

Report

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Natural Resource and Fuel Sectional Committee
Advisory Committee for Natural Resources and Energy

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Introduction

- Since the two rounds of oil shocks in the 1970s and then the Great East Japan Earthquake in 2011, fuel, which supports our country's energy needs, has been changing in its mix from moment to moment. It is an undeniable fact that so-called fossil fuels account for the majority of the energy supply. Most recently, fossil fuels represented more than 90% of the total primary energy demand, pushing up its share in the power source mix to levels slightly lower than 90%. Energy Demand and Supply Outlook 2030, which was announced recently and based on Strategic Energy Plan 2014, forecasted that fossil fuels would account for as much as three-fourths of the total primary energy demand in 2030, with the share of oil the largest at about 30%. In the power source mix, the share of fossil fuels is forecasted to increase up to about 55%. In addition, because our country depends on import for almost all fossil fuel supply, it is safe to say that mainly from the viewpoint of how to procure them steadily, securing the stable supply of natural resources and fuel is one of the most important challenges for our energy strategy, and people's life and economic activities that the strategy is expected to bolster.
- To summarize the basic concept of future policies on natural resources and fuel, Natural Resources and Fuel Sectional Committee, Advisory Committee for Natural Resources and Energy, held Oil and Natural Gas Subcommittee and Mining Subcommittee, putting together the interim reports of both the subcommittees in July 2014. Based on the changes in domestic and international situations and the progress in policy implementation since last year, this Report, prepared by this Sectional Committee, summarizes the accomplishments made in the past year and current status, and relooks at the future direction of our comprehensive policies on natural resources and fuel.

Chapter I: Policies on oil and natural gas

- The interim report presented by Oil and Natural Gas Committee last year pointed out that in light of the concept of energy policies based on 3E+S and the current trends in energy demand-supply and international oil markets, the following three objectives should be met to ensure stable energy supply, the most important issue about our natural resources and fuel policies: (1) the management of uncertainty about energy supply mostly from overseas, (2) the access to fuel supply at a general public level even in the event of a domestic disaster, and (3) the robust industrial base that will allow the above two objectives to be met. The Japanese government should play a responsible role in meeting the three objectives by taking into account the changes in energy demand-supply structure. The following summarizes our oil and natural gas policies in more detail.

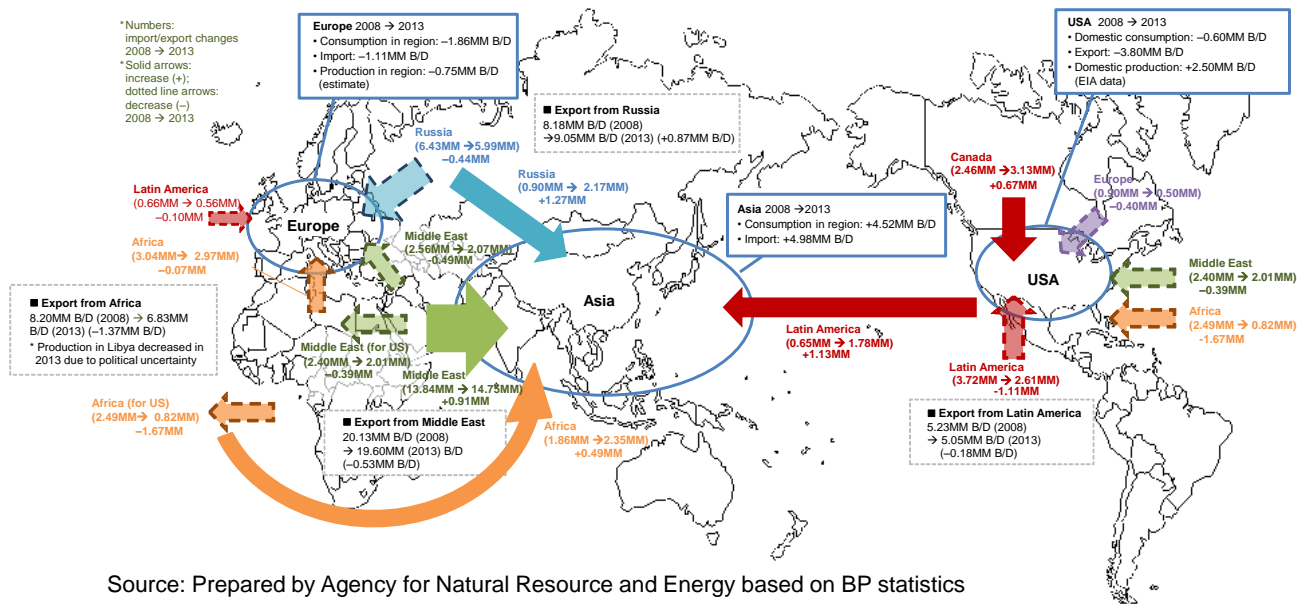
1. Changes in energy demand and supply structure

(1) Changes in global situation

i) Global oil market trends

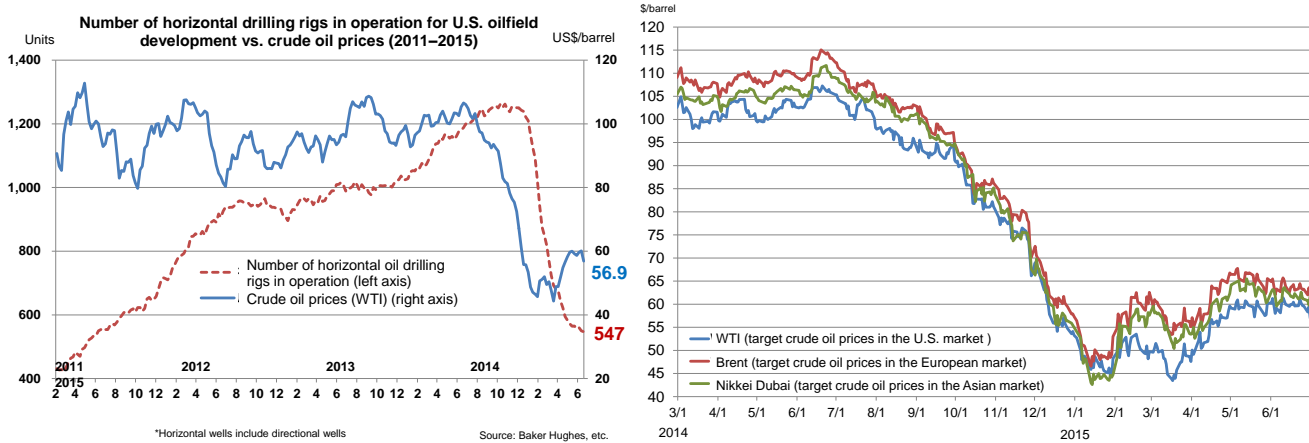
- The Shale Revolution in North America has made substantial structural changes in the worldwide energy supply chain. Because of the steady increase in shale oil production, U.S. crude oil output has increased roughly 3.7 million barrels per day (BD) from approximately 5.0 million BD in 2008 to 8.7 million BD in 2014. That movement has reduced the U.S.'s dependence on imported oil, resulting in oil-producing countries such as Latin America looking for non-U.S. export destinations. They are increasingly interested particularly in Asia, where oil demand is increasing, as a new market for them.

Changes in supply structure of oil (incl. crude oil and oil products)

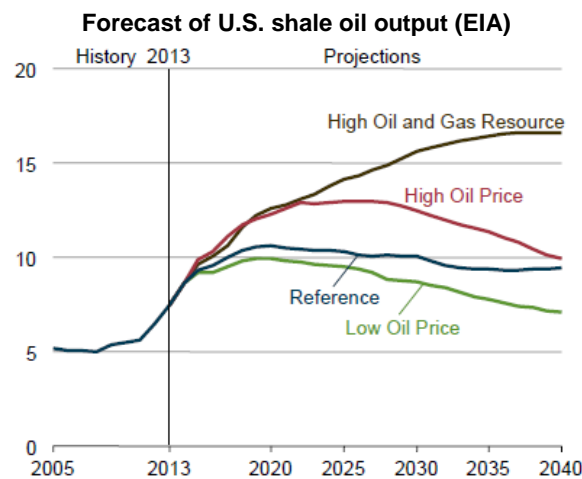


- Despite the increasing oil production in the U.S., crude oil prices remained stable at high levels. It was because geopolitical risks in the Middle East and the North Africa were rising in the wake of the Arab Spring, and because oil demand in developing countries including Asia was increasing steadily. However, the economic stagnation in Europe and the decelerating economic growth in China began to overshadow the future of the global demand for crude oil. In June 2014, when Libya reportedly resumed its oil export capacity, oil prices fell primarily in Europe, to which Libya supplied more than 70% of its crude oil exports. Furthermore, citing the structural changes in the global oil supply chain and the lack of cooperation from non-OPEC oil-producing countries, Saudi Arabia did not cut its oil production, and oil prices continued to moderately fall in the market. Up to that point, Saudi Arabia, had been playing the role of a coordinator in international oil supply as a swing producer.
- While the U.S. continued to ramp up its oil production, Russia, which needed to secure national revenues from crude oil export under the economic sanctions associated with the Russia-Ukraine gas dispute, continued high-levels of oil production even after the summer of 2014. In addition, during its November 2014 Conference, OPEC decided to maintain the current oil production levels, which caused crude oil prices to plummet. In January 2015, Brent crude oil prices dropped to the mid-\$40/barrel level for the first time in the last five years and ten months.
- The OPEC countries anticipated that such oil price declines would force the U.S. to reduce its shale oil production, because the cost to produce shale oil was relatively higher than that of conventional crude oil. But U.S. oil development companies successfully improved their productivity, especially by focusing on higher-capacity wells. As a result, U.S. oil production continued on the rise. On the other hand, international crude oil prices began to pick up in February 2015 because the number of operating drilling rigs decreased in the U.S., and because the pace of additional U.S. shale oil production was forecasted to decline in the future. Since the end of April 2015, Brent crude oil prices have been hovering around \$60/barrel, 30–40% above the bottom price.

Changes in crude oil prices



With crude oil prices recovering, the pace of the reduction in the number of operating drilling rigs is moderating in the U.S.. And the upward trend of oil output is expected to continue in the medium term. According to the forecast by the U.S. Energy Information Administration (EIA), U.S. crude oil output will reach a peak around 2020 after exceeding a level of 10 million BD, and will stay around 9.0–10.0 million BD levels from that point forward. (Source: EIA "Annual Energy Outlook 2015 (Reference case)")

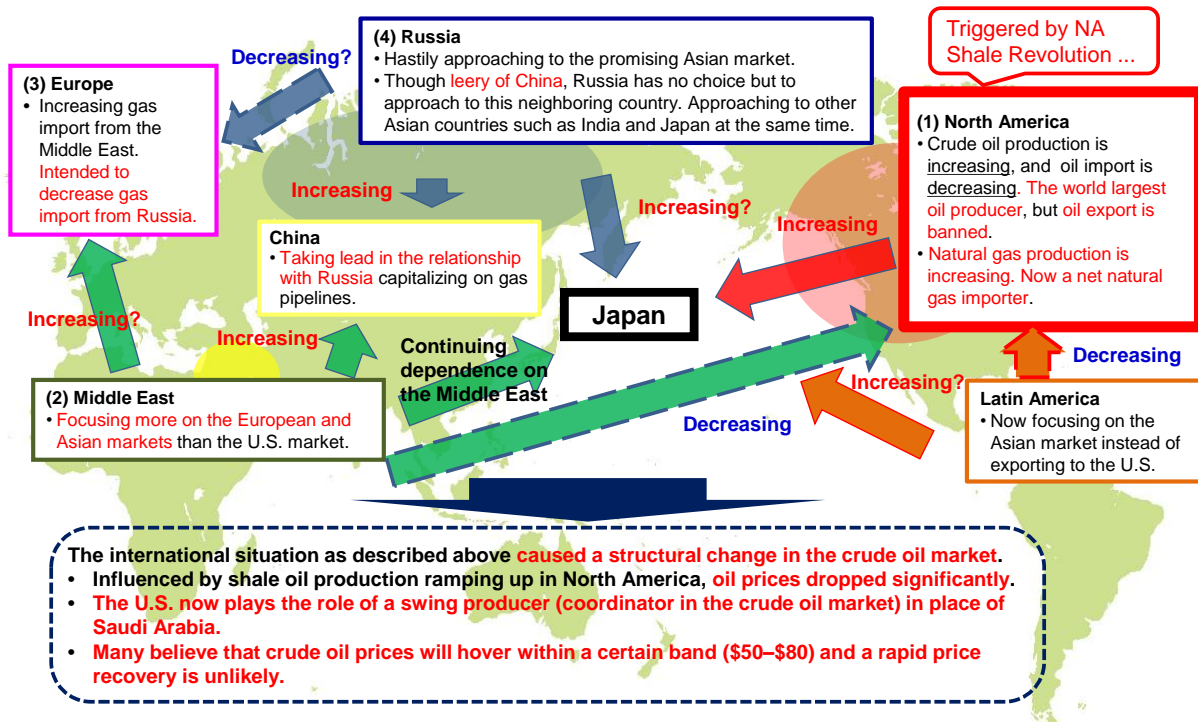


- When crude oil prices go up, the U.S. increases its shale oil output relatively quickly to avoid excessive price hikes. On the other hand, when crude oil prices go down, the increase in shale oil output can be moderated within a certain period of time. Taking the advantage of these characteristics of shale oil production, the U.S. is now taking the role of a swing producer in the crude oil market in place of Saudi Arabia. On the other hand, if U.S. oil output levels off at some point in the future, the U.S. may not be able to play the role of a swing producer well from the standpoint of surplus production capacity, an important factor that should be monitored in a situation where oil prices fluctuate violently.
- At the same time, some people believe that even if crude oil demand increases mainly in developing countries in the near future, the upward trend of U.S. crude oil output will put downward pressure on international crude oil prices. On the other hand, there is the strong view that if U.S. crude oil output levels off in 2020 or later, and if oil demand in developing countries is still expanding, crude oil prices will continue to rise. More specifically, EIA forecasts that international crude oil prices will increase to \$79/barrel in 2020, \$91/barrel in 2025, \$106/barrel in 2030, and \$122/barrel in 2035. (Source: EIA "Annual Energy Outlook 2015 (Reference case)")
- If crude oil prices continue to hover at low levels as we see today, it will benefit the world economy and oil importing countries including Japan a great deal. When it comes to upstream development, on the other hand, the falling crude oil prices have made many oil projects unprofitable. As a result, some oil-producing countries face a financial crisis, and high-cost projects have been delayed or suspended.

ii) Trends in the natural gas market

- Thanks to the progress of shale gas development, U.S. natural gas output began to rise in 2006 and hit a record high in 2011, making it the world's largest natural gas producing country. The U.S., a natural gas net importer today, is expected to become a net exporter in 2020. In preparation for the start of natural gas export including for non-FTA countries, the Federal Energy Regulatory Commission (FERC) is approving one project after another for the construction of natural gas export facilities and gas export operation. Japanese companies are involved in five out of the seven export projects that had been approved before May 2015. At the same time, U.S. shale gas output is expected to steadily grow in the next 25 years or so.
- Before the U.S. started to ramp up its shale gas production, Qatar and the U.S. had been constructing an LNG export/import terminal, respectively, in anticipation of increasing natural gas demand in the U.S.. Qatar, knowing that the U.S. would no longer require more imported natural gas, decided to expand its customer base to European countries. At that time, European countries were trying to reduce their dependence on Russia, and were looking for cheaper natural gas sources. As a natural consequence, Qatar successfully started to increase its natural gas export to Europe around 2009. Furthermore, Japan's LNG demand soared in the wake of the Great East Japan Earthquake in 2011. Under such situation, Qatar decided to shift part of its LNG exports to Japan, which allowed Qatar to sell at higher prices than selling to European countries. On the other hand, European countries, taking advantage of the presence of the alternative LNG supplier, gained price bargaining power against Russia. For this reason, European countries ended up increasing their natural gas imports from Russia again.
- In the wake of the Russia-Ukraine gas dispute in 2014, Europe raised awareness about the security of gas supply, and re-started to look for a way to move away from the dependence on Russia. Hit badly by the oil price declines as well as the economic sanctions by Japan, the U.S. and Europe, Russia faced severe economic conditions. To find new natural gas customers and move away from its dependence on Europe, Russia tried to strengthen the relations with East Asia countries such as China and Japan. Russia produced successful results particularly with China. In May and November 2014, Russia agreed with China to supply its natural gas from Eastern Siberia and Western Siberia, respectively, through two pipelines connecting the two countries. But the Russian side is very leery of too much dependence on China, because the partner would often take a hardline stance in negotiations taking advantage of the presence of multiple natural gas sources other than Russia. In fact, Russia is holding high expectations for the Japanese market as a new natural gas export destination.
- Natural gas prices, particularly those price indexes linked with crude oil prices, quickly fell on a global basis, following the sharp drop in crude oil prices with a time lag of a few months. In the meantime, the demand for natural gas in Asia has been sluggish primarily because of China's economic slowdown. In addition, as its nuclear power plants will be restarted in the future, Japan's demand for natural gas is expected to decrease in due course. Because of the sluggish demand for natural gas in the entire Asia, gas prices in the region have continued to fall since November 2014. Spot natural gas prices, in particular, have dipped more than 60% compared to the beginning of 2014. As a result, the so-called Asian natural gas price premium has been decreasing at a rapid pace since early 2014. Natural gas producing countries in the ASEAN region, where domestic demand is sharply increasing, see their capacity to export declining.
- These changes in the relations between natural gas prices and its demand and supply, are affecting the progress of upstream development, particularly in LNG projects. Most of the projects, whose development started when international oil prices were high, need to be reviewed to see if they still make business sense. Given that LNG projects take a long time to complete, some people warn that such stagnating projects may raise a concern about oil production capacity in the future.

Changes in global energy situation



iii) Movements of global business operators

- To cope with the changes in crude oil and natural gas prices, oil and natural gas development companies and related service provider companies already started their large-scale business reconstruction. Recently announced potential acquisitions in this field include Halliburton (US) to acquire Baker Hughes (US) announced in November 2014 (\$35 billion), Repsol (Spain) to acquire Talisman (Canada) in December 2014 (\$13 billion), and Royal Dutch Shell (UK and the Netherlands) to acquire BG (UK) in April 2015 (£47 billion or \$70 billion). Those announcements indicate that global energy companies are driving their business reconstruction.
- At the same time, global energy companies are reviewing their ongoing oil and gas upstream developments on a project-by-project basis. For example, the FLNG (floating liquefied natural gas) project in Australia has postponed its FEED (front-end engineering design: the basic design that comes after conceptual design and feasibility study) and FID (final investment decision). The oil sands project in Canada has cut its capital and other spending.
- The sluggish prices and uncertain demand of natural gas, in particular, are making it difficult to invest in upstream gas developments. What attracts our attention is movements of the European gas majors that aim to devise a mechanism to expand gas demand. Prior to the World Gas Conference held in June 2015, the European gas majors issued a joint communiqué claiming that the dependence on coal-fired thermal power and renewable energy is not appropriate and that the shift to natural-gas-fired thermal power is necessary. To that end, they called for the introduction of a carbon pricing mechanism.

iv) Movements of major countries

- As described above, the U.S. lifted the self-sufficiency of energy supply taking advantage of the Shale Revolution, decreasing its dependence on imported oil and gas from the Middle East. However, some people are concerned that this movement may reduce the degree of U.S. involvement in the current situation in the Middle East. If that is the case, the movement of the U.S. may escalate a concern about geopolitical risks in the region.
- In a circumstance where regional conflicts are hard to control, the Middle East and the North Africa see the radicals intensifying their military activities. A classical religious confrontation, particularly when it involves an ISIL-like group that acts across the border, is difficult to

respond to within the bounds of international order. Additionally, if a radical offers a so-called franchise system that invites an increasing number of advocates no matter where they live, that conflict is difficult to contain within the region. In fact, risks stemming from radical activities by such a group are increasing.

- Besides the increasing uncertainty about security in the Middle East and the North Africa, China's recent movements in the South China Sea, our country's transportation route of energy resources, could be one of the risk factors associated with future energy supply.

Yemen

- Last year in Yemen, Shiite rebels known as Houthis, based in the northern part of the country, began to intensify their military activities. In March 2015, Saudi Arabia and some other countries, at the request of the Yemeni government, launched air strikes against the base of the Houthis. As Yemen's crude oil output accounts for only a small portion of the world total, the impacts of that operation on international crude oil prices were limited. If the situation worsens, however, it may affect the navigation of crude oil and LNG carriers in the Strait of Bab-el-Mandeb.

Iraq

- As military activities of ISIL are centered in the northwestern part of Iraq and south of the Kurds area, the impacts of such activities on the southern part of the country were limited. That region accounts for about 90% of the total crude oil production in Iraq. The oil fields in southern Iraq, which include the oil fields where a privately owned Japanese company, JAPEX, is operating, have been increasing their oil production. According to an IEA announcement, the country's crude oil output hit a record high of 3.85 million BD in May 2015. On the other hand, it was pointed out recently that part of the Iraqi crude oil is becoming heavier. This is a new challenge that Iraq must tackle. The tension between Iraq and the Kurds area, which includes the military activities ISIL, could affect the country's crude oil output in the future.

Iran

- In November 2013, the Joint Plan of Action (JPA) was agreed between EU3+3 and Iran. In July 2014, the measure designed to temporarily relieve the sanctions against Iran based on the JPA was extended for about four months. In November 2014, the parties agreed to extend the temporary relief through the end of June 2015. In April 2015, they agreed to the major parts of the Joint Comprehensive Plan of Action, and reached a final agreement on July 14, 2015. If Iran fulfills the agreement faithfully and the sanctions are lifted, it may affect our crude oil imports from Iran and movements of international crude oil prices. It is therefore necessary to closely watch how this matter will develop.

Saudi Arabia

- According to the International Energy Agency (IEA), Saudi Arabia is steadily producing crude oil at a rate of about 10 million BD. It is believed that the country is maintaining oil output at such high levels for the purpose of maintaining its share in the international crude oil market despite the oil price drop last year.
- As a major change in the country's governing structure, Saudi Arabia issued a royal decree in April 2015 to appoint Deputy Crown Prince Muhammad bin Nayef as new Crown Prince, and Defense Minister Mohammad bin Salman, who is the son of King Salman, as new Deputy Crown Prince. In addition, the supervisory structure of Saudi Aramco was restructured. The company had a new supreme council, and Deputy Crown Prince Mohammad bin Salman took the position of Chairman. It is necessary to closely watch how much those changes will affect the country's oil production and export policies in the future.

Libya

- In Libya, Islamic forces, which gained control by force of its capital city Tripoli, and secularists, which had to move to the east after the invasion, have been in conflict since August 2014 on the west and east sides of the country, respectively. In this situation, there are two governments in the country. Libya is still seeing armed conflicts, destruction of crude oil pipelines, intensifying military activities of ISIL, etc. Under such situation, Libya's crude oil output is hovering as low as about 0.30 million BD. The increase and decrease in oil output in Libya have big impacts on international crude oil prices particularly in the European market.

Canada

- With shale gas production expanding, Canada is studying the feasibility of several LNG projects in British Columbia on the west coast. Those projects, in which some Japanese companies participate, aim to start exporting natural gas around 2020. To make it happen, the projects will have to overcome several hurdles such as federal approval for environmental assessment. With respect to the oil sands projects in the country, the current output is smaller than estimated earlier, but is expected to grow in the future.

Mexico

- With crude oil production in the U.S. increasing, oil exports from Mexico to the U.S. have been declining rapidly in recent years. For this reason, Mexico reopened last year a crude oil export terminal on the Pacific coast (Port of Salina Cruz) with the aim to export more crude oil to Asia including Japan. Our country regards Mexico as one of the most promising crude oil suppliers in the future.
- Mexico, which had been driving its energy reform under the leadership of President Pena Nieto, decided to open its oil and gas industries to private companies including foreign capitals. In the past, those industries were monopolized by the nation. In August 2014, the country developed and refined the secondary laws and other necessary legal requirements to lay out the details of the energy reform initiative. While the implementation of the reform is behind original schedule due to the recent oil price declines, the round-one bidding process for each block is under way at present.
- Mexico has the world's sixth largest shale gas reserves. As the energy reform will push along shale gas development, the country is likely to consider exporting LNG. There is the possibility that Mexico will become one of our country's LNG sources in the future.

Venezuela

- Venezuela has the world's largest crude oil reserves, and the Orinoco area is abundant in heavy crude. Amid growing concern about the country's debt default as a result of the recent international oil price declines, the Venezuelan government is trying to collaborate with other countries, as seen in the joint Orinoco area development with Russia and the announcement about financing from China. Some people believe that the country will hardly be able to increase its oil output in such a tough situation where related exploration and development programs are delaying. On the other hand, there is speculation that the government is set to review its oil policy, and strengthen financially stricken state-owned Petroleum of Venezuela (PDVSA) with the help of foreign capitals.

Russia

- In response to the crisis between Russia and Ukraine, the West is currently imposing sanctions against Russia in the energy sector, too. EU decided to extend their sanctions, originally set to expire at the end of July 2015, to January 2016. Although these sanctions by the West have had little impact on Russia's short-term oil output (Russia's crude oil output: 10.77 BD in 2013 → 10.84 BD in 2014), special attention should be paid to longer-term impacts.

- The influence of these sanctions, the movement of Europe to reduce its dependence on Russia, and the recent crude oil price declines negatively impact Russian economy. To get out of this situation, Russia becomes increasingly interested in Asia, where oil demand is expected to grow in the future. As mentioned above, Russia announced the construction of the pipelines to supply natural gas to China, which puts Russia in a situation where there is no choice but to depend on China especially in the energy sector. For this reason, Russia becomes increasingly leery of China.

China

- China, now the largest energy consuming country in the world, has increased its presence in the international energy market, and is expected to grow further in the future. In May 2015, Russia became the largest crude oil supplier for China.
- In the "Energy Development Strategy Action Plan 2014–2020" published in 2014, the Chinese government announced its plans to expand domestic natural gas production in response to the increasing domestic demand for natural gas. Specifically, the country is promoting the development of shale gas production in the inland areas. On the other hand, it is said that there are many technical issues to be solved before starting the full-scale development of shale gas production, such as the development of drilling technologies suited for China-specific geological conditions, infrastructure construction in the inland and highland areas, access to water supply required for fracking, measures against water pollution, etc.
- In addition, there are other plans for natural gas supply through new coalbed methane developments, the capacity expansion of the Central Asia-China Gas Pipeline, the construction of a new Russia-China West-East Pipeline, the expansion of LNG import facilities on the coast areas and more. The total of these additional supply capacities is expected to substantially exceed the forecasted increase in total gas demand.
- While currently procuring about 50% of its total oil imports from Middle Eastern oil-producing countries, China is expanding its procurement of crude oil from African and South America oil-producing countries, and is also increasing the acquisition of resource interests, taking advantage of its infrastructure investment and finance in the regions.
- On the other hand, the scale expansion of upstream development through the acquisition of overseas active assets by state-owned oil companies, which had been seen till 2013, has leveled off after oil prices declined and domestic demand slowed down.

(2) Changes in domestic situation

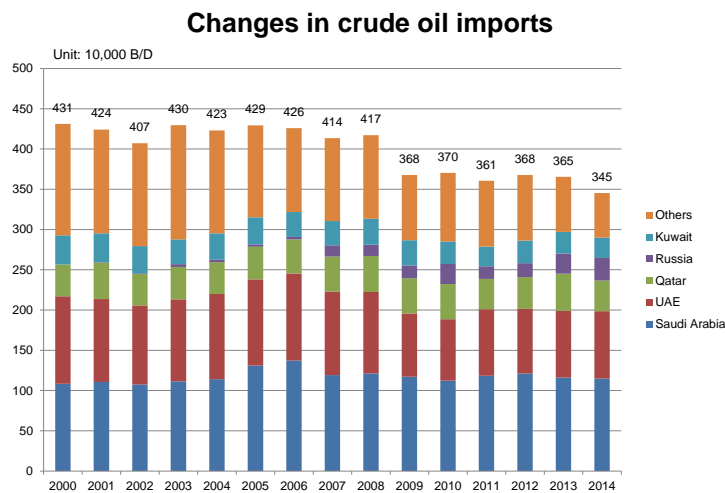
i) Domestic trends in demand and supply

- The domestic demand for energy products has been on the decline because of the trend of young people driving less, improved fuel economy, the widespread use of high efficiency devices, and fuel conversion in industrial fields, etc.. As a result, crude oil imports have decreased from approximately 4.60 million BD in 1994 down to approximately 3.45 BD in 2014. Especially in 2014, the demand for crude oil fell about 5% from the previous year, influenced by the decrease in demand after the consumption tax was raised and oil prices went up in the summer. In the next five years, the demand for crude oil is expected to decrease at an average annual rate of about 1.4%, and gasoline at about 1.8% (FY2015 Oil Product Demand Forecast). Domestic oil refining capacity and the number of service stations (SS) have been decreasing accordingly.
- Similarly, the demand for LPG has been declining since the latter half of the 1990s (about 15% down from the peak year). The demand in FY2014 was 15.39 million tons, about 1% down from the previous year. As the import of low-calorific-value shale gas will grow in the future, the demand for LPG for a calorific value adjustment purpose is expected to increase. In the next five years, the demand for LPG is expected to increase at an average annual rate of 0.6% and 3.0% without and with power generation use, respectively (FY2015 Oil Product Demand Forecast).

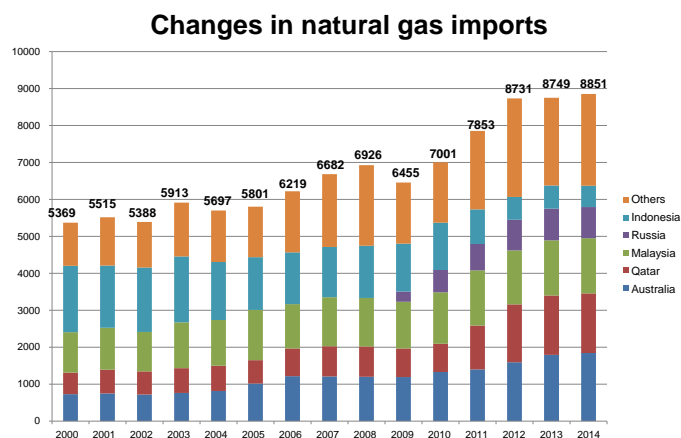
- The demand for natural gas has substantially increased for power generation use because of the shutdown of nuclear power plants after the Great East Japan Earthquake. The demand for natural gas had increased about 24% from approximately 70 million tons in 2010 to approximately 87 million tons in 2012 and then leveled off. Depending on how soon the nuclear power plants will be restarted, the demand for natural gas is expected to decline in the coming years.

ii) Changes in supplier countries

- Regarding crude oil, the import from Indonesia and China began to decrease in 1987 and our country's dependence on the Middle East has increased again to 83% in 2014. On the other hand, the import from Russia, which has a haul distance advantage over other countries, has increased recently, and now accounts for about 8% of Japan's total crude imports, the second largest supplier next to the Middle East.



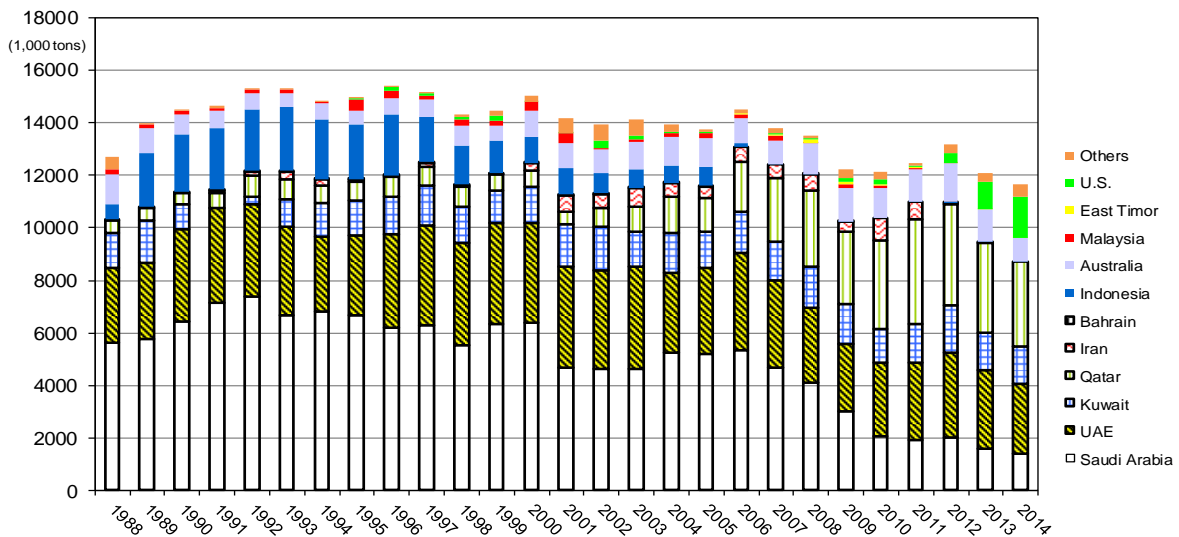
- At present, our country's natural gas import sources are broken down to about 30% from the Middle East, 20% from Australia, 10% from Russia, 30% from Asia, and the remainder 10% from other regions. With the exception of Qatar, whose share has increased after the Great East Japan Earthquake, Japan is diversifying natural gas sources and started procurement from Papua New Guinea in 2014. The projects that will support the increasing procurement of natural gas from the U.S. and Australia are proceeding steadily.



Unit: 10,000 tons

- The LPG produced in the oil refining process in Japan today accounts for about 16% of the total demand, but Japan's dependence of imported LPG on the Middle East used to be as much as about 90%. However, the import of shale-associated LPG from the U.S. has been increasing in the past few years, which accounted for 16.9% of the total imports in FY2014. As a result, Japan's dependence on the Middle East has decreased down to around 72%.

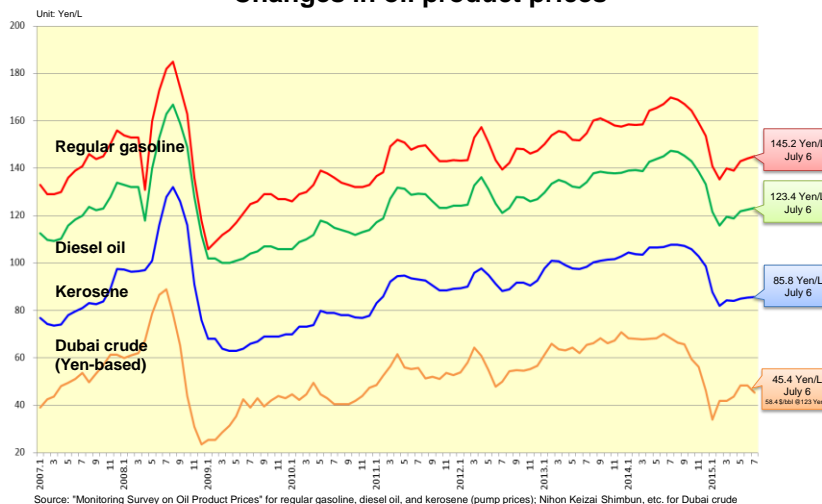
Changes in LPG imports



iii) Fuel price trends

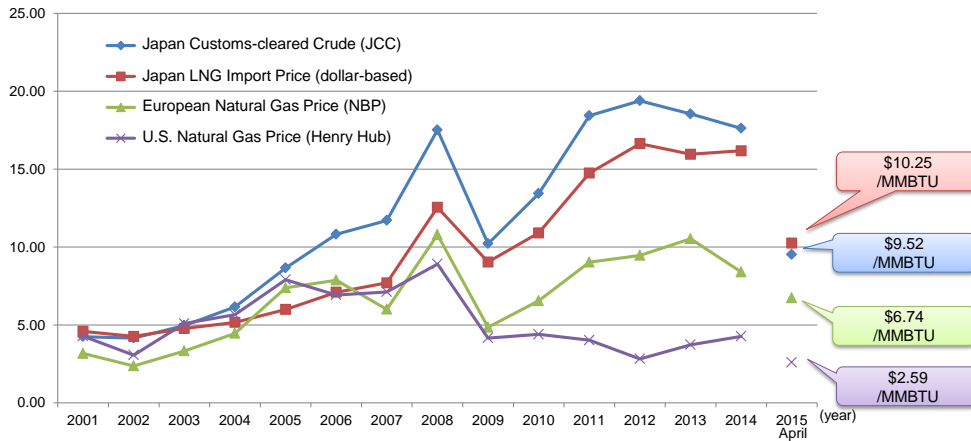
- Influenced by the above-mentioned trends in international crude oil prices as well as currency fluctuations, prices of imported crude oil exceeded 70 Yen/liter in the summer of 2014, pushing up oil product prices in Japan. For example, gasoline retail prices climbed close to 170 Yen/liter. Then oil product prices began to fall reflecting the changes in crude oil prices, which hit bottom in February 2015 (when gasoline was priced at slightly above 133 Yen/liter). From that point forward, prices of oil products have been on the rise again, mostly reflecting the crude oil price reversal at that time. As of July 6, 2015, the price of imported crude oil was 45 Yen/liter, and retail gasoline was priced at around 145 Yen/liter.

Changes in oil product prices



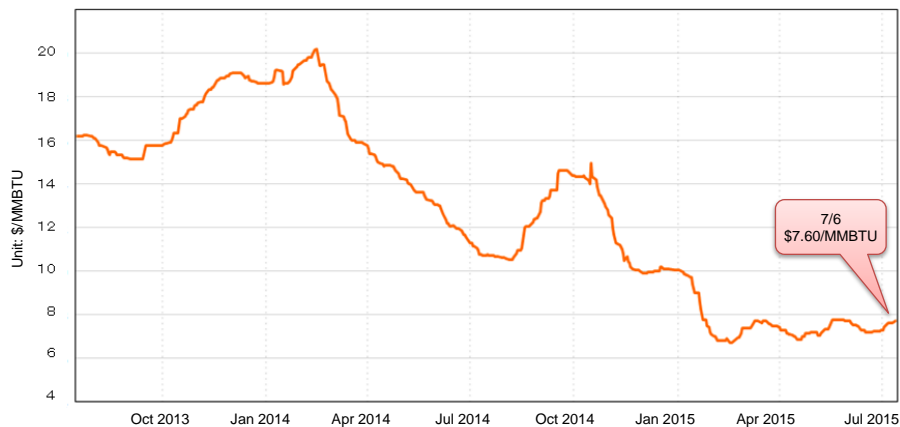
- Imported natural gas is priced largely linked with international crude oil prices, and the price in 2009 was an average of \$9/million BTU (British thermal unit). In 2012 after the Earthquake occurred, however, those prices went up to an average of \$16.6/million BTU as a result of increased crude oil prices, currency fluctuations, increased gas demand, and many other factors. The impact of the crude oil price declines after the summer of 2014 became obvious in natural gas prices with a time lag of a few months. The price in April 2015 was \$10.3/million BTU. Imported natural gas prices on a Yen basis dropped 29% in April 2015 from the same month of the previous year. LNG spot prices (JKM) dropped to around \$7/million BTU, reflecting the slack demand-supply balance.

Changes in natural gas prices



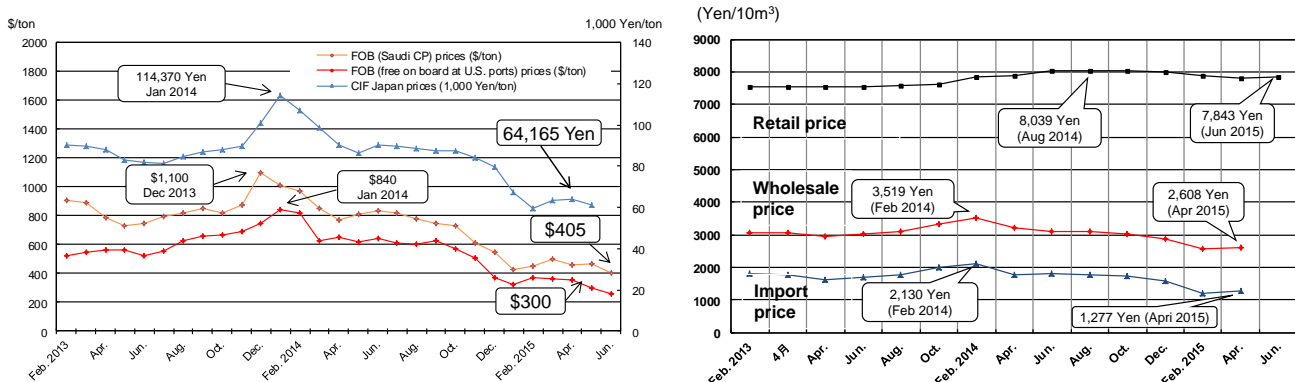
*The prices for April 2015 are preliminary figures.

