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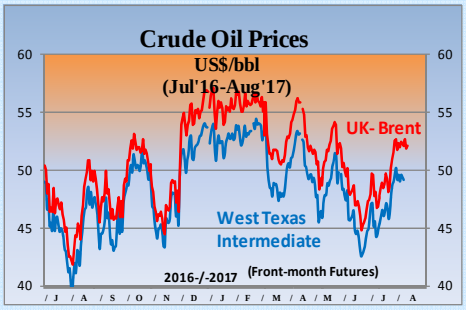
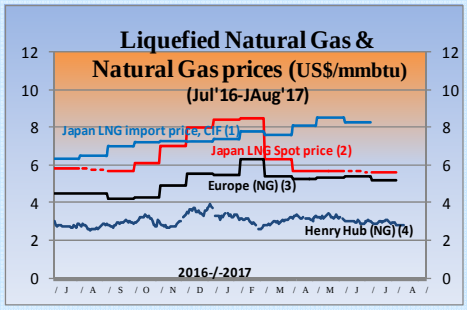
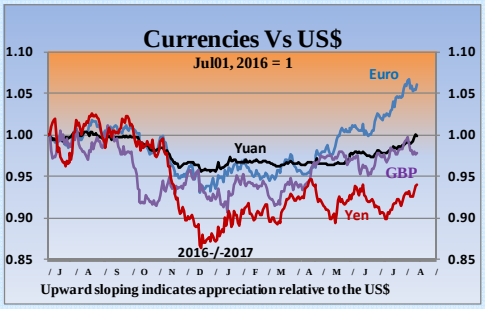


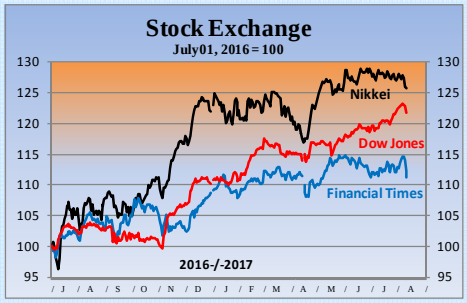
Source: DOE-EIA, NASDAQ



Sources:
(1) Ministry of Finance "Japan Trade Statistics"
(2) Ministry of Economy, Trade and Industry
(contract month basis)
(3) Estimated by World Bank and World Gas Intelligence
(4) DOE-EIA, NYMEX (Front-month Futures)
(5) Investing.com



Source: x-rates.com



Source: Financial Times

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The IEEJ's recent Economic and Energy Outlook of Japan projects that as the Japanese economy expands, consumption of fossil fuels will decrease due to the restarting of nuclear power plants and energy conservation, thus improving the energy self-sufficiency rate and reducing CO_2 emissions.

2. Developments in Nuclear Power

Regarding the removal of fuels from Monju, there is a disagreement between Fukui Governor Nishikawa, who is calling for prudence, and NRA Chairman Tanaka, who prioritizes speed. A scientific discussion is needed.

3. Recent Developments in Oil and LNG Markets

With the US production hike and decreased compliance by OPEC and non-OPEC countries with the production cut, international oil prices are unlikely to rise soon. In the LNG market, attention must be paid to Qatar's plans to boost production and its impact.

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At the G20 Summit in Germany, an Action Plan was announced aiming to achieve both economic growth and an energy transition to address climate change. In Japan, a draft opinion report by the Energy Efficiency and Conservation Subcommittee was submitted.

5. Developments in Promoting the Use of Ammonia

The use of ammonia as an energy carrier and directly as a fuel is being promoted. Ammonia can be produced using existing technology and supply chains, and it is hoped that such usage will contribute to decarbonization efforts.

1. Economic and Energy Outlook of Japan through FY 2018

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On July 25, the IEEJ released the Energy and Economic Outlook of Japan through FY2018. This article projects the situation through FY2017 and 2018, focusing on the outline of the Reference Scenario. Real GDP growth of Japan for FY2017 is expected to be 1.4%, as strong exports supported by overseas economic growth prop up the economy. For FY2018, GDP growth is estimated at 1.1% despite slower exports, driven by strong domestic demand including Olympics-related investment.

