⁸ Excludes fuel costs for purchased electricity generated by autoproducers.

With only Reactors 3 and 4 at the Ohi Nuclear Power Station having resumed operation and other plants not yet restarted, a roadmap to ensure imports of U.S. LNG should be firmly established. However, it is uncertain whether U.S. LNG can actually be imported at a low price. Key factors are the extent to which the U.S. domestic price of natural gas that is material of LNG will rise and the level of margins will be charged. The latter will be largely affected by the future policy of the U.S. government. NETA Economic Consulting's report also concludes that the United States will enjoy larger benefits if American companies become involved in the liquefaction of natural gas and LNG transport, which means higher import prices for Japan. Acknowledging the possibility that U.S. LNG may fail to be imported in sufficient volumes at as low a price as expected, Japan needs to be well prepared.

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