Changes in LNG spot prices (JKM)



- With respect to LPG procurement prices, Saudi Aramco contract prices (CP) rose to \$1,100/ton in December 2013. Then, CP sharply dropped around July 2014 because cheap U.S. shale-associated LPG (which is priced based on Mont Belvieu gas prices--a spot LPG price index in the U.S.) became widely available in the market, and because international crude oil prices declined. The difference between the two spot LPG price indexes narrowed down to about \$100/ton, and procurement prices have dropped about 68% from year-ago levels. LPG import prices dropped about 43% from 114,370 Yen/ton in January 2014 to 64,165 Yen/ton in April 2015. On the other hand, it is pointed out that such decline in import prices may not be fully reflected to domestic LPG retail prices. This topic will be described later in this report.

Left: Changes in LPG FOB (Saudi CP vs. U.S. Mont Belvieu) and CIF prices
Right: Changes in LPG import, wholesale, and retail prices

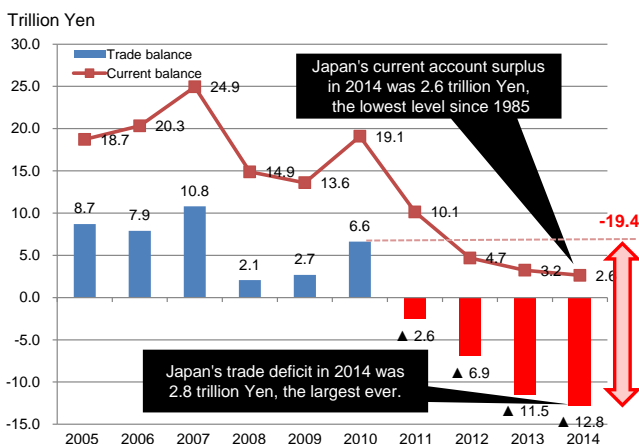


- In the wake of the Great East Japan Earthquake, all the nuclear power plants in Japan were shut down, and prices of other fuels went up. As a result, electricity prices rose about 25% for household use and about 40% for industrial use between FY2010 and FY2014. The major reasons for those price hikes were the increase in fuel cost and the rise in the electricity surcharge on the introduction of the feed-in tariff scheme for renewable energy. It is assumed that the declines in LNG prices will lead to reductions in electricity prices with a time lag of a few months. However, it is expected that the surcharge on renewable-energy-derived electricity will continue to rise.
- From the standpoint of global competitiveness, the steep rise in energy cost is becoming a major concern for corporations that are operating in our country.

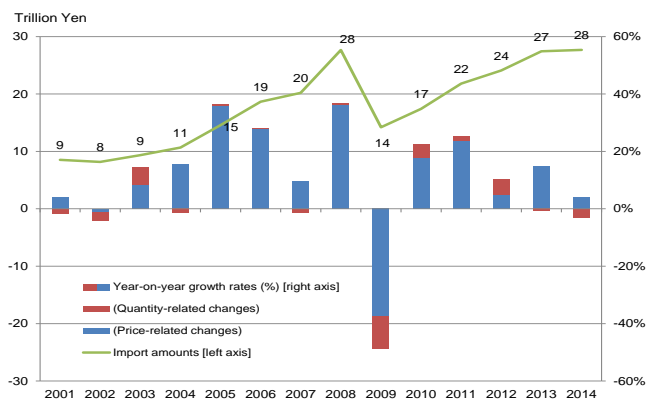
iv) Trends in trade balance

- Japan's trade balance has sharply worsened since the Great East Japan Earthquake, because of the increase in crude oil and natural gas imports mainly for power generation use, the continuous rise in crude oil prices from the latter half of 2011 to the summer of 2014, the increase in natural gas prices linked with crude oil, and then the weakening Japanese currency. Japan's trade balance, which fell into the red in 2011 for the first time in 31 years, has worsened by more than 19 trillion Yen from a surplus of 6.6 trillion Yen in 2010 to a deficit of 12.8 trillion Yen in 2014. The import amount of crude oil, petroleum products, and LNG has increased by 10.3 trillion Yen in the five years, which is equivalent to more than half of the drop in the trade balance for the same period.
- In addition to the trade balance, the current balance was in the red between November 2013 and January 2014.
- Recently, the import amount of crude oil and natural gas dropped significantly because of the decline in crude oil prices. As a result, the trade deficit is quickly decreasing. Thanks to that boon as well as the increase in exports driven by companies, which wanted to see a better bottom line just before the fiscal year ended, a trade surplus was recorded in March 2015 for the first time in 2 years and 9 months. But the trade balance fell into the red in April 2015 again.

Changes in Japan's trade balance



Changes in fossil fuel import amounts



v) Energy system reforms and implementation

- In June 2015, the bill to revise the Electricity Business Act and the Gas Business Act was passed into law. The law is applicable to the third stage of the three-stage Electricity System Reform, namely (1) the expansion of wide area electrical grid operation, (2) the full liberalization of retail electricity and power generation markets, and (3) enhanced neutrality in the legally unbundled power transmission and distribution sectors. In the electricity market from FY2016, and the city gas market from FY2017, new entrants will be invited from other business fields, and a number of new service/rate menus, such as combined sales of

electricity, gas, and telecommunication services, will be made available. It is expected that this energy system reform will integrate the energy markets more.

- With respect to the impact of the energy reform on LPG distribution business, if the existing city gas pipelines are extended to wider areas in the future, the competition between city gas and LPG may become fiercer. From the standpoint of economic efficiency, the supply of city gas through gas pipelines is possible only in the areas where a certain level of demand cluster exists. In other areas, LPG is likely to continue to take a major role.
- In July 2014, the Japanese government announced the new criteria for Act on Sophisticated Methods of Energy Supply Structures. While domestic oil demand is continuing to decline, the government urges, through this notification, sophisticated use of oil, and eventually a restructuring of oil refinery and wholesale businesses, with the aim of reforming the existing oversupply market structure. Based on the old criteria for Act on Sophisticated Methods of Energy Supply Structures, our country's crude oil processing capacity was reduced from approximately 4.89 million BD at the beginning April 2008 to approximately 3.95 million BD at the end of March 2014. As a result, Japan's installation rate of heavy oil cracking units increased from 10% to 13%. If all the Japanese oil companies are going to meet the new criteria only through the reduction in their processing capacity, our country's crude oil processing capacity will be slashed by approximately 0.40 million BD by the end of March 2017. As a result, Japan's installation rate of residual oil processing units will increase from 45% to 50%.

vi) Cooperation between domestic energy companies

- Facing the change in competitive environment stemming from market liberalization, the forecasted decline in medium-term domestic energy demand, and the current tough business conditions, domestic energy companies are moving forward with a number of business alliances and reconstruction.
- For instance, Tokyo Electric Power and Chubu Electric Power jointly formed at the end of April 2015 JERA Co., Inc., a comprehensive alliance that will manage both companies' fuel and power generation departments. The new company will procure fuels for the two parent companies in a comprehensive manner, which is expected to increase their bargaining power in fuel price negotiations to reduce fuel costs.
- With respect to LPG wholesale companies, Cosmo Oil, Showa Shell Sekiyu, Sumitomo Corporation, and Tonen General Sekiyu integrated their LPG businesses to start a new alliance company "Gyxis Corporation" in April 2015. It is expected that their global competitiveness will be strengthened, and the risk of supply disruptions will be reduced by improvements in business efficiency through the business integration, strengthened approaches to overseas markets, enhanced bargaining power against LPG producing countries, and then the availability of diversified gas sources.

vii) Proposed long-term energy demand and supply outlook and target for greenhouse gas emission reductions in preventive measures for global warming

- Based on the Strategic Energy Plan, which was approved in a cabinet meeting in April 2014, Energy Demand and Supply Outlook 2030 was presented in July 2015 by Subcommittee on Long-term Energy Demand and Supply Outlook under Advisory Committee for Natural Resources and Energy.
- Toward the achievement of (3E+S) basic policies, and with enhanced safety as the most important premise, the Energy Demand and Supply Outlook 2030 presented an energy mix for FY2030 with the aim to meet the following three goals: (1) the energy self-sufficiency ratio should be raised to levels higher than before the Great East Japan Earthquake (to around 25%), (2) electricity cost should be reduced to lower levels than today, and (3) the target for greenhouse gas emission reductions should be at least as high as the targets proposed by the West.
- Specifically, the Energy Demand and Supply Outlook 2030 estimates that the energy mix on a primary energy basis will consist of about 30% oil (40% in FY2013), about 3% LPG (3%), and about 18% natural gas (24%). When nuclear power and renewable energy are added,

the Outlook 2030 estimates that the energy self-sufficiency ratio will become about 24.3%. On the other hand, the power source mix will consist of about 3% oil (12% 10-year average immediately before the Earthquake), about 27% natural gas (27%), and about 22%–24% renewable energy (11%). The Outlook 2030 also estimates that this power source mix will not need to increase electricity prices from today's levels.

- With respect to CO₂ emissions, the Energy Demand and Supply Outlook 2030 estimates that energy-derived CO₂ emissions will be reduced 21.9% by FY2030 compared to FY2013 levels. Based on this estimate, the Japanese government announced in June 2015 a total of 26.0% reduction in CO₂ emissions as its target for protective measures for global warming, which will be presented at COP21 later this year.

viii) Growing public interests in stable energy supplies as a result of controversy over the national security legislation

- National security related bills are now being deliberated in the Diet. In the process, Diet members are arguing possible disruptions in crude oil and natural gas supplies from the Middle East if the Strait of Hormuz is blocked, as one of the specific cases where the nation's existence could be threatened. Such fuel supply disruptions could create turmoil in our country's economy and the lives of citizens. Through these arguments, our country's public interests are growing with respect to the diversification of fuel exporting countries, sufficient quantities of stockpiling, bypass routes when the Strait of Hormuz is blocked, release of stockpiling in emergency, actions that should be taken domestically, and many more.

2. Approaches to uncertainty in energy resource supplies from foreign countries

(1) Diversification of fuel types, reduction of risks from importing each fuel type, reductions in procurement prices, and how fuels should be consumed

i) Overview

- As described in the interim report summarized by Oil and Natural Gas Committee in the summer of 2014, the following measures need to be taken in order to secure fuel supply for stable and appropriate prices: (1) all fuel types should be diversified, and to make it happen, the use of those fuels on the demand side should be diversified at the same time; (2) fuel exporting countries should be diversified for each fuel type; (3) to ensure fuel procurement from an exporting country even during tight demand and supply conditions in emergency, the relationship with the resource-rich country should be strengthened and its upstream stakes should be acquired; and (4) domestic resource developments should be pursued as the least risky option, and the self-sufficiency ratios of those natural resources should be increased.
- As proposed in the interim report, it is extremely effective if there is a tool that allows us to quantitatively measure the difference in approaches to energy security between other countries, and how the difference varies depending on the way each approach is implemented. For this reason, our team tried to develop an energy risk assessment index (energy security index) as the measure that quantitatively benchmarks procurement risks, based on information about how much energy types are diversified, how many countries are procuring from each fuel exporting country, and how risky each fuel country is. The team applied the index for the quantitative analysis of various policies and efforts. (Please see "Energy Risk Assessment Index" for details.) The use of this index allows us to see whether the energy risk will increase (to a higher index value) when some political measure is taken (for example, part of fuel exporting countries is changed) or to know which option will have the greatest impact from an energy security standpoint when multiple policy options are available.
- By reference to these quantitative analyses in our future studies on policies and business operators' activities, the stability of fuel supply will be enhanced effectively and efficiently.
- Among specific policies to which this quantitative analysis will be applied are risk money supply and support in subsidies and taxation through Japan Oil, Gas and Metals National

Corporation (hereinafter referred to as "JOGMEC"), the strengthening of the relationship with resource-rich countries as well as the development of new exporting countries through resource-seeking diplomacy, and support in R&D and promotion that would help diversify the use of resources on the demand side. It is important to link these energy risk assessments to business operators' activities.

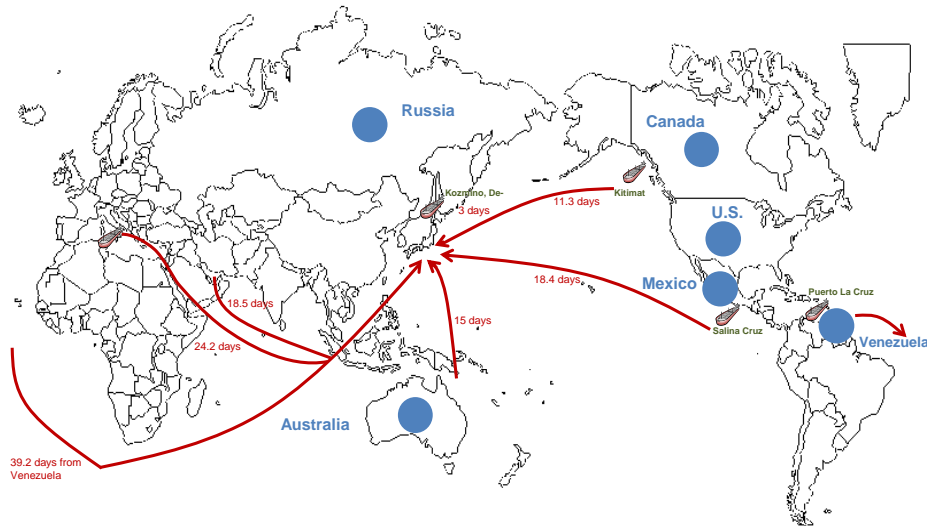
- With respect to the acquisition of upstream stakes, the original target that "Japan's ratio of independent oil and natural gas developments including domestic developments in 2030 is set at 40% or higher" should be maintained in the future.

ii) Oil

(a) Diversification of oil exporting countries

- In 2014, our country's dependence on crude oil procurement from the Middle East and Russia was about 83% and 8%, respectively, and the risk of oil supply disruptions is the highest of all fuels. For this reason, the reduction in the dependence of crude oil from the Middle East, and the diversification of oil exporting countries, would provide the greatest contribution to stable fuel supply in the future. As described later, this fact is clearly pointed out in our quantitative analysis results.
- The increase in shale oil production in North America brought about major changes in the structure of the world's crude oil supply chain. Before shale oil became mainstream, Asian oil producing countries, such as Indonesia and China, had gradually decreased oil exports, as their domestic demand increased. As a result of oil production expansion in the U.S., which is a net oil importer, oil producing countries such as Latin America and West Africa, which were exporting crude oil mainly to North America, are now forced to look for new customers in the Asian market, where oil demand is growing. This movement is creating opportunities for our country to be able to procure crude oil from other countries than Middle Eastern countries.
- In diversifying energy exporting countries, it makes sense to look at countries mainly on the Pacific Rim, from which crude oil can be hauled within a relatively small number of days and without passing choke points. One of such countries is Russia, which has been increasing crude oil exports to Japan in the past few years, and the procurement of more oil from the country should be pursued. Among other candidates are Latin American countries including Mexico, which has plans for export capacity expansion at ports on the Pacific coast with the aim to export more crude oil to Asia. Japan will strengthen the relationship and expand crude oil procurement based on those countries' technical and financial needs. In the meantime, the time has come to start studying the possibility of procuring crude oil from the mainland U.S. and Alaska.
- The U.S. bans the export of crude oil by law in principle, but the market is currently being supplied with a glut of crude oil, as domestic production has been on the rise. Furthermore, in response to the concern that crude oil export might have negative impacts on domestic gasoline prices, a government agency already presented its view that the rationale was unclear. For these reasons, there have been arguments about a review of the oil embargo since 2014, and in fact a revision bill was submitted in March 2015.

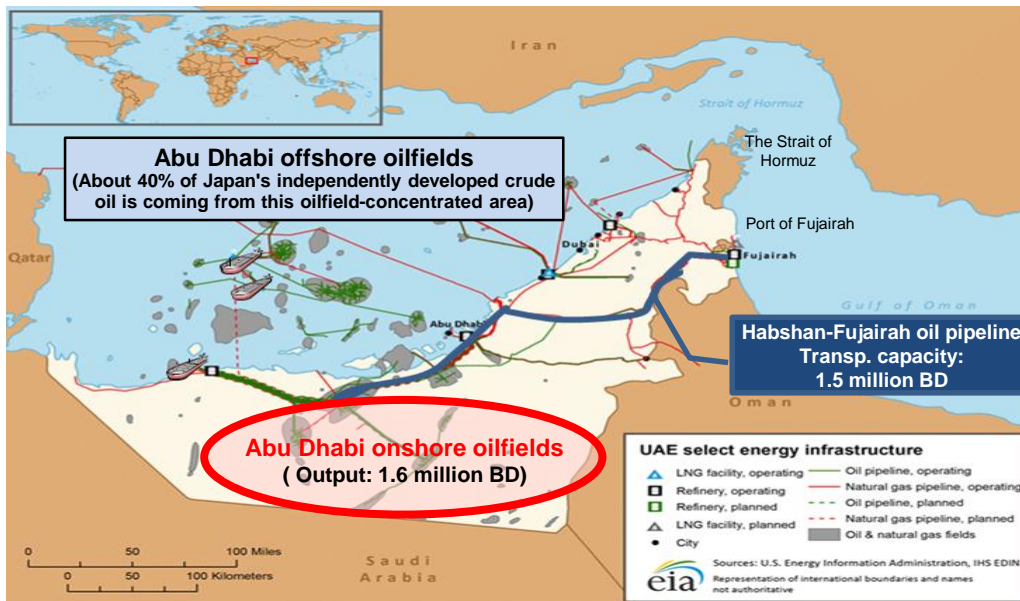
Approaches to ensuring stable fossil fuel supplies (crude oil)



(b) Acquisition of upstream stakes and strengthening of relationship with resource-rich countries

- Even if Japan continues to drive the diversification of oil exporting countries, there is no doubt that Middle Eastern oil-producing countries, which have huge oil reserves and production volume, will remain the largest crude supplier to our country in the foreseeable future. Japan will have to pay attention to some critical factors that might threaten the stability in the Middle East in the future, such as the rise of radicals including ISIL. At the same time, with the aim to stabilize to some extent the supply of crude oil from Middle Eastern countries in the event of an emergency, Japan should continue working hard to strengthen the relationship with those high-risk countries. It is particularly important to deepen the cooperative relationships by providing what they really want in uniquely Japanese ways.
- Saudi Arabia and the UAE, for instance, possess oil pipelines on their lands that enable crude oil export bypassing the Strait of Hormuz. It is therefore important that Japan will share the same understanding with these countries about the effective use of those pipelines to haul crude oil to our country in the event of an emergency.
- With respect to the acquisition of upstream stakes, which should be proactively pursued from the standpoint of raising the certainty of fuel procurement in emergency, Japanese companies have greater opportunities today than ever in acquiring upstream stakes in the Middle East, Latin America, Africa, North America, and other regions, now that the funding of upstream developments is becoming short due to oil price declines. Based on such circumstances, Japan should desperately seize this opportunity by proactively supplying risk money through JOGMEC and by spurring resource-seeking diplomacy.
- One of the specific examples is Mexico, where energy reforms are currently under way. The Mexican government already started to call for bids on the stakes for offshore oilfields in the shallow water area. Foreign capitals, too, are solicited for the bids. The government plans to call for bids on other oilfields in the deep-water area down the road. These upstream development projects are something Japan should pay special attention to. Another example is the East Africa that is expected to have large-scale oil reserves. If their upstream developments progress smoothly in the region, Japan hopefully may be able to import crude oil through the acquisition of their stakes.
- In April 2015, INPEX Corporation successfully acquired the stake (5%) of one of the world's largest onshore oilfields in the emirate of Abu Dhabi, the United Arab Emirates (the UAE) for the first time as an Asian company. The crude oil from that oilfield, which could be hauled to Japan bypassing the Strait of Hormuz, is expected to greatly contribute to our country's effort to ensure stable crude oil supply. Thus far, Japan has lobbied the Abu Dhabi government through high-level connections with the aim to acquire this stake, and at the same time has extended support in a wide range of fields such as education and healthcare. It can be said that such resource-seeking diplomatic efforts resulted in this successful acquisition of the stake.

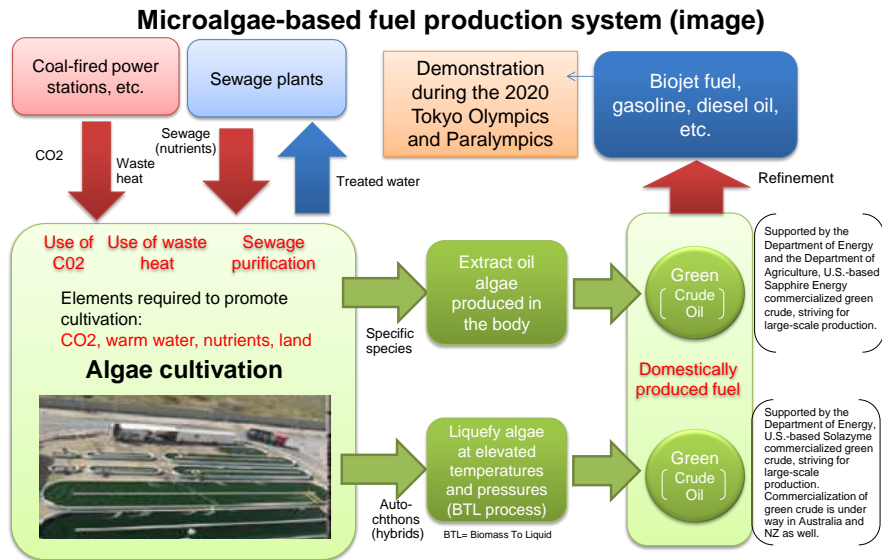
Abu Dhabi onshore oilfields and Habshan–Fujairah oil pipeline



- About 40% of our country's total independently developed crude oil (a little less than 10% of Japan's total crude oil imports) concentrates in Abu Dhabi's offshore oilfields. However, more than 60% of such oilfield stakes are scheduled to expire in 2018. For Japanese companies to be able to re-acquire the same stakes in the bids after the expiration in 2018, Japan should continue to lobby the Abu Dhabi government through high-level connections, and provide support in a wide range of fields such as education and healthcare.
- Other than the above-mentioned upstream developments, an oil deposit was found in April 2015 in the ultra deep-water exploration project off Sabah in Malaysia, which is operated by a Japanese company. Japan is supplying risk money to this project through JOGMEC.

(c) Domestic resource developments

- As domestic resources that exist within our country are the most stable energy sources, many exploration and trial drilling activities have been conducted to date. It is necessary for the Japanese government to continue its research activities in unexplored areas through the utilization of 3-D seismic vessel SHIGEN, share obtained data with concerned parties, and conduct trial drilling at promising points. As a result, Japanese companies will be encouraged to pursue more oilfield explorations. It is also important to get involved in the development of domestic resources by leveraging new oilfield exploration techniques and through the development of engineers and researchers.
- For geological reasons, there are only a few areas in the vicinity of Japan where conventional oil and gas fields exist. In this light, it is important for Japan to drive the development of innovative domestic fuels, based on novel ideas such as the development of algae biofuels. Japan's energy self-sufficiency ratio should be increased in such a way.
- As to the biofuels that are produced from microalga as promising non-fossil-derived domestic fuels, it is possible to promote algal cultivation, while producing complex effects at the same time, by using CO₂ and heat released from thermal power plants and nitrogen and phosphorus contained in sewage. The results of demonstration experiments to date indicate that such biofuels have many issues to be solved, as represented by the high cost. However, the multi-faceted approaches to such studies are expected to bring about a reduction in microalgae cultivation cost, a decrease in CO₂ emissions, and sewage purification effects. It is important to move ahead with studies and commercialization for such domestic energy sources, which can be applied to a variety of applications.



(d) Cost reductions

- Because crude oil is traded based on international price indexes in principle, extremely large differences in procurement prices are rarely seen.
- Once their energy exporting countries are diversified, however, importing countries may gain bargaining power.
- Given the fact that U.S. WTI crude oil spot prices have gone below European Brent crude oil spot prices in many past cases, if crude oil trades based on WTI become more popular in the international market, the crude oil procurement prices that have been determined based on Brent are expected to decline through index arbitrage trading.

(e) Diversified use of fuels in transportation sector including land and marine transportation

Overview

- When our country's risks of fuel supply disruptions are compared by industrial sector, the risk in the transportation sector, which depends on oil products for more than 95% of its fuel consumption, is extremely higher than other sectors. This point is more obvious when analyzed using the Energy Risk Assessment Index (which is described later in more detail).
- It is no doubt that oil will continue to be one of our important energy sources, and that it will have the largest share in our country's primary supply mix in 2030. The analysis using the Energy Risk Assessment Index already confirmed that stockpiling could reduce the high risk of supply disruptions (which is described later in more detail). The largely localized risk distribution in the transportation sector is not desirable from the standpoint of minimizing that impact on the life of citizens and economic activities in the event of an emergency.
- This said, as oil is forecasted to have about 30% share in the primary energy supply mix by FY2030, the existing excessive dependence on oil would be addressed anyhow. As energy-exporting countries are diversified more, risks associated with fuel supply will decrease more. The uneven risk distribution in the transportation sector could jeopardize logistics, which are the infrastructure for everyday life and economic activities, in the event of an emergency such as a crude oil supply disruption. It is therefore important to take adequate measures to deal with the vulnerability in that sector. As a natural consequence, such an approach could lead to the increased number of alternative means of emergency logistics that would come in handy in the event of a disaster.
- With respect to passenger cars, next-generation vehicles, such as electric vehicles (EVs) and fuel-cell-powered vehicles (FCVs), are expected to spread more as consumer choices in the future. Those vehicles will take advantage of the temporary industrial policies that triggered the widespread use of hybrid electric vehicles (HEVs) in the past. The Long-term Energy Demand and Supply Outlook forecasts that EVs/plug-in hybrid vehicles (PHVs) and FCVs will account for 16% and 1%, respectively, of the total passenger cars sold in FY2030.

- In the wake of the Great East Japan Earthquake, LPG-powered vehicles could access to LPG stations relatively smoothly. Today, there are slightly less than 1,600 LPG stations in operation in Japan. In addition, overseas trends in this field suggest that auto makers are striving to develop and commercialize more LPG-powered vehicles including LPG electric hybrid vehicles (LPGHVs), bi-fuel vehicles, and dual fuel vehicles that are powered by diesel oil mixed with LPG, all of which are expected to show up in the market in the foreseeable future.
- On the other hand, the majority of trucks and marine vessels, which are more influential than passenger cars in the logistics infrastructure, still depend heavily on oil, and the diversification of fuels has not progressed at all. For the purpose of setting up a system that can deal with the demand for transportation in the event of an emergency, Japan should diversify fuels in the transportation sector, particularly in land and marine transportation. With the help of appropriate policies, the following specific issues should be solved.

Introduction of biofuels

- With respect to biofuel, Act on Sophisticated Methods of Energy Supply Structures requires that oil refining and wholesale companies introduce 500 thousand kl of crude oil equivalent of bioethanol by FY2017, for the purpose of introducing non-fossil fuels. The Japanese government has been encouraging them to meet the target so far, and will continue to do so in the future to make sure the target will be eventually met. On the other hand, the Japanese government will have to promote R&D on next-generation biofuels that would enable steady bioethanol procurement, domestically or through development import. (The next generation biofuels refer specifically to cellulosic ethanol (2G) that is designed to avoid potential competition with edible ethanol, and the above-mentioned biofuel (3G) produced from microalga.)
- ICAO, the international civil aviation organization under the United Nations, and IATA, the private international air transport association, are striving to realize carbon neutral in the world's aviation sector by 2020. Japanese airline companies, too, are going to do the same. The introduction of biojet fuel is currently being studied in the Japanese aviation sector for the purpose of reducing greenhouse gas emissions in the skies. In anticipation of a demonstration flight during Tokyo 2020 Olympics and Paralympics, the collaboration with the Ministry of Land, Infrastructure, Transport and Tourism would be useful in developing necessary infrastructures and commercializing the use of biojet fuel.

Expansion of natural-gas-powered freight transportation

- Large trucks are playing a major role in logistics in our country, and approximately 2.3 million units of large trucks are in operation today. The majority of these trucks are powered by oil fuel, with the exception of approximately 20 thousand units powered by compressed natural gas (CNG). In overseas countries such as China and the U.S., the introduction and widespread use of CNG- and LNG-powered trucks are taking off from the standpoint of cost effectiveness and environmental performance. For example, China has been promoting the introduction of NG-powered vehicles since the 2000s to as measures to prevent air pollution. Approximately 2.8 million and 170 thousand units of CNG- and LNG-powered large trucks, respectively, are in operation in China today.
- For the purpose of increasing alternative means of logistics in the event of an emergency, our country, too, needs to promote the introduction of these types of freight trucks that are directly linked to the life of citizens and industries. With respect to LNG-powered trucks, it is hoped that Japan will start to sell LNG-powered trucks in the home market. The need of developing a new infrastructure is one of the challenges in spreading NG-powered trucks. There are already about 300 CNG stations in Japan. Because an LNG-powered truck can travel approximately 1,000 km on a charge, LNG stations set up at about 10 to 20 locations across the country may be able to cover their LNG demand. (It is estimated that an LNG station costs about 200–300 million Yen to set up.)

- For more widespread use, NG-powered vehicles will have to reduce vehicle prices, improve fuel economy, and decrease fuel prices. Preferably, future efforts toward the widespread use of NG-powered vehicles should be made after potential issues are organized, and in cooperation with private companies and related ministries and agencies.
- In the marine transportation sector, the introduction of dual-fuel-powered vessels, which can use LNG as an additional fuel, started in compliance with the environmental regulations stipulated by the International Maritime Organization (IMO). At the same time, the use of LNG-powered vessels is already becoming popular, particularly in European and North American waters, where strict regulations against SO_x and NO_x emissions were introduced in advance. While assessing trends in these international environmental regulations, Japan needs to study how to introduce LNG-powered vessels jointly with related ministries and agencies.

Understanding of trends in GTL introduction

- GTL (Gas-to-Liquid), which refers to synthetic hydrocarbons produced from natural gas, will probably be used primarily as alternative fuels to diesel oil. There are some estimates that GTL emits less CO₂ than diesel oil on a lifecycle basis.
- At today's technical levels, GTL production cost is too high, and its commercial production seems difficult where natural gas prices are high. Because our country is importing almost all natural gas from foreign countries, GTL would cost us more than crude-oil-derived diesel oil at present.
- JOGMEC successfully established the JAPAN-GTL process, and is utilizing the unique technique as a means of technical assistance to strengthen the relationship with gas-producing countries such as Turkmenistan and Mozambique. Japan will have to reduce natural gas prices to make GTL spread widely at home, but special attention should be paid on an ongoing basis to the trends in GTL developments in the other parts of the world.

iii) Natural gas

(a) Diversification of exporting countries

- As described above, LNG exporting countries have been diversified at a steady pace. For example, the import of LNG from Papua New Guinea started in 2014 (at a rate of 2.2 million tons per year). In Australia, a new LNG project started production at the end of 2014. In 2015, other multiple projects are starting LNG production, and at the end of 2016, Ichthys LNG project, which is operated by a Japanese company, will start LNG export to Japan. The import of shale gas-derived LNG from the U.S. is scheduled to start in 2016, and at the same time the import of LNG from Russia is increasing. Japan may be importing LNG from Mozambique and Canada in the future. In similar ways, our country's dependence on the Middle East is expected to further decline.

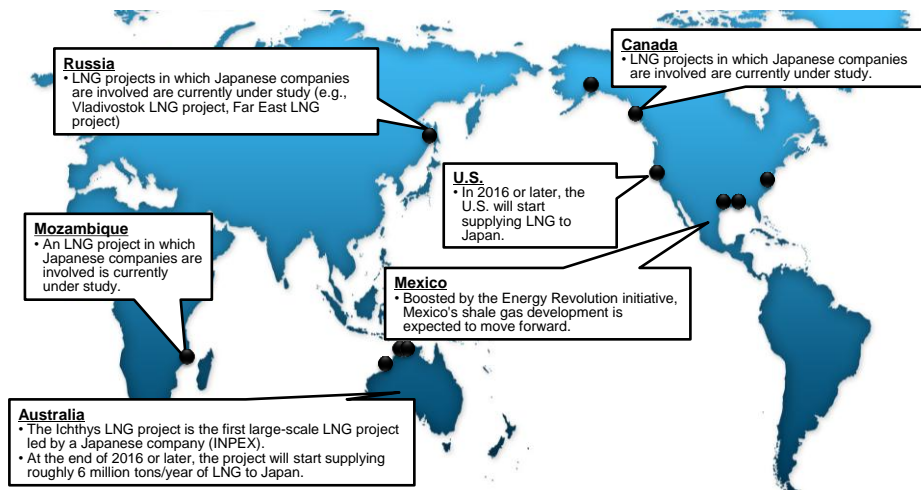
(b) Acquisition of upstream stakes

- The shipment of LNG requires the development of necessary infrastructures such as natural gas liquefaction facilities. In addition to the acquisition of upstream natural gas stakes, participation in natural gas liquefaction projects (LNG projects) plays an important role in securing stable LNG supply.
- The import of shale gas-derived LNG from five projects in the U.S. is planned to start in 2016. Japanese companies are involved in the construction of LNG liquefaction facilities for Freeport and Cameron LNG liquefaction projects.
- The import of natural gas from Russia, which is geographically close to our country, already represents 10% of Japan's total natural gas imports. The natural gas has been imported so far from the Russian LNG projects in which Japanese companies participate. Japanese and Russian companies are now studying the realization of LNG projects in the Far East and Sakhalin regions to export LNG from there to Japan.
- In British Columbia on the west coast of Canada, multiple LNG projects are now under way with the aim to start LNG export around 2020, and Japanese companies are involved in those projects. To realize those projects, several issues will have to be solved, such as federal approval for environmental assessment.

- In Mozambique, natural gas projects for development, liquefaction, and export are now under way, in which Japanese companies are involved.
- As seen in the above cases, participation in upstream stakes has recently increased the volume of LNG that Japanese companies have a right to take. However, domestic LNG demand is not likely to increase in the near future. At the same time, there are uncertain factors like the accident on a Chinese gas pipeline, so serious that it might impact LNG demand in the entire world. From the standpoint of ensuring stable supply of natural gas at home, preferably Japan should be able to secure sufficient quantities of LNG ready for shipment in case of an emergency. The seemingly best strategy that surplus LNG will be sold in the international market at ordinary times, and that LNG will be shipped to Japan in emergency instead, would require the development of overseas distribution routes from scratch. From the above-mentioned viewpoints, Japan should acquire upstream and mid-stream natural gas stakes, needs to know about international LNG marketing approaches today and in the future, and also needs to understand Japanese companies' activities and challenges better.

Approaches to diversification of fossil fuel exporting countries (natural gas)

Major LNG production projects currently under study



(c) Cost reductions

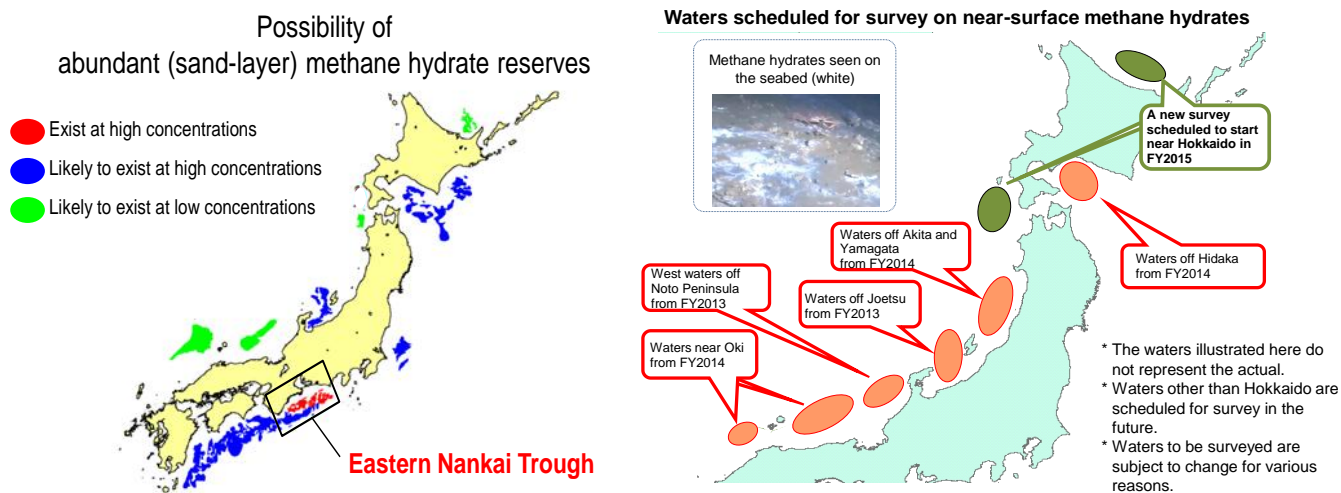
- Though stable at present as a result of crude oil price declines, LNG prices may hike again when the demand for LNG increases in Asia. Taking advantage of bargaining power in the best buyer's market right now, Japan needs to steadily implement LNG procurement at competitive prices and take countermeasures against price hike risks.
- Specifically, Japan should strengthen the buyer side's bargaining power through a joint purchase scheme like the one devised in the above-mentioned comprehensive alliance between the fuel and power generation departments of Tokyo Electric and Chubu Electric, and also should develop diversified price formulas other than indexes linked to crude oil prices.
- Furthermore, while sharing useful information with gas-producing countries through LNG Producer-Consumer Conferences, Japan should enhance the buyer side's bargaining power through the strengthened cooperation among gas-consuming countries. It is also important for Japan to strive for the construction of a flexible and fluid trading market by relaxing or eliminating destination clauses.

(d) Development of domestic resources

- The production of natural gas from domestic gas fields has been on the decline in recent years. In addition to the development of conventional natural gas, methane hydrates, which abundantly exist in waters around Japan, are raising expectations as non-conventional resources. The Basic Policies for Economic and Fiscal Management and Reform (so-called Big-Boned Policy) and the Growth Strategy, which include the Basic Plan on Ocean Policy

and the Fundamental Plan for National Resilience, emphasize the need to develop such methane hydrates.

- Sand-layer methane hydrates, which exist abundantly on the Pacific Ocean side, is now undergoing the technical improvement process, based on the results of the offshore gas production experiment conducted in the spring of 2013. At the same time, in November 2014 Japan and the U.S. signed the memorandum of understanding on joint development of methane hydrates. Based on this agreement, a trial drilling will be conducted in Alaska by the end of FY2015 at the earliest, in preparation for an onshore production test scheduled later. It is important to move ahead with technical developments toward commercialization through a long-term offshore production test that will be conducted in 2017 using various improvement technologies, and through collaborative demonstration tests with the U.S..
- It is known that near-surface methane hydrate deposits exist mainly on the Japan Sea side, and the survey to estimate their reserves will be completed by the end of FY2015. Methane hydrate reserves in waters around Japan will be assessed based on the results from the long-term tests described above. If the existence of sufficient quantities of methane hydrate reserves is confirmed as a result of the assessment, the Japanese government will go ahead with full-scale research and studies about resource recovery technologies. It is recommended that this possibly world-leading project be stepped up toward the technical development phase in a way that allows many ideas to be incrementally narrowed down to a few, without being trapped by stereotypical views, by inviting experts from various fields, and incorporating many different ideas.
- With respect to the development of wet natural gas, similarly to its development of crude oil, needs to push along its exploration activities by expeditiously conducting basic drilling surveys, while continuing to utilize SHIGEN.



- It is expected that substantial quantities of natural gas reserves exist in domestic water-soluble natural gas fields, which include the South Kanto region, the largest gas reserves in Japan. However, its current production volume is limited to low levels in consideration of possible ground subsidence when the volume is increased. In FY2014, the potential of the water-soluble natural gas fields in the South Kanto region was re-evaluated from the viewpoints of the securing of domestic energy resources and the creation of next-generation industries, proposing the direction of future technical developments related to sustainable production. It is important to move ahead with the development of water-soluble natural gas in the future, by studying how to implement onsite demonstration tests concerning the return of groundwater to the shallow ground layer and the gas production in the shallow waters, which does not involve onshore ground subsidence.
- The potential of these domestic energy resources will help enhance our bargaining power in future negotiations with overseas natural gas producers.