Based on these assumptions, domestic primary energy supply will decrease by 0.1% in FY2017 owing to the progress of energy conservation, despite the positive contribution from increased manufacturing output. The decrease will be greater in FY2018 at 0.6% due to slower production activities compared to the previous fiscal year. Natural gas and oil for power generation will be the main contributors to the decline, due to the restarting of more nuclear power plants (10 units at the end of FY2018) and the increased use of renewables. The ratio of nuclear power to total electricity output will increase to 7% in FY2018 from 2% in FY2016. The energy self-sufficiency rate will be 11.9% in FY2017 and 12.8% in FY2018, surpassing 10% for the first time since the Great East Japan Earthquake. Final energy consumption will decrease by 0.5% in FY2017 and 0.8% in FY2018.

By type of energy, electricity sales will edge up 0.4% in FY2017 as the sales of extra-high voltage, high voltage and other industrial electricities increase due to the expansion of production activities, exceeding the decrease in lighting services and low voltage electricity. In FY2018, the increase in industrial electricities will weaken and flatten out overall. City gas sales will increase 1.0% and reach a record high in FY2017, driven by industrial use. The increase will slow in FY2018 to 0.6%. Fuel oil sales will fall by 1.6% in FY2017 as more nuclear power plants are restarted and by 1.7% in FY2018 due to a decrease in naphtha for the chemical industry, marking six consecutive years of decline.

For renewable power, if all of the current capacity of 66.9 GW (FIT licensed capacity of 94.6 GW as of end-February 2017 minus an expired capacity of 27.7 GW) goes into operation, consumers will shoulder a cumulative cost of 45 trillion yen in 20 years, including the cost for capacities that shifted to the new FIT system. This is equivalent to a rise in electricity tariffs of ¥2.6/kWh (11% for residential, 16% for industrial).

Under the energy supply and demand situation described above, energy-related CO_2 emissions will decrease for five consecutive years after reaching a record high in FY2013. Emissions will fall below 1,100 $MtCO_2$ to 1,096 $MtCO_2$ for the first time in 25 years except in FY2009 following the bankruptcy of Lehman Brothers. This is a reduction of 11.3% from FY2013 levels while the target under the Paris Agreement is minus 26% from FY2013 levels in FY2030. A decomposition analysis of the contributions to the change in energy-related CO_2 emissions by decarbonization, energy efficiency, shift between fossil fuels and income shows that decarbonization by the use of nuclear and renewable energies is the greatest contributor to the decrease at nearly double the contribution by energy efficiency.

Compared to the situation if no nuclear power plants were restarted, the Reference Scenario (10 units restarted as of end-FY2018) would result in an additional 500 billion yen in real GDP, a 2.9 percentage point increase in energy self sufficiency rate, and a 2.7% reduction in CO_2 emissions, demonstrating that restarting nuclear power does contribute to the 3E policy.

2. Developments in Nuclear Power

Tomoko Murakami, Manager
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From June 26 through 29, an international conference of the International Framework for Nuclear Energy Cooperation (IFNEC) was held in Paris, France. The conference discussed various topics common to many countries, such as assistance and fund raising for emerging countries in introducing nuclear technology, high-level radioactive waste repositories, and transfer of technology from developed countries to emerging countries including safety regulations and human resource development.

Notably, a meeting of the Ad Hoc Nuclear Supplier and Customer Countries Engagement Group on the 28th discussed the "establishment of international and domestic supply chain and localization" at the strong request of Poland and others considering newly introducing nuclear power. The Group discussed the four areas of cooperation between the suppliers and adopters of nuclear technology (safety, project management, finance and social acceptance, and responsibility of interested parties) based on 24 key questions. At international conferences that address topics on which countries' views are divided, such as the multilateral management of radioactive wastes and safety regulations for emerging countries, countries need to continue to adhere to principles such as remaining open to objections and respecting the views of others.

Following President Moon's declaration on June 19 to phase nuclear out, on June 27, the South Korean Cabinet decided to conduct a democratic national debate and assess public opinion on whether to continue the construction of Shin Kori Units 5 and 6, and to provisionally halt all preparations for the units for three months while the poll was rounded up. Accordingly, on July 14, Korea Hydro & Nuclear Power (KHNP) announced that it would suspend preparations for three months while the government committee set up specifically for this purpose conducts the national debate and opinion poll. KHNP plans to make utmost efforts to prevent deterioration of equipment and materials during the suspension to minimize the inevitable losses of the operator and constructors. The recent developments in South Korea suggest that a policy reversal without clear grounds can sometimes have serious consequences.