(e) Approaches to gas supply security

- The above-mentioned Russia-Ukraine dispute made European countries recognize once again the importance of gas supply security. That event made them more concerned about the energy security risk stemming from its dependence on natural gas supply through the gas pipelines from Russia. In G7 Energy Ministers Meeting 2015, too, developed countries shared the importance of securing stable gas supply.
- Unlike IEA that flexibly rearranges crude oil supply destinations in the event of a supply disruption somewhere in the world, there is no such international forum or mechanism for natural gas. LNG is very difficult to stock, and in fact is not stockpiled more than its working inventory.
- For Asia and Europe, which extremely rely on imported natural gas, the role of LNG is critical in the event of an emergency like a supply disruption, because it offers greater flexibility to energy transportation than gas pipelines. This observation makes it important to have a gas security perspective by linking the European gas market with its Asian counterpart including Japan.
- This is also the best opportunity for Japan, the world's largest LNG-consuming country, to take the initiative in encouraging productive international discussion in cooperation with IEA. As confirmed in the G7 summit in 2015, the 4th LNG Producer-Consumer Conference to be held in September 2015 will serve as the venue to discuss global gas supply security. Taking that opportunity, Japan should proactively share useful information with other member countries, while pursuing the possibility of enhanced cooperation among gas-consuming countries, which may involve gas-producing countries. To make it happen, it is recommended that Japan first list specifically what problems can happen in the event of an LNG supply disruption, and then discuss what actions both the production and consumption sides can take realistically, with the characteristics of LNG taken into consideration.
- Partly based on the agreement in the G7 summit in 2014, the number of the LNG contracts whose destination clauses are relaxed are gradually increasing, making it less harder to rearrange LNG supply destinations in case of an emergency. It is necessary to continue the effort to relax destination clauses, and at the same time enhance transparency and fluidity in the LNG market.
- In September 2014, an over-the-counter LNG trading market was opened for the first time in Asia. It is expected that the LNG trading market will be utilized effectively as a means for LNG user companies to hedge price fluctuation risks.

iv) LP gas (LPG)

(a) Diversification of exporting countries

- As described above, imported LPG accounts for about 80% of the total demand in Japan. Japan's dependence on LPG from the Middle East is still hovering around 72%, though it is declining as the import from the U.S. increases. In addition, about 16% of the total LPG supply is domestically refined imported crude oil. As 82% of that crude oil depends on the Middle East, Japan's net dependence on the Middle East for LPG supply remains around a little less than 74%.
- This is why the procurement of North American shale-associated LPG should be increased in the future. The share of the U.S. in Japan's LPG imports increased from about 10% in FY2013 to about 17% in FY2014. Spot-based LPG procurement by Japanese wholesale companies reached about 2 million tons in FY2014. With the current status of closed term-based contracts taken into account, the procurement of spot base LPG is expected to increase further. This is why Japanese LPG wholesalers are predicted to increase procurement from the U.S., which continues to be advantageous in pricing.
- It is important to continue to diversify LPG supply sources, for instance, by studying possible procurement from other countries than the U.S., which does not require transportation through choke points, such as Australia, East Timor, Africa, and Latin America. The recent movements of business integration between Japanese LPG companies may help develop a new strategic approach to the study on how LPG procurement should be diversified.

(b) Acquisition of upstream stakes

- In August 2014, Idemitsu Kosan started the import of LPG (butane gas) from Ferndale LPG Terminal (Washington, US) of PetroGas, a subsidiary of the Idemitsu–AltaGas (Canada) joint venture. Now that Japan established a new route for importing LPG from the west coast of North America, LPG procurement cost is expected to decrease significantly with compared to the existing routes around the Cape of Good Hope and through the Panama Canal. This new LPG import route is particularly important from the standpoint of our country's energy security, because it does not require passing through a choke point. In most cases, LPG is produced together with oil and natural gas. As several projects are now under way in Australia and U.S. progress, Japan's LPG procurement from these countries will likely to increase. It is hoped that the development of these LPG terminals will help our country diversify LPG exporting countries further.

(c) Cost reductions

- The import of LPG from the U.S. brought great merits to Japan from the standpoints of cost reductions as well as procurement diversification. In the first place, Mont Belvieu gas prices in the U.S. are generally lower than Saudi CP price indexes in the Middle East. The procurement of LPG at U.S. market prices contributed significantly to Japanese companies that are trying to reduce LPG procurement cost.
- In addition, the distribution of LPG at such low price levels in the international gas market led to the increased number of LPG arbitrage trades, which significantly dropped Saudi CP price levels. As a result, the price difference between Saudi CP and Mont Belvieu became smaller, and CP-based unit LPG import prices declined accordingly.
- Having two pricing options now, Japanese LPG buyers will be able to execute their bargaining power differently than the ways they tried to in the past.
- Furthermore, the current ocean freight for importing LPG from the U.S. to Japan is expected to decrease, once the extension work of the Panama Canal is completed. As a result, the competition between U.S. LPG and Middle Eastern LPG will likely to intensify in the future. Such market situation makes it possible that Japan will negotiate with Middle Eastern countries for more price reductions, while continuing to procure LPG from the U.S., making the most of their low prices.
- As described above, in April 2015 four Japanese gas-related companies integrated their LPG business into an alliance company called Gyxis Corporation. As a result, three major LPG wholesalers now hold about 80% share in Japan's total LPG import. In addition, ENEOS GLOBE Corporation and Atomos Energy Corporation recently announced that they started talks toward an extensive business alliance. Hopefully, Japanese LPG wholesale companies will pursue more joint procurement and business cooperation opportunities, which will help strengthen their negotiating power against LPG exporting countries.

(2) Development of demand and supply system in preparation for disruptions in fuel supply from overseas countries

i) Oil stockpiling

(a) Present state and role of oil stockpiling

National stockpiling, private stockpiling, and joint stockpiling with oil producing countries (JSOPC)

- In our country, there are three types of oil stockpiling programs, namely "national stockpiling" and "private stockpiling" in accordance with the Oil Stockpiling Act, and "joint stockpiling with oil producing countries (JSOPC)," which is equivalent to the first two. (As of the end of April 2015, the oil stockpiling are broken down to (1) national: crude 48.9 million kl / products 1.37 million kl (98 days worth on IEA (International Energy Agency) standard / 118 days worth per Oil Stockpiling Act), (2) private: crude 16.59 million kl / products 17.14 million kl (70 days

worth / 81 days worth), and then (3) JSOPC: crude 1.11 million kl (2 days worth on IEA standard, 3 days worth per Oil Stockpiling Act.)¹

- Japan's oil stockpiling system initially started as a private stockpiling program under administrative guidance, and then it was legislated as the Oil Stockpiling Act in 1975. National stockpiling started in 1978 and reached a level of 50 million kl in 1997. Since then, it has been hovering at almost the same level to date. When Japan started its oil stockpiling system, the standard private stockpiling was set at 90 days worth of domestic oil demand to meet the requirements IEA recommended at that time. After national stockpiling increased to a certain level, the standard private stockpiling had been reduced by 4 days worth every year since 1989, which then fell to 70 days worth in 1993. Since then, private stockpiling has remained at the same level to date.

Since 2009, Japan has been proceeding with a project called "Joint Stockpiling with Oil Producing Countries (JSOPC)" with the UAE (the United Arab Emirates) and Saudi Arabia². In this project, the state-run oil companies in the UAE and Saudi Arabia lease privately owned oil storage tanks located in Japan (Kiire, Okinawa). At ordinary times, these companies in the oil-producing countries are allowed to use that facility for their own commercial activities. On the other hand, when an oil supply disruption breaks out, this project scheme allows Japanese companies to preferentially receive the crude oil stored in those tanks. This is a significant project not only because our country will be able to quickly respond to an imminent oil supply disruption, but also because Japan may enjoy secondary benefits such as strengthened relationship with these oil-producing countries. During their meeting in February 2014, Prince Muhammad of the Emirate of Abu Dhabi, the UAE, and Prime Minister Mr. Abe agreed to increase the capacity of the oil storage tanks for the joint stockpiling project up to one million kl. Additionally, in November 2014 Mr. Takagi, Senior Vice Minister of Economy, Trade and Industry (METI), and Mr. Suweidi, a member of the Abu Dhabi Supreme Petroleum Council (SPC), signed a memorandum of understanding (MOU) about the continuation and expansion of this project.

- In the event of an oil shortage due to a supply (import) disruption from overseas, in the event of a shortage in a certain area due to the occurrence of a domestic disaster, or in the situation where such an oil supply shortage is considered highly likely to happen, Minister of METI can call (in accordance with the Oil Stockpiling Act) stockpiling release (i.e., the release of national stockpiling and the relaxation of the obligation to maintain private stockpiling—a reduction in the standard stockpiling). Similar instructions shall be applied to the release of JSOPC stockpiling. IEA member nations are supposed to undertake cooperative oil release in the event of a global-scale oil supply disruption, or in the situation where such an oil supply disruption is likely to happen. Japan participates in this framework.

Roles and positions of national stockpiling, private stockpiling, and joint stockpiling with oil producing countries (JSOPC)

- In the "Strategic Energy Plan" approved by the Cabinet in April 2014, "joint-stockpiling with oil producing countries (JSOPC)" was classified as the "third stockpiling" that is equivalent to national and private stockpiling. Based on this revision in the Plan, the roles and positions of "national stockpiling," "private stockpiling," and "JSOPC stockpiling" in our country's oil stockpiling policy could be re-classified as shown below. (The volume of "JSOPC stockpiling" is now positioned as quasi-national stockpiling, assuming that leased oil tanks always store crude oil equivalent to half the tank capacity.)
 - "National stockpiling" is the stockpiling held by the nation. This stockpiling plays a last-resort role by backing up gradually decreasing private stockpiling during initial response to an emergency situation.

¹ In addition to national oil storage terminals, national oil stockpiling is stored in leased private oil tanks (e.g., tanks at refineries). Private oil stockpiling is to oblige oil manufacturers (such as refineries, wholesalers, and trading firms) to hold the quantities of oil exceeding their operating stock. Such stockpiling is stored at each company's refineries and oil tank sites.

² In December 2009, a project between JX Nippon Oil & Energy Corporation and Abu Dhabi National Oil Company (ADNOC) started at JX Kiire Terminal in Kagoshima Prefecture. In February 2010, another project started at Okinawa CTS Terminal (OCC) in Okinawa, in cooperation with Saudi Aramco.

- "Private stockpiling" is the stockpiling held by domestic oil manufacturers. This stockpiling is highly mobile, which allows oil products to be immediately supplied from refineries to the market. For this reason, this stockpiling plays the role of initial response to an emergency situation.
- "JSOPC stockpiling" is the stockpiling held by state-run oil companies in oil-producing countries. These companies guarantee that Japanese companies will preferentially receive crude oil in an emergency situation. Just like national stockpiling, this stockpiling plays the role of backing up private stockpiling on an as-needed base.

Emergency stockpiling release (e.g., oil import disruption due to a Middle East crisis)

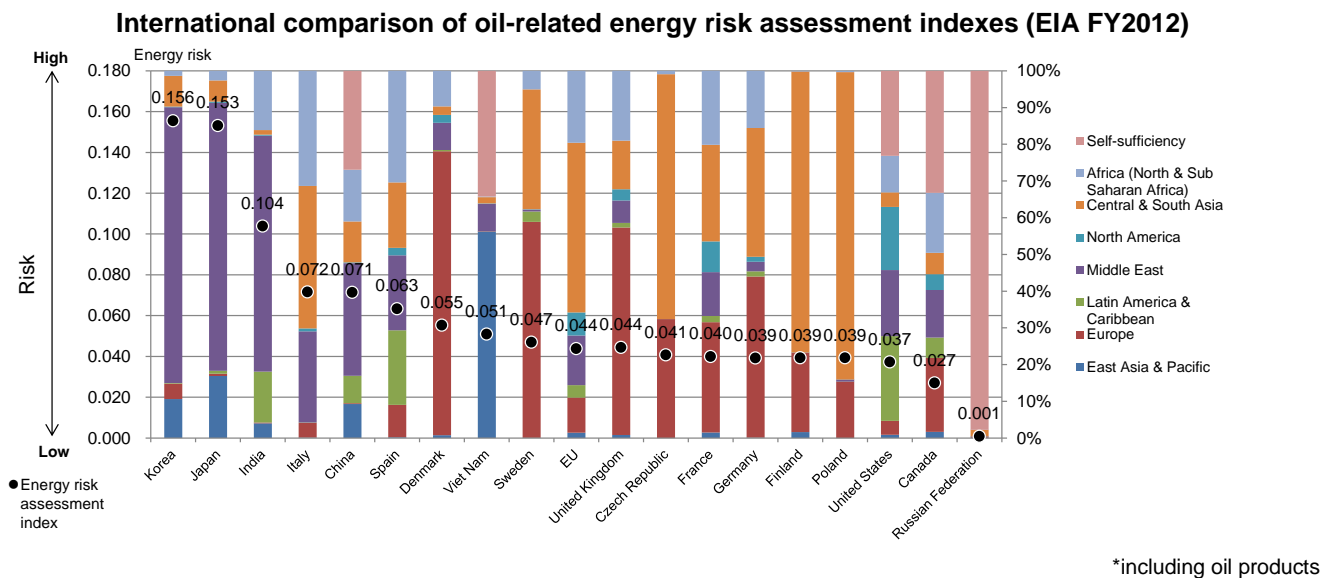
- In the event of an oil import disruption, for example, due to a Middle East crisis, oil stockpiling will be released incrementally, with the severity of the supply disruption regularly checked. Even in such an emergency situation, oil products like gasoline will be distributed through its regular oil supply chain via the refining process at refineries and the intermediate storage at oil tank sites. For this reason, the crude oil stock sitting at refineries and oil tank sites, namely private stockpiling, will be supplied in principle to the market first. And national and JSOPC stockpiling play the role of backing up gradually decreasing private stockpiling on an as-needed basis.
- In about three weeks after the occurrence of an emergency, oil tankers at sea navigating east of the Strait of Hormuz will be arriving at refineries in Japan one after another. Under this critical situation, the Japanese government calls for self-controlled use of oil for unnecessary and non-urgent applications (i.e., voluntary demand control). The government implements a "reduction in private stockpiling requirements (in terms of days worth), determines the "nomination of oil refineries and wholesalers"³ (by listening to them what oil types they want released and how much)" in preparation for the release of national and JSOPC stockpiling, makes sure that all stockpiling release procedures have been set up, and finally green-lights the release of oil stockpiling to the market.
- After all these tankers (offshore oil stock on tankers) arrived at destinations, the Japanese government makes decisions on an "additional reduction in private stockpiling requirements" and an "additional release of national and JSOPC stockpiling" for the purpose of replenishing decreasing private stockpiling with national and JSOPC stockpiling.
- Despite the stockpiling release, if the oil supply disruption seems to linger, and if a major oil shortage is likely to happen, the Japanese government needs to invoke the Petroleum Supply and Demand Adjustment Act in order to start tighter oil demand and supply control (i.e. forced demand control).
- The Japanese government should take public's consumer psychology into full consideration, which helps minimize the confusion in the daily life of people stemming from the fuel supply problem. It is therefore recommended that the government develop a refined and sophisticated risk communication system at ordinary times, so that unified and coordinated information would be distributed in a speedy, timely manner. Such a system would provide a sense of security, without fanning uneasiness among people. For instance, the Japanese government may want to announce, at an early stage when the situation is not yet so serious, that the country is prepared for national oil stockpiling release to the market. In this case, however, the citizen side may believe that the country might be already in such a pressing situation that requires national stockpiling release. Some experts point out that such a government action may trigger unnecessary confusion among people. As illustrated in this specific example, utmost attention should be paid to how such critical information should be shared and distributed in the event of an emergency. This is the kind of systems that should be prepared at ordinary times.

(b) Concept of future stockpiling mix: total, national, private, and JSOPC oil stockpiling

- The international risk comparison based on energy risk assessment indexes clearly shows in the figure below that Japan and South Korea are exposed to high oil procurement risks.

³ These oil refineries and wholesalers refer to Oil Refineries and Specified Oil Distributors stipulated in Oil Stockpiling Act.

Despite its oil stockpiling in excess of the average of net oil importers among IEA member nations, Japan should be fully prepared against possible oil supply disruptions on an on-going basis.



- Based on the situation above, our country should hold total oil stockpiling (i.e., national, private, and JSOPC combined) well in excess of the 90-day-worth standard oil stockpiling that IEA wants its member nations to maintain. In this case, the volume of crude oil equivalent to a half of "JSOPC stockpiling" is set as quasi-national stockpiling as described earlier, and Japan should secure "roughly 90-day-worth" oil stockpiling, which is equal to the sum of "national stockpiling" and "a half of JSOPC stockpiling."
- In light that the "JSOPC stockpiling" scheme brings the secondary benefits that the relationship with the partner oil-producing countries can be strengthened, Japan is going to expand the scale of the existing JSOPC stockpiling projects with the UAE and Saudi Arabia. In anticipation of additional project partner countries, Japan needs to continue to promote this kind of effort in the future. When expanding the scale of this project (in volume and additional partners), however, the remaining capacity of oil tanks available in Japan, and how to share cost between the two parties, should be taken into account. Because it is difficult to find domestic oil tankers of adequate sizes recently, the transportation capacity required to haul oil from stockpiling terminals to domestic destinations will have to be increased.
- If an unexpected decrease in demand renders stockpiling-related assets (such as crude oil and tanks) extremely surplus in the future (over 90 days worth of stockpiling), Japan should take every possible measure for the effective use of such assets.
- It is recommended to review the existing oil stockpiling policy on an ongoing basis, reflecting the changes in oil demand and supply conditions, and with the help of energy risk assessment indexes (security indexes). As mentioned above, private stockpiling is responsible for initial response to an emergency situation, and its standard stockpiling volume is set at "70 days worth" in the Oil Stockpiling Act and its Implementation Ordinance. The concept for "70 days worth" would have to be reviewed separately and deliberately from various viewpoints, such as (1) the influence on the existing nation-wide oil supply networks, given that each oil wholesaler group today has a different set of nation-wide distribution network that includes oil tank sites and service stations. (If that target is chosen, it may end up worsening the current problem of sparsely distributed service stations), (2) the influence on companies that have stockpiling responsibilities from the standpoints of financial evaluation, business reconstruction (e.g., for what purposes refineries are utilized), and international competitiveness; and then (3) crude oil procurement risks that vary depending on the country.

(c) Response to management issues about national oil stockpiling Improvements in mobility of national stockpiling release

- National stockpiling plays the role of backing up decreasing private stockpiling in the event of a supply shortage due to a disrupted crude oil import. This is why "mobility" in stockpiling release should be improved on an ongoing basis. (Mobility is the ability to efficiently release substantial quantities of crude oil to satisfy the urgent needs of oil refineries and wholesalers that are supplying energy using crude oil to the market.) Improving the mobility would require "ensured tanker transportation capacity," "continued training," and "improved capability at oil terminals" from a quantitative viewpoint (i.e., the viewpoint of efficiently releasing substantial quantities of crude oil). On the other hand, from a qualitative viewpoint (i.e., the viewpoint of releasing the crude oil that satisfies the characteristics of refining facilities and the needs of oil refineries and wholesalers), Japan is going to accelerate the pace of rearranging the oil-type mix (heavy, medium, and light) in national oil stockpiling to the oil-type mix in crude oil being imported today. To enhance mobility in stockpiling release, such oil-type rearrangements should be implemented in effective and creative ways, for example, as part of releasing training.

Enhanced safety and efficiency in management system of national oil stockpiling

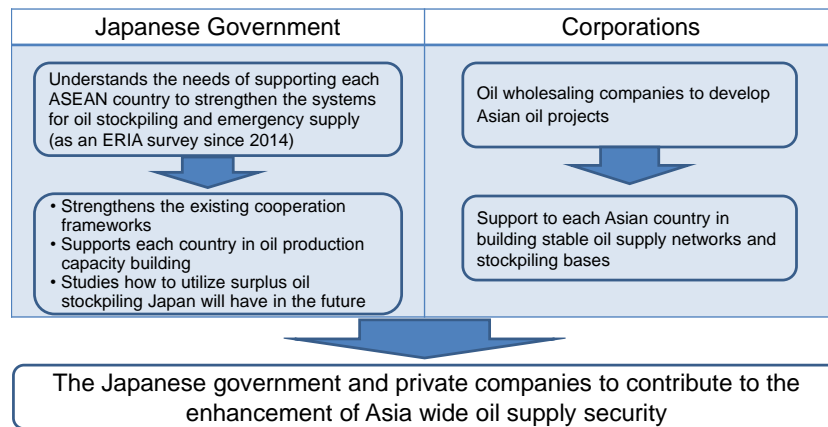
- As a result of the ongoing project reviews aimed at improved efficiency, total outsourcing expenses, such as for national oil stockpiling management, which is the cost required to manage national stockpiling oil and terminals (10 in total), have been reduced by roughly 20 billion Yen in the past 10 years. The budget for such outsourcing expenses for FY2015 was compressed to around 43.1 billion Yen.
- In addition, based on the instructions made during the Budget Execution Audit 2014 by the Ministry of Finance, the subsidies for oil stockpiling projects (e.g., private tank leasing charge), which cover the cost required to store national oil stockpiling in leased tanks at refineries and oil tank sites that are owned by oil refining and wholesaling companies, have been streamlined to make budget spending more effective. The costs required to manage national oil stockpiling and terminals will have to be streamlined on an ongoing basis to the extent that would not hamper political objectives such as the maintenance of safety and mobility improvements.

(d) Support for building Asia-wide energy security

- Oil demand in non-OECD (and non-IEA) Asian countries is expected to grow further in the future. This means that Asian countries face the same problems as Japan does when a global crude oil disruption such as a Middle East crisis occurs. To enhance our country's energy security, it is important that the whole Asian region will improve their crisis management capability and prevent panic attacks when such an emergency actually happens.
- But today, only a few ASEAN countries hold oil stockpiling, but the level of their stockpiling volume is lower than the 90 days worth that IEA obliges its member nations to maintain.
- In cooperation with domestic and overseas institutions such as ERIA (Economic Research Institute for ASEAN and East Asia)⁴, the Agency for Natural Resource and Energy is providing bilateral and multilateral support for the training programs of human resource development and emergency response, which are designed to step up oil-related energy security in the Asian region. In FY2014, the Agency together with JOGMEC provided data required to develop a master plan and proposed conceivable policy options for a Cambodian oil-stockpiling program. In June 2015, in cooperation with JOGMEC and IEA, the Agency also provided a week-long program for human resource development to director-general-level officers who were responsible for oil-related government policies in each ASEAN country.

⁴ ERIA, an institution that was established in 2008 for the purpose of promoting economic integration in East Asia, provides analytical research and policy recommendations. At present, 16 countries—10 ASEAN countries, Japan, China, South Korea, India, Australia, and New Zealand--participate in the institution headquartered in Jakarta (Indonesia).

- Our country should support the development of Asia-wide energy security, not just from its viewpoint but also by the involvement of all other Asian countries that face the same geopolitical and disaster risks regardless whether it is multi or bilateral support. This type of support should be boosted in combination with other development projects promoted by Japanese oil industry in Asian countries. This topic is described later.



(e) Concept of supply prioritization and demand restraints in emergency

- In the event of an emergency like an oil supply disruption from overseas, if the supply disruption lasts for a long period of time, and if an oil supply shortage is likely to happen despite stockpiling release measures, the demand-supply balance will be adjusted in accordance with the Petroleum Supply and Demand Adjustment Act.
- In an effort to develop a legal framework for oil demand-supply balance and pricing in emergency, the Petroleum Supply and Demand Adjustment Act was enacted in 1973 after the first energy crisis occurred, along with the "Act on Emergency Measures for Stabilization of National Life." Although the Japanese government actually took some measures under this Act in the wake of the first energy crisis, there has not been another case since then. At the time of the first energy crisis, based on the Petroleum Supply and Demand Adjustment Act, and also in accordance with a notification of the implementation of measures by Prime Minister (Article 4, Paragraph 1), the Japanese government invoked the setting of an oil supply target by (then) Minister of Economy, Trade and Industry (METI) (Notification) (Article 5), the implementation of restricted oil use (Ordinance) (Article 7), and the notification of a target for oil use reduction (Article 8). Prior to the enactment of this Act, under administrative guidance by (then) METI, the Japanese government implemented measures to save the use of gasoline for unnecessary and non-urgent applications (e.g., self-restraint service station operation on Sundays and holidays), and the installation of advisory offices in each prefecture where the Petroleum Commercial Union helped local users find available oil products.
- As extension of these measures, this Act also includes other provisions, such as the instructions from METI Minister to service station owners for restrictions on fueling quantities and the shortening of service hours (Article 9), and then necessary support to help ordinary consumers and medium- and small-sized business owners find available oil products (Article 11). If these measures have trouble improving the situation, this Act is allowed to stipulate other necessary provisions on forced demand-supply adjustments (e.g., oil allocation and distribution), though such provisions have not been implemented to date (Article 12).

Summary of demand-supply control measures in accordance with the Petroleum Supply and Demand Adjustment Act

[Demand restraints]

- Restrictions on oil use (Article 7)
- Obligations of fuel use reduction efforts to meet oil saving targets (Article 8)

[Supply control]

- Setting of oil supply targets by Minister of Economy, Trade and Industry (Article 5)
- Development and submission of oil refineries' plans for oil production, import, and distribution (Article 6)
- Restrictions on how oil distributors sell oil products (Article 9)
- Minister of Economy, Trade and Industry can instruct designated oil distributors to set aside oil for businesses and activities that are essential to the protection of people's lives, health and properties, or the securing of public interest (Article 10)
- Minister of Economy, Trade and Industry can instruct oil distributors to help find available oil for ordinary consumers, small- and medium-sized business, agriculture, forestry, and fishery operators, and also for railway, communication, and medical services, and other businesses and activities of high public interest (Article 11)

- At ordinary times, relevant ministries, local governments, and business operators should try to understand and share (1) specific operations of measures for demand-supply adjustments in emergency situations, and (2) oil types and quantities that ordinary households and socially important infrastructures would need. In addition, these groups should always get people to understand and share the concept of supply prioritization, which will help minimize fuel supply related confusion among people.
- With respect to policy-based supply prioritization and demand restraints, which would help improve the effectiveness of these measures and minimize impacts on the people's life in emergency situations, the accuracy level of simulation studies based on likely emergencies should be enhanced. At the same time, it is important for both the demand and supply sides to share the same understanding, as pointed out in the interim report of Oil and Natural Gas Committee in FY2014.
- For instance, the prioritization listed below is based on the standpoint of minimizing impacts on people's life. When applied to real situations, however, final prioritization judgments should not be made stereotypically but based on the conditions on the disaster-hit areas.

Fuel supply for logistics services (distribution of everyday commodities) **takes priority over** that for the movement of people (e.g., sightseeing and leisure)
Fuel supply to consumer goods manufacturing facilities **takes priority over** that to amusement facilities
Fuel supply to public transportation **takes priority over** that for privately owned vehicles
Fuel supply to medical institutions **takes priority over** that to other types of institutions

ii) **LP gas stockpiling**

- National oil gas stockpiling is stored at national LP gas stockpiling terminals at five locations in Japan. LP gas filling is currently under way at two underground terminals in Kurashiki and Namikata, whose facilities were completed in March 2013, and the level of LP gas stockpiling at the end of March 2015 was around 950 thousand tons, or 32 days worth of the standard stockpiling volume stipulated in the Oil Stockpiling Act.
- According to "Oil Product Demand Forecast FY2015–FY2019," the demand for LP gas in FY2019 is forecasted to be 2.9% higher compared to FY2014 levels, and the 40-day-worth of the total LP gas imports is forecasted to increase to around 1,350 thousand tons. With the upward trend in the "40-day-worth" stockpiling volume continuing from FY2014, the

stockpiling cost of national LP gas should be cut further by comparing costs with other national and private stockpiling terminals. It is also important to achieve the target of importing and storing 1.5 million tons of LP gas at the national LP gas stockpiling terminals by FY2017.

- In its FY2014 interim report, Oil and Natural Gas Committee concluded that, given the recently increasing LP gas import from the U.S., the standard private LP gas stockpiling volume should be carefully reviewed on the assumptions that (1) LP gas business operators have reliable systems and operational plans in place, by which they will definitely be able to supply the fuel to the domestic market even in the event of an emergency situation, and (2) when the stockpiling cost of oil gas importers decreases, that portion of the cost reductions should be reflected to their distribution prices. As described later, in fact, the decreases in LP gas import and wholesale prices have not been reflected to retail prices to date. Because LP gas import is forecasted to continue to grow, particularly import from countries where geopolitical risks are low, the above-mentioned assumptions should be discussed in more detail in the future, while checking how much progress Japan has made thus far.

iii) Natural gas stockpiling

- Japan has been diversifying its natural gas exporting countries, and its dependence on the Middle East has fallen to about 30%. For this reason, it is highly likely that Japan will be able to avoid a natural gas shortage in the event of a supply disruption caused by the Middle East. In addition, because about 70% of the currently imported natural gas is consumed for electric power generation, a supply disruption caused by the Middle East could be taken care of by alternative electric power sources. Natural gas, which is difficult to stockpile in a gas state, needs to be stored in tanks as liquefied natural gas (LNG). The storage of natural gas requires a huge amount of additional investments, such as the cost of additional energy required to keep the gas in a liquid state and the cost of constructing new storage tanks.
- From the standpoints described above, stockpiling of natural gas should be deliberately studied taking its feasibility and cost effectiveness into full consideration. In the meantime, the use of underground gas storage facilities built in depleted gas fields might reduce LNG procurement cost in the future by taking advantage of seasonal LNG spot price differences. Intensive legal and technical studies should be conducted on an as-needed basis, so that necessary measures could be taken when storage capacity in gas fields ramps up at some point in the future.

3. Establishment of energy demand-supply control system in preparation for possible disasters

- In the wake of the Great East Japan Earthquake on March 11, 2011, not only oil supply infrastructures (e.g., refineries and oil storage sites) but also logistics infrastructures (e.g., roads, railroads, and ports) as well as logistics means (e.g., tank lorries and tankers) were damaged or destroyed in the wide-ranging areas from the Tohoku region to the Kanto region. Due to the lack of integrated systems for oil supply coordination and support, the government and the oil industry had to spend a lot of time setting up an emergency oil supply system, having trouble supplying oil to the disaster-hit areas in an expeditious manner.
- Based on the lessons learned from their slow response to that earthquake disaster, the Japanese government and the oil industry have worked out necessary measures in preparation for future disasters. They are striving to establish emergency energy demand-supply control systems in preparation for upcoming catastrophic disasters (e.g., Tokyo Inland earthquakes, Nankai Trough earthquakes). To develop such new supply systems designed to cover the entire oil supply network, which are capable of supplying oil products to disaster-hit areas and victims, the Japanese government and the oil industry need to develop both software- and hardware-based countermeasures in a vigorous, urgent manner, with the support of the oil industry, other related industries, relevant ministries and agencies, and local governments.

(1) Facilitated emergency demand-supply adjustments and logistics (mainly software-based measurements)

i) Oil

(a) Decentralized national oil product stockpiling across the country, effective stockpiling release, and risk communication

- National oil stockpiling at the time of the Great East Japan Earthquake was intended for only crude oil supply disruptions from overseas countries, and almost all the stockpiling consisted of crude oil. In the first place, there had been no legally bound measures in Japan for stockpiling release in response to natural disasters. Based on the lessons learned at that time, the Japanese government amended the Oil Stockpiling Act and legally enabled the application of oil stockpiling release to domestic natural disasters. Today, about 4 days worth of total demand for gasoline, diesel oil, kerosene, and type-A heavy oil are separately stocked across the country as national product-form stockpiling ready for immediate release in the event of a disaster. To adequately balance stockpiling volume among different regions, 4 days worth of the demand at each of the 10 regional blocks should be targeted and achieved as soon as possible. These requirements are specified in the Plan for Joint-Operations of Oil Supply in Disasters (i.e., the Oil Stockpiling Act).
- More discussions should be held to work out practical and specific emergency measures in the event of a supply shortage due to a domestic disaster, and develop the procedure and concept on stockpiling release. One of the lessons learned from the Great East Japan Earthquake is that when the standard volume of private stockpiling is tentatively relaxed after a disaster occurs, piecemeal and incremental relaxations, for example, "3-day- worth reduction" can hamper the oil refining and wholesaling companies that are delivering oil products to the disaster-hit areas in an expeditious, flexible manner. Some experts point out, however, that drastic relaxations should be implemented immediately after a disaster breaks out, if there is no imminent risk of an oil supply disruption from overseas and the disaster-hit areas want oil products delivered quickly.
- Similarly to the response to an oil supply disruption from overseas, utmost attention should be paid to the way to send and distribute emergency information about stockpiling release. It is important to develop a sophisticated risk communication system at ordinary times, by taking people's consumer psychology into full consideration, and by providing people with the sense of security, instead of fanning their anxiety. Such risk communication would allow unified information to be shared with people in an urgent, appropriate manner.

(b) Summary of concepts on prioritizing urgent supply requests

- If a catastrophic disaster like a mega-earthquake occurs, the Japanese government is set to lead emergency oil supply operations in response to urgent supply requests from the disaster-hit prefectures. There is an argument about how the government should prioritize presumably a substantial number of supply requests in such an emergency situation. In the "Fundamental Plan for National Resilience" (which was approved in the Cabinet meeting in June 2014), there is a statement that says, "Assuming that there will be limitations to emergency oil supply in the wake of a catastrophic disaster, our country will summarize in advance its concepts on how to prioritize emergency oil supply destinations."
- On the other hand, the stereotypical prioritization of supply destinations may lead to ill effects, which will have to be carefully avoided. In addition, a large number of prioritized facilities may contribute to the loss of the initial objective of prioritization, which also will have to be avoided.
- Based on the points discussed above as well as the degree of contribution to emergency post-disaster restoration, the following points seem to represent our concepts on how emergency oil supply destinations should be prioritized.

Fuel supply to disaster-hit areas **takes priority over** fuel supply to other areas

Fuel supply to core service stations **takes priority over** fuel supply to ordinary service stations

Fuel supply to emergency vehicles **takes priority over** fuel supply to ordinary vehicles

Fuel supply to public facilities serving as central shelters **takes priority over** fuel supply to other public facilities

Fuel supply to designated public and local public institutions for post-disaster operations **takes priority over** fuel supply to ordinary private companies for business continuation

- The concepts of supply prioritization vary by many factors, such as where the disaster occurs (e.g., isolated area, remote island), and when it occurs, and the severity of damage. And supply prioritization should be determined based on actual damage conditions in each case. Such concepts of supply prioritization may be accumulated and systematized to a high level over time, after experiencing more similar damage scenarios in the future. Always getting many people to understand and share the resulting concepts of prioritization is considered to contribute to smooth fuel supply in the event of an emergency.

(c) Concept of demand-supply control and supply prioritization when Petroleum Supply and Demand Adjustment Act is invoked

- When a substantial domestic oil shortage occurs in the event of a disaster, and if the shortage seems to impact people's life seriously, the Petroleum Supply and Demand Adjustment Act will be invoked.
- In the event of a "catastrophic" disaster, unlike the concept of supply prioritization after a supply disruption from overseas, oil supply should be prioritized from the standpoints of ensuring the operation of alternative power sources that will serve to back up disaster relief activities by the Self-Defense Forces (SDF) and others, and starting the operation of heavy-duty vehicles and equipment to open up and restore disaster-hit road and port infrastructures and suspended electricity and city gas supplies. Based on these points, all concerned parties should have the same understanding in interpreting and executing the specific supply prioritization stipulated in the Petroleum Supply and Demand Adjustment Act.

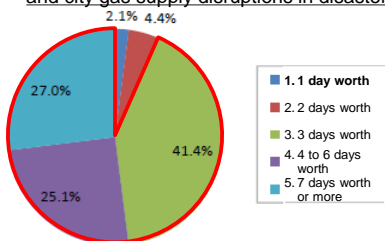
(d) Promotion of user-side "self-stockpiling"

- All of the above-mentioned measures are related to backup measures from the viewpoint of the supplier side. Based on the lessons learned from the Great East Japan Earthquake, the user side, too, should take and strengthen similar countermeasures, understanding that there are limitations to what supplier-side stockpiling can accomplish.
- In the wake of the Great East Japan Earthquake, our country faced the situation, "While there is enough oil in stock in hand, but there is no way to take it out there" because of damaged road and port infrastructures and shortages of transportation means (e.g., tank lorries). Given that a Tokyo Inland earthquake and a Nankai Trough earthquake are imminent, it is important to maintain the operation of socially important infrastructures (e.g., hospitals, telecommunications, broadcasting, financial institutions), which are integral to the protection of human lives and the maintenance of social functions even during the period before the road and port infrastructures are restored and logistics services are resumed. As to fuel used to drive emergency generators, the demand side responsible for the maintenance of socially important infrastructures should promote "self-stockpiling" by all means.
- According to a survey conducted by ANRE in 2014, only about a half (53.4%) of the surveyed facilities in broadcasting, telecommunications and finance sectors as well as disaster base hospitals (a total of 699 facilities) stockpiled 3 days worth or more of fuel for private power generation. Even among the surveyed socially important infrastructures in which "self-stockpiling" effort was under way, (1) many of them stockpiled type-A heavy oil (which is susceptible to quality deterioration), and (2) their stockpiled fuel has not been replaced,

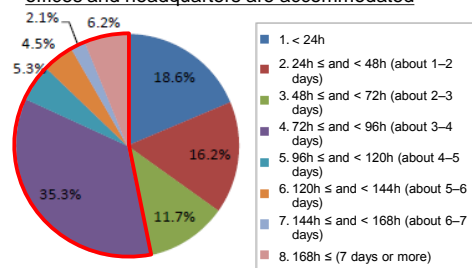
consumed, or checked for quality deterioration on a regular basis. The survey results raised a concern about the possibility that the use of aged fuel might cause problems in operating power generators, even if they are well maintained and the fuel is stockpiled at ordinary times.

- The government needs to support the development of measures for the maintenance of fuel quality, in cooperation with relevant ministries and agencies, by further promoting self-stockpiling effort in these socially important infrastructures, and by sharing necessary information (e.g., results of research on preventing fuel quality deterioration) with the user side. The ANRE, having already conducted a survey on oil product quality deterioration, should share the study results with as many demand-side facilities as possible. Following this survey on fuel quality deterioration, the ANRE should conduct additional surveys and experiments toward the achievement of long-life fuel stockpiling. To support such self-stockpiling initiative in socially important infrastructures utilizing the results of this survey and others, the oil industry is expected to commercialize and distribute long-life diesel oil that contains an additional amount of oxidation inhibitors, and proactively promote its quality control and replacement services as new business.

● Days of oil and LP gas stockpiling considered sufficient to survive electricity and city gas supply disruptions in disasters

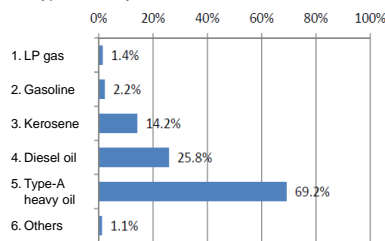


● Days of fuel stockpiling for private electric generators at socially important facilities such as corporate and government buildings, where head offices and headquarters are accommodated



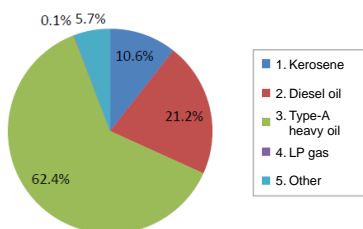
● Types of stockpiled fuel oils

About 70% of the stockpiled fuel oils is "type-A heavy oil."



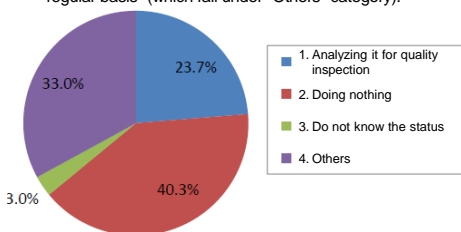
● Fuel types used for private electric generators

The mix of fuel types for private electric generators consists of "type-A heavy oil" that accounts for the largest at about 60%, "diesel oil" about 20%, and "kerosene" about 10%.



● Quality control

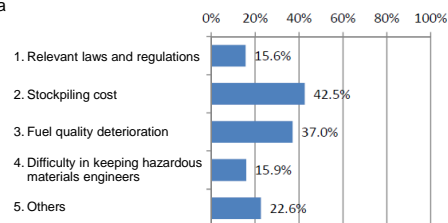
About 40% of the facilities surveyed "are doing nothing" about fuel quality control. And, about 20% "are analyzing it for quality inspection," and about 30% are conducting "fuel quality inspections by actually operating the generator" and "fuel replacement on a regular basis" (which fall under "Others" category).



- ["Other" major fuel maintenance methods]
- Making sure fuel quality is maintained, by operating the generator
 - Fuel replacement on a regular basis
 - Use of conventional fuels

● Issues involved in stockpiling fuels

About 40% of the specific obstacles and issues involved in stockpiling fuels are related to "stockpiling cost" and "fuel quality deterioration."



- ["Other" major issues]
- The need to locate an appropriate stockpiling point and space
 - The need to negotiate with the building owner
 - Because of the uncertainty of fuel supply in the event of an earthquake disaster, efficiently estimating stockpiling is difficult.

- Additionally, the Japanese government has been providing support for installing and implementing oil product tanks and private power generation facilities at public facilities that serve as temporary shelters in disasters (e.g., schools, community centers) and private facilities where evacuation of occupants is deemed practically difficult (e.g., hospitals, special nursing homes) through the "Oil Products Use Promotion Project". It will be required in the future to raise public awareness on disaster preparedness, such as practicing frequent refueling of private use vehicles and commercial vehicles with gasoline or diesel and stockpiling of kerosene. Specifically, it is hoped that the Japanese government will utilize public information etc. in encouraging municipalities and relevant industries to clarify the placement of the said activities in their disaster preparedness and response measures.
- Even if fuel is stockpiled at a facility, you cannot start the power generator when electricity supply is interrupted. For this reason, the Japanese government needs to support the installation of self-sustaining equipment with built-in batteries (e.g., ecofeel: high efficiency oil-fired water heater) at public facilities (e.g., schools, hospitals, communication centers) and individual houses.

(e) Designation of oil refining and wholesaling companies as "designated public institutions" stipulated in Disaster Countermeasures Basic Act

- Effective on April 1, 2015, eight oil refining and wholesaling companies⁵ were designated as additional "designated public institutions" in accordance with the Disaster Countermeasures Basic Act. This opportunity allows the oil industry to strengthen at ordinary times the relationship with other designated public institutions and designated administrative agencies with respect to disaster response countermeasures. As a result of this designation, the oil industry took clearly defined responsibilities in our country's overall disaster response initiative (e.g., formulation and disclosure of the "Disaster Management Operation Plan," implementation of disaster emergency responses under the direction of the Director-General of Disaster Control Headquarters). On the other hand, several pending issues have been addressed in order to facilitate emergency disaster countermeasures and post-disaster restoration, which include the simplified procedure for tank lorries passing through emergency routes (only advance notification of "emergency traffic vehicles") and granted access to "Central Disaster Management Radio Communications Network."

Preferential treatment granted to "designated public institutions" and resulting obligations

Preferential Treatment	Obligations
<p>(1) When taking emergency disaster countermeasures (e.g., urgent oil supply, early restorations of refineries, oil tank sites, etc.), these institutions are allowed to notify in advance their vehicles like tank lorries as "emergency traffic vehicles" (which are permitted to pass emergency routes even just after the occurrence of a disaster). (This simplified procedure allows the institutions to scramble their tank lorries to the disaster-stricken areas.)</p> <p>(2) These institutions are granted access to "Central Disaster Management Radio Communications Network." (The network is a communication line that connects the prime minister's office, central government offices, designated public institutions, prefectures, and the five major cities in the Tokyo metropolitan area, and shares information about damage situation and the status of countermeasure implementation in the event of a disaster.)</p> <p>(3) During post-disaster restoration activities, these institutions are exempted from various obligations imposed under the Environmental Impact Assessment Law (Environmental Assessment Law). (Those obligations include careful considerations in the planning stage, choices of target objectives, decisions on assessment procedures, the implementation of assessment, hearings on assessment results, etc.)</p>	<p>(1) These institutions are obliged to formulate and publicize their "Disaster Management Operation Plans"^(*) (in which each institution lays out its own tasks in line with the Basic Disaster Management Plan).</p> <p>^(*) The Regional Disaster Prevention Plans formulated by prefectures shall not conflict with the "Disaster Management Operation Plans" prepared by designated public institutions (Article 40).</p> <p>(2) These institutions are requested to offer necessary cooperation under the instruction of Director-Generals of Disaster Control Headquarters, which includes implementing emergency disaster countermeasures, providing useful data and information, etc.</p> <p>(3) These institutions are asked to implement disaster prevention measures (e.g., reorganization, education, exercises, supplies, stockpiling, maintenance, inspection), emergency disaster measures (e.g., issuing warnings, evacuation calls, the urgent restoration of socially important facilities/equipment, information gathering, reporting of damage situation), and then disaster measures.</p>

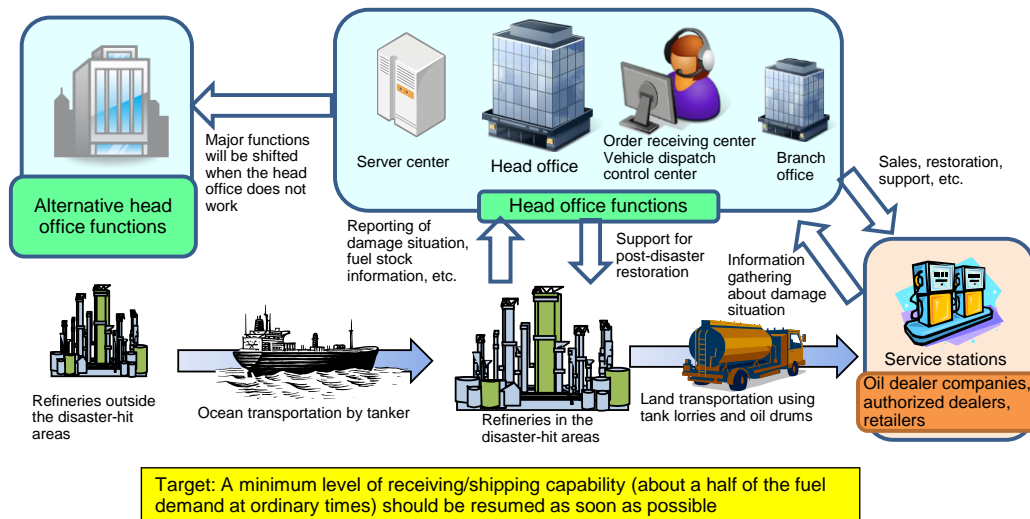
(f) Evaluation ratings and constant reviews of "Affiliate Companies BCP" for oil refining / wholesaling companies

- The oil supply chain in Japan is made up of "oil refining / wholesaling companies," which refine oil products mainly at their refineries and then wholesale the products through their distribution channel, "transportation companies," which transport the products to service stations and other destinations via tankers and tank lorries, and then "subsidiary sales companies, authorized dealers, and retailers (which belong to each oil refining and wholesaling company)," which sell the products at their service stations. On the other hand, the oil supply chain is built on a number of business operators that do not necessarily belong to the same capital group. For this reason, the early recovery of the following functions is required in the event of a catastrophic earthquake in order to resume oil supply as quickly as possible, while those business operators are working hard in a unified manner: (1) demand-supply adjustment and tank lorry dispatch control functions at the head offices of oil refining and wholesaling companies, (2) receiving and shipping functions at refineries and oil storage sites, and (3) logistics and distribution functions at transportation companies, and subsidiary sales companies, authorized dealers, and retailers (affiliate service stations). To

⁵ Eight oil refining and wholesaling companies: JX Nippon Oil & Energy, Idemitsu Kosan, Showa Shell Oil, Cosmo Oil, TonenGeneral Sekiyu, Fuji Oil, Taiyo Oil, and Nansei Sekiyu

this end, each oil refining / wholesaling company formulates its "Affiliate Companies BCP (Business Continuity Plan)," which covers the entire supply network of its affiliate companies, which ranges from refineries to service stations, in response to a request from the Agency for Natural Resources and Energy (ANRE), based on the guideline developed by Petroleum Association of Japan, and on the assumption that a Tokyo Inland earthquake or a Nankai Trough earthquake is likely to occur.

Functions that should be covered in "Affiliate Companies BCP" of each oil refining / wholesaling company



- In FY2013, the ANRE started to have external experts review and rank "Affiliate Companies BCP" formulated by each oil refining / wholesaling company (with the results not disclosed). Based on FY2013 review results, which was positioned as "trial phase," the evaluation standards for Affiliate Companies BCP were amended in FY2014, which included (1) itemized evaluation standards and (2) comprehensive evaluation standards. The amendment was made for the purpose of raising the level of the existing post-disaster supply recovery targets and ensuring its effectiveness, and from the need to leave some margin for the fair evaluation of additional creative ideas proposed by each company. In FY2014 review, it was confirmed that each company tried to improve its crisis management capability more as compared to FY2013. Specifically, the companies (1) drastically reviewed the organization for its crisis management department, and also (2) reviewed their BCP across vertically divided departments, such as production, demand-supply control, logistics, and sales departments. (Results of FY2014 review: no [S / A+] rating, 5 [A], 2 [B+], 1 [B], and no [C].)
- When evaluating "Affiliate Companies BCP" for FY2014, ANRE asked each oil refining and wholesaling company to shorten the target length of time before oil supply is resumed, once each company completes its multi-year revamping work aimed to make its infrastructure more resilient. It is hoped that each company will review its own "Affiliate Companies BCP" on an ongoing basis, shorten the target length of time before oil supply is resumed, and expedite the establishment of its post-disaster business continuation system that covers its entire supply network.

Points of BCP evaluation rating amended in FY2014

(1) Addition to individual evaluation standards (concept of "Excellent")

[Trial phase] BCP evaluation standards (individual items)		[This time] BCP evaluation standards (individual items)	
<p>• Each BCP evaluation item is assessed and rated according to three grades, "Excellent," "Good," and "Fail."</p>		<p>• Each BCP evaluation item is assessed and rated according to four grades, "Excellent," "Good," "Fair," and "Fail." With a new evaluation item "Exceptional" added to the rating, the descriptions for the existing "Excellent" and "Good" have been modified.</p>	
Rating	Description	Rating	Description
—	—	Excellent	Exceptional activities (especially the ones that are carefully prepared and creative)
Excellent	Excellent activities	Good	Excellent activities
Good	Activities which satisfy the minimum required level	Fair	Activities which satisfy the minimum required level
Fail	Activities which do not satisfy the minimum required level	Fail	Activities which do not satisfy the minimum required level

(2) Addition to comprehensive evaluation standards (concepts of "S" and "A+")

[Trial phase] BCP evaluation standards (comprehensive evaluation)			[This time] BCP evaluation standards (comprehensive evaluation)		
<p>• Based on the results of individual evaluation items, each company's BCP is comprehensively assessed and rated according to four grades, "A," "B+," "B," and "C"</p>			<p>• Based on the results of individual evaluation items, each company's BCP is comprehensively assessed and rated according to six grades, "S," "A+," "A," "B+," "B" and "C"</p>		
Rating	Rating criteria	Number of companies	Rating	Rating criteria	Number of companies
—	—	—	S	The individual evaluations are all "Excellent"	0 (NA)
—	—	—	A+	At least 50% of the individual evaluations are "Excellent" (but the target for the resumption of oil supply must be "Excellent") with no "Fair" or "Fail"	0 (NA)
A	At least 50% of the individual evaluations are "Excellent" and "Good" with no "Fail"	0 (NA)	A	The total of "Excellent" and "Good" accounts for at least 50% of the individual evaluations with no "Fail." (This does not include the case where "Excellent" represents 50% or more. The target for resumption of oil supply must be "Excellent" or "Good")	5
B+	At least one and less than 50% of the individual evaluations are "Excellent" and "Good" with no "Fail"	5	B+	At least one and less than 50% of the individual evaluations are "Excellent" and "Good" with no "Fail"	2
B	The individual evaluations are all "Good"	1	B	The individual evaluations are all "Good"	1
C	The individual evaluations have at least one "Fail" rating	2	C	The individual evaluations have at least one "Fail" rating	0 (NA)

(g) Establishment of cooperative framework with relevant ministries, agencies, and local governments toward more facilitated fuel logistics in disasters

- Oil refining and wholesaling companies, which want to supply oil to the disaster-hit areas smoothly in the event of a disaster, would find it imperative to cooperate among the oil industry, relevant ministries and agencies, and the disaster-hit local governments, for instance, when opening up water routes and roads that lead to refineries and oil tank sites as soon as possible (e.g., rubble removal, restoration work), temporary lifting regulations on passing through long, wide, and underwater tunnels, providing cooperative transportation of oil in drums to the areas that have trouble refueling their vehicles, and then constructing makeshift mini service stations).
- In its interim report FY2014, Oil and Natural Gas Committee stressed the importance of listing and sharing, in advance at ordinary times, major adjustment items such as the operation of task forces that becomes necessary in the event of a disaster, the exceptional operations of some regulations, and the direction of all these adjustments. This process requires the involvement of relevant ministries and agencies, such as the Cabinet Office, the Ministry of Internal Affairs and Communications, the Fire and Disaster Management Agency, the Ministry of Land, Infrastructure, Transport and Tourism, the Ministry of Defense, the National Police Agency, and local governments in possible disaster-stricken areas. The interim report pointed out the need to conduct continual exercises on decision making and field operations in actual emergency situations. For each of the four issues brought up in the interim report (i.e., "early opening of water routes and roads that lead to oil refineries and

tank sites," "facilitated traffic of tank lorries and railroad cars," "cooperative fuel transportation to the areas that have trouble refueling their vehicles," and "establishment of local oil supply environment"), the roles of relevant ministries and agencies and possible disaster-hit local governments have recently been defined in the "Plan for Specific Emergency Post-Disaster Activities in the Event of a Nankai Trough Earthquake" (decided in the executive meeting of Central Disaster Management Council on March 30, 2015).

Promotion of joint exercises with relevant ministries, agencies, and local governments toward more facilitated fuel logistics in disasters

- It is necessary that oil refining and wholesaling companies, service stations, as well as relevant ministries and agencies, will continue to conduct various types of exercises in an integrated manner. Among those exercises are those based on the "Plan for Joint-Operations of Oil Supply in Disasters" in accordance with the Oil Stockpiling Act, and joint fuel transportation exercises, which started in 2014, involving the Agency for Natural Resource and Energy (ANRE), the oil industry, and the Ministry of Defense, and the Self-Defense Forces.
- Two disaster prevention drills were held in November 2014: one was an exercise based on the "Plan for Joint-Operations of Oil Supply in Disasters" as part of the event held on "Tsunami Disaster Prevention Day," and the other was a joint fuel supply exercise involving the Ministry of Defense and the Self-Defense Forces at the event site of "Michinoku Alert 2014." In May 2015, in Kyushu, Kyushu Bureau of Economy, Trade and Industry joined for the first time a desktop exercise of JGSDF Western Army-sponsored "Southwest Rescue." In June 2015, in Shikoku, Shikoku Bureau of Economy, Trade and Industry joined Kochi Prefecture-sponsored "Kochi Prefecture Disaster Prevention Drill" and conducted an exercise jointly with JGSDF Middle Army, Kochi Prefecture, and Shimanto-cho. In such joint exercises, Self Defense Forces' (SDF's) vehicles hauled oil drums, which were filled at a refinery in Ehime Prefecture, to a predetermined site in Kochi Prefecture, where local government staff, voluntary organizations for disaster prevention, and other groups refueled cars at a makeshift mini service station, which was installed by the local government, or transferred the oil drums to other locations. It is necessary to continue to deploy such joint exercises throughout the country, with the support of local governments, SDF, and local Bureaus of Economy, Trade and Industries.
- As described later, it is necessary to continue to boost supply exercises as part of the comprehensive disaster-preparedness drills sponsored by local governments, particularly from the viewpoint of utilizing the Disaster Response Agreement, which was concluded between Oil Commercial Union and local governments. (The Agreement offers prioritized refueling to police and firefighting vehicles and fuel supply to socially important infrastructures like water and sewerage facilities in disasters.)

Joint oil supply exercises as part of "Kochi Prefecture Comprehensive Disaster-Preparedness Drills"

On June 7 (Sun), 2015, an oil supply exercise was conducted under the assumption that the area is hit by a tsunami disaster caused by a Nankai Trough earthquake. That exercise was conducted as part of "Kochi Prefecture Comprehensive Disaster-Preparedness Drills," with the support of ANRE, Shikoku Bureau of Economy, Trade and Industry, JGSDF Middle Army, the oil industry (Taiyo Oil), a local government (Shimanto-cho), and voluntary organizations for disaster prevention. That oil supply exercise included practical operations such as SDF's cooperative fuel transportation support under the assumption that privately owned tank lorries run short, and the installation of a "makeshift mini service station" by the disaster-hit local government under the assumption that the area was hit by tsunamis (in fact, such mini service stations were built in the wake of the Great East Japan Earthquake). It is hoped that this type of disaster exercise model will be deployed throughout the country.

- (1) JGSDF Middle Army entered the site at Taiyo Oil Shikoku Refinery in Ehime Prefecture, with empty drums loaded on their large trucks. After filling the drums with fuel oils (i.e., kerosene and diesel oil), the Army drove the trucks over the mountains to the (virtual) disaster-hit area in Kochi Prefecture.



- (2) The JGSDF Middle Army vehicles arrived at Kubokawa Junior High School located near the Comprehensive Disaster Prevention Center (in Shimanto Ryokurin Park) in Kochi Prefecture, passing the fuels over to the Prefecture (bottom-left photo). The Army filled consumer-use 18-liter polyethylene tanks with kerosene together with Shimanto-cho Government Office and voluntary organizations for disaster prevention (bottom-right photo), delivering the oil containers by privately owned vehicles to other disaster prevention centers in the region. The Army also put diesel oil into firefighting and water supply vehicles.



Improvements in local disaster response capability

- For the purpose of smoothly implementing the "Plan for Joint-Operations of Oil Supply in Disasters (Oil Stockpiling Act)," the Petroleum Association, 31 prefectures, and 14 government agencies have concluded by the end of FY2014 a memorandum of understanding (MOU) on sharing information about socially important facilities (e.g., government office buildings, public hospitals). It is hoped that the Petroleum Association and "all" prefectures will conclude the MOU as soon as possible so that the information about socially important facilities that require urgent fuel supply could be shared in the event of an emergency. Particularly, contact information, floor plans, and other basic information such as the filler port specification and capacity of oil tanks are helpful.

Status of MOU conclusion between Petroleum Association and prefectures on sharing information about socially important facilities in emergency situations

No	Local government	Conclusion	No	Local government	Conclusion	No	Local government	Conclusion	No	Government agency	Conclusion
No	Tokyo	2008.11	13	Osaka	2013.3	25	Ibaraki	2014.4	5	1st Regional Coast Guard HQ	2015.2
1	Saitama	2012.3	14	Iwate	2013.6	26	Fukuoka	2014.4	6	2nd Regional Coast Guard HQ	2015.2
2	Yamagata	2012.10	15	Hokkaido	2013.7	27	Mie	2014.8	7	4th Regional Coast Guard HQ	2015.2
3	Gunma	2012.11	16	Tochigi	2013.8	28	Kagawa	2014.9	8	6th Regional Coast Guard HQ	2015.2
4	Aomori	2013.1	17	Tokushima	2013.10	29	Fukui	2014.10	9	7th Regional Coast Guard HQ	2015.2
5	Saga	2013.2	18	Hiroshima	2013.11	30	Oita	2014.12	10	8th Regional Coast Guard HQ	2015.2
6	Wakayama	2013.2	19	Chiba	2014.11	31	Aichi	2015.3	11	9th Regional Coast Guard HQ	2015.2
7	Miyagi	2013.2	20	Okayama	2014.2	No	Government agency	Conclusion	12	10th Regional Coast Guard HQ	2015.2
8	Kanagawa	2013.3	21	Akita	2014.3	1	Shikoku Regional Bureau	2013.3	13	11th Regional Coast Guard HQ	2015.2
9	Shizuoka	2013.3	22	Tottori	2014.3	2	Kyushu Regional Bureau	2013.9	14	5th Regional Coast Guard HQ	2015.2
10	Kagoshima	2013.3	23	Niigata	2014.4	3	Hokuriku Regional Bureau	2014.2			
11	Kyoto	2013.3	24	Toyama	2014.4	4	3rd Regional Coast Guard HQ	2015.1			

Enhancement of community-based cooperation with Petroleum Commercial Union and local governments

- In response to urgent supply requests from the disaster-hit prefectures in the event of a disaster, there have been many cases in which the local government and local Petroleum Commercial Union conclude a disaster agreement, which offers prioritized fuel supply, support to people who walk home, and other preferential treatment in disasters. As of now, 46 out of the 47 prefectures in Japan have concluded such an agreement.
 - The Gunma prefectural government and Gunma Petroleum Commercial Union formulated “Guidelines for Fuel Supply in Disasters etc.” based on a Fuel Supply Agreement they concluded. The Guidelines summarized information that needs to be shared from ordinary times (e.g., information sharing between the prefectural government and the Union in disasters, designation of facilities etc. that become the targets of fuel supply, fuel supply system in ordinary times and in disasters), based on a disaster agreement. The Guidelines will ensure the Fuel Supply Agreement to function properly in disasters.
 - The Aomori prefectural government implemented a system that enables centralized information gathering of the stocks for each oil type at service stations in the prefecture, in cooperation with the Aomori Petroleum Commercial Union. Additionally, the prefectural government clearly designated important facilities and emergency vehicles that become the target of prioritized fuel supply in disasters.
 - On concluding a Disaster Fuel Supply Agreement, the relevant prefectural government and Petroleum Commercial Union are preferably to refer to the examples above and establish a system that enables sharing of detailed information on disaster responses.
- A majority of emergency vehicles that will be needed immediately after occurrence of disasters are vehicles used by the police, firehouses, and local governments. For that reason, disaster prevention plans of local governments are required to place securement of fuels in disasters as part of regional disaster prevention activities. The Japanese government has been supporting the local government's effort to promote emergency fuel stockpiling in the region, and also has been promoting collaboration between prefectures and Petroleum Commercial Union. It is still important to continue to boost fuel supply exercises as part of local governments' comprehensive disaster preparedness drills, aiming at enhancing the effectiveness of the Disaster Response Agreement.
- In the wake of the Great East Japan Earthquake, service stations in the disaster-hit areas did not work well because of the influence of tsunamis and power outages. In the areas where oil supply could hardly be expected, "makeshift mini service stations" were built at shelters like schools to supply fuel directly out of oil drums. In the future, the community side, with the support of the local government, should be trained to be able to put fuel out of the drums delivered into emergency vehicles, portable cans, and other containers, in

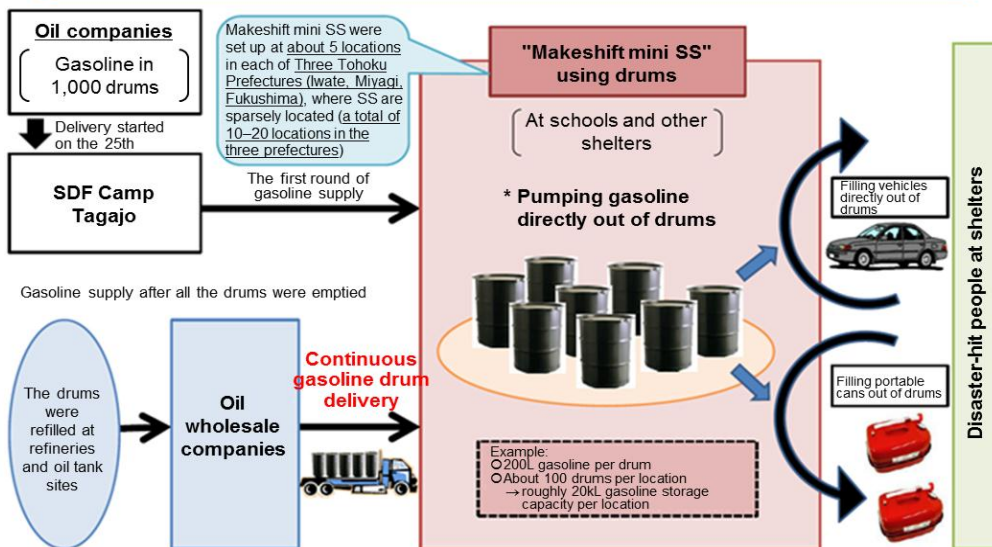
accordance with the guidelines of the Fire and Disaster Management Agency for temporary storage and handling of hazardous materials. Just like the joint oil supply exercises conducted as part of the above-mentioned "Kochi Prefecture Comprehensive Disaster-Preparedness Drills," the community side in the region is asked to make full advance preparations at ordinary times in pursuit of independent, self-supported disaster response capability. To that end, the community side should continue disaster drills as part of the local government's disaster drills, with the support of the entire community in the region (e.g., local service stations, firefighting teams).

- Additionally, when the Great East Japan Earthquake occurred, some disaster-affected areas faced difficulty in supplying petrol specifically, because service stations failed to operate properly due to tsunami damage or blackouts. At such areas, "temporary mini service stations" were established by bringing oil filled drums to shelters etc. (e.g., schools) and oils were supplied from such temporary service stations. Assuming a similar situation arising in the future in case of Tokyo Inland earthquakes or Nankai Trough earthquakes, ANRE and the Ministry of Defense commenced arrangement of cooperative petrol-filled drum transport systems during the "Heisei 26 Joint Exercise Rescue (JXR)" (described above). It will be required, from now, for local societies (especially local governments) to make preparations for carrying out oil filling operation from delivered oil drums to emergency vehicles, jerry cans, etc. based on the guidelines on temporary storage and handling of dangerous goods issued by the Fire and Disaster Management Agency. Such preparations need to be thorough and in detail, which could be achieved by, for instance, conducting exercises aiming at enabling independent operation from ordinary times through cooperation within the whole society (e.g., regional service station sector, volunteer firefighters) as part of emergency drills hosted by local governments.

Reference: Refueling directly out of oil drums in the wake of the Great East Japan Earthquake (conducted at a total of 10 to 20 locations in Three Tohoku Prefectures: Iwate, Miyagi, and Fukushima)

Ensuring fine-tuned gasoline supply to the disaster victims by setting up drum-based "makeshift mini service stations"

- In the areas where gasoline is hardly available because of the service stations not operating well, provide fine-tuned gasoline supply to the disaster victims at drum-based "makeshift mini service stations" set up at shelters such as schools.
- Ensure continued gasoline supply in cooperation with oil wholesale companies, not a one-time emergency supply out of the drum.



Source: Iwate Nippo website



Source: NPO NEOS website

Functional enhancement of core service stations

- For core service stations to function without fail in the event of a disaster, the supply chain of oil products that leads to those stations must be resilient. As described above, each oil refining / wholesale company is required to formulate its "Affiliate Company BCP." The BCP requires each company to commit to prioritized oil supply to its core service stations. In accordance with the Plan for Joint-Operations of Oil Supply in Disasters, the BCP also

requires each company to develop a system that will allow oil products like gasoline to be supplied outside the bounds of the company.

- To help all core service stations effectively support the local government's early post-disaster restoration and reconstruction in the event of a disaster, ANRE-sponsored training and exercises intended for personnel at core service stations are currently under way in all prefectures. Recent training programs for post-disaster activities include the training on how to avoid turmoil at a service station and the actual operation of the private generator that is installed at a service station. In addition, the number of cooperative disaster drills between core service stations and local governments is increasing. What is important is that core service stations will continue to enhance its capability by accumulating know-how, increasing the volume of oil product stockpiling, and activating its engagement in disaster response measures in the entire region through these exercises jointly with local governments. Equally important is that the Japanese government will continue to support and encourage the activities of core service stations.

Information sharing system in disasters

In February 2014, heavy snowfall induced an emergency situation mainly in Yamanashi Prefecture, where major confusions pertaining to oil supply were avoided by gathering information on the disaster damage and stocks with the cooperation of wholesalers, service stations, and relevant ministries. Meanwhile, gathering of information on the operational status and stocks of service stations, for instance, required calling each individual service station. This occurred partially because that understanding on the operating conditions was not fully shared among relevant personnel for when the disaster coordination plan under the disaster information system of Petroleum Association does not come into effect. Like this example, there remained various issues for advance information gathering systems assuming potential wide area large scale disasters.

- There is a need to develop a system that enables thorough and quick understanding of stock status at service stations, and thus urgent oil product deliveries in emergency situations. Such a system should be able to quickly understand the status of stock and operation at service stations in the entire region, which includes not only affiliate service stations but also private service stations. The challenges in this case would include how such a system should be demonstrated, and how effectively this system should be linked to the existing system owned by Petroleum Association.

ii) LP gas

(a) Concept of LP gas supply prioritization and demand restraint in emergency

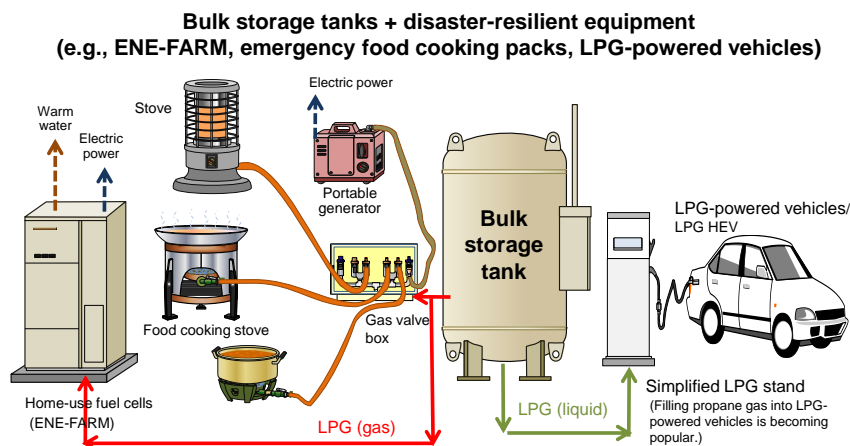
- When the disaster causes "a substantial shortage" of LP gas supply in Japan, and if the shortage is expected to significantly impact people's life, the Petroleum Supply and Demand Adjustment Act will be invoked. When LP gas supply is prioritized, and if its demand is restrained under the Act, post-disaster measures should be taken based on a similar concept to what was developed for supply disruptions from overseas.
- In the event of a large-scale disaster, however, LP gas should be preferentially supplied to public facilities that can serve as shelters, as well as facilities in which many occupants find it difficult to evacuate in emergency (e.g., hospitals, nursing homes). This is a different procedure from supply disruptions from overseas. Based on the above discussion, when interpreting and executing supply prioritization as stipulated in the Petroleum Supply and Demand Adjustment Act, concerned parties should organize case examples based on the priority listed below.

Fuel supply to shelters **takes priority over** fuel supply to other facilities

Fuel supply to core service stations **takes priority over** fuel supply to ordinary service stations

(b) LP gas self-stockpiling

- In the event of a mega earthquake, a great deal of time will be spent to restore damaged road and seaway infrastructures, as a result of which energy supply networks may be disrupted. For this reason, fuel "self-stockpiling" is considered to be one of the effective means to ensure self-sustaining business continuation in the next few days after the disaster occurs. In this context, ordinary household LP gas users are considered to have "self-stockpiling" in place in the form of on-the-premises stock. Similarly, the Japanese government has been increasing the country's stockpiling capacity by promoting the installation of disaster-oriented LP gas bulk tanks, which can stock LP gas locally, at facilities that can be called as "socially important infrastructures" (e.g., central and local government office buildings, facilities for telecommunications, broadcasting, and finance fields, disaster base hospitals, schools), and also at facilities that can serve as shelters in the event of an emergency. By the end of FY2014, 245 facilities throughout the country had such LP gas bulk tanks installed. At the same time, the use of LP gas bulk tanks at ordinary times helped improve fuel diversification in the community. In the future, energy self-stockpiling with bulk LP gas should be promoted further for socially important facilities (e.g., hospitals, public facilities), whose functions are expected to continue even in the event of a disaster. In addition, it is necessary to conduct a survey to better understand the status of how this self-stockpiling is practically operated in the field.



(c) Establishment of cooperative framework among relevant ministries, agencies, and local governments toward more facilitated fuel logistics in disasters

- LP gas played an active role in the disaster-stricken areas in the wake of the Great East Japan Earthquake. Because of the well-developed supply chain leading to end users and its stockpiling system, and thanks to its advantages such as portability and ease of storage, LP gas is regarded as the "last-resort" energy supply in disasters. Given such usefulness of LP gas in disasters, the member companies of Japan LP Gas Association located in 38 prefectures are positioned as "designated public institutions" that are stipulated in the Disaster Countermeasures Basic Act. The representative of the member company located in each prefecture is appointed as a member of the Disaster Prevention Council under the leadership of Governor in the prefecture. So far, the member companies of Japan LP Gas Association have concluded agreements on fuel supply in disasters with 71% of the total local governments including cities, wards, towns, and villages. As a lifeline crisis supporter, the LP gas industry is playing a critical role in the regional post-disaster response measures. Taking advantage of its current position, the LP gas industry should continue to conclude more disaster preparedness agreements with other local governments, and at the same time should strengthen its emergency supply capability and the cooperation with designated administrative agencies.
- To maintain the unique position of LP gas industry and its role as the "last-resort" energy supply in disasters, the Japanese government formulated the "Plan for Joint-Operations of LPG Supply in Disasters" (hereinafter, "Plan for Supply Joint-Operations") for each of the nine regions in the country in accordance with the Oil Stockpiling Act. At the same time, the Japanese government established "Core Service Station Committee" in each region to

implement disaster exercises in line with Plan for Supply Joint-Operations, and then came up with necessary amendments. The Committee is currently developing a disaster management system that satisfies local needs in each region, by implementing exercises involving local governments and following up those exercises.

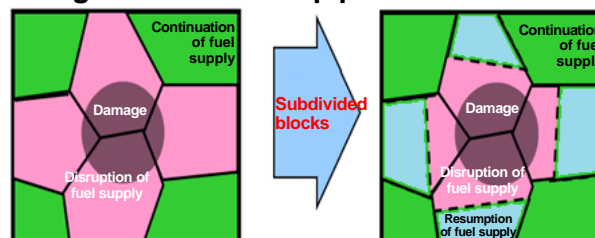
- In FY2014, the Committee conducted information transmission exercises in accordance with "Plan for Supply Joint-Operations" for each of the nine regions in the country. In sync with Plan for Supply Joint-Operations, the Committee also conducted exercises to operate an LP gas import terminal using mobile power source vehicles, and also implemented exercises to operate core service stations and supply alternative fuels. In FY2015, based on the results of the exercises conducted in FY2014, the Committee should continue more exercises in accordance with "Plan for Supply Joint-Operations" in preparation for possible disasters.
- Among the exercises conducted in FY2014, there were some cases in which business operators in different affiliate groups had trouble filling LP gas and also sharing information due to the difference in LP gas cylinder management and information systems. For this reason, part of the activities planned for FY2015 will be dedicated to ensuring information system interchangeability and the smooth development of information sharing systems. The outcome will have to be put in place by the end of FY2016

iii) Natural gas

(a) Development of supply system that enables early post-disaster restoration

- In the event of a disaster, gas supply to the disaster-hit areas should be stopped immediately to prevent secondary disasters from occurring, and the areas with no gas supply should be minimized. To that end, gas operators have been developing systems that divide their pipeline network into a certain number of blocks so that gas supply can be controlled by individual block. Furthermore, the promotion of subdivided blocks would be effective from the viewpoint of earlier post-disaster restoration.

Image of subdivided pipeline blocks






(b) Enhancement of wide-area cooperative system in disasters

- For the purpose of encouraging wide-range cooperation in disasters, Japan Gas Association (hereinafter, "JGA") enacted in 1968 "Outline of Disaster Relief Measures for Earthquakes and Flooding." "When large-scale disaster-hit business operators find it difficult to independently recover from the damage, the Association will ask other business operators to join disaster relief activities. In the wake of the Great Hanshin-Awaji Earthquake, up to 3,700 persons a day from a total of 155 companies were involved in disaster relief activities. Similarly, up to 4,100 persons a day from a total of 58 companies contributed to post-disaster activities in the wake of the Great East Japan Earthquake. Such contributions helped the earthquake-stricken areas resume gas supply within a little less than two months with the exception of catastrophically damaged areas. It is important to continue to strengthen such wide-area cooperation systems.

(c) Ensured gas supply from mobile gas-generating and temporary gas-producing equipment

- The use of mobile gas-generating equipment is one of the most effective ways to ensure gas supply in disasters. Disaster-hit socially important facilities (e.g., hospitals, welfare facilities) are allowed to utilize such equipment on a preferential basis.
- In preparation for the case where disaster-hit companies alone are unable to deal with the

situation using their own emergency equipment in the event of a large-scale disaster, JGA formulated in 2008 "Guideline for Wide-area, Shared Use of Mobile Gas-generating Equipment in Large-scale Disasters." The guideline clearly defines the rules on how disaster-hit companies, relief companies, JGA headquarters, and JGA district offices should share approximately 2,000 units of mobile gas-generating equipment deployed throughout the country.

	Propane air type (PA type)	Compressed gas type (CNG type)	Liquefied gas type (LNG type)
Main features	The ejector sucks air from the atmosphere with the help of gas pressure in LPG containers. The air is mixed with LPG to generate propane air (PA) low-pressure gas, which falls under the same gas group as city gas (i.e., natural gas).	The equipment depressurizes (to a low or medium pressure) a calorific-value-adjusted, odorized gas, which is compressed to about 20MPa and filled in CNG cadre containers, supplying the gas at natural gas stations and other appropriate places.	The equipment vaporizes a calorific-value-adjusted, odorized LNG, which is filled in LNG cryogenic containers, supplying the gas at LNG stations and other appropriate places.
Example			

- To expedite post-disaster restoration when LNG satellite terminals are damaged, JGA developed a wide-area system that allows operator companies to share LNG vaporizers. The system voluntarily operated by JGA member companies started in December 2014. It is important for JGA to continue to promote this type of post-disaster measure.



(d) Self-sustaining fuel use on the user side

- Because natural gas is a fuel that is difficult to store on the demand side, post-disaster restoration of supply infrastructures as described above should be pursued in the event of a natural gas supply disruption. On the other hand, when electric power supply is disrupted but natural gas supply is maintained, backup electric power and heat can be supplied from residential self-sustaining ENE-FARM with built-in storage batteries, and industrial- and business-use gas co-generation systems. From the standpoint of uninterrupted operation in disasters, the widespread use of these self-sustaining energy supply systems is considered to be important.

(2) Enhanced resilience of energy supply infrastructures (hardware-based measures)

i) Oil

(a) Enhanced resilience of refineries and oil storage sites (countermeasures against earthquakes, ground liquefaction, lateral flow, etc.)

- Given that the occurrence of catastrophic disasters like Tokyo Inland earthquakes and Nankai Trough earthquakes is imminent, oil is expected to play a significant role as a "last-resort" energy supply in the event that electric power and city gas supplies are disrupted, as our country experienced in the wake of the Great East Japan Earthquake. To

that end, oil supply infrastructures, such as oil refineries and storage sites, should be fully prepared for such possible catastrophic disasters. Specifically, oil refining facilities must be shut down safely without causing secondary disasters like fire; damage to oil product receiving and shipping facilities must be minimized so that the receiving and shipping functions could be resumed as early as possible with the help of backup power (i.e., the function to release the oil stocked at oil refineries, with energy supplied from other regions).