For the decommissioning of the fast breeder demonstrative reactor Monju decided in December 2016, a milestone to completing the removal of fuels in 5.5 years has been established at the request of the Nuclear Regulation Authority (NRA). At a meeting with NRA Chairman Shunichi Tanaka at the Fukui Prefectural Government on July 7, Fukui Governor Nishikawa requested that the decommissioning should be conducted with utmost care without rushing the operator to remove the fuels.

In response, Chairman Tanaka reportedly explained the legitimacy of removing the fuels quickly, naming a criticality accident as the greatest concern for a large fast reactor. However, there are various other risks such as loss of cooling and external hazards, and this matter involves major technical issues. The NRA and the operator JAEA should disclose a transparent decommissioning process and execute it appropriately, including giving persuasive, rational reasons for the argument that it is safer in the long term to keep the fuels in the reactor vessel, which is a robust boundary.

3. Recent Developments in Oil and LNG Markets

Yoshikazu Kobayashi, Senior Economist, Manager
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From June, international oil prices had remained in the $40/barrel range until recently. Global oil demand itself is increasing steadily, and the supply-demand balance has now almost evened out from an oversupply of 1.3 mb/d in the first quarter of last year. The ever-increasing private oil inventory of the OECD also stopped to grow, and the supply-demand balance has started to tighten somewhat compared to the last year.

However, recent new developments have included an upturn in US oil output and lower compliance with the production cut by OPEC and non-OPEC countries, sending oil prices down. The ministerial meeting of OPEC and non-OPEC countries on July 24 saw some progress such as reducing Saudi Arabia's exports and setting a production cap for Nigeria, but the achievements were not sufficient to reverse the current outlook for lower prices, and international oil prices are unlikely to rise soon.

It has been some time since concerns were raised over sluggish upstream investment due to the low oil prices and its impact. However, according to the International Energy Agency's global energy investment outlook released on July 11, the global upstream investment is likely to increase 3% year-on-year in 2017 after falling 44% from 2014 to 2016. In particular, investment in US shale will surge by 53% year-on-year, and is expected to drive global upstream investments alongside Russia (up 6% year-on-year) and the Middle East (up 4% year-on-year).

Regarding investments in medium- to long-term LNG production capabilities, Qatar announced that it would lift its moratorium on new developments and boost its production capacity to 100 million tonnes by 2024. Qatar has already exported 79.3 million tonnes in 2016, exceeding its official capacity of 77 million tonnes, and is considered capable of adding over 10 million tonnes by bottlenecking. Thus, the 100 million-tonne production capacity target is not unrealistic. The timing of the announcement may have been related to Iran's announcement that it would develop its South Pars gas field, which is geologically connected to Qatar's North Field.

What matters is not whether the numerical target production capacity of 100 million tonnes can be achieved, but the fact that Qatar is once again working hard to boost production of LNG, which is among the world's most cost-competitive, after the moratorium since 2005. This in itself is desirable from the perspective of securing long-term global LNG supply capabilities. However, the rising regional uncertainty, including the severance of diplomatic ties with and economic sanctions on Qatar by Saudi Arabia and the UAE, could hinder efforts to boost production.

4. Update on Policies Related to Climate Change

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On July 7 and 8, the G20 Summit was held in Hamburg, Germany. The Leaders' Declaration took note of the US's decision to withdraw from the Paris Agreement, as well as the OECD report "Investing in Climate, Investing in Growth," which was mentioned in this newsletter last month and emphasizes that taking action on climate change will boost economic growth. The leaders also agreed on the G20 Hamburg Climate and Energy Action Plan for Growth ("the Action Plan") in the Leaders' Declaration.

The Action Plan took note of the IEA/IRENA report "Perspectives for the Energy Transition," while inviting the IEA, IRENA and other international organizations to provide a regular update report on the global transformation of the energy sector and further investment needs. Further, the Action Plan included exploring how to create an Energy Efficiency Hub that promotes international cooperation on energy efficiency, to avoid duplication of tasks among international organizations working on energy efficiency. The Action Plan also noted that the industry-led Task Force on Climate-related Financial Disclosures has completed work, which includes recommendations on voluntary disclosures of climate-related financial risks by companies. Meanwhile, Chancellor Merkel's attempt to achieve results in climate change issues at the G20 Summit ahead of the September election had not been as successful as hoped.