- Given this background, the Ministry of Economy, Trade and Industry (METI) has completed by the end of FY2013 (i.e., by the end of March 2014) thorough assessments on ground liquefaction and aseismic performance at a total of 25 plants (chemical and steel plants as well as oil refineries) located in industrial complexes within the areas where Tokyo Inland earthquakes and Nankai Trough mega earthquakes are likely to happen.⁶ More specifically, (1) these companies are currently taking earthquake-resistant measures in compliance with the existing laws and ordinances (e.g., Fire Services Act, High Pressure Gas Safety Act), and (2) these companies, willing to conduct more stringent risk assessments based on the level of seismic ground motions that exceeds the level required by the existing laws and ordinances, conducted such full assessments on their own plants, entrusted by METI.
- As far as oil refineries are concerned, in particular, each oil refining / wholesaling company conducted its full assessment in accordance with "Procedures for Evaluating Earthquake Resistance of Oil Refineries (March 26, 2013)"⁷ jointly prepared by ANRE, external experts, and representatives from the oil industry, and based on the following seismic ground motions that were published by the Cabinet Office (Central Disaster Management Council) as the latest data at the time of the assessments (May 2013) that assumed the occurrence of possible Tokyo Inland earthquakes and Nankai Trough earthquakes.
 - Tokyo Inland earthquakes (Hypothetical seismic ground motion data published in 2005. M7-class earthquakes assumed to occur in the northern part of Tokyo Bay and in the fault groups of Miura Peninsula. Those earthquakes are said to occur several times just before an M8-class earthquake assumed to occur at intervals of 200–400 years.)
 - Nankai Trough earthquakes (Hypothetical seismic ground motion data published in 2012. These earthquakes, the largest possible earthquakes to occur in Japan, are said to occur once in every 1,000 years or at a lower frequency.
- This survey was conducted based on the existing ground data that were submitted by each business operator and based on the results from additional boring surveys for the points that needed extra information. This approach helped us better understand in a comprehensive manner, risks of ground liquefaction and lateral flow in the entire refinery area, which included the area along the sea bank that had needed more information.

Example: Results of ground liquefaction risk assessments using PL (liquefaction potential index) method (summary)

	PL = 0	0 < PL ≤ 5	5 < PL ≤ 15	15 < PL	Total
Tokyo Inland earthquakes					
M7-class earthquakes that are expected to occur in the northern part of Tokyo Bay and the fault groups of Miura Peninsula (which are said to occur several times just before M8-class earthquakes that occur at intervals of 200 to 400 years). This survey is based on the hypothetical data on seismic ground motion that was published by the Cabinet Office in 2005.					
Kanto District incl. Tokyo Bay	370 points	914 points	836 points	707 points	2,827 points
Nankai Trough earthquakes					
These earthquakes, conceivably the largest that might occur in Japan, are said to take place once in every 1,000 years or at a lower frequency. This survey is based on the hypothetical data on seismic ground motion that was published by the Cabinet Office in 2012.					
Chubu District incl. Ise Bay Kinki District incl. Osaka Bay Chugoku and Shikoku Districts Kyushu and Okinawa Districts	589 points	540 points	757 points	1,441 points	3,327 points

⁶ These assessments were conducted under the "Industrial and Energy Infrastructure Resilience Investigation Project" funded by the FY2012 supplementary budget (carried forward to FY2013).

⁷ "Procedures for Evaluating Earthquake Resistance of Oil Refineries" were published as "Research Study on Petroleum Industry System FY2012" (study on assessment procedures for earthquake resistance of oil refineries and oil terminals in Japan). URL: http://www.meti.go.jp/meti_lib/report/2013fy/E003798.pdf

(*) Assessment using PL method (probability of liquefaction index)

This method provides a guideline for the probability of liquefaction damage in the target ground and in its vicinity. The classification of PL values and the probability of liquefaction were based generally on that proposed by Iwasaki, et al. (1980).

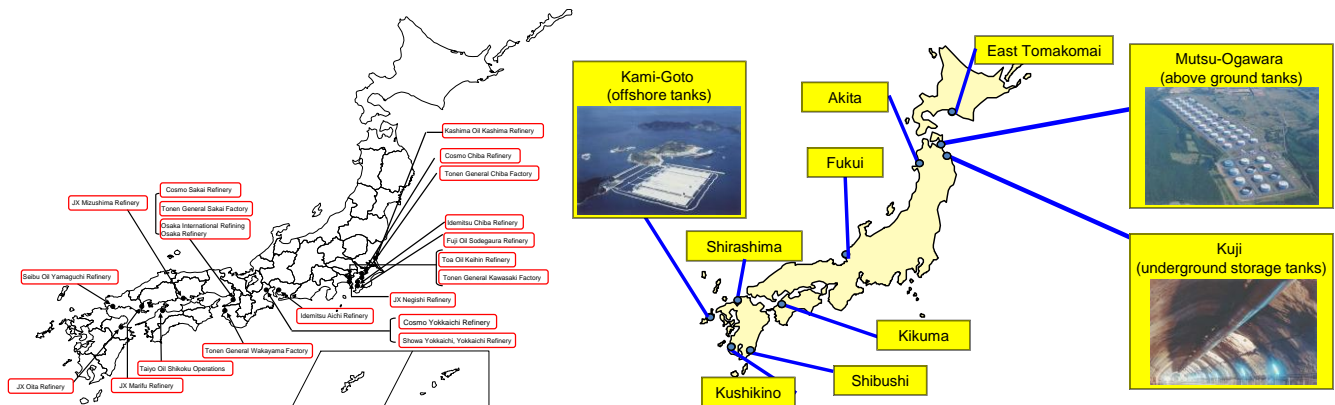
- PL = 0: The risk of liquefaction is extremely low. Detailed surveys on liquefaction are unnecessary.
- 0 < PL ≤ 5: The risk of liquefaction is low. More detailed surveys are necessary for especially important structures.
- 5 < PL ≤ 15: The risk of liquefaction is high. Detailed surveys are necessary for especially important structures. Countermeasures against liquefaction are generally necessary.
- 15 < PL: The risk of liquefaction is extremely high. Detailed surveys on liquefaction and Countermeasures against liquefaction are essential.

(Source: T. Iwasaki, F. Tatsuoka, K. Tokida, S. Yasuda: Prediction of Ground Liquefaction Probability in Event of an Earthquake, Tsuchi-to-Kiso, Vol. 28, No. 4, p23–p29, 1980)

- Based on the results of the thorough assessments, the oil refining and wholesaling companies identified where in their own refineries and storage sites are vulnerable. To achieve the supply restoration target committed in its "Affiliate Companies BCP," each company developed an oil supply resilience enhancement plan, based on which it already started to construct more earthquake-resistant structures at its plants. The Japanese government already budgeted such resilience enhancement efforts, and the public-private initiative is currently under way at steady pace.
- At the end of FY2014, the progression rate of earthquake resistance enhancement at refineries was 11%, and the penetration percentage of three-piece emergency set (i.e., emergency power generators, emergency communication systems like satellite communications, and oil drum filling and shipping facilities) was 76%. Based on the results of the thorough resilience assessments conducted in FY2013, each oil refining/wholesaling company will prepare plans for investment in resilience enhancement, while maintaining consistency with its own "Affiliate Companies BCP," especially the targeted length of time before fuel supply is resumed. It is hoped that in line with such investment plans, measures to enhance resistance to earthquakes, ground liquefaction, and lateral flow will be implemented as soon as possible.
- With respect to national stockpiling terminals, the Japanese government started a fiscal investment and loan scheme in FY2011, and is moving forward with reinforcement design and construction with the help of seismic diagnosis so that socially important structures and buildings could withstand possibly the largest seismic ground motion. The government is also conducting preliminary surveys on countermeasures against tsunamis and ground liquefaction. The reinforcement construction aimed to improve particularly earthquake resistance has been completed at 3 out of 15 national stockpiling terminals. The Japanese government should continue to promote resilience enhancement construction like these.

Locations of refineries that have taken resilience enhancement measures (left)

Locations of national stockpiling terminals that have taken resilience enhancement measures (right)



(b) Development of disaster bases like core service stations

- There were many problems related to oil supply in the wake of the Great East Japan Earthquake. In addition to those problems, the fuel meters at many service stations stopped working mainly because of power outage, making refueling at the filling stations difficult. Those problems led to fuel supply problems in the disaster-stricken areas. To prevent recurrence of such troubles, the Oil Stockpiling Act was amended so that emergency vehicles could be refueled on a preferential basis in the event of a disaster. At the same time, it was decided that core disaster-oriented filling stations (core service stations), equipped with private power generators and large-sized tanks, would be set up throughout the country. Since FY2011, about 1,600 core service stations have been built across the country with the support of Petroleum Commercial Unions, Petroleum Association, Nippon Expressway Companies, and prefectures.
- By stockpiling certain quantities of oil in cooperation with local governments, core service stations will further strengthen their function as an oil product supply hub in disasters. Since FY2014, oil product stockpiling has accelerated, supported jointly by ANRE and local governments. As a result, business operators in 24 prefectures (core service stations at 646 locations, small fuel distribution bases at 205 locations) have introduced or shored up oil product stockpiling. By continually evoking local governments' awareness of disaster prevention, the Japanese government should ingrain maintenance of post-disaster oil product supply chain into regional disaster prevention policies.
- Among service stations other than core service stations, there are some that are willing and eager to play the role of supporting stable supply of oil products in disasters. Given the recent tough business environment, the Japanese government needs to support such service stations to ensure their sound financial base. In FY2014 supplementary budget, the government subsidized the introduction of energy-efficient car washers, high efficiency fuel meters, etc., which were thought to improve their bottom lines. The government should and support these service stations in a consistent, effective manner, for example by subsidizing the replacement of underground tanks with larger tanks with the aim to enhance their disaster response capability.

ii) LP gas

(a) Enhanced resilience of LP gas import terminals

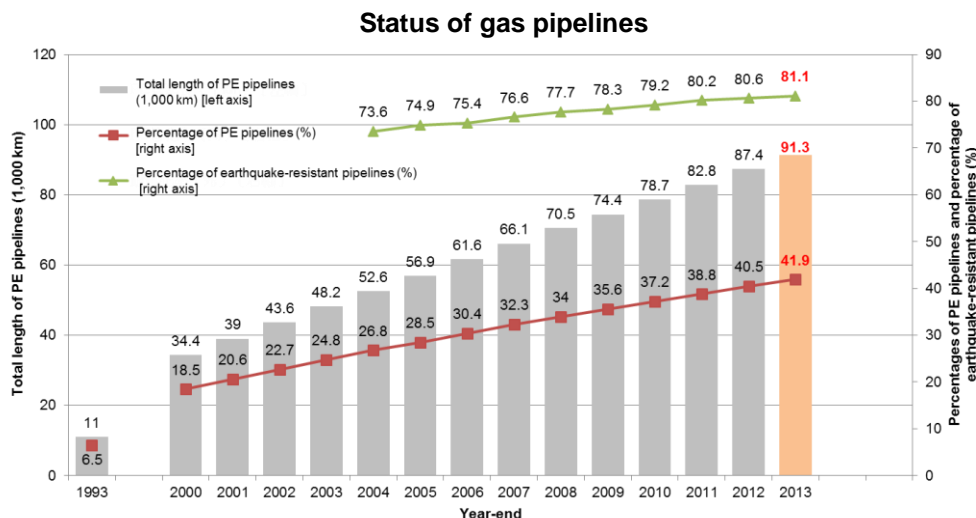
- There was an explosion accident at an LP gas production plant in the wake of the Great East Japan Earthquake. As a result, the safety standards for tanks in accordance with the High Pressure Gas Safety Act were reviewed in November 2013. At the same time, the earthquake-resistant design standards for LP gas facilities were strengthened, and the standards for braces were newly introduced. With these new standards put in place, the Japanese government asked business operators to assess earthquake resistance performance. In turn, based on such assessments, the government supported them in revamping their LP gas facilities in a systematic manner. With respect to refrigerated storage tanks (flat bottom tanks) at LP gas import terminals, on the other hand, there are some issues to be solved, such as the method to revamp the tanks, and the decrease in tank capacity during the revamping period. The LP gas industry should support the LP gas industry with technical approaches to these fundamental issues in order to meet the latest earthquake resistance standards.

iii) Natural gas

(a) Improved earthquake resistance of gas pipelines

- One of the most effective ways to improve the earthquake resistance of low-pressure gas pipelines is to replace them with polyethylene pipe, which has high elongation, excellent corrosion resistance, and semi-permanent service life. In 1982, the technical standards of the Gas Industry Law specified the use of polyethylene as a new material for low-pressure gas pipelines. And since the 1990s, low-pressure gas has been replaced with polyethylene pipe. At the end of 2013, the percentage of polyethylene pipe reached 41.9% of the total length of main and branch gas pipelines. With ductile cast iron pipes using mechanical joints

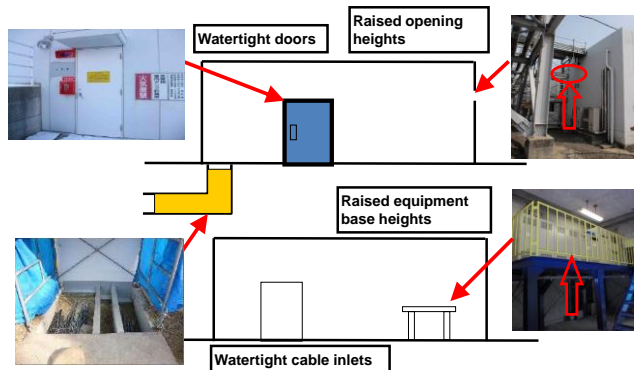
with a built-in leak-preventing device and other earthquake-resistant pipes included, the percentage of earthquake-resistant pipes reached 81.1% of the total length of main and branch gas pipelines at the end of 2013. The natural gas industry should continue to take this measure and increase the percentage of earthquake-resistant gas pipelines further.



(b) Measures against earthquakes and tsunamis at LNG terminals

- In March 2012, based on the damage caused by the Great East Japan Earthquake and business operators' post-disaster activities, Disaster Risk Management WG of Gas Safety Subcommittee, Urban Heat Energy Committee, Advisory Committee for Natural Resources and Energy, presented a report concerning countermeasures against future earthquakes and tsunamis. With respect to countermeasures against tsunamis, in particular, the report newly specified the performance requirements that the disaster-hit facilities should meet depending on the level of tsunami, asking each business operator to come up with necessary countermeasures depending on the expected level of tsunami that the company will have to face at some point in the future.
- In response to this report, in 2013, Japan Gas Association (JGA), formulated its guidelines for countermeasures against tsunamis, which proposed specific actions, such as measures against inundation into buildings, raising the base height of electrical equipment, and installing emergency power generators. Based on the guidelines, each business operator has taken countermeasure against tsunamis, such as watertight buildings for key facilities and raised equipment base levels and the openings of buildings.

An example of implemented tsunami countermeasures (building for electrical equipment)



(c) Enhancement of complementary system between LNG terminals

- The development of natural gas pipelines to build a complementary system between LNG terminals is important from the viewpoint of improving resilience in the existing LNG supply system. For example, the "Strategic Energy Plan" presented the basic directions toward the development of LNG terminals and the enhancement of their capabilities, transportation

- routes on the Pacific Ocean and the Japan Sea sides, the development of gas pipelines, etc.
- In the law to amend part of the Electricity Business Act that passed the current Diet, all gas pipeline service providers shall be obliged to make efforts to interconnect their gas pipelines for the purpose of promoting gas pipeline networks. In accordance with the law, a system has been established to allow the country to instruct/decide on discussion between two service providers about a pipeline interconnection deal, if one side refuses to such discussion. In addition to such legal action, the following actions are currently under study: (1) an action that allows a gas pipeline service provider to recover its development cost for the gas pipeline that brings about large-scale benefits by having the cost included in the wheeling charge to gas companies in that region, (2) an action that allows the pipeline service provider to set a higher rate of return from the project for a certain period of time after the pipeline is completed.
 - Toward the enactment of this amended law, the Japanese government should study how this system should be practically operated in more detail. At the same time, the government should study the development of gas demand and comprehensive pipeline promotion toward large-scale gas pipeline networks, and also should come up with Japan's consistent gas pipeline policy from the standpoints of cost effectiveness and enhanced national resilience.

4. Reconstruction of the business condition of industries which are responsible for supplying energy sustainably in Japan

(1) Strengthening the business condition of oil and LP gas industries

i) Oil refinery and wholesale industry

(a) Current situations and issues

- Oil is an important source of energy, which is estimated to account for 30% of all primary energy supply even in FY2030. Additionally, oil is superior to electricity and gas in terms of the mobility, storage, etc., and is expected to function as the last resort of energy supply in disasters when there emerges disruption to supply of electricity and gas. Therefore, the oil industry in charge of oil supply has an important function to support the industry and lives in Japan both in ordinary times and in emergencies, and stabilization of the revenue base of oil industry through improved international competitiveness is a significantly important issue which directly relates to the national energy security, beyond the benefits for individual companies.
- However, according to the “Forecast of Oil Product Demand from FY2014 to FY2018” issued by ANRE, the domestic demand for oil products is predicted to decrease due to factors such as (1) population decline and (2) improved fuel efficiency, at a rate of 1.6% per year, by 7.8% in total, over to FY2018⁸. Under the future prospect of declining domestic demand for oil, the task for the oil industry is to convert to a business structure that does not fall into a profit-ignoring excessive price war.

[List of Japanese oil refiners (as of the end of May 2015)]

Oil refiner		Refinery name	Refining capacity (BD: barrels per day)	Refining capacity share*
JX Group	JX Nippon Oil & Energy Corporation	Sendai Refinery, Negishi Refinery, Mizushima Refinery, Marifu Refinery, Oita Refinery	1,425,700	36.4%
	Kashima Oil Co., Ltd.	Kashima Refinery		
	Osaka International Refining Co., Ltd.	Osaka Refinery		
Tonen General Sekiyu K.K.		Chiba Refinery, Kawasaki Refinery, Sakai Refinery, Wakayama Refinery	698,000	17.8%
Idemitsu Kosan Co., Ltd.		Hokkaido Refinery, Chiba Refinery/Plant, Aichi Refinery	535,000	13.7%
COSMO OIL Co., Ltd.		Chiba Refinery, Yokkaichi Refinery, Sakai Refinery	452,000	11.5%
Showa Shell Group	TOA Oil Co., Ltd.	Keihin Refinery	445,000	11.4%
	Showa Yokkaichi Sekiyu Co., Ltd.	Yokkaichi Refinery		
	Seibu Oil Co., Ltd.	Yamaguchi Refinery		
Fuji Oil Company, Ltd.		Sodegaura Refinery	143,000	3.7%
Taiyo Oil Co., Ltd.		Shikoku Operations	118,000	3.0%
Nansei Sekiyu K.K.		Nishihara Refinery	100,000	2.6%

* Refining capacity share is rounded off to the first decimal place and the sum does not necessarily become 100%.

- Amid such a situation, ANRE conducted a survey for the market structure in June 2014 based on the Article 50 of the Industrial Competitiveness Enhancement Act, and issued “Report of the Research of the Oil Refinery Market Structure” (June 30, 2014; hereinafter referred to as “Article 50 Research”). The Article 50 Research concluded that the oil refinery market in Japan is in an “oversupply structure” in general, and “if the current profit situation and supply capacity remain in the future, there is a grave concern for falling into a serious oversupply structure”. The Article 50 Research also commented on the “failure of wholesale price formative function”, pointing out a task to build an appropriate pricing mechanism including fair and transparent price index. Additionally, referencing the global benchmark

⁸ Since forecast for type-C heavy oil is not conducted, the predicted actual result for FY2013 is used as the forecast value.

(assessment index: especially the index of HSB Solomon Associates LLC), the Article 50 Research pointed out room for improvement at oil refiners regarding the high production cost arising from factors including the operational reliability of facility and energy cost.

- To improve the profitability in the future, approach from both “reduction of production cost” through improved productivity of refineries and “optimization of wholesale price formative function” will be required. To that end, future tasks include “drastic improvement of the productivity of refineries” (optimizing facilities, increasing added values, improving the operational reliability, and improving the energy efficiency), “strategic procurement of crude oil”, and “building a fair and transparent pricing mechanism etc.”, as described below. In addition, another task for the oil companies is to grow/transform into international “Total Energy Solution Companies” under the future prospect of declining domestic demand for oil.

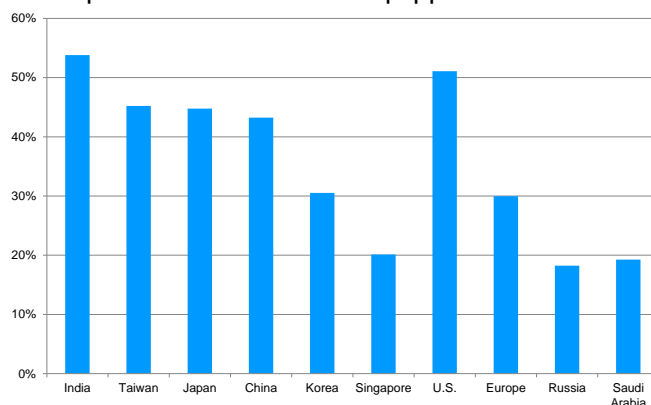
[Drastic improvement of the productivity of refineries]

[1] Optimizing facilities and increasing added values (resolving excessive refining capacity, integrated operation of industrial complexes, improving residual oil processing capacity, and improving the yield of petrochemical products etc.)

- Oil refineries are required to maintain high facility operation rate and improve the profit, under a refining capacity that flexibly changes in accordance with the changes in the domestic and overseas demand. To that end, it is essential to promote optimization of facilities through reduction of excessive refining capacity at oil refineries. This activity is critically important for recovering the profitability and thereby maintaining the sustainable oil supply system in Japan.
- In so doing it is meaningful to optimize facilities through integrated operation of oil refineries in and out of industrial complexes, instead of individual companies gradually reducing the refining capacity of refineries and as a result reducing their production efficiency. To date the oil industrial complexes including Kashima, Chiba and Mizushima have worked on improving the production efficiency by accommodating each other raw materials etc. among oil refineries and between oil refinery and petrochemical plant, and collaboration between oil refinery and petrochemical plant is considered highly effective.
- Various forms of business restructuring within an industrial complex or for adjacent regions will be continuously required, such as 1) combination of normal refineries and business sites consisting of residual oil cracking units (without atmospheric distillers), lubricant and petrochemical equipment etc., and 2) further unification and integrated operation by combining petrochemical plants into the mix.
- While the yield of clean oil products (e.g., transport fuels) and petrochemical products per crude oil unit inflicts a major impact on the production cost at refineries, the yield depends on the “Complexity” of the facility. One of indices of the complexity is the equip rate of “residual oil cracking units⁹” (“capacity of residual oil cracking units” divided by “capacity of atmospheric distillers”: capacity for producing clean oils (e.g., transport fuels) from residual oils that are produced during the refining process). According to international comparison, Japan’s rate of equipped residual oil cracking units is placed at a high level. This point should be considered as the strength of Japan’s oil refinery industry and should be improved in the future as the source of international competitiveness.
- Further, it will be required to build production systems that flexibly comply with the demand for fuels and petrochemical products at oil refineries, such as improved yield of propylene that is produced from fluid catalytic cracking (FCC) units. To that end, continuous efforts are required to be made on 1) capital investment and improved operation rate that lead to improved rate of equipped residual oil cracking units as well as improved yield of byproducts with high added value (e.g., petrochemical products), and 2) promotion of “noble use of oil” by reducing the quantity of residual oils produced during the refining process through technical development etc. of catalysts etc.

⁹ The “residual oil cracking units” in this context refer to residue fluid catalytic cracking units, residue pyrolysis units, residue hydro-cracking units, heavy oil direct desulfurization units, solvent de-asphalting units, and catalytic cracking units.

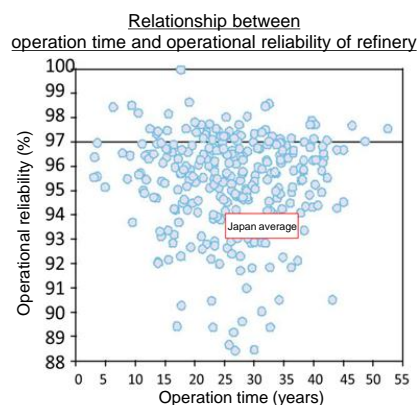
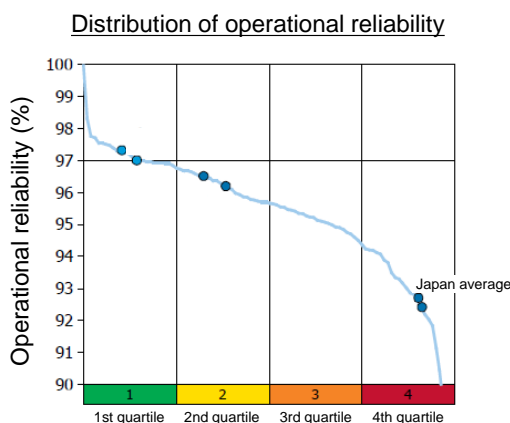
[International comparison of “the rate of equipped residual oil cracking units”]



Source: Research by ANRE. * Note that values for countries other than Japan do not include “solvent de-asphalting units”.

[2] Improving the operational reliability

- The facility operation rate of Japanese oil refineries is at a poor level on a global scale¹⁰. To begin with, in order to maintain high facility operation rate, the period of facility outage due to facility malfunctioning or unplanned repairs needs to be shortened. In other words, the “operational reliability”¹¹ of the facility needs to be improved. However, it is pointed out that the facility outage period of Japanese oil refineries is longer than that of South Korean refineries or large-scale exporting oil refineries in the Asia-Pacific region¹². There is another indication stating that the operational reliability of Japan’s oil refineries is only as much as 92.7% while that of the highest ranked groups among medium-scale oil refinery groups (the scale of approximately 100,000-250,000 BD) in the world is approximately 97%.
- Therefore, it will be required to promote improvement of the efficiency of maintenance costs as well as sufficient maintenance that supports stable operation. As a side note, there is no association between the “operational reliability” and the years of operation for oil refineries, and oil refineries with many years of operation can still maintain high “operational reliability”. There certainly remains room for improvement in Japanese oil refineries.



Source: “Report on International Comparison, Analysis, etc. of the Competitiveness of Japan’s Oil Refinery Industry”

Source: “Report on International Comparison, Analysis, etc. of the Competitiveness of Japan’s Oil Refinery Industry”

[3] Improving the energy efficiency

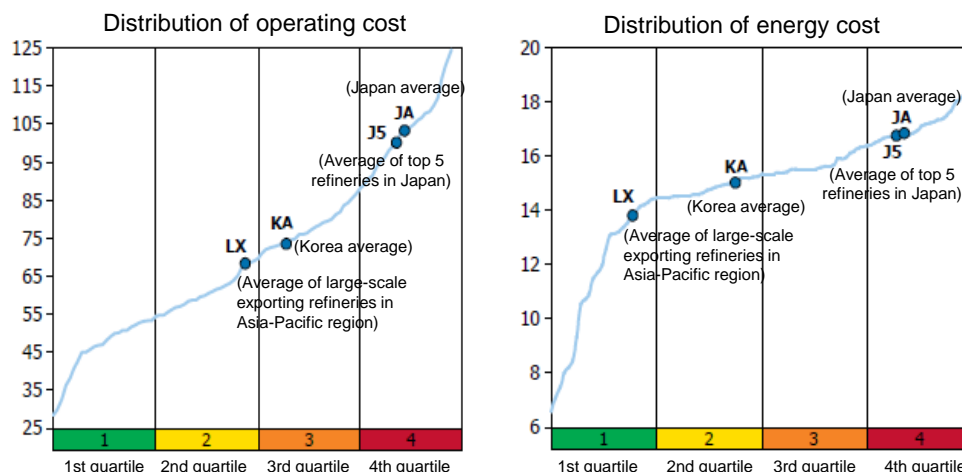
- The energy efficiency of Japanese oil refineries needs to be improved by consolidating the “energy cost” that is known to account for more than two thirds of the “operating cost”. While it was pointed that a large amount of energy spent at oil refineries is a factor of poor energy efficiency, it was also pointed out that a large amount of intermediate inventories increases

¹⁰ The average facility operation rate of the business year 2012 was 72.2% for Japanese oil refineries, 87.2% for South Korean oil refineries, and 86.8% for large-scale exporting oil refineries in the Asia-Pacific region. (Source: Report on International Comparison, Analysis, etc. of the Competitiveness of Japan’s Oil Refinery Industry 2013)

¹¹ An index that exhibits the operability of each equipment at oil refineries within the year. For instance, if the “operational reliability” is 90%, the refinery was in an operable state for 328.5 days and in an inoperable state for 36.5 days in the year.

¹² It must be noted that there was a comment stating that the facility outage period in other countries is shorter than that in Japan because the regulations in such countries are more relaxed than that in Japan.

the operation frequency of heating furnaces and fuel use for generation steam is inflicting a negative influence. To that end, steps to improve the energy efficiency should be taken, including communization of utility facilities within industrial complexes.



Source: "Report on International Comparison, Analysis, etc. of the Competitiveness of Japan's Oil Refinery Industry"

[Strategic procurement of crude oil]

- Considering the high percentage of crude oil price in the fuel production cost, in order to improve the productivity of oil refineries, it will be necessary to promote 1) strategic procurement of crude oils (including those from North America etc.) through public-private cooperation, taking into account the trend of "heavy-light gap" in crude oil prices and the geopolitical risks, and 2) best mix of crude oils (optimal combination of heavy crude oils and light crude oils including condensates) in accordance with the equipment composition of oil refineries. Additionally, as BCP in preparation of import disruption events due to Middle East crisis etc., it is necessary to diversify the procurement of crude oils based on the geopolitical risks.

[Building a fair and transparent pricing mechanism etc.]

- Oil refinery and wholesale companies have adopted the "market-linked pricing system" in deciding the wholesale prices, where spot trading prices etc. are used as indices. Price indicator is an important function with high public nature that helps realizing healthy market mechanisms. However, there have been raised 1) concern over the credibility of spot trading price indicator, 2) comment saying the cost is not properly reflected on the price, and 3) comment saying the demand-and-supply sensitivity is low (e.g., spot price does not increase even when the market is moving with low level of stocks). It will be required in the future to build a more appropriate pricing mechanism that uses fair and transparent price indicators.
- In addition to building a fair and transparent pricing mechanism, it will be necessary to optimize the logistics and marketing networks that lay beyond shipping of oil products out of oil refineries, with paying attention to maintenance of the nationwide sustainable oil supply systems.

[Growing/transforming into international "Total Energy Solution Companies" through expansion of overseas business etc.]

- Since the oil demand in Japan is predicted to continuously decrease in the future, oil refinery and wholesale companies will likely face further difficulties in gaining stable profit from the domestic oil product market alone if they stay in the current situation. Therefore, from now on, oil companies will require strategic activities to transform themselves into international "Total Energy Solution Companies". Such activities include 1) further enrichment of upstream business (resource development business for oil, natural gas, metal ores, etc.) and overseas oil refinery and petrochemical business, and 2) alliance formation or business restructuring across the boundary of existing energy industries such as oil, electricity and gas.
- In order to allocate enough operating resources to such future growth strategies, it is essential to establish sustainably profitable systems in the domestic oil product market by, for

instance, promoting facility optimization of domestic refineries through reduction of excessive refining capacity and unified operation as described above.

(b) Future activities

For the tasks indicated above, taking into account the market structure survey conducted in June 2014 based on the Article 50 of the Industrial Competitiveness Enhancement Act, future activities shall be taken in the directionalities outlined below, including application of the “Standard for Oil Refiners Concerning the Effective Use of Crude Oils etc. for 3 Years from FY2014” (hereinafter referred to as “the Second Standard”) of the “Act on the Promotion of Development and Introduction of Alternative Energy” (the Alternative Energy Act) announced by the Minister of Economy, Trade and Industry in response to the Interim Report issued by the Advisory Committee for Natural Resources and Energy in July.

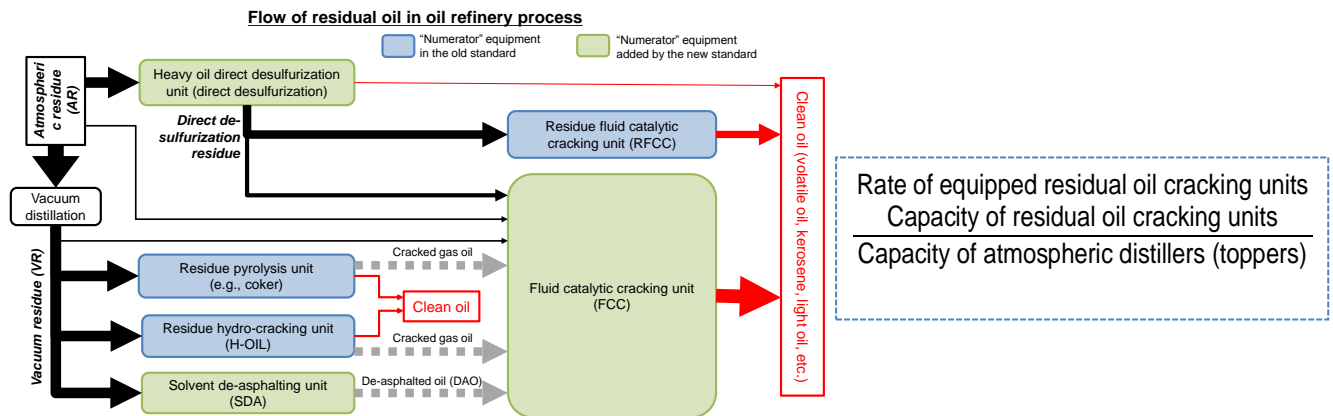
[Promoting business restructuring and facility optimization through application of the “Second Standard” of the Alternative Energy Act, etc.]

[1] Outline of the “Second Standard” of the Alternative Energy Act

- The “Second Standard” of the Alternative Energy Act aims at improving the newly defined “rate of equipped residual oil cracking units” (refers to the ratio of the capacity of residual oil cracking units to that of atmospheric distillers) by March 31, 2017 as the target completion date, in order to promote facility optimization by oil refiners towards “effective use of crude oils etc. (i.e. extracting many clean oil products per crude oil unit)” in response to the change in the business environment of the crude oil market etc. since the implementation of the “First Standard”. (Note that oil companies are required to take action, including step-wise action, to reach the goal as early as possible without waiting for the target completion date.)
- The rate of equipped residual oil cracking units for the entire Japanese oil refinery industry is approximately 45% as of March 31, 2014. Aiming at improving the equip rate to about 50% by the end of March 2017 taking into account the predicted future demand, each company is assigned with individual improvement target (as shown in the Table below) in accordance with the rate of equipped residual oil cracking units of the company as of the date to start counting (March 31, 2014).¹³

(Reference) Concept of “residual oil cracking units”

“Residual oil cracking units” are pieces of equipment that contribute to processing of “atmospheric residue” or “vacuum residue” and producing clean oils from these “residues”. Specifically, they should be (1) “heavy oil cracking units” that were specified by the old standard, namely, residue fluid catalytic cracking units (RFCC), pyrolysis units (e.g., cokers), residue hydro-cracking units (H-Oil), and new additions, (2) heavy oil direct desulfurization units (direct desulfurization), (3) fluid catalytic cracking units (FCC), and (4) solvent de-asphalting units (SDA).



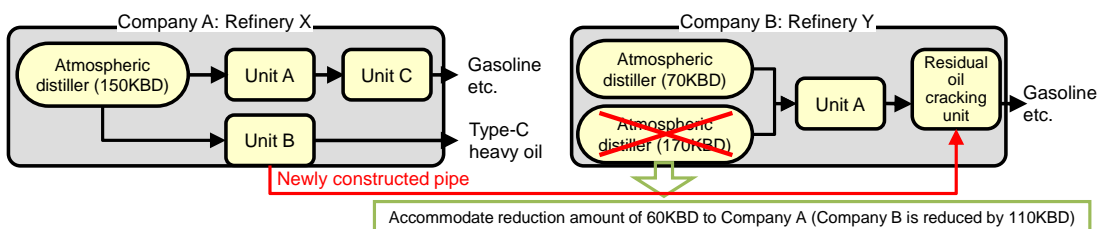
¹³ If each company improved the equip rate solely by reducing the capacity of atmospheric distillers, the refining capacity in Japan will be reduced from the current value of approximately 3.95 million BD by approximately 0.40 million BD. This is considered to be an appropriate level, taking into account the demand-supply gap in Japan derived from the predicted future demand.

(Reference) Improvement target requested by the “Second Standard” of the Alternative Energy Act

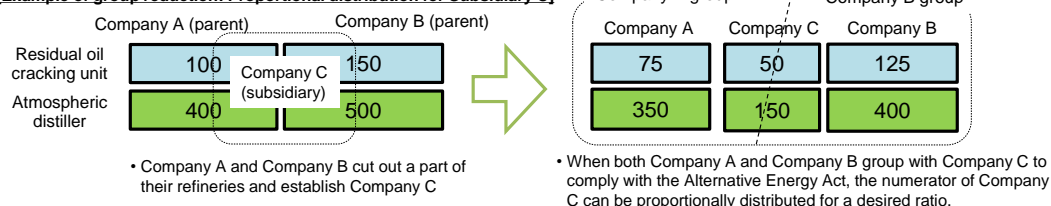
	Improvement target of equip rate requested to be achieved by FY2016
Company with the equip rate as of March 31, 2014 is <u>55% or higher</u>	9% or greater
Company with the equip rate as of March 31, 2014 is <u>45% or higher and less than 55%</u>	11% or greater
Company with the equip rate as of March 31, 2014 is <u>less than 45%</u>	13% or greater

- Oil companies are required to conduct facility optimization to improve the rate of equipped residual oil cracking units by (1) increasing the processing capacity of residual oil cracking units (increasing the numerator), (2) reducing the processing capacity of atmospheric distillers (reducing the denominator), or by (3) combination of (1) and (2), in accordance with their own growth strategy. Regarding “increasing the numerator” (new or additional establishment of residual oil cracking units), consideration to a) practical effects in improving “effective use of crude oils etc.” and b) sustainable supply of oil, through establishment of “flexible production system” (e.g., production switching system for oil products and petrochemical products) were newly added as requirements. Regarding “reducing the denominator” (reduction of the number of atmospheric distillers), reviews were carried out in accordance with the current state of refinery management (e.g., approving the reduction of nominal capacity).
- Additionally, it is expected that oil companies undertake business restructuring on their own decision, including consolidation to or enhancement of highly efficient oil refining facilities etc. and disposal of inefficient facilities. Therefore, the “Second Standard” introduced steps to facilitate enterprise partnerships, such as (1) allowing equipment capacity accommodation measures through partnerships etc., and (2) allowing application of “measures equivalent to” the main rules if required for progressing business restructuring.
- Furthermore, petrochemical complexes (e.g., oil refineries) support the employment of the surrounding areas and play core roles in the local society. Therefore, structural improvement of the oil industry via business restructuring of oil refineries etc. should be conducted under plans that give careful and thorough consideration to the employment and economy of the surrounding areas.

[Example of collaborated reduction: Proportional distribution of reduction of processing capacity of atmospheric distiller of Company B]



[Example of group reduction: Proportional distribution for Subsidiary C]



[2] Applying the “Second Standard” of the Alternative Energy Act and progress status of business restructuring and facility optimization

- To shift the operating resources to the growing industrial fields and to further reinforce the stable oil supply system, oil companies are expected to strongly promote business restructuring and facility optimization at oil refineries etc. in the domestic oil sector, including taking early action and, if needed, step-wise action, without waiting for the target completion date of the “Second Standard” of the Alternative Energy Act at the end of fiscal 2016.
- By the end of October 2014 oil companies have submitted to the Minister of Economy, Trade and Industry a “detailed plan of facility optimization (improvement of the rate of equipped residual oil cracking units)” as a specific plan for achieving the goal (plan on achieving the goal of effective use for crude oils etc.) as well as a “policy for restructuring business” which becomes the base of the detailed plan. Since then, ANRE has followed up the detailed activities at the companies roughly quarterly and requested them to take early action.
- As a result, at the end of March 2015, Idemitsu Kosan Co., Ltd. and Tonen General Sekiyu K.K. improved the rate of equipped residual oil cracking units by reducing the nominal capacity of atmospheric distillers. Additionally, in May 2015, Showa Shell Sekiyu K.K. and COSMO OIL Co., Ltd. announced to promote operation optimization of their refineries at the Yokkaichi Industrial Complex area by stopping one of two atmospheric distillers at COSMO OIL Yokkaichi Refinery as of the end of March 2017 through business collaboration at the Industrial Complex. Further, in response to the “First Standard” of the Alternative Energy Act, also for the Chiba Industrial Complex area, Tonen General Sekiyu K.K. and COSMO OIL Co., Ltd. announced to consolidate their business at Chiba Refineries and to promote operation integration and optimization by stopping one of two atmospheric distillers at COSMO OIL Chiba Refinery. These examples indicate the effects of applying the Standard of the Alternative Energy Act.
- In contrast to these activities, there are companies that have not announced or taken any action, despite the fact that the “Second Standard” of the Alternative Energy Act requests oil companies to take early action without waiting for the target completion date, the end of March 2017. It is strongly desirable that the entire oil industry to squarely face the business environment and to make an early decision on taking step-wise action for facility optimization or business restructuring towards strengthening the international competitiveness, by making swift management decisions with a sense of crisis.

(Reference 1) Rate of equipped residual oil cracking units*1

	Equip rate as of March 31, 2014*5	Equip rate as of June 30, 2015*5
JX Nippon Oil & Energy Corporation*2	46.2%	46.2%
Idemitsu Kosan Co., Ltd.	51.5%	53.5%*6
COSMO OIL Co., Ltd.	43.4%	43.4%
Showa Shell Sekiyu K.K.*3	59.4%	59.4%
Tonen General Sekiyu K.K.*4	35.9%	36.5%*7
Fuji Oil Company, Ltd.	48.3%	48.3%
Taiyo Oil Co., Ltd.	24.6%	24.6%

*1 Rate of equipped residual oil cracking units = [Capacity of residual oil cracking units] / [Capacity of atmospheric distillers]

*2 JX Nippon Oil & Energy Corporation includes Kashima Oil Co., Ltd. and Osaka International Refining Co., Ltd.

*3 Showa Shell Sekiyu K.K. includes TOA Oil Co., Ltd., Showa Yokkaichi Sekiyu Co., Ltd. and Seibu Oil Co., Ltd.

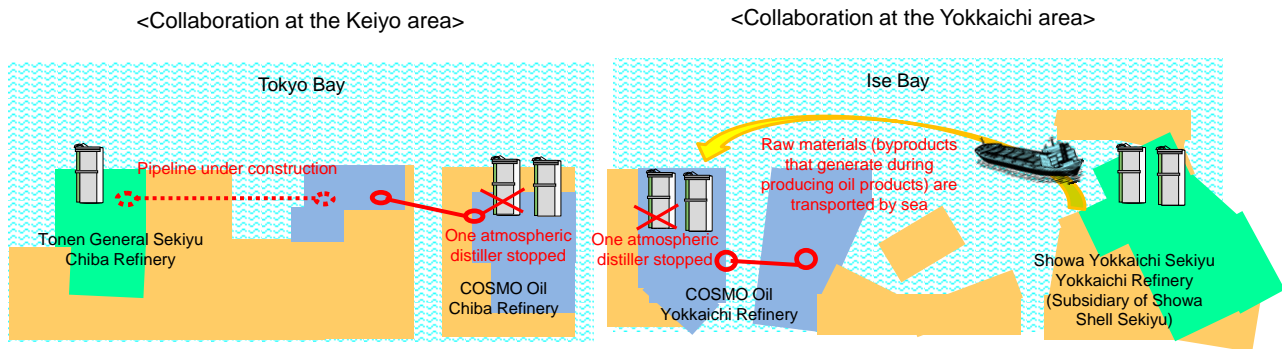
*4 Tonen General Sekiyu K.K. includes former Kyokuto Petroleum Industries, Ltd.

*5 The equip rate is rounded off to the first decimal place. The equip rate as of March 31, 2014 includes the capacity change carried out to meet the Standard stipulated in 2010.

*6 The equip rate of Idemitsu Kosan Co., Ltd. was increased because the nominal capacity of Chiba Refinery was reduced by 20,000 BD as of March 31, 2015.

*7 The equip rate of Tonen General Sekiyu K.K. was increased because the nominal capacity of Kawasaki Refinery was reduced by 10,000 BD as of March 31, 2015.

(Reference 2) Oil refinery unification and collaboration conception at Keiyo and Yokkaichi Industrial Complexes



[Promoting facility maintenance measures toward improved operational reliability and availability of facility]

- Towards “improving the operational reliability”, it is necessary to consider and promote fundamental measures under public-private cooperation, including reduction of the maintenance cost by so-called “risk based maintenance” through the utilization and analysis of maintenance and operation data inside oil refinery, realization of long-term continuous operation, reduction of failure risks, and improvement of the operational reliability of facilities. The Japanese government and the oil industry shall work together in promoting comprehensive measures based on the issues below¹⁴.

[1] Issues with facility management (e.g., management decisions, limitation in testing techniques)

- Oil companies should enhance their facility maintenance by preferentially injecting maintenance costs to the points with exceptionally high risk that were identified through risk assessment of the whole refinery facility, and by promoting activities to reduce inspection or management points (e.g., removal of unused pipes) for improving the management efficiency. To that end, appropriate management decisions need to be made, not to shortsightedly pursue continuous operation with neglecting proper investment into maintenance that supports stable operation in the medium- to long-term.
- It has been pointed out that there exist limitations in the current testing techniques, including difficulties in finding “external corruptions” of pipes, poor reliability of testing methods (e.g., method for predicting life of deteriorated parts), and a large amount of incidental expenses incurring (e.g., “footing” to be built for inspection, measures against asbestos). To solve such issues, technical development required for advancing inspection and repair works at refineries should be promoted through public-private cooperation.

[2] Issues with utilizing information or preceding cases (e.g., utilization of data inside oil refinery, utilization of lessons learnt in past accidents)

- The big data that is created through daily operation of refineries (e.g., information inside the operation diary and transfer diary, information on close-call incidents, information on accidents and troubles) is not fully analyzed nor utilized for the purpose of detecting the signs of accidents or troubles. In the first place, detailed IT utilization methods (e.g., text mining) have not been established, and their effects are yet to be identified. It will also be required to progress technological development etc. on combining such data with sensor-related data, as a mid- to long-term task.
- Additionally, information on the accidents and troubles that occurred in the oil industry is shared only shallowly; sharing abundant volume of information detailing indirect factors and background factors is not put into practice. Based on the voices raised about the necessity of such data in actual on-site operation, the accident information sharing system currently developed by the Petroleum Association should be continuously reviewed.

¹⁴ See “Causal Analysis of Accidents at Refineries in Japan”, on-site investigations conducted by ANRE to 5 randomly selected oil refineries during the period from December 2012 to March 2013.

[3] Issues with HRD system

- In the future, generations with no experience in “establishing or launching oil refineries” and little experience in starting up or shutting down under an unsteady state may take core roles in the operation of oil refineries. Assuming such a situation, oil companies should divert themselves from the past HRD methods, and should consider and promote support using advanced technologies, such as introduction of plant simulators that use conditions similar to actual machines and introduction of IT-based operation support tools.

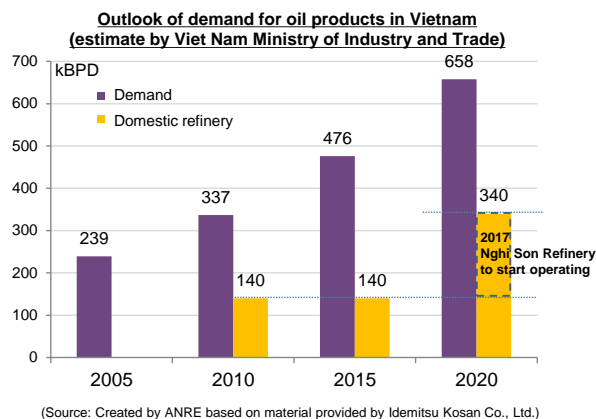
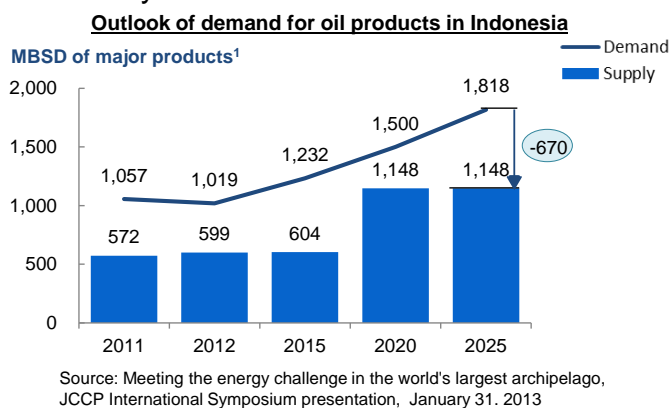
[Promoting R&D toward increasing added values, improving the operational reliability, etc.]

- In order to further strengthen the profitability of oil refineries after the progress in the facility optimization and business restructuring in response to the Alternative Energy Act, oil companies have to pursue (1) increasing the income by improving the yield of high added value products per crude oil unit (so-called “noble use of oil”), (2) reducing the fixed expenses per product unit by stably operating the facilities, and (3) reducing the variable expenses per product unit by reducing the energy cost that accounts for 70% of the operating cost. On top of that, (4) the public sector and the private sector have to work together in narrowing down the priority subjects and promoting technological development, based on the viewpoint of developing the “strength” in expanding oil refinery business to Asian countries etc. in the future.
- Prioritizing such major issues of Japan’s oil refineries, namely, “noble use of oil”, “improving the operational reliability”, and “improving the energy efficiency”, the Japanese government shall provide undisrupted R&D support from the basic research through to demonstration and practical application, with the view of promoting the development and entry of young researchers or researchers from different fields.
- Especially, R&D that contribute to improving the energy efficiency need to be promoted in accordance with the needs of the oil refinery and wholesale companies, including support for R&D seeds at engineering business operators etc. Furthermore, in order to secure human resources that take charge of the future of the oil industry, it is necessary to establish an environment that facilitates development of young researchers at universities and central research institutions etc. of companies.
- Regarding the basic technological development project for petroleomics that has been promoted intensely, based on the potential of it becoming an innovative base technology in the future, there is a necessity to accumulate “small results” and “useful results” that meet the operation strategy of oil companies or needs at manufacturing sites, by taking advantage of past research results. It is essentially important to propagate the recognition on the usefulness of petroleomics into oil refiners in the first place.

[Promoting international development of downstream oil business (import, refinery, wholesale, retail)]

- To realize future growth in the oil business sector under the declining domestic demand for oil, oil companies will need new strategies for upstream business (resource development) and downstream business (oil import, refinery, wholesale, retail, etc. in Asia). While the excess in oil supply capability is predicted to extend in Asia as a whole, detailed analysis indicates that the oil demand and supply environment varies from country to country. For instance, growth of downstream business is expected to occur in countries that promote so-called “consumption site refinery principle” policies, and there are countries that are expected to have high demand on new or additional construction of oil refineries and expanded opportunity for foreign capitals to enter in the import, wholesale and retail business, such as Vietnam, Indonesia and Myanmar. It will become necessary to gather information on the demand-supply trend for oils and petrochemical products in such countries, and discuss the candidate areas that will be the targets of direct investment for expanding the mid-reach and downstream business. Decision will have to be made as swiftly as possible, taking into account the depth and characteristics of business base for each company that has been

developed through fuel export, lubricating oil business, etc. Idemitsu Kosan Co., Ltd. has already commenced new establishment of an oil refinery in Vietnam, and JX Nippon Oil & Energy Corporation has signed MOU with Vietnam and Indonesia to consider starting oil refinery business in these countries.



- Direct investment for expanding the downstream business in an Asian country will require intergovernmental cooperation between Japan and the target country for arranging investment environment etc. Here, it has to be noted that the status of oil supply network, governmental functions, etc. vary depending on the country. Therefore, when promoting energy projects into countries that are likely to undergo development of oil supply network in the future, it will be necessary for both the public and private sectors to engage in the projects from the national oil supply system designing stage (designing of ideal supply network consisting of oil refineries, oil terminals, and service stations as well as formulation of necessary legal regulations), instead of restricting themselves to individual participations in refinery building projects. It will also become necessary to make efforts in facilitating project financing from the project implementation stages, for the purpose of smoothly carrying out the project. For instance, for Myanmar, METI held “Energy Policy Development in Myanmar” in FY2014, and appealed the Ministry of Energy of Myanmar to open doors to foreign companies including Japanese companies in joint venture tendering for importing, storing, distributing and selling of oil products in the country. It also is planned to newly establish “Energy Policy Dialogue” with Myanmar in FY2015.
- It is necessary to promote such activities in the future by public-private cooperation through the “Council on International Development of Energy Industry through Export of Infrastructure, etc.” launched inside ANRE in June 2015, “Energy Policy Dialogue” planned to be held with Asian countries in the future, HRD programs (e.g., JOGMEC, JCCP (Japan Cooperation Center, Petroleum)), etc., including cooperation for designing and improving the investment environment and emergency supply system at the target country.
- Additionally, in regard to the direct investment into resource rich countries, it has to be noted that the upstream sector is not receiving much attention investment-wise from Japanese oil refinery and wholesale companies. Therefore, it is desirable to extend participation of Japanese oil refinery and wholesale companies in mid-reach and downstream business into participation in the upstream sector as well. Such activities will need to be comprehensively promoted through public-private cooperation.

[Growing/transforming into Total Energy Solution Companies]

- It will become difficult in the future for oil companies to picture growth strategies through domestic oil business alone. Therefore, oil companies will require strategies to grow or transform into “Total Energy Solution Companies” that deal with the 1) upstream sector (resource development), 2) mid-reach and downstream sector (oil refinery, sales, petrochemical) at local areas in Asian countries as described above, and the 3) domestic electricity and gas sector that has been further liberalized through the Electricity System Reform.

- Viewing the progress in the liberalization of electricity and gas system through reform, there have been active movements by oil companies observed lately in expanding their power generation business by collaborating with electricity companies or gas companies. For instance, in May 2015, Idemitsu Kosan Co., Ltd. jointly established “Chiba-Sodegaura Energy Co., Ltd.” with Kyushu Electric Power Co., Inc. and Tokyo Gas Co., Ltd., to promote constructing a coal-fired power plant at the Keiyo area. In January 2015, Tonen General Sekiyu K.K. submitted a “Planning Stage Environmental Impact Statement” to the Minister of Economy, Trade and Industry etc., toward establishment of a natural gas power plant at the Shimizu area. Oil companies are also working on power generation business using renewable energy (e.g., solar, wind power, geothermal, biomass) and introduction of new fuels including biofuels and hydrogen station business, in pursuit of new business opportunities.
- The important thing here is not for oil companies to progress mere “business diversification” by taking the opportunity of electricity and gas system reform, but for them to transform into internationally competitive “Total Energy Solution Companies” by forming alliance across the boundary of existing energy industry such as oil, electricity and gas or through business restructuring.
- In the first place, for the purpose of securing the investment capability for promoting such activities as well, oil companies are expected to accelerate business restructuring and facility optimization beyond the “capital boundary” or “geographic boundary” in the downstream oil business as the main business sector. While it goes without saying that such business restructuring and facility optimization at oil companies are to be conducted on their own term, it is also important that the Japanese government arranges an environment that facilitates such corporate actions. The Japanese government should take necessary steps with carefully observing changes in the market structure that may occur due to activities etc. taken by oil companies.

ii) LP gas industry (wholesale)

(a) Reform of LP gas industry (wholesale)

- Regarding LP gas wholesalers, COSMO OIL Co., Ltd., Showa Shell Sekiyu K.K. Sumitomo Corporation and Tonen General Sekiyu K.K. have consolidated their LP gas business and inaugurated a new company “GYXIS Corporation” in April 2015. Through this, the three major LP gas wholesalers will take up to about 80% share for the import amount in Japan. In the future, the Japanese government shall encourage oil companies to take necessary actions, including improving the efficiency of their business, enhancing the activity toward entering the overseas markets, reinforcing the purchasing power for LP gas producing countries, and promoting the diversification of supplier countries.
- Further, advanced movements by LP gas wholesalers in joint procurement, restructuring, collaboration, etc. are expected to enhance their negotiating power, represented by the recent announcement by ENEOS Globe Corporation and Astomos Energy Corporation in commencing consideration on broad business collaboration.

(b) Overseas development of LP gas-related equipment

- Interest in products made by Japanese LP gas equipment manufacturers is increasing in emerging countries especially those in Southeast Asia, and in fact these products have become widely used in such countries. It is important to take such a move as an opportunity for Japanese enterprises to expand their LP gas supply service business to overseas countries, instead of limiting it solely to export of equipment. It is necessary to promote international development of Japanese LP gas industry by investigating the supply structure and actual state of LP gas trading overseas.

(2) Maintaining and strengthening the business that supports local life and economy

i) Oil retail business

(a) Current situations around the oil retail business

- The total number of service stations has been gradually declining after peaking in FY1994 with 60,421 stands (a total of 33,510 service stations at the end of FY2014). The sales amount of gasoline is expected to continuously decline in the future (at an annual reduction rate of 2.4%) due to structural factors such as aging population with fewer children and improved fuel efficiency of cars. Currently, the crude oil cost accounts for approximately 40% of the retail gasoline price, and tax component (e.g., gasoline tax) approximately 40%. These two elements account for more than 80% of retail gasoline price (approximately 80% for light oils, and approximately 75% for kerosene), and oil refinery/wholesale business operators and oil retail business operators are sharing profits from the remaining limited margin.
- Oil companies play important roles in realizing sustainable oil supply, and it is essentially important for them to continue their business amid the assumed situation of continuously declining domestic demand for oil products. To achieve that, appropriate level of margin needs to be secured through competition of various business models under healthy frameworks of competition and without oil companies engaging in price competition merely for the purpose of extending the sales amount. Securing appropriate margin will enable making necessary reinvestment as well.

(b) Direction of response by oil retail business that plays a role of stable supply and supporting the local community

- Service stations play a role of stable fuel supply and support the local community. In order for such service stations to continue their business, they are required to undertake various activities to secure appropriate level of margin through subjective business judgment, considering the current situation and future outlook. It is deemed effective for the Japanese government to gather and analyze the information on preceding response cases and consider measures with the relevant parties depending on the business status (e.g., scale and location of service stations), in order to promote 1) review of business model in oil product sales through advancement and rationalization of service station-related facilities and distribution and 2) strengthening of business power of service stations through provision of services other than oil products etc.
- Functions of service stations serve as indispensable infrastructure for the local community, not only for stable provision of energy. “Formation of small bases”, one of regional revitalization activities, also places systems to sustainably supply oil products as a function necessary for maintaining and securing services for local life. To support service stations in strengthening their business base, there is a necessity to consider and implement various support activities with maintaining collaboration with ministries and agents in charge of local policies, municipalities and relevant business operators.

(c) Measures against issues of underpopulated areas with few or no service station and supporting isolated islands

- It has become actualized that some areas with substantially declining service stations are facing “issues of underpopulated areas with few or no service stations are in short supply”. At such areas, people experience difficulties in purchasing gasoline for cars or diesel for farming equipment, or in delivery of kerosene for elderly people in winter. Oil refinery and wholesale companies (hereinafter referred to as “wholesalers”), oil retailers and the Japanese government are required to respond to the local request for the sustainable supply of oil products through thorough operation rationalization of service stations and national aid.
- ANRE conducted demonstration projects over three years from FY2011 to FY2013, in order to establish a supply system at areas where service stations are in short supply that meets the actual circumstances of each area. The projects identified the directionality of activities such as converting service stations into multipurpose bases for selling and delivering commodities as well and downsizing of oil tanks. They also identified the necessity of all-out activities by the local residents and governments in sustaining operation of service stations.

- Based on these findings, in FY2014, the rate of subsidy for replacing underground tanks at service stations or for installing simple meters corresponding to the demand trend was raised, for cases where cooperation between oil retailers and local governments is identified (e.g., placing the measures for maintaining sustainable supply of oil products in the municipal plans based on the Act on Special Measures for Promotion for Independence for Underpopulated Areas (Underpopulation Act)). This is a conversion of framework; in the previous framework the Japanese government was the sole provider of support for service stations, while in the new framework local public organizations engage in providing support for service stations and the Japanese government provides assistance for maintaining functions of service stations deemed necessary by the locals. In FY2014, Gonohe (Aomori), Kitahiroshima (Hiroshima) and Shingu (Wakayama) included establishment and maintenance of service stations in their plans for promoting the independence of underpopulated areas for the purpose of stable supply of fuels at such areas, and ANRE provided support to the relevant service stations in a form of increased subsidies.
- Additionally, in order to facilitate independent activities by municipalities, local residents, etc., in March 2015, the Japanese government, oil wholesalers, industry organizations (e.g., Petroleum Association of Japan, Petroleum Commercial Unions), etc., established the Council for Underpopulated Areas with few or no Service stations. The Council may fully utilize its framework in encouraging activities by municipalities and local residents on securing fuel supply functions that are necessary for the local community and in coordinating and implementing measures specifically tailored to various local situations.
- To reduce the operating cost of service stations in areas where service stations are in short supply, it is important to consider the possibilities of solving issues by technical means, introduction of new operation system, etc. Taking into account the current movement to seek efficient operation forms for service stands that meet the local characteristics, the Fire and Disaster Management Agency commenced considerations on security measures based on the local characteristics, where an employee (certified hazardous materials engineer) comes out of a store etc. at the station and performs refueling only when there is a customer requiring refueling. ANRE also shall provide support in demonstrations of technological development etc. that contributes to reducing the operating cost of service stations.
- In order to maintain the functions of service stations in areas where service stations are in short supply, it is essential for the relevant parties to have the common awareness on the necessity of service stations, and for the local community to commit itself in maintaining the fuel supply functions necessary for the local community via methods that meet the local needs. The Japanese government is required to make efforts in inducing commitment of local people and in providing support for strengthening the business base of service stations that are willing to contribute to sustained supply of oil products in local areas, while building cooperative relationship with the ministries in charge of such local policies and with the relevant business operators.
- Regarding isolated islands, the distribution cost of oil products for such islands is higher than that at the main island, and the Japanese government provides subsidies corresponding to the cost difference. In response to the indication by the Board of Audit of Japan in FY2014 stating that the unit amount of subsidy shall be reviewed so that the subsidy reflects the actual state of distribution cost for isolated islands, ANRE conducted survey on the distribution cost. Based on these activities, the subsidies shall undergo appropriate review to reflect the actual situation of isolated islands.

(d) Consideration on expanding the opportunity of receiving orders from the public sector for small and medium oil retailers that take charge of sustained fuel supply in emergencies

- As described above, small and medium oil retailers affiliated to petroleum unions that concluded a disaster agreement with municipalities play an important role in sustained local supply of oil products in emergencies, such as prioritization of fuel supply to public vehicles (e.g., fire-engine, vehicles owned by municipality) or to important facilities (e.g., water and sewer services). Amid the prospect of declining domestic demand for oil products, all

necessary measures shall be taken for business continuation of such small and medium oil retailers that are willing to contribute to sustained supply of oil products in emergencies. To that end, the “Contract Policy of the Government regarding Small and Medium Enterprises” based on the conventional Act on Ensuring the Receipt of Orders from the Government and Other Public Agencies by Small and Medium-sized Enterprise (Government and Public Office Demand Act) stipulated that small and medium-sized local enterprises and small-scale business operators (including unions suited for satisfying government and public office demands) are to be actively utilized as necessary in establishing a sustainable supply system in emergencies through agreements etc.

- Lately, for the purpose of spreading a virtuous cycle of economy throughout Japan, the Government and Public Office Demand Act was revised to expand activities for supporting small and medium local enterprises through demands from the public sector. In so doing, it is important to appropriately secure the opportunity of receiving orders from the public sector for small and medium local oil retailers that take charge of sustained fuel supply in emergencies, from the viewpoint of enhancing the resilience of oil supply network. For that reason, the Japanese government shall consider clearly describing in the “Contract Policy of the Government regarding Small and Medium Enterprises” based on the Act considerate measures for small and medium local oil retailers that concluded a disaster agreement. Additionally, there is a necessity to follow up the status of activities by local governments so that the aforementioned activities that contributes to enhancing the resilience of oil supply network spread not only to the national government but also to local governments.

(e) Addressing new issues

- Regarding the volatile organic compounds (VOCs) considered as the causal substances of PM2.5 (fine particles), their emissions by fuel retailers including oil retailers have remained the same over years, accounting for approximately 15% of the national emissions. The necessity for promoting measures against fuel evaporative emissions while refueling and unloading was pointed out at the Expert Committee on Motor Vehicle Emissions of the Central Environment Council (February 2015). Suppression of VOC emissions requires considerations on measures against air pollution as well as measures based on the actual situation of oil retailers from the viewpoint of ensuring the business continuation of service stations, including understanding the actual state of VOC emissions and investigation of the cost-effectiveness of such measures.

ii) LP gas retailers

(a) Responding to the gas system reform

- Amid the liberalization of city gas retail business through the gas system reform, LP gas retailers are anticipated to be preferentially selected by local users and contribute to the revitalization of local economy by taking advantage of the trust from local residents earned through highly community-based business and by providing services etc. that are more attractive to users than before.
- Approximately 24 million households use LP gas in Japan, and the LP gas supply chain has already spread throughout the nation including semi-mountainous areas. It is important to fully utilize such infrastructure and to develop business that meets the needs of each local area. For instance, it is desirable for local LP gas supply industry to aim at becoming a “comprehensive life infrastructure industry” to support local life by providing various community-based life services (e.g., elderly monitoring service and nursing care by utilizing a LP gas central monitoring system) as a package. Services using new equipment such as fiberglass reinforced plastic (FRP) containers may also warrant valuable.
- Based on such understandings, there is a necessity to develop an environment to realize such a movement, by utilizing various system designing opportunities that are planned to be held in accordance with the revision of the Gas Business Act (revised in June 2015).
- Additionally, some major LP gas retailers exhibit movements toward becoming community-based comprehensive energy supply entities, including entry to power generation business by use of renewable energies etc., bundled sale of electricity for

household, and entry to the city gas sector.

- Furthermore, some LP gas retailers started to take action aiming at optimizing allocation of operating resources, improving the productivity, etc. by obtaining approval for a business restructuring plan based on the Industrial Competitiveness Enhancement Act to eliminate redundant business, clarify decision-making process, etc. Taking into account such movements, the Japanese government shall continuously promote improvement of distribution structure and strengthening of business base of retailers.

(b) Reviewing the safety regulations and systems

- Regarding the safety, while LP gas retail business has a certain level of similarity with the community gas utility business etc. under the Gas Business Act, there are many differences in terms of the safety regulations. To that end, in June 2015, the Liquefied Petroleum Gas Subcommittee and Gas Safety Subcommittee of the Industrial Safety Committee, Industrial Structure Council were summoned, where an indication “it is important to ensure the consistency for those that can be evaluated in a similar manner technically” was made for safety regulations under the Act on the Securing of Safety and the Optimization of Transaction of Liquefied Petroleum Gas and the Gas Business Act. The Subcommittees plan to gather information on the issues etc. on actual operation and work on ensuring the consistency among regulations and systems.

(3) Forming a fair and transparent market

i) Oil products

(a) Current situations and issues of affiliate trading and non-affiliate trading

- Oil products such as gasoline cannot be easily differentiated from products of other companies in terms of quality etc., and the competition tends to concentrate in the prices. Meanwhile, wholesalers have two distribution routes, namely, route for affiliate companies and route for non-affiliate companies, and there is a gap in the wholesale prices between the two routes. Naturally, there have been voices raised requesting improvements in pricing issues, including 1) the gap in wholesale prices reaching the level to cripple the price competitiveness of affiliate service stations, and 2) non-transparency of the calculation basis related to wholesale prices and sale-related cost proposed by wholesalers to affiliate service stations. There also is a comment stating that the share of subsidiaries of wholesalers in the market is increasing and there have been new entries from other business sectors in late years, and the competition within affiliate companies has become severer. A fairer trading structure without falling into a profit-ignoring excessive price war can be effectively realized by improving the transparency of the actual state of distribution and prices in trading, which should be promoted through cooperation and collaboration of wholesalers and retailers. It also is important, as a premise, for oil business operators to inform consumers of correct information on taxes etc. laid on oil products.
- Sales of gasoline by general special agent retailers used to account for a large majority of domestic sales, but have fallen below 60% in FY2013. Meanwhile, sales by service stations of subsidiaries of wholesalers have increased to approximately 22% and sales by trading companies have increased to approximately 14%.
- There have been voices raised from affiliate service stations of wholesalers stating that the gap in the wholesale prices between affiliate trading and non-affiliate trading is placing major pressure on their business. Amid such a situation, the Japan Fair Trade Commission (JFTC) conducted an investigation on the actual state of distribution, and issued “Report on the Survey of Gasoline Trading” in July 2013.
- In the Report, JFTC indicated issues in wholesalers’ interaction with affiliated special agent retailers, including non-transparency in the calculation basis of wholesale prices or sale-related costs and monotonous restriction or banning on handling of *Gyoutengyoku* (Gyoushakan Tenbai Gyoku: Inter-supplier resale oil products. Refers to gasoline that circulates through non-affiliated routes) for all affiliated special agent retailers. JFTC concluded that these activities by wholesalers are inappropriate from the viewpoint of establishing fair competitive environment.

- While affiliate trading stands on continuous contractual relationship between wholesalers and retailers, the wholesale prices in non-affiliate trading are highly subject to the demand-supply situation and do not include delivery cost or sale-related costs. Therefore, in many cases the wholesale prices in non-affiliate trading remain lower than that in affiliate trading.
- Taking into account these issues, ANRE has conducted quarterly hearing from wholesalers since July 2013, for the purpose of identifying the actual distribution status of non-affiliate trading. The hearing found that in general the gap in the wholesale prices between affiliate trading and non-affiliate trading widened since the middle of year 2013 (from 3.7 yen/L in June 2013 to 4.9 yen/L in September 2013), which were then in a trend of narrowing down until the middle of year 2014 (2.8 yen/L as of June 2014), and is now transitioning at a level around 3 yen (3.2 yen/L as of March 2015). Accordingly, the percentage of shipping amount for non-affiliate companies in the total shipping amount is in a trend of gradual decrease.
- Since the price gap between affiliate trading and non-affiliate trading is prone to become the main source of sense of unfairness or discontent to special agent retailers, it will be required for wholesalers to maintain fair trading with affiliated special agent retailers, such as not to practice any act that may violate the Act on Prohibition of Private Monopolization and Maintenance of Fair Trade (Anti-Monopoly Act) like sudden and one-sided suspension of trading or raising of wholesale prices to affiliated special agent retailers simply because they handled cheap *Gyoutengyoku*.

(b) Implementing the Certificates of Oil Products Distribution

- Distribution of oil products involves with multiple layers of trading from wholesalers to finally be sold to the consumers at service stations. Usually trades individually complete by themselves and there has been no method to envisage the whole picture of distribution. However, non-transparency is another factor of sense of unfairness or discontent to special agent retailers, and the Japanese government requested wholesalers and oil retailers to consider introducing the Certificates of Oil Products Distribution (COPD) for the purpose of improving the transparency. JFTC requested wholesalers to regard oil products that were traded through non-affiliate channels (e.g., trading companies) in the same manner as they do for affiliated oil products, if the oil products are identified to be shipped from an affiliate wholesaler via COPD. All wholesalers accepted this request in principle, and COPD was officially implemented in April 2014 as a voluntary initiative of the oil industry.
- Through COPD, service stations can clearly identify the source of gasoline their company purchased, and wholesalers can improve the transparency of affiliate trading by realizing the final destination of the gasoline they shipped. In fact, using COPD, the final destination is clarified for about 94% of amount of gasoline shipped by wholesalers of the company (excluding exports) as of March 2015, indicating a certain level of progress in improving the transparency. In the future, relevant parties shall follow up the implementation status of COPD, understand the actual situation of gasoline distribution in local areas, verify the adoption rate of COPD and its effects, and take necessary measures based on the results.

(c) Reviewing the quality assurance planning system under the Act on the Quality Control of Gasoline and Other Fuels (system to decrease the times for quality specification)

- The Act on the Quality Control of Gasoline and Other Fuels (hereinafter referred to as the “QC Act”) has a clause that stipulates easing of the obligation to carry out quality analysis at service stations from once every 10 days to once every year if the Japanese government identifies fulfillment of the requirements “distribution route of gasoline from the wholesaler is fixed” and “no modification is made to the quality in the distribution route”, because the quality of gasoline is assured by wholesalers. In January 2014, JFTC requested wholesalers to regard their own oil products shipped by themselves same as affiliated oil products regardless of the market routes. However, under the system of the then QC Act, the above clause did not apply to gasoline purchased by affiliate special agent retailers from those other than wholesalers or affiliate special agent retailers, because in such cases the

distribution routes are not identifiable as fixed even if shipped by themselves.

- Therefore, under the previous QC Act, the system to decrease the times for quality specification does not apply to gasoline regarded the same as affiliated oil products through COPD etc., which was considered irrational and the requirements were reviewed at the request of JFTC. Specifically, reduction of the times for quality specification is applicable to cases where, for instance, the origin of the gasoline can be confirmed as own gasoline etc. by using COPD etc. and the quality of gasoline and other fuels can be assuredly guaranteed when all the personnel involved with the main distribution route (identified distribution route) assume the responsibility on the quality, which came into force in June 15, 2015. As a result, it has become possible to apply the system to decrease the times for quality specification for when, for instance, the origin of gasoline can be confirmed as shipped by the wholesaler itself by COPD even when the gasoline was purchased by retailers from routes other than wholesalers or affiliate special agent retailers.

(d) Ideal mechanism for deciding wholesale prices

- In October 2008, wholesalers changed the mechanism for deciding wholesale prices to a market-linked pricing system where the spot price was used as the practical indicator to decide wholesale prices. However, in 2013, the spot price did not properly reflect the crude oil price increase, and there arose a question over the propriety of spot price as a price indicator. Accordingly, in spring 2014, the mechanism for deciding wholesale prices was revised.
- Specifically, while the concept of the mechanism for deciding wholesale prices linked to the market was inherited, the mechanism was revised to observe various indicators including domestic retail prices, overseas oil prices, and crude oil prices, instead of relying solely on the domestic spot price. There were then some changes to the market environment including the crude oil price increasing toward the summer of 2014, followed by falling, and bottoming out in January 2015. Amid such a situation, regarding the mechanism for deciding wholesale prices, recognition sharing among wholesalers and special agent/general retailers as well as ensuring the predictability of wholesale prices (e.g., setting and implementing standard prices to prevent ex-post price adjustment) will be continuously required.
- Furthermore, in FY2014, audit of Japanese oil price reporting agencies was conducted by the International Organization of Securities Commissions (IOSCO) based on the “Principles for Oil Price Reporting Agencies” for the first time in Japan. It is important to continue to maintain the reliability of investigation methods of price reporting agencies by conforming to the IOSCO Principles etc. and to promote clarification and optimization of oil product pricing mechanisms by, for instance, considering the methods for vitalizing the commodity futures market.

(e) Cooperation and collaboration between wholesalers and oil retailers

- The abovementioned steps for establishing a fair and transparent market essentially require cooperation and collaboration between wholesalers and retailers. In April 2014, an opportunity was made for wholesalers and the service station industry to discuss various issues of the oil industry pertaining to the distribution of gasoline (e.g., maintenance of fair competitive environment), and similar opportunities have then been continually created. Including such a framework, relevant parties are required to maintain close communication and continuously engage in activities for resolving the issues at hand.

ii) LP gas

(a) Current situations and issues of LP gas retail

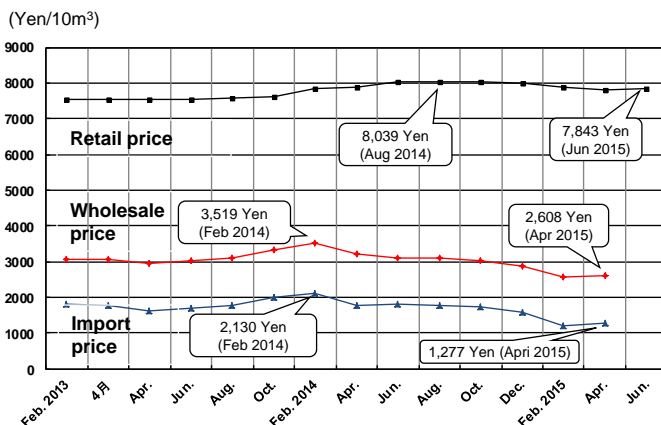
- In regard to the price of LP gas, users attribute the ongoing high retail prices of LP gas to delayed business rationalization, few options available for LP gas retailers at condominiums etc., and high delivery cost due to widespread user locations. Additionally, the consumer retail prices of LP gas for households have a gap among regions, due to the cost structure specific to distributed energy that is affected by the local sales and delivery issues. Further, amid the abovementioned sharp drop of international indices of LP gas, there are many

comments indicating that import prices are not fully reflected on the domestic retail prices and the time to reflect the prices varies company to company. According to the petroleum gas price survey commissioned by ANRE, the wholesale price peaked at 3519 yen in February 2014 and then dropped to 2608 yen in April 2015 due to the fall of import price thereafter. Meanwhile, the retail price marked record high 8039 yen in August 2014, while the price as of June 2015 was 7843 yen; the range of drop is substantially smaller than the change in the wholesale price. As mentioned above, the content of activities taken by enterprises varies widely, and some enterprises reduce prices lower than the average figure. However, not many enterprises disclose their charging system, and in many cases the retail price ends up remaining high. Such a situation may divert consumers from LP gas and eventuate into a matter of life and death for the future of LP gas industry, and may also inflict serious adverse effects on the security of entire nation if consumers stay away from LP gas that has major advantage in disasters.

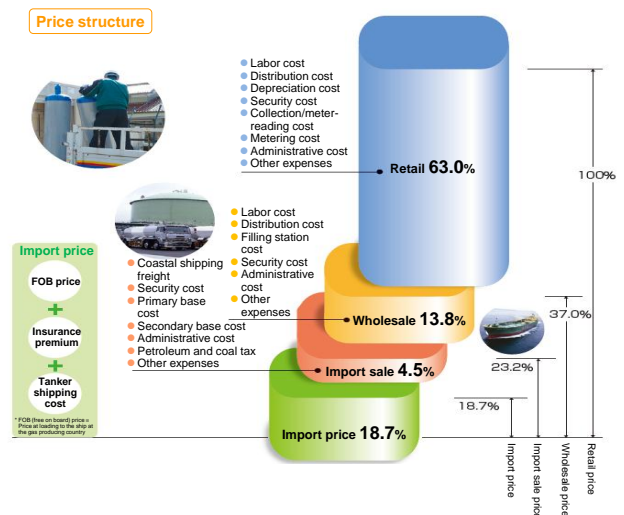
(b) Improving the transparency of LP gas retail price

- Based on such issues, in an attempt of gaining understanding from consumers, the LP gas industry revised the industrial guidelines “LP Gas Sales Guidelines” to obligate LP gas companies to present a charging table at the time of signing a contract (based on the Act on the Securing of Safety and the Optimization of Transaction of Liquefied Petroleum Gas) and to enforce them to comply with legal regulations such as banning of deceptive solicitation (based on the Act on Specified Commercial Transactions). Additionally, all the LP gas business operators in Japan are thoroughly informed of the request to implement measures (e.g., (1) managing complaints and counsels from consumers, (2) providing explanations and documents on soliciting, (3) providing explanations and documents on contracting) similar to the consumer protection measures that are to be enforced onto electricity and gas retail business operators after the complete liberalization of the industry through the recent electricity and gas system reform.
- Additionally, using their websites, prefectural LP gas associations promote gathering of information on regional LP gas retailers, presenting the local average retail price through the petroleum gas price survey commissioned by ANRE and gathering and disclosing of information on local retail stores.
- However, such activities must be carried out swiftly and in a wide range, or it will become increasingly difficult to obtain understanding from consumers. The Japanese government needs to strongly promote and follow up activities, such as disclosure of “LP Gas Sales Guidelines” on the relevant websites, gathering and publication of further detailed and broader information, horizontal expansion of best practice, improving the supply structure (e.g., consolidation of filling stations), and ensuring and improving the transparency of retail prices including the concept of price setting.