In Japan, the Energy Efficiency and Conservation Subcommittee of the Advisory Committee for Natural Resources and Energy submitted its draft opinion report at its fourth meeting held on July 28. Based on the energy conservation progress since the release of the interim report in January, the draft opinion concluded that large-scale investment in energy conservation and efforts in the transportation sector must be strongly promoted.

Under the Energy Conservation Act, each year, companies are required to submit a three- to five-year medium- to long-term plan for achieving their targets and a regular report on their use of energy. Based on the reports, companies are categorized in classes from excellent to off-track. In the last meeting, to boost investment in energy conservation, the Subcommittee proposed giving extra points to the companies that include an investment plan in their medium- to long-term plans, when their reports are evaluated. Further, regarding enhancing energy conservation in the transportation sector, new challenges are emerging, such as the increase in smaller-volume, higher-frequency freight transport and re-delivery of home delivery parcels. To tackle these challenges, franchise headquarters are working on the central management of orders from retail stores and the transportation management between manufacturers and retail stores, and e-commerce operators are working on reducing re-deliveries. Based on these circumstances, the Subcommittee suggested that collaboration should be promoted among the various companies engaged in transportation.

Further, regarding the improvement of power generation efficiency, the Energy Conservation Act sets efficiency standards for thermal power generation, such as an overall generation efficiency of at least 44.3% for each electricity producer. The first reports on efficiency will be submitted at the regular reporting in FY2017. Accordingly, the Judgment Criteria Working Group for Thermal Power under the Energy Efficiency and Conservation Subcommittee will evaluate the probability to achieve the efficiency level established in alignment with the Energy Mix, and consider a scheme for joint implementation between electricity producers.

5. Developments in Promoting the Use of Ammonia

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In early July, a test for mixed combustion of ammonia was conducted in Chugoku Electric's coal thermal power plant. Like hydrogen, ammonia, which does not produce CO_2 when burned, has been receiving attention as a low-carbon electricity fuel in recent years.

Currently, ammonia is used primarily as a fertilizer and chemical material, but there have been attempts in the past to use it for energy. Records show that ammonia was used during the two World Wars as a fuel for buses and cars in Europe to deal with the unstable supply of petroleum products. Further, around 1960, it was used as rocket fuel for a US high-altitude, supersonic prototype. After that, ammonia was studied as an energy carrier for transporting and storing hydrogen rather than as an energy source itself. The potential of ammonia as an energy carrier was explored under the International Clean Energy Network Using Hydrogen Conversion (WE-NET) in Japan and in the DOE's office of hydrogen energy in the US in 2006.

In Japan, the use of ammonia has been driven in recent years by the Cross-ministerial Strategic Innovation Promotion Program (SIP) launched in FY2014 under the Council for Science, Technology and Innovation. The Program aims to use ammonia as a fuel as well as an energy carrier, and promotes R&D on the ammonia direct-combustion gas turbine and ammonia fuel cell as well as on mixed combustion in coal thermal power plants described above. The underlying idea is that it is more efficient to use ammonia directly as a fuel rather than decomposing it and using the hydrogen obtained, as is done when using ammonia as an energy carrier. As the SIP is scheduled to end in FY2018, the Green Ammonia Consortium of 21 major institutes and corporations is due to be launched soon to continue the research and development.

Ammonia has various advantages in addition to not emitting CO_2 when used. For instance, it has an established production technology (the Haber-Bosch process) and is available in large quantities worldwide as a fertilizer. The availability of established technology and supply chains means that there are relatively few barriers to overcome in each phase of RDD&D (research and development, demonstration and deployment). However, ammonia is a deleterious substance that requires strict security control, which makes it unsuitable for distributed use and more suited for large-scale thermal power generation under centralized management. Further, ammonia must be produced without CO_2 emissions. As the hydrogen required for ammonia synthesis is currently produced from natural gas, CCS is essential for CO_2-free ammonia production. Alternatively, hydrogen would have to be produced from renewable energies.

For energy carriers, studies on a technologically-feasible and economically-efficient supply chain are required. Attention must be paid to the developments in R&D for ammonia, alongside liquefied hydrogen and methylcyclohexane on which demonstrations are separately underway.

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