[Transition in LP gas import, wholesale and retail prices (re-presented)]



[LP gas price structure]

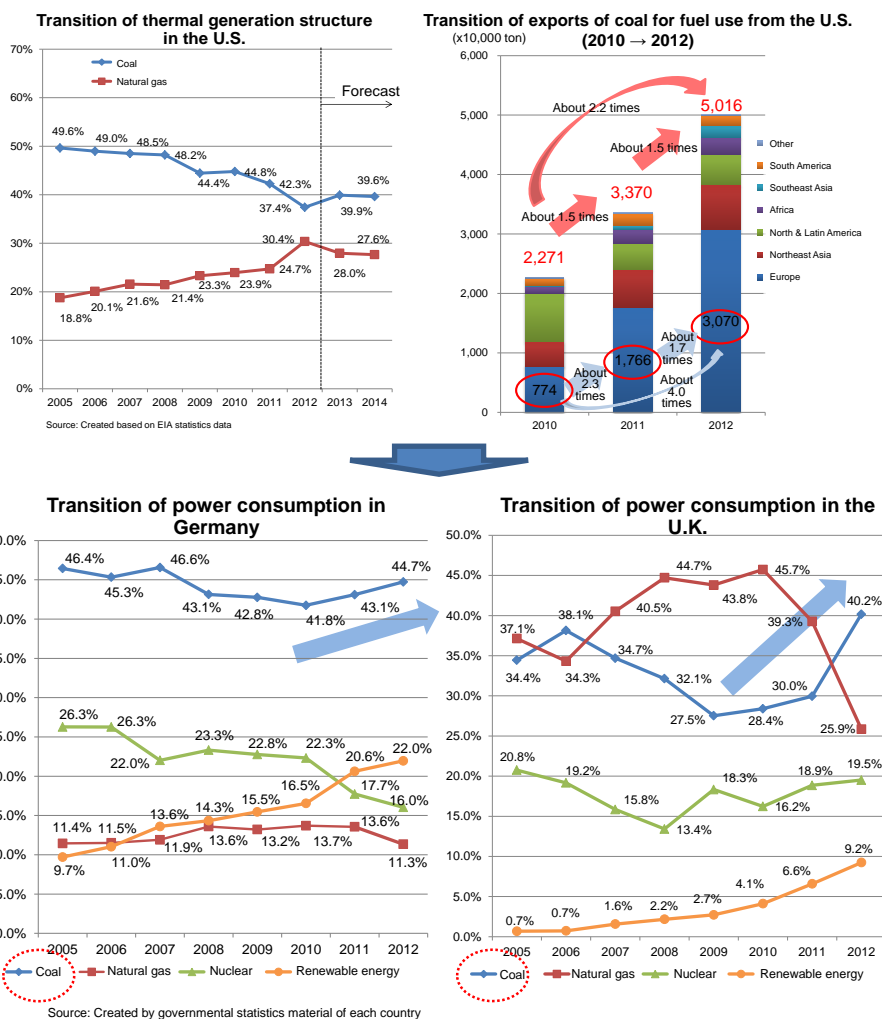


Chapter II: Policies on coal

1. Changes in energy demand and supply structure

i) Trends in the coal market

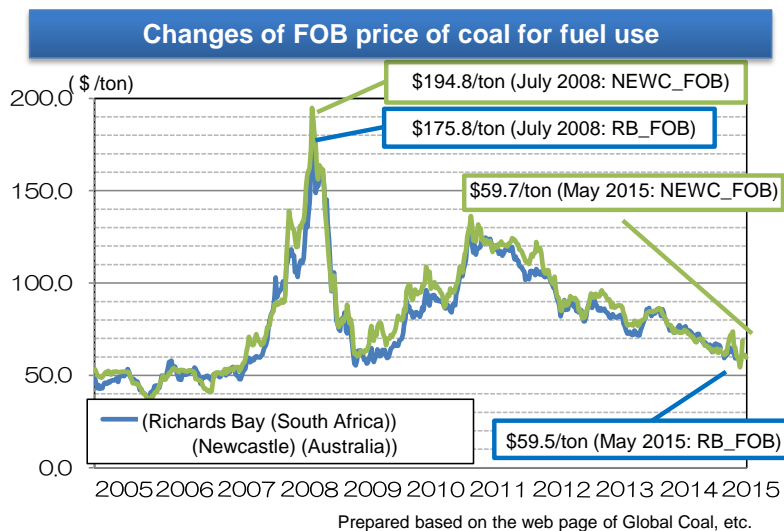
- The world's coal demand and supply structure has changed drastically in the last 10 years. In China and India the consumption of coal became about twice the level in 2005 due to the increased demand for electricity and steel along with the rapid economic growth and other factors. Currently, these two countries account for half of the global coal consumption.
- Additionally, in the US the majority of aged coal-fired power plants are replaced by gas-fired power plants using cheap domestic natural gas associated with the "Shale Gas Revolution" etc. Accordingly, majority of surplus coal in the US is exported to Europe who deregulated electricity and seeks cheap source of energy, causing an increase in the ratio of coal-fired power generation in Europe.



- Along with the increase in the consumption, the import amount also increased in China and India in the last 10 years, and these countries have turned into net coal importers. Regarding coal for fuel use, Japan was the largest importer in the world 10 years ago, but currently is the 3rd largest importer after China and India. Due to the increased import by China, India, etc. and the increased export from Indonesia etc. to meet the increased demand, the total trade volume increased approximately twofold from 2003 over to 2013.

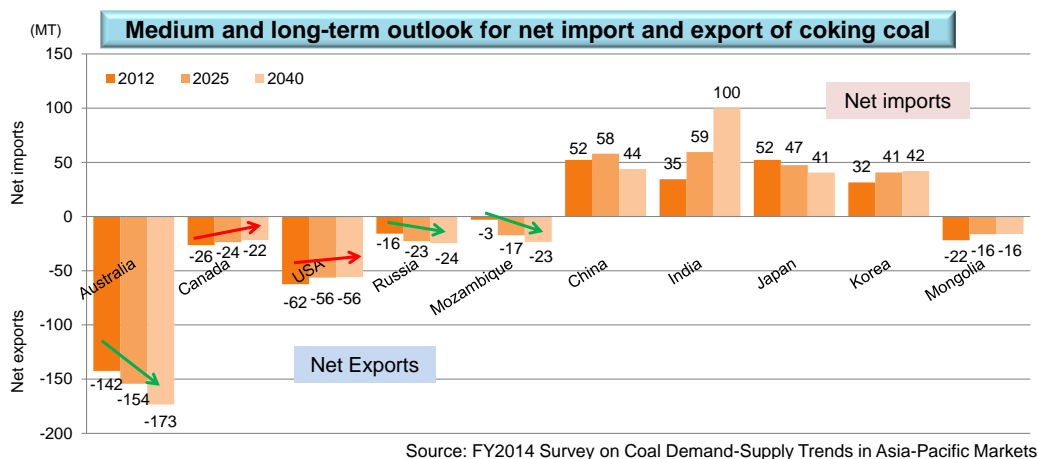
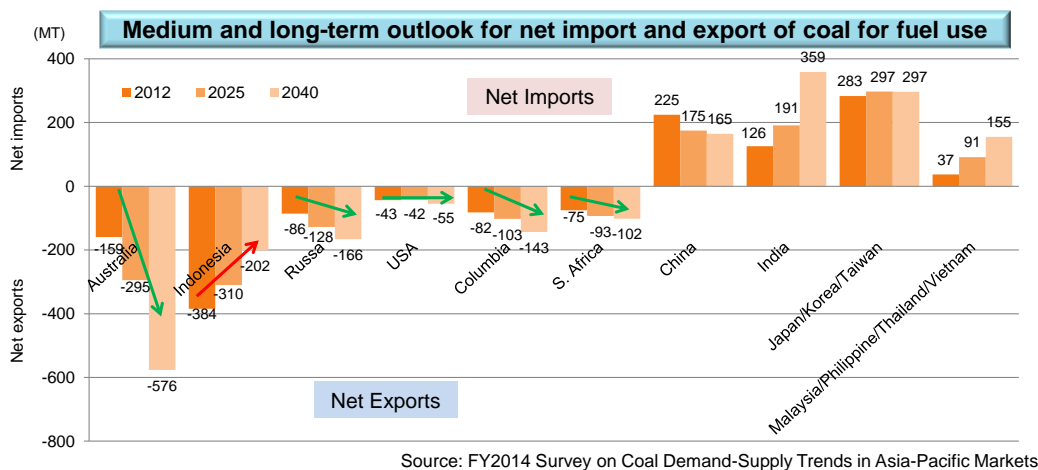
Position of Japan in coal trade (for fuel use)								
2003			2010			2013 (estimated)		
	Importing country	Import volume (million tons)		Importing country	Import volume (million tons)		Importing country	Import volume (million tons)
	1 Japan	110.7		1 China	137.2		1 China	250.1
	2 Korea	53.1		2 Japan	129.0		2 India	142.2
	3 Taiwan	49.4		3 Korea	90.4		3 Japan	141.8
	4 Germany	29.2		4 India	81.3		4 Korea	95.5
	5 UK	25.4		5 Taiwan	57.6		5 Taiwan	61.5

- Coal prices remained low in early 2000's until they suddenly increased for both coal for fuel use and coking coal because the supply did not catch up with the increase in global demand that started in 2003. Additionally, during the period from 2007 to 2008, the prices soared due to temporary disruption of supply caused by abnormal weather in Australia and other factors. During this period, the spot price of Australian coal for fuel use increased to 5-6 times of the level in early 2000's.
- Coal prices then fell sharply as a reaction to the price soar and because of drop in the demand due to the worldwide recession. While the prices exhibited another trend of increase during the period from 2009 to 2011, they currently are at a substantially low level as the coal market is experiencing oversupply both in Europe and Asia due to various factors including reduction in the demand growth in China, stagnancy of European market, increased export from the US, and reduction in the production and export capability in Australia. Coal prices remain low even now, and the price of Australian coal for fuel use is about one third of the level during the soared price period in 2008.



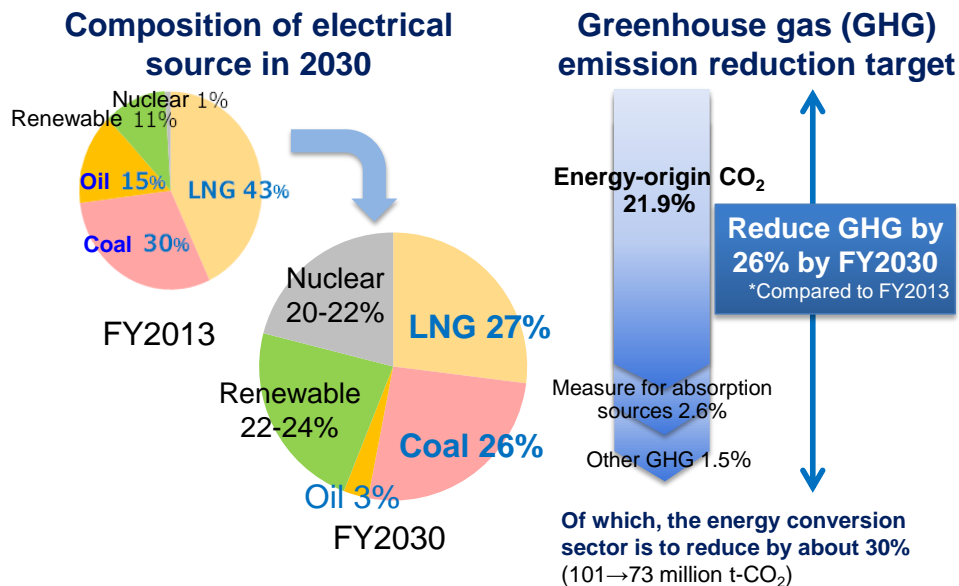
- In terms of the medium- to long-term trends in coal demand and supply, while the increase in the demand for coking coal may slow down, the demand for coal for fuel use may continue to increase in non-OECD countries centering on Asia. The prices are considered to gradually increase accordingly. IEA forecasts the world's demand for coal for fuel use will increase to 1.2 times and the coal prices will become about 1.3-1.4 times over to year 2040.
- Additionally, associated with the stagnant coal prices in recent years and other factors, there are negative trends observed in the world for both coal for fuel use and coking coal, including closure of high-cost mines of high grade coals and reduction in the number of new promising projects. Consequently, there is a concern over future reduction in the supply and tightened demand-supply balance for high grade coals that have been conventionally used by

Japanese users.



ii) Placement of coal use in Japan

- In the Basic Energy Plan decided by the Cabinet in April 2014, coal was evaluated as “fuel for base load power sources superior in supply stability and economy” and placed as fuel to be “utilized with reducing the environmental burden by effectively using high-efficiency coal-fired power generation etc.”
- Based on the Basic Energy Plan, in June 2015, the Long-term Energy Supply and Demand Outlook Subcommittee established under the Advisory Committee for Natural Resources and Energy formulated a draft version “Long-term Energy Supply and Demand Outlook” (Energy Mix) to outlook the energy demand and supply structure in FY2030. The basic policy of energy mix exhibited in the draft was to simultaneously achieve “3E+S” (energy security, economy, environmental conservation, and safety) and to establish a well-balanced energy composition, with coal accounting for approximately 25% of total primary energy (25% in FY2013) and approximately 26% of the composition of electrical source (24% in average over 10 years prior to the Great East Japan Earthquake).
- At the same time, viewing COP21 that will be held in December 2015, the Energy Mix declared to clearly hold up reduction targets equivalent to those for Europe and the US and to aim at identifying matters that contribute to leading the world in reducing the greenhouse gas emissions. From the viewpoint of reducing the CO₂ emissions, the Energy Mix also indicated a policy for the thermal power generation field to further improve the efficiency of coal-fired and LNG thermal power generation and utilize it with reducing the environmental burden.
- Similarly, as measures that became the basis of the topped-up greenhouse gas emissions reduction target of 26% in FY2030 (compared to FY2013) in Japan’s draft promise (draft by the Japanese government), the draft Outlook proposed improving the efficiency of thermal power generation along with promoted introduction of renewable energy and utilization of nuclear power generation with confirmed safety.



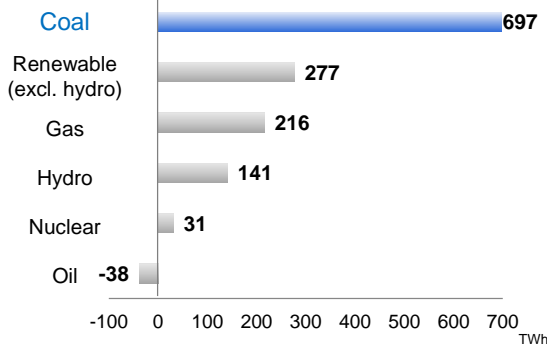
- Meanwhile, there exist plans to build small-scale coal-fired power plants that are poorer in efficiency compared to large-scale coal-fired power plants. Such a movement is serving as a matter of concern in promoting improvement of the efficiency of thermal power generation.

iii) Trends of domestic and overseas use of coal-fired thermal

- The energy demand in emerging countries such as those in Southeast Asia is expected to increase by 80% over the next 20 years. To improve the accessibility to energy and to cater for increased power demand associated with economic development, establishment of infrastructure in the energy sector has become an urgent task.
- Many emerging countries have no choice but to rely on coal-fired thermal for ensuring the energy security and for the necessity of highly economic power source. For instance, to satisfy the electricity demand that is rapidly increasing along with its economic growth, Indonesia announced a plan to develop new power sources with the total capacity of 35 GW in 5 years from 2015 to 2019, where coal-fired thermal is to account for over 50% of the capacity introduced.
- Taking into account such circumstances, to achieve both the utilization of coal-fired thermal and the reduction of environmental burden via suppressed CO₂ emissions in emerging countries, the important task is to promote improvement of the efficiency of coal-fired power generation in such countries. According to IEA's estimation¹⁵, while about half of coal-fired power plants currently built in the world uses low-efficiency subcritical pressure technology, if the efficiency of all coal-fired thermal power plants in the world becomes equivalent to the level of cutting-edge coal-fired power generation technology, ultrasupercritical (USC) coal combustion technology, the amount of CO₂ in the world originating from coal as of 2040 would become about 20% lower than the current level.

¹⁵ IEA "World Energy Outlook 2014"

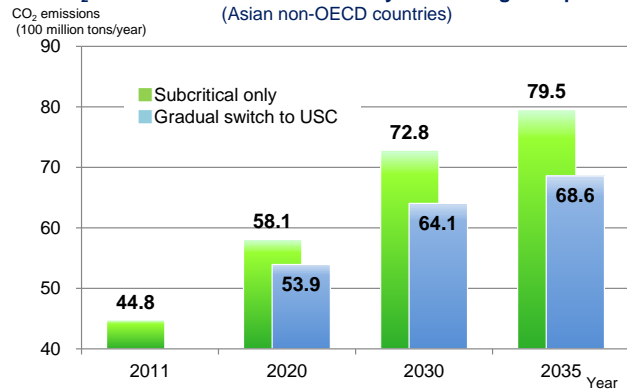
Growth of electricity demand in ASEAN countries



*2011 (Actual) → 2035 (Estimate)

Source: WEO Special Report 2013 Southeast Asia Energy Outlook

CO₂ emission reduction achieved by introducing USC plants



Source: Created by the Ministry of Economy, Trade and Industry on the basis World Energy Outlook 2013, IEA

- Japan's coal-fired power generation technologies including USC have achieved the world's highest level efficiencies, and widespread application of Japan's technologies to emerging countries may contribute to promoting measures against climate change in the world.
- Meanwhile, some countries such as the US and UK consider it inappropriate to use limited public funds on high-carbon sectors and are requesting other countries to place restriction on the public financial aid (e.g., export finance) for newly established overseas coal-fired power generation facilities without CCS (carbon capture and storage) equipment. In response to this move, discussions are held at the OECD export credits meetings on ideal export credits for coal-fired power generation from the viewpoint of export credits' contribution to measures against climate change.

2. Securing cheap and stable supply

(1) Considering the diversification etc. of supplier countries

i) Diversifying the supplier countries

- Currently, coal for fuel use for power generation is stably supplied to Japan centering on export from Australia and Indonesia. However, the domestic demand for coal is increasing in Indonesia associated with the increasing demand for electricity. Further, backed by the rising resource nationalism, Indonesia implemented policies to suppress export of coal including obligation for domestic supply and controlled coal prices, and the export amount is expected to reduce drastically in the future. Currently the amount of coal for fuel use imported to Japan from Australia is at a high level accounting for 73.9% (year 2014), and a decrease in import amount from Indonesia will automatically increase Japan's reliance on Australia further.
- Regarding coking coal for steel production, Japanese users stably procure it centering on import from Australia. Japan's current reliance on Australia in the supply of coking coal is over 70%, and the reliance may further increase in the future.
- Australia may continue to be placed as the most stable and largest coal supplier country for Japan, considering the aspects of estimated reserves of high grade coal, transport distance, state of infrastructure development and political trends. However, lately there arose a debate on whether the Great Barrier Reef shall be registered to the List of World Heritage in Danger, which posed a risk that may affect the use of harbors mainly used for export of coking coal. While this matter of registering to the List of World Heritage in Danger was deferred, there still exists a risk pertaining to environmental response of Australia, and attention needs to be continuously paid on Australia's movement on environmental response.
- Taking into account these factors, while the basic concept of coal procurement will remain as ensuring stable supply from Australia, it is important to give considerations on the possibility of diversifying the supplier countries to a certain degree in the future. For coal for fuel use, the potential suppliers include North American countries, Russia and Columbia, while efforts will be continuously made on the stable supply from Indonesia. For coking coal, the potential suppliers include North American countries, Russia, Mozambique and Mongol.

ii) Activities toward reducing the procurement cost of coal for fuel use

- Although the coal prices remained low in the last several years, power companies have been promoting activities aiming at reduction of coal procurement cost from the viewpoint of suppressing the increasing cost of thermal power generation. Specifically, these activities include introduction of special vessels for transporting coal, increasing the size of receiving harbors, improvement of bargaining power through joint procurement etc., switchover from contract on long-term fixed rates to procurement using market-linked prices, and increasing the ratio of spot contracts.
- Power companies also started to carry out activities to realize economic procurement of coal from the market. The activities include reduction of the ratio of long-term contracts with specified coal brands and switchover to specification specified contracts without specifying brands or spot contracts where the market supplies the required amount as necessity arises. From the viewpoints of reducing the procurement cost as well as to be prepared for potential reduced supply of high grade coal in the future, it is important to widen the coal types usable at power plants, and such activities promoted by power companies may prove valuable in the future.

iii) Supporting coal development and securing interests in coal producing countries

- Providing coal producing countries with support for coal development and participation of Japanese companies in particular in the development to acquire interests is considered a valid means for securing various types of coal required by Japanese users over a mid- to long-term. For each of the coal for fuel use sector and the coking coal sector, currently, JOGMEC provides support for geological structure survey, formulation of master plans and HRD for coal producing countries. In addition, Japanese companies provide support in a form of funding for mining exploration and loan guarantee for the development and production stages, and JBIC provides support through financing.
- When a development project involves with acquiring interests, in many cases there arises a necessity to develop various infrastructure as well and the project becomes bloated. Based on such circumstances and the trends of coal development and coal market, considerations will be continuously made on the desirable support measures by JOGMEC for acquiring interests.
- Additionally, as an indicative target for promoting such activities and sustainably procuring coal required by Japanese coal users at low cost, Japan shall aim at achieving an independent development rate of 60% or greater by FY2030.

(2) Technological development for expanding the use of low grade coal

- To stabilize the demand supply balance in the coal market, it is also important to promote activities toward expanding the use of so-called low grade coals including unused lignite and low-quality subbituminous coal in coal producing countries.
- Currently, Japan promotes development of technologies to reform low grade coals and use for power generation domestically and overseas and technologies to manufacture substitute natural gas (SNG), fertilizer, or hydrogen from lignite. Japan will continuously promote such activities toward expanded use of low grade coal through public-private collaboration.

3. Promoting environment-conscious use of coal

(1) Improving the efficiency and low carbonization of coal-fired power generation

i) Promoting improvement of the efficiency of coal-fired power generation

- Further activities to suppress CO₂ emissions will be required to realize the best energy mix and to achieve the greenhouse gas emissions reduction target in FY2030 in Japan's draft promise, including promoting improvement of the efficiency of coal-fired power generation.
- Currently, new coal-fired power plant construction projects are in progress, including small-scale coal-fired power plants. The efficiency of small-scale coal-fired power plants is relatively lower than that of large-scale power plants, and there are voices of concern heard

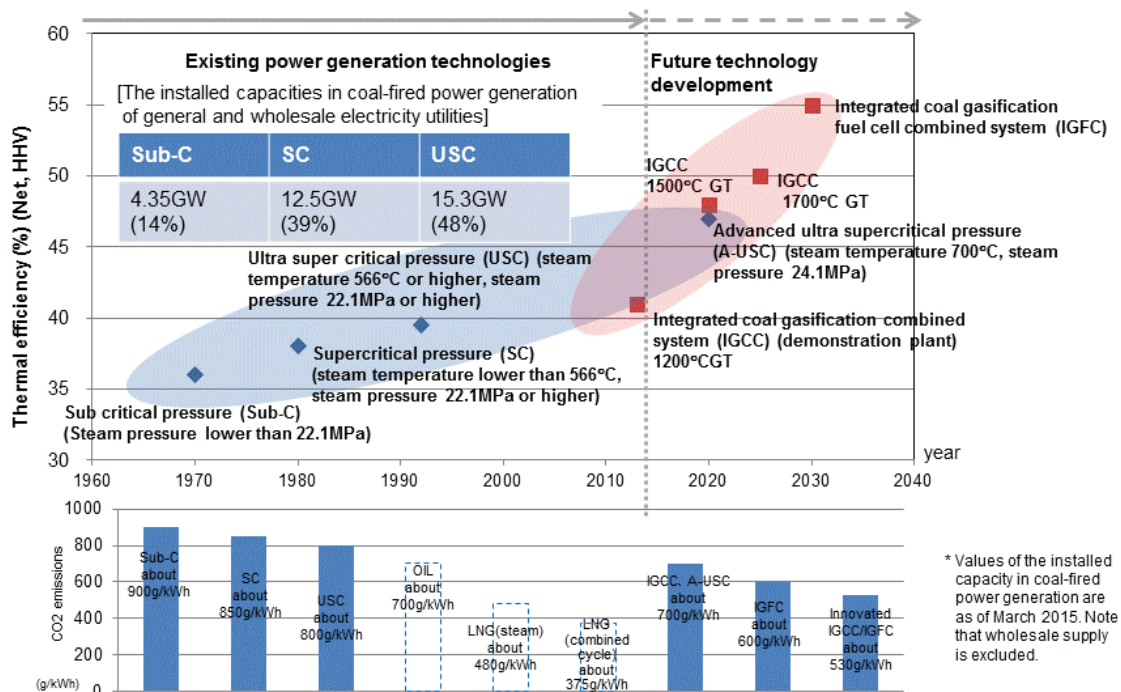
from the viewpoints of achieving the greenhouse gas emissions reduction target or improving the efficiency of coal-fired power generation.

- The Japanese government has requested the entire electricity industry to establish an independent framework that achieves emissions suppression in a form consistent with the plan and target of global warming measures, and will continue to encourage the industry to work on early establishment of such a framework.
- Additionally, based on the concept of Energy Mix, aiming at realizing the national average power generation efficiency equivalent to USC by 2030, the Japanese government is to undertake consideration on tightening of regulations under the Act on the Rational Use of Energy, from the viewpoint of suppressing the increase in the number of low-efficiency small-scale coal-fired power stations. Specifically, the Japanese government will progress discussion by establishing “WG on Classification Standards pertaining to Thermal Power Generation” under the Energy Efficiency and Conservation Subcommittee, Advisory Committee for Natural Resources and Energy, and will take necessary measures as early as possible.

ii) Accelerating development of next-generation thermal power generation technologies

- To improve the efficiency of thermal power generation, it is important to realize early next-generation technologies (e.g., advanced ultrasupercritical (A-USC), integrated coal gasification combined cycle (IGCC), integrated gasification fuel cell (IGFC)) and expand their use as they become available, in addition to the current state-of-the-art technology, USC. Compared to USC, IGCC and IGFC allowed for reducing CO₂ emissions by about 20% and 30%, respectively, and smooth progress in the development of such technologies enables paving the way for realizing further low carbonization in the coal-fired thermal power generation sector.

<Improvement in efficiency of coal-fired power generation>



- Coal-fired thermal power generation is superior in the supply stability and economy, and is considered to be continuously used as an important source of power not only in Japan but in the world especially in emerging countries. Under such a prospect, the important task is how to realize low carbonization of coal-fired power generation in a form consistent with the world’s measures against climate change. Japan has utilized coal-fired thermal power generation with reducing the environmental burden to the smallest level in the world by

realizing USC ahead of the world and spread its use in the country.

- It is extremely important for Japan to continue to promote development of next-generation technologies and utilize them in the country, from the viewpoints of (1) maintaining the future use of coal-fired power generation in the world while reducing its environmental burden and (2) contributing to the improvement of global energy security.
- To that end, in June 2015, METI established “Council toward Early Realization of Next-generation Thermal Power Generation” consisting of knowledgeable persons from the industry, academia and the government, and commenced discussions on measures to establish and implement technologies related to next-generation thermal power generation as early as possible, including LNG thermal and CCS and CCU described later. In the future, a roadmap of technological development will be formulated based on the outcome of discussions, and the technological development will be accelerated accordingly through public-private cooperation.

iii) Biomass mixed combustion

- In addition to the development and implementation of such next-generation technologies, high expectation is placed on mixed combustion with biomass as a promising means to suppress the current CO₂ emissions from coal-fired power generation. Mixed combustion with biomass is carbon neutral and contributes to promoted disposition of unwanted wood etc., yet spread of its use essentially requires assured procurement of biomass fuel in sufficient quantities. Considerations will be made in the future on the issues related to widespread use of biomass mixed combustion, including regulatory and environmental factors.

(2) Developing technologies related to CO₂ capture and storage (CCS) and use (CCU)

- Technologies to capture CO₂ emitted from power plants or factories and to store (carbon capture and storage; CCS) or use (carbon capture and use; CCU) can become an ace to reduce CO₂ emissions from coal-fired thermal power generation to near zero. The Energy Mix also placed the development and use of technologies related to CCS and CCU as initiatives to be promoted viewing FY2030 onward.
- In regard to CCS, aiming at realizing CCS technologies by around 2020, development of CO₂ separation and collection technologies, development of CO₂ monitoring technologies, large-scale demonstration projects, and survey for locations suitable for CO₂ sequestration are currently in progress in Japan.
- In regard to CCU, while currently large-scale processing of CO₂ is difficult to realize, CCU is superior cost-wise as in leading to manufacture of valuables and beneficial in terms of no locational restriction involved with reservoir. Improvement in the CO₂ processing capability and the efficiency in manufacturing valuables through future technological innovations may lead to expanded use of CCU in the future.
- In Japan, development is in progress for technologies that lead the world, in the fields of biofuel manufacturing from algae and artificial photosynthesis. These activities will achieve processing of CO₂ from coal-fired power plants as well as various other goals including production of domestic algae biofuel.
- At the abovementioned Council toward Early Realization of Next-generation Thermal Power Generation, discussions will also be held on the issues etc. with technological development for carbon capture, utilization and storage (CCUS), and future development targets and measures for establishing CCUS technologies early will be incorporated into the roadmap of technological development.

4. Overseas development of Japan’s low carbonization technologies

(1) Contributing to global-scale reduction of environmental burden by introducing high efficiency coal-fired thermal power generation in emerging countries etc.

- Regarding the handling of coal-fired thermal power generation, there are indications inside

and outside Japan on the necessity to suppress new construction early and to transition to renewable energy or gas-fired thermal power generation, including the opinion in the UK and the US about imposing restriction on public aids.

- However, amid the increasing demand for coal-fired power generation in the world centering on Asian emerging countries, the real state of affairs is that it is inevitable to keep utilizing coal-fired power generation in order to achieve both the improved energy access in such countries and the reduction of environmental burden.
- The energy mix of a country shall be determined based on the situation and issues the country is under, and many countries essentially require a certain percentage of coal-fired power generation in their energy mix. Nowadays, even developed countries including the US and Germany rely on coal-fired power generation for 30-40% of the total power generation, and the needs for coal-fired power generation is particularly high in developing countries that require economic source of power.
- Based on such circumstances in the world, the most realistic and effective measure against climate change is to improve the efficiency of coal-fired power plants centering on those in developing countries. For this concept, the Japanese government shall endeavor to promote gaining understanding through active appeal in bilateral talks and international arenas, and shall continue to express its opinions also at discussions on the handling of OECD export credits. Japan's coal use technologies represented by coal-fired power generation with the world's highest efficiency level are important for Japan to contribute to the world, and we will continue to actively promote overseas development of such technologies.

(2) Spreading and promoting overseas development of high efficiency coal-fired thermal

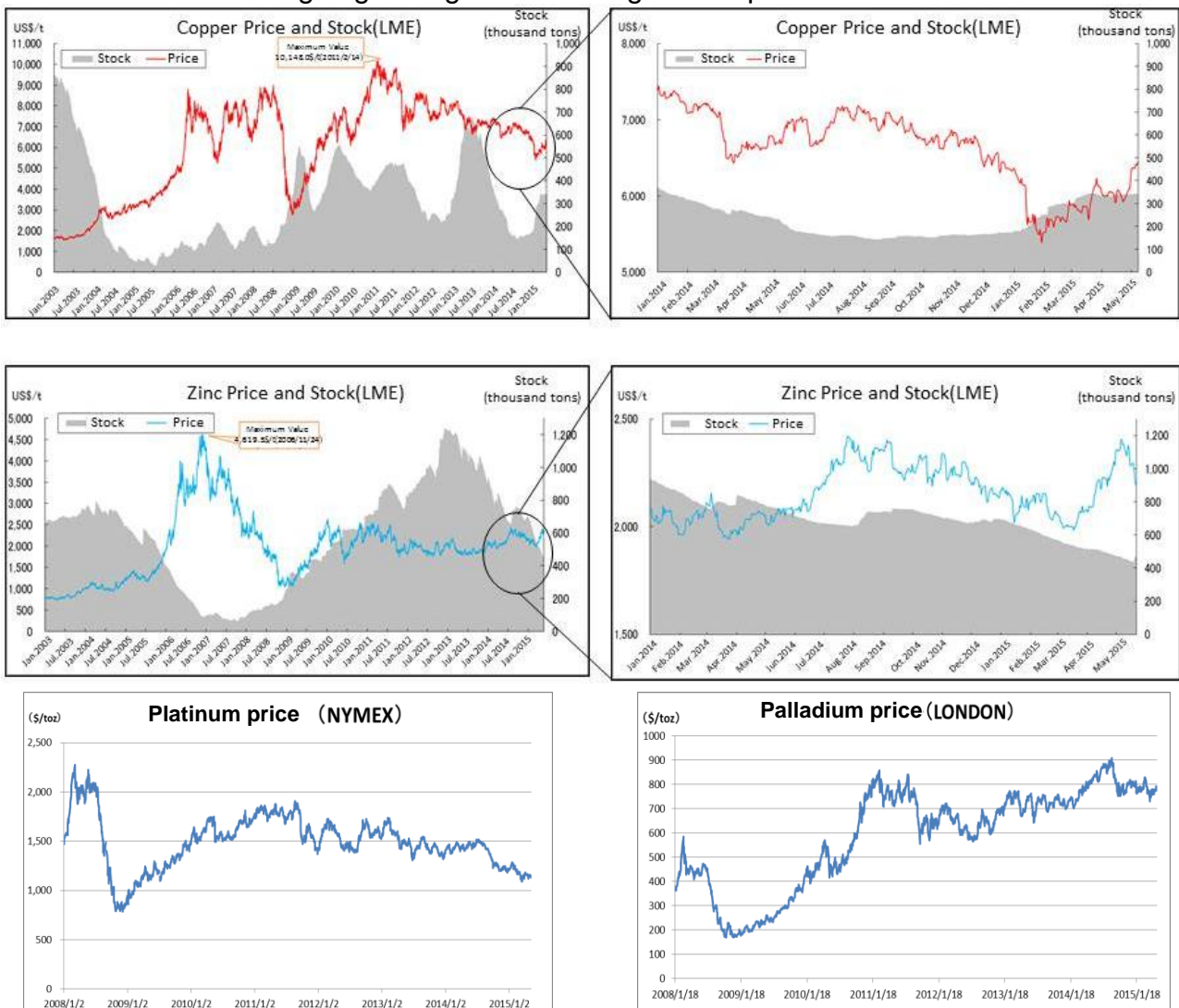
- Under the situation where development of energy infrastructure including coal-fired power plants is an urgent task centering on emerging countries in Asia, as described above, the important task for Japan is how to contribute to the development of infrastructure in countries by utilizing its advanced technologies and know-how.
- Currently, as the "Enevolution" initiative to promote international development of the energy industry, the Japanese government is working on activities to cultivate and acquire energy infrastructure development projects including provision of support for energy strategies etc. in emerging countries through political dialogs and provision of technologies and know-how on individual projects. In line with that, in May 2015, Prime Minister Shinzo Abe announced the "Partnership for Quality Infrastructure".
- In the future, Japan will make continuous efforts in widespread application of its world's finest technologies to the world, by utilizing the activities above as well as other various means including public financial aid, feasibility study support for formulating development projects, PR at international symposiums and engineers exchange, and intergovernmental political dialogs.
- Further, along with spreading Japan's world's finest technologies, the Japanese government shall continue to make considerations on the possibility of utilizing frameworks established between two countries for, for instance, transfer of technologies on energy and environment.

Chapter III: Policies on mineral resources

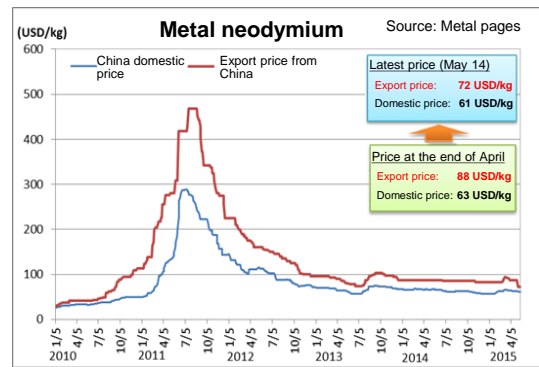
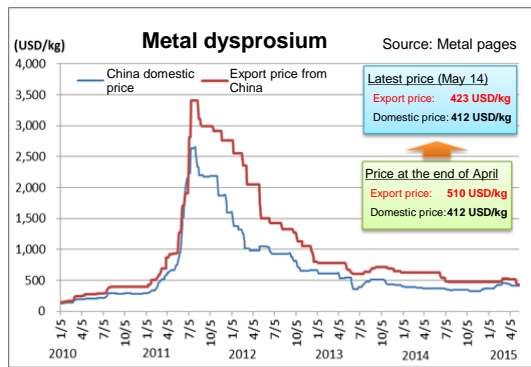
1. Current situations related to mineral resources

(1) Trends in the mineral resource markets

- Metal prices started to increase sharply in 2005 due to the increased demand in emerging countries and the inflow of speculative money until they plummeted in 2008 because of the worldwide decline in demand etc. triggered by the bankruptcy of Lehman Brothers. After recovering for a few years, metal prices started to decline in 2011 and have since remained in a downward trend due to factors including the stagnant European markets, concern over slowdown of emerging nations' economies, and the fall of crude oil price. Investment into mines also remains at a low level affected by the revival and radicalization of resource nationalism.
- China used to lead the world in metal demand, yet its economy is expected to shift from the conventional high growth line in response to the announcement of its economy entering a “New Normal” declared at the National People’s Congress in March 2015. Accordingly, there arose a concern over the reduction in the demand for mineral resources.
- Under such situations, the mineral resource markets are exhibiting trends that follow the demand and supply status of each mineral type. For instance, the price of platinum that is indispensable as catalyst etc. remains low due to the stagnant demand for Europe, while the price of palladium is transitioning at high values affected by the labor dispute in the Republic of South Africa and ongoing strong demand for gasoline-powered vehicles.



- Regarding rare earth elements, although their prices soared during the period from 2010 to 2011 due to tightened export regulations in China, the prices then decreased and remain low since 2013 due to the low demand resulted from reduced usage and promoted recycling and the abolish of export regulations in China in response to losing a case at WTO.



(2) Trends of mineral resource companies

- The financial conditions of major resource companies focusing on upstream development of base metals are deteriorating due to the necessity to explore hard-to-reach locations for new development projects, reduction in the grade of ore as well as the fall in the resource prices. Some major resource companies exhibit a movement to progress sorting of core and non-core projects and to liquidate assets of non-core projects. The business performance of Japanese upstream development sector is temporarily worsened (e.g., major impairment), affected by factors including the abovementioned fall in resource prices and the delay in full-scale production at copper mines.
- Although such a movement of asset liquidation by major resource companies is considered an opportunity for Japanese enterprises to acquire interests, the majority of projects subject to liquidation is not financially feasible (e.g., involves with technical difficulties, high overall cost). Japanese enterprises are inferior to major resource companies in the financial muscle as individual company, and they require political aid to expand the investment opportunities amid the increasing difficulties for prospecting, development and production projects.
- Regarding the FY2014 settlement of 8 major nonferrous metal companies, the profit in the mine investment sector became poorer due to the fall in the nonferrous metal prices, yet the profit in the metal refinery sector was improved because of factors including weak yen, improvement in the minerals purchasing conditions and promoted recovery of rare metals. As a result, despite the steep rise in the electricity rate, all the companies recorded increased income and profit (total sales of 8 major nonferrous metal companies: 4,951.2 billion yen, operating profit: 327.8 billion yen, current net income: 203.8 billion yen). Nonferrous smelting companies are promoting activities for reinforcing their business base envisaging the mid- to long-term decline in domestic demand and future changes in the competition environment, from various viewpoints in accordance with the business environment of the company (e.g., trends of demand/supply and prices that vary depending on the mineral type, cost of development and refining, trends of consumers).

2. Establishing strategic policies for securing stable supply based on the actual situations for each mineral type

(1) Understanding the actual situations for each mineral type

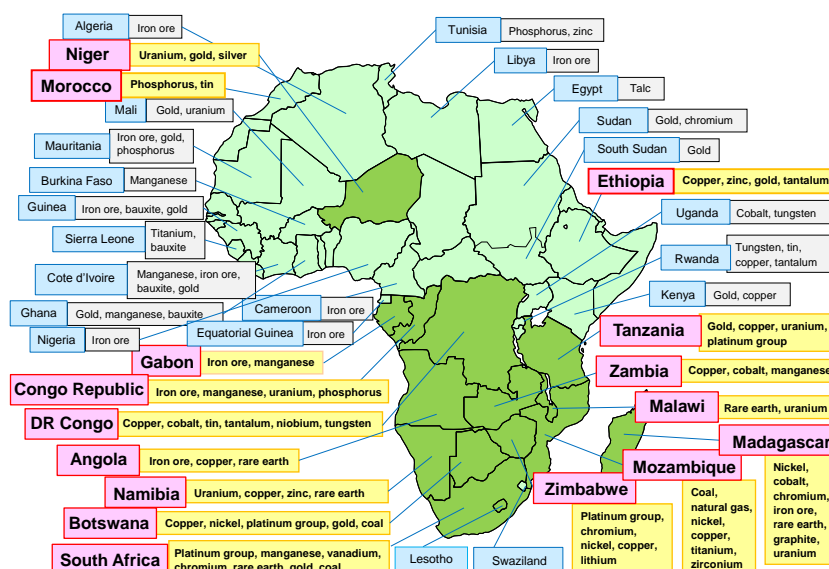
- Based on hearing to corporates etc., the Japanese government conducts risk analysis for each mineral type toward securing the stable supply. Specifically, it is important to conduct risk analysis for each mineral type based on the reserves, level of uneven distribution, recyclability and demand-supply outlook at the supply side and the procurement reliance, substitutability, etc. at the demand side, and to enhance the measures in accordance with the risk.
- The Japanese government has started giving considerations on the quantitative evaluation methods for each mineral type with referencing the method of security indexing in the energy sector, and will aim at summarizing the concept to a certain degree within this fiscal year.

(2) Re-establishing strategic policies for securing stable supply

i) Analyzing demand-supply structure (supply chain) for each mineral type, and securing stable supply strategically depending on the need

- Diversification of supply sources may be the most effective as a measure to reduce the uncertainty of supply. From such a viewpoint, since July 2014, the Japanese government started dispatching public-private mission teams targeting regions with abundant potential of mineral resources yet limited advancement by Japanese companies due to the insufficient investment environment. Through such activities the Japanese government encouraged private companies to obtain information on the investment environment in resource-rich countries (e.g., status of production technology and infrastructure development, tax system, establishment status of mining law), in an attempt of creating opportunities of mid- to long-term investment.
- Regarding copper for which South American countries account for 60% or more of import to Japan, in order to facilitate diversification of supply sources as the Japanese government, JOGMEC initiated a prospecting project (Afar-Tigray Project) in Ethiopia where the potential of mineral resources has been identified yet geological survey has not been conducted satisfactorily. Among African countries Ethiopia is relatively stable in terms of the investment environment including the political situation, and if the prospect produces favorable results then JOGMEC will transfer the interests to Japanese business operators.
- Regarding zinc for which the supply is expected to become tight globally due to reduced production and closure of large-scale mines in recent years, funded by JOGMEC through its risk money supply, a private business operator started a prospecting project in Mexico.
- Additionally, in order to accelerate the strengthening of governmental relationship with African countries with high resource potential, the Japanese government held the 2nd Japan Africa Ministerial Meeting (JAMM) and a business seminar. At JAMM, considering the fact that issues of expanding the resource development investment in Africa have been clarified in the two meetings held, an agreement was reached to strengthen bilateral relationship and advance to the Japan Africa Ministerial Partnership (JAMP) to address each individual issue of resource-rich countries in Africa.

[Resource potential of African countries]



- Meanwhile, due to the fall of Japan's relative position in the world economy, there emerged a concern over Japanese enterprises losing the bargaining power in the future at mineral resources procuring phases. For that reason, with paying due consideration to Japan's position, in order to raise the bargaining power of Japanese enterprises at mineral resources procuring phases, a study meeting on the ideal methods for procuring raw materials was held with the attendance of legal professionals, which exposed legal issues on joint mineral

purchasing by multiple companies that require attention. Activities for joint procurement through inter-company cooperation may become realized in specific projects in the future.

- It is important to continue such public-private activities and to assuredly promote activities to diversify the supply sources. In so doing, it is also important for the Japanese government to promote establishment of necessary political support measures including prospect support by JOGMEC, provision of risk money from the prospecting phase through the development phase to the full-scale production phase, and tax system (depletion allowance and reserve for overseas investment loss). For base metals, the Japanese government is required to facilitate sustained activities to achieve the self-sufficiency rate of 80% or more including the bullions produced from ores imported from mines for which Japanese companies hold interests and those produced from recycling.

ii) Utilizing WTO framework etc. against revival and radicalization of resource nationalism

(a) Response to China's export regulations on rare earth elements etc.

- Regarding the supply disruption risk arising from the tightened export regulations in China, the risk was greatly reduced by various activities including filing and winning a suit at WTO through Japan-US-Europe cooperation, participation in projects outside China through public-private collaboration, promoted recycling and reduced usage. However, represented by the US rare earth element production company Molycorp having requested application of Chapter 11 of the US Federal Bankruptcy Code in June 2015 and entering the process of reconstruction, the stagnant rare earth element prices are currently inflicting negative impact on projects outside China. Such a movement raises a concern over recurrence of heavily concentrated supply of rare earth elements from China being accelerated, and continuous support for projects outside China is required.
- Additionally, for the supply disruption risk of rare earth elements having been actualized, there is a trend to regard rare earth elements as raw materials with high supply risk and to avoid using them. If such a trend spreads to other elements and raw materials, it may end up with restricting the strength of Japan's industry, namely, the ability to utilize raw materials to their maximum potential and to raise the competitiveness of production industry etc. Taking into account the actualization of supply disruption risk for rare earth elements caused by China, it is vitally important for the Japanese government and relevant companies including user companies to continue taking actions to reduce the uncertainties from early stages prior to such supply disruption risk actualizing.

(b) Response to political changes in resource-rich countries (e.g., revision of mining law in Indonesia and Philippines)

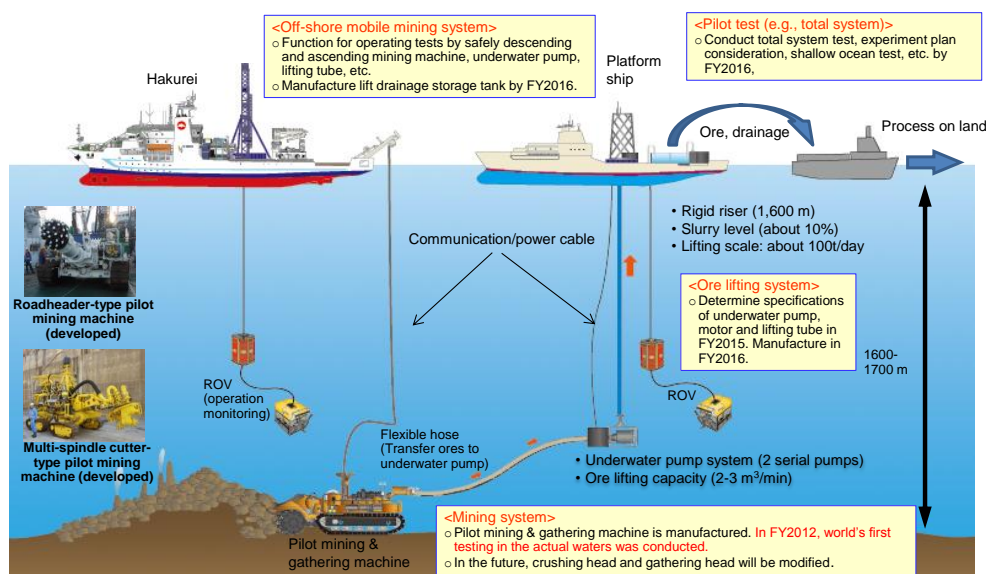
- The new Mining Law of Indonesia came into force in January 2014. The new Law prohibits export of unprocessed ores of nickel etc., while it implements an export licensing system for copper concentrates until January 2017. With understanding that such practical embargoes violate the WTO Agreements, it is important for the Japanese government to restart bilateral talks with the new Joko government and to request the Indonesian government to lift the ban on export of unprocessed ores by utilizing again WTO consultations/lawsuit and cooperation with other consumer countries. Additionally, like the revision of the Philippine Mining Act (ban on export of unprocessed ores), for political changes in resource-rich countries, there is a necessity to have inter-governmental discussions towards solution prior to system revision. Such political changes in resource-rich countries are issues of resources diplomacy, which shall be addressed steadily by cooperating with the Ministry of Foreign Affairs and diplomatic establishments abroad.

iii) Continuous activities for developing domestic ocean mineral resources

- Projects to develop ocean mineral resources are unlikely to become comparable with mine development on land within several years. However, it is also needed to recognize the fact that Japan used to be the largest copper producing country in the world yet it now completely relies on export from overseas countries as the source of copper concentrates. Considering

no new large-scale copper mines etc. discovered in recent years, there is no guarantee that sufficient amounts of mineral resources will be continuously supplied in the future solely from existing mineral deposits on land. Amid the situation of countries in the world starting to eye on ocean mineral resources, if Japan has established survey and production technologies ahead of other countries, Japan will be able to lead the world in the field of ocean resources development. Especially Japan holds the 6th largest exclusive economic zone in the world, and various types of ocean mineral resources are said to exist in the seabed; Japan is in a perfect environment to acquire technologies pertaining to development of ocean mineral resources. For Japan to promote ocean mineral resources development activities, it is important to steadily build results in both the fields of 1) reserve survey and 2) development of production technologies with having such a long-term view.

- Regarding the reserve survey, in December 2014, JOGMEC found a seafloor hydrothermal deposit (tentative name: Noho Site) near the Iheya knoll 150 km northwest of the main island of Okinawa. Additionally, in January 2015, JOGMEC found a new seafloor hydrothermal deposit (tentative name: Gondo Site) off the coast of Kumejima Island in cooperation with the Japan Coast Guard. Especially, analysis on the samples obtained at the Gondo Site using ROV (remotely operated unmanned vehicle) exhibited copper grades as high as 13% (the copper grade of copper mines on land is approximately 1%), indicating high potential as a resource. It is important to continuously prospect for new deposits and to intensely survey the existing sites in the next several years to evaluate their reserves early.
- Regarding the development of production technologies, basic performance tests of pilot drilling machines in the actual waters were completed by FY2014 in general. There is no past case of testing pilot drilling machine in the actual waters in the world, and to further ensure the technical advantage of Japan in this field it is important to continuously improve the drilling performance (e.g., modification of pilot drilling machine for long-term continuous operation).
- In the future Japan will intensely work on connection to mineral lifting system, development of pump system, etc., aiming at conducting pilot test of a mining and mineral lifting system in FY2017. Such a pilot project is unprecedented in the world, and expected to encounter various difficulties finance-wise and technology-wise. It is important for Japan to promote the activities by establishing an all-Japan system of ocean mineral resources development with JOGMEC playing a core role as the control tower.



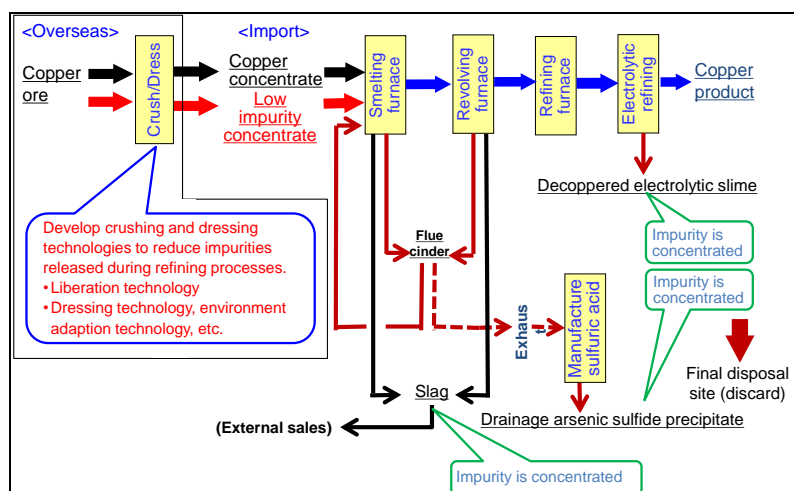
- Regarding marine sediment (sludge) containing rare earth elements, it was determined to evaluate their potential as resource in FY2015. It is important to swiftly summarize the results of reserve survey and production technology survey at the waters near the Minamitorishima Island over the last 3 years and to clarify the policy of activities for FY2016 onwards.

- Regarding the manganese nodule lot off the coast of Hawaii, an official exploration contract was concluded between the International Seabed Authority and the Deep Ocean Resources Development Co., Ltd. (DORD) in 2001, and its 15 years of contract period will come to an end in June 2016. Based on the results of past exploration, the lot is considered to have a certain level of potential and there is a certain level of accumulation of production technology development that has been worked on, and it is important to continue to explore with viewing the timing for shifting to development in the future. Additionally, considering that other countries (e.g., Russia, China, Korea, France) concluded an exploration contract off the coast of Hawaii like Japan did and are determined to extend their exploration contract, Japan shall also apply for extending the exploration contract. In so doing, continuation of exploration by Japan alone will pose difficulties especially financially, and it is important to establish cooperative relationship with relevant countries so that exploration can be conducted efficiently through collaboration with other countries including France.
- Regarding the response to legislative systems including environmental response, the Japanese government shall make considerations without delay taking into account the situations of the ocean mineral resource development described above.

3. Developing business environment of nonferrous smelters which are responsible for stable supply of mineral resources

(1) Addressing the increase in impurity during smelting etc.

- Regarding the development of technologies for removing impurities during smelting that has been the common issue for Japanese nonferrous smelting business operators, a committee was established within JOGMEC, and various surveys were conducted with the participation of members consisting of 7 nonferrous smelting business operators and 12 researchers majoring in resources. The surveys include investigation on the mineralogical characteristics of arsenic-containing copper concentrates, survey of trends in technologies for removing impurities during smelting in Japan and overseas, and survey on the actual situations of environmental regulations in resource-rich countries.
- For FY2015, based on the survey results, aiming at acquiring technologies to economically remove arsenic from copper concentrates, it is important to promote pioneering research on means that become candidates of techniques for removing arsenic during the crushing and selection processes and to link such pioneering research to basic and demonstration research in the future.



(2) Response to tightening of regulations in the resources sector

- June 2015, the “Act to Prevent Mercury Contamination on Environment” was enacted as a relevant domestic law of the Minamata Convention of Mercury that was adopted in October 2013. Considering mercury remaining in the environment or accumulated in organisms and potentially causing adverse effects on human health and living environment as well as the

fact that Japanese nonferrous smelting business operators are the largest dischargers of mercury collected in Japan, nonferrous smelting business operators are required to conduct appropriate control of mercury-containing recyclable resources that generate during the smelting process. Meanwhile, mercury-containing recyclable resources also contain valuable metals other than mercury, and appropriate control has been conducted by nonferrous smelting business operators. Therefore, on formulating the detailed enforcement regulations of the Act in the future, it is important to ensure that the regulations reflect the actual situations so that they do not end up becoming overregulation.

- Additionally, based on the Industrial Safety and Health Act, risk assessment is currently in progress for antimony trioxide (Sb_2O_3) regarding the health of workers. Antimony is used as a flame retardant synergist in various plastics found in automobiles, home appliances, office automation equipment, building materials, etc., and in Japan antimony smelting business operators refine raw materials purchased from China into high quality antimony trioxide and sell them to resin and rubber manufacturers. While the most important thing is that health management of workers is assuredly performed at antimony smelters, if the results of risk assessment suggest the necessity to implement strict health hazard prevention measures, it will become difficult to smelt antimony in Japan. On conducting the risk assessment, it is important to give considerations on the level of regulations in other countries and the actual work situations.
- The Japanese government shall consider strengthening the international competitiveness of Japanese nonferrous smelting business operators by, for instance, taking the tightening regulations on mineral resources in the world as an excellent opportunity and by formulating rules to request bullion users to purchase bullions from nonferrous smelters that comply with a certain level of environmental regulations.

(3) Response to soaring electricity price

- Nonferrous smelting is a mass electricity consumption industry, and the soaring electricity price is continuously putting pressure on the business condition of smelters. Based on such a situation, it is important to continue R&D pertaining to reduction of electricity consumption in the smelting process using recycled raw materials and to work on activities including encouragement of the use of the expanded subsidy program for energy efficiency (subsidy for local factory, small and medium enterprises, etc. to introduce energy efficient equipment).

(4) Developing and securing human resources

- Regarding the development and securing of human resources, Japanese private business operators are taking activities and initiatives. Examples include continuous work on projects to develop small-scale mines, development of human resources that possess know-how etc. of process to shift from prospecting to development, and a program currently considered by the industry to introduce the nonferrous industry to pupils and students in collaboration with the Science Museum (Kitanomaru Park, Chiyoda Ward, Tokyo) and other facilities. In the future, it is important for the Japanese government to provide support for endowed courses undertaken by private business operators at universities, Japan Mining Engineering & Training Center, etc. (e.g., new frontier leader program for rare-metal and resources (Leading Program) at Akita University) as well as for “Copper 2016” planned to be held in Kobe in November 2016. It is also important for the Japanese government to consider implementing supportive measures such as adding the view into developing human resources to the consideration elements for selecting mine development projects for the risk money supply support.

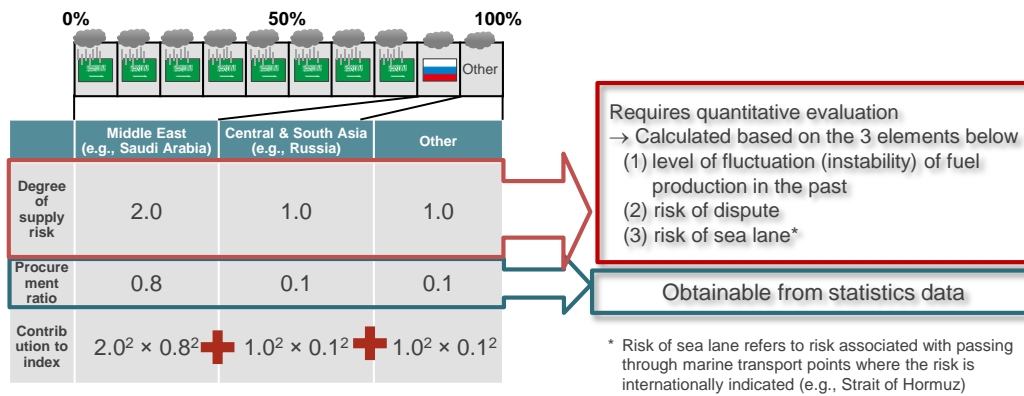
Chapter IV: Energy risk assessment index (security index)

- Japan relies on import for a large majority of main fuels such as crude oil, natural gas and coal, and it is specifically important for Japan to secure stable and sustainable procurement. From such a viewpoint, the Interim Report issued by the Oil and Natural Gas Committee in July 2014 stated the importance of formulating index that becomes the reference for judging the energy security. Based on the discussions held thereafter in response to the Interim Report, the Committee formulated the energy risk assessment index (security index) as below and conducted analysis, as a clue to understand the current situation of energy security, specific weakness, and what kind of difficult-to-address situations can be improved to what degree.
- The importance of this index lies on its ability to derive a mutually comparative index based on the risk and the degree of dispersion for each supplier country, yet it also enables further analysis by applying it to various sectors or enterprises as individual procurer not merely to make numerical comparisons for the entire country. That is, the index does not aim at being able to describe everything just by one index, instead, it finds its value in the ability to derive many indications by applying it in various forms and to analyze what changes will inflict what level of impact to which sector. Additionally, while it essentially focuses on procurement, the index enables, for instance, understanding the flexibility at the demand side when the current situation of demand is indexed and analyzed for each sector. Regarding the resilience of supply chain in Japan, we haven't reached the state of formularizing the assessment using this index as of now, yet for this point considerations are given to the aforementioned BCP assessment and it is possible to include procurement risk assessment in BCP assessment instead. The index is expected to undergo various modifications and to be utilized in the selection of corporate strategy and governmental policies.

(1) Concept of energy risk assessment index

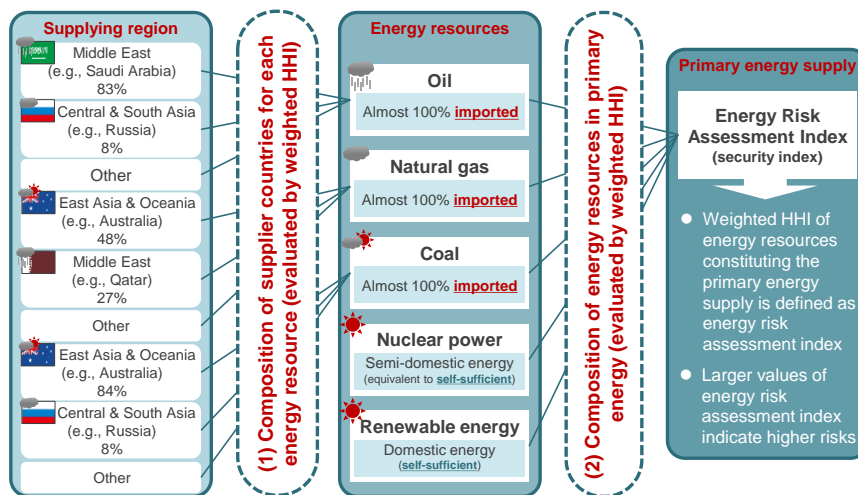
- In general, when the number of types of fuels used as source of energy is relatively large, well-balanced procurement of the fuels reduces the risk for when one of fuels becomes unprocurable for some reasons. The overall risk reduces when the number of reliable fuel types is 3 instead of 2, or 4 instead of 3. However, such diversification of fuel types presupposes the flexibility and technical capability at the user side.
- Next, it is often the case that the risk varies depending on the fuel type. For instance, when comparing oil and coal, the procurement risk of oil is usually higher than that of coal. In such cases, the relative stability increases when the reliance on high-risk fuel is reduced and a larger amount of low-risk fuel is procured. Further, if there is a self-supplied fuel, the risk associated with procuring the fuel from overseas is null, and the overall risk becomes smaller when the reliance on the fuel is higher.
- Additionally, when the risk of procurement becomes smaller for each fuel, the overall risk becomes smaller even if the procurement ratio remains the same. When considering the risk of each fuel, similar to the fuel selection described above, the risk can also be reduced by diversifying the supplier countries, reducing the procurement ratio from high-risk countries, and by increasing the ratio of self-supply.
- To that end, we considered using the Herfindahl-Hirschman Index (HHI, sum of each share squared; an index to measure the degree of dispersion) to quantify the risk of fuels. For instance, Japan imports oil from Middle East 80%, Russia 10% and others 10%; in this case, HHI is calculated to be $(0.8)^2 + (0.1)^2 + (0.1)^2 = 0.66$. Natural gas is imported from Middle East 30%, Russia 10%, East Asia and Oceania 50% and others 10%, and the risk value of natural gas becomes $(0.3)^2 + (0.1)^2 + (0.5)^2 + (0.1)^2 = 0.36$, indicative of the risk being lower than oil.

Next, we add the risk of each supplier country. The weighted HHI (risk index) is expressed as a sum of each risk and share squared and multiplied. For instance, assuming the risk of Middle East being 2, Russia 1 and others 1, the weighted HHI (risk index) of oil is calculated to be $2^2 \times (0.8)^2 + 1^2 \times (0.1)^2 + 1^2 \times (0.1)^2 = 2.58$.



When the ratio of import from high-risk areas is hypothetically reduced to Middle East 40%, Russia 30% and others 30%, the weighted HHI becomes $2^2 \times (0.4)^2 + 1^2 \times (0.3)^2 + 1^2 \times (0.3)^2 = 0.82$, indicated a greatly reduced risk index.

- Using the risk index derived for each fuel like this, it is possible to derive the total risk index (security index) for the entire primary energy supply from the state of dispersion of fuels (share of each fuel) and the risk of each fuel.



- One of key points here is how to quantize the risk of each supplier country. In this Chapter, the risk was quantized from (1) the level of fluctuation (instability) of fuel production in the past (standard deviation), (2) state of disputes occurred in the past, and (3) the risk of sea lane between Japan and the relevant supplier country (number of choke points the transport vessels pass by)¹⁶.

(2) Analysis on the energy risk assessment index

i) Comparison for various countries and effects of stocking

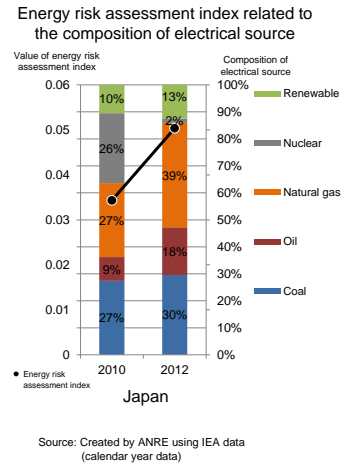
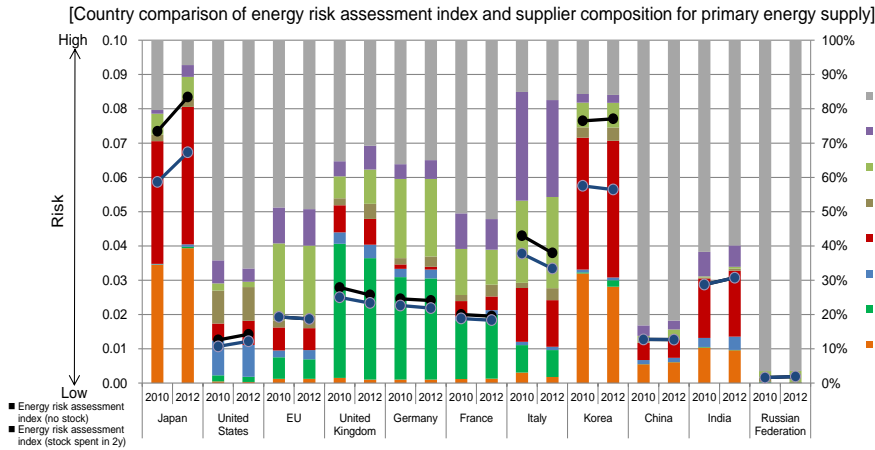
- The risk of primary energy supply is compared for various countries using this index. As a result, it was found that the level of risk for Japan is relatively high among major countries in the world, at a similar level with Korea. Specifically, the difference between China and Japan/Korea is prominent among East Asian countries. Additionally, the risk has clearly risen since the Great East Japan Earthquake; a similar trend is observed for the composition of electrical source.
- The comparison exhibits that basically countries with high energy self-sufficiency rate is high in the stability, and in the case of Europe, the risk is lower as the entire EU region rather than

¹⁶ The following was carried out for the calculation in this Chapter:

- For natural gas, the procurement ratio by means of pipeline and LNG in each country was reflected on risk assessment;
- South China Sea was added as a choke point, and the risk of the Strait of Malacca was reduced lower than other choke points since alternative routes are available; and,
- The supply stability of each energy is assessed by the oil production data, and the regional risk is derived from the supply stability weighted averaged by the export amount of each energy type by country for each region.

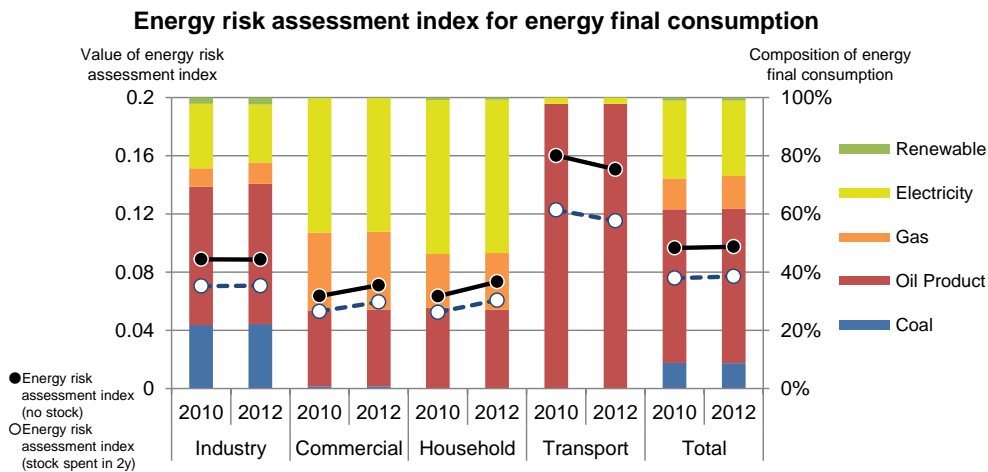
as individual countries.

- Additionally, calculation of the energy risk assessment index by assuming the oil stock as self-supplied energy substantially reduces the risk, quantitatively indicating the importance of oil stocking policies.
- * Assuming a scenario where each country spends the stock in 2 years, half of the stocked amount was regarded as self-supplied energy.



ii) Sectorial comparison of the energy risk assessment index for energy final consumption

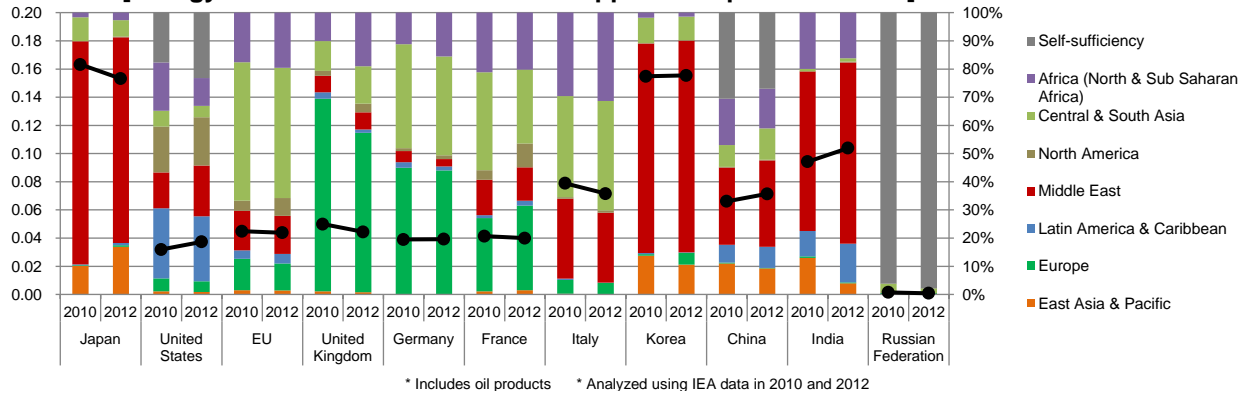
- Analysis on Japan's risk for each sector reveals exceptionally high risk for the transportation sector that relies on oil for more than 95%. The cause of such high risk is the low demand flexibility in the transportation sector compared to other sectors, and this analysis identifies the possibility to improve the figure in the future through diversification at the demand side.



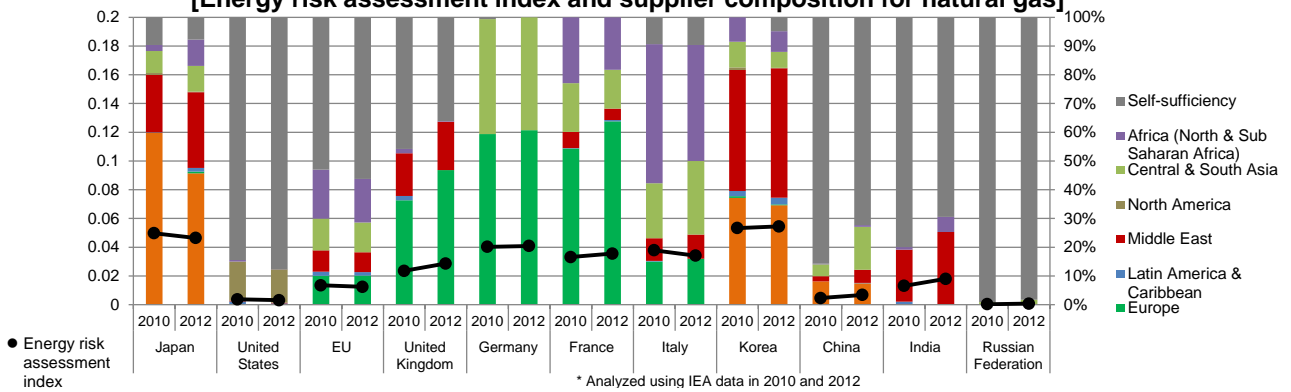
iii) Energy risk assessment index by fuel type

- Comparison of the energy security by fuel for countries in the world identifies that, regarding oil, the risk is high for the countries with high reliance on Middle East, namely, Japan, Korea and India. While China also imports a large amount of oil from Middle East, the risk is low because of the relatively high self-sufficiency rate. Regarding natural gas, diversification of procurement is more progressed in Japan than in Korea and accordingly the risk is lower in Japan than in Korea, yet both Japan and Korea are still in a severe situation compared to other countries because of lack of domestic production and other factors. Regarding LP gas, comparison between year 2012 and year 2014 reveals that the procurement risk for Japan has been improved to a certain degree due to the increased procurement of LP gas from the US associated with the development of shale gas.

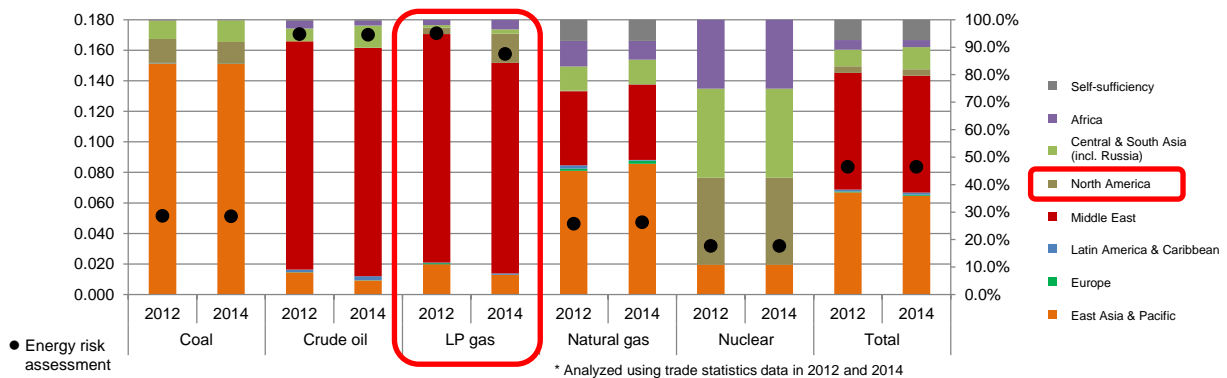
[Energy risk assessment index and supplier composition for oil]



[Energy risk assessment index and supplier composition for natural gas]

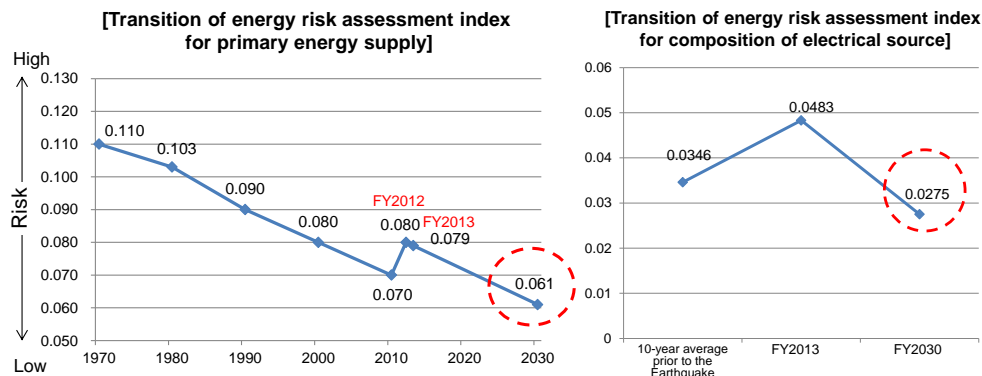


[Energy risk assessment index on Japan's procurement of each fuel]



iv) Assessment of Long-term Energy Supply and Demand Outlook using the energy risk assessment index

- As a result of assessing the primary energy supply and the composition of electrical source indicated by the Energy Supply and Demand Outlook for 2030 using the energy risk assessment index, it was confirmed that the risk was substantially reduced even compared with prior to the Great East Japan Earthquake.



[Sensitivity analysis for composition of electrical source in 2030]

	Coal -1%	LNG -1%	Nuclear -1%	Renewable -1%
Coal +1%		+0.2%	+1.5%	+1.7%
LNG +1%	-0.1%		+1.4%	+1.6%
Nuclear +1%	-1.5%	-1.4%		+0.2%
Renewable +1%	-1.7%	-1.6%	-0.2%	

v) Sensitivity analysis using the energy risk assessment index

- Utilization of the energy risk assessment index enables analyzing not only the current risk but also the level of future change in the risk under certain presuppositions when changes occur to the situation. As shown in the charts above, the risk index by fuel is the highest for oil, followed by LP gas, natural gas, and coal.
- Replacing fuel with high procurement risk by fuel with low procurement risk improves the risk index. For instance, when 5% of oil procurement is replaced by natural gas, the overall risk index of Japan's primary energy supply decreases by 6.6%. On contrary, when 5% of coal is replaced by natural gas, the risk index increases by 0.8%. Note that these calculations assume that each fuel is imported from the relevant regions under the ratio that is the same as the current ratio.
- Similarly, when 5% of oil procurement is changed from Middle East to North America, the overall risk index of Japan's primary energy supply decreases by 5.0%, and the risk index for oil decreases by 6.3%.
- Like these examples, by utilizing the energy risk assessment index, it becomes possible to compare changes in corporate actions and the effects of implementing specific policies and to identify the impacts of such activities.

vi) Utilizing the energy risk assessment index in international discussions

- Regarding the energy risk assessment index, opinions on its concept are exchanged with the governments of other countries or international organizations and these entities exhibit interest in the concept. Since the energy security is an important issue in terms of the national security as well, it is important to continue to deepen discussions with the relevant parties.

Conclusion

- The situations surrounding the resources and energy in the world continue to change violently in terms of the prices, supply-demand balance and political affairs, and the flow of resources in the world is changing substantially. The fall in the prices of resources served beneficially to the economy of Japan, and the situation of sustainable supply becoming difficult due to financial reasons was avoided for the time being. Meanwhile, securing stable supply in a quantitative sense still remains as a major issue for Japan for its heavy reliance on the world including Middle East for the large majority of resources it uses.
- The increased resource supply power in the world and the movement of more resource-rich countries seeking new buyers have brought golden opportunities for Japan to diversify the supplier countries including the US and Russia. Japan shall not lose out such opportunities for securing the stable supply of resources throughout Japan, for the viewpoint of sustainable production activities of enterprises, and for the viewpoint of building the bargaining power.
- At the same time, from the mid- to long-term viewpoint, technological challenges towards development of home resources including microalgae and methane hydrate contribute to both the diversification of suppliers and the strengthening of bargaining power.
- While the outcome of such activities can be quantitatively visualized by using the energy risk assessment index (security index), the time has come for Japan to strategically make political selection including cooperation with other countries and business selection by enterprises with keeping the outcome in mind.
- Additionally, while the fall in the prices of resources is casting a blight on the vitality of Japan's resource- and energy-related business, it also expands opportunities in the global market including interests for the upstream business, and Japanese companies are expected to promote their international development by taking such opportunities.
- Meanwhile, the scale of the Japanese market has a high probability to shrink in the future, and the advanced liberalization of electricity and gas systems through system reforms will further facilitate collaboration and business restructuring among Japanese energy business operators. Especially the oil refinery business operators who underwent liberalization ahead of other sectors are qualified and obliged to become pioneers of advanced energy business restructuring and conversion to Total Energy Solution Companies in the future by promoting business restructuring without hesitation, also for the purpose of securing the business base to accomplish their mission to stably supply oil in Japan.
- When it comes to the relationship with consumers, under the situation of shrinking market in Japan, the business operators that are selected by consumers in terms of the prices and services will most likely survive in the future. However, that doesn't automatically justify leaving everything to the market principle. In order to establish systems to appropriately provide energy as a substance essential for life and economic activities even at places with advancing population decline, the Japanese government and energy business operators have to work together in developing a system to search solutions ideal for the given situations specific to the region, while anticipating municipalities to take their own roles voluntarily and independently.
- Securing the stable and sustainable supply is the mainstay of resources and fuel policies, and it is important for the public and private sectors to continuously work together in realizing stable procurement from overseas, maintaining the domestic supply chain and strengthening the industrial infrastructure to support the supply chain, with properly responding to and utilizing the world's trends on the environmental issues including the global warming issue. To that end, the relevant parties are expected to share the sense of impending crisis and play their own roles cooperatively.
- The Natural Resources and Fuel Committee will continue to pay attention to the environmental changes and to make necessary discussions on the ideal future resource and fuel policies.