Interim Report

July 2014

Petroleum and Natural Gas Subcommittee
Natural Resource and Fuel Committee
Advisory Committee for Natural Resources and Energy

Contents

0. Introduction

Dynamic changes are occurring over the world energy demand and supply structure, as exemplified by the Shale Revolution in the U.S., the changes in Europe-Russia and China-Russia relations since the Ukraine issue broke out, the increasing destabilizing factors and disputes in the Middle East, the growing energy demand in China, India, other countries in Asia, and the Middle East, and the confrontations over natural resources in the East China Sea and the South China Sea. These international situations are dramatically changing our country's environment that maintains sustainable energy supply.

On the other hand, Japan, where all the nuclear power stations have been shut down since the Great East Japan Earthquake, increasingly depends on fossil fuels as well as the Middle East. At the same time, our country is having serious impacts from the rising fuel prices, in particular, driven by hefty global energy demand and the changes in international situations. The increases in energy and feedstock prices would decrease our international competitiveness, leading to the shift of Japanese industrial operations to overseas locations. Furthermore, the rapid increase in total fuel import volume is leaving large trade deficits in our country. Should this situation continue or worsen in the future to the extent that our current balance falls in the red, the confidence in our economy and currency might deteriorate. This also might lead to a further increase in fuel cost, making it economically difficult to secure necessary energy on a sustainable basis.

Talking about domestic circumstance, our experience from the Great East Japan Earthquake and record snowfalls indicated that the development of a stable energy supply infrastructure would become an important challenge. On the other hand, while the government is now sharing data about disasters that might occur in the future, such as great earthquakes along the Nankai Trough, there is an increasing need to be ready for devastating disasters by analyzing and assessing their impacts.

Even if energy is secured, it does not mean that our country will be able to supply that energy steadily. To sustain energy supply, domestic energy operators should have a stable business base. Given the tough business conditions that domestic energy suppliers are facing today, and as the reforms of various energy markets progress further, the reinforcement of their business bases is becoming a big challenge.

As stated above, toward the most important theme in our policies for natural resources and fuels, "Maintaining Sustainable Energy Supply," our country should pursue cheaper prices, strengthen the ability to respond to disasters, and ensure domestic industrial infrastructures, in addition to proactively getting natural resources from overseas.

Focusing on the theme Maintaining Sustainable Energy Supply, Natural Resource and Fuel Committee, Advisory Committee for Natural Resources and Energy, and Petroleum and Natural Gas Subcommittee of the same Committee, have been studying various measures that our country should take in the future, based on the viewpoints of energy policies as listed in Strategic Energy Plan, which was approved in a Cabinet meeting on April 11, 2014.

This report is an interim summary about the future direction for the policies for natural resources and fuels, about which Natural Resource and Fuel Committee and Petroleum and Natural Gas Subcommittee have discussed. Based on this direction, the government will help implement specific policies and explore further consideration in the future.

1. State of energy demand and supply structure surrounding our country

(1) Global energy demand and supply structure trends

i) Changes in global energy demand and supply structure in the wake of Shale Revolution

The development of a new mining technique in North America enabled the extraction of natural gas and oil from shale formations. Since 2006, North America has been increasing its production of unconventional fossil fuels, making a significant impact on world energy demand and supply structure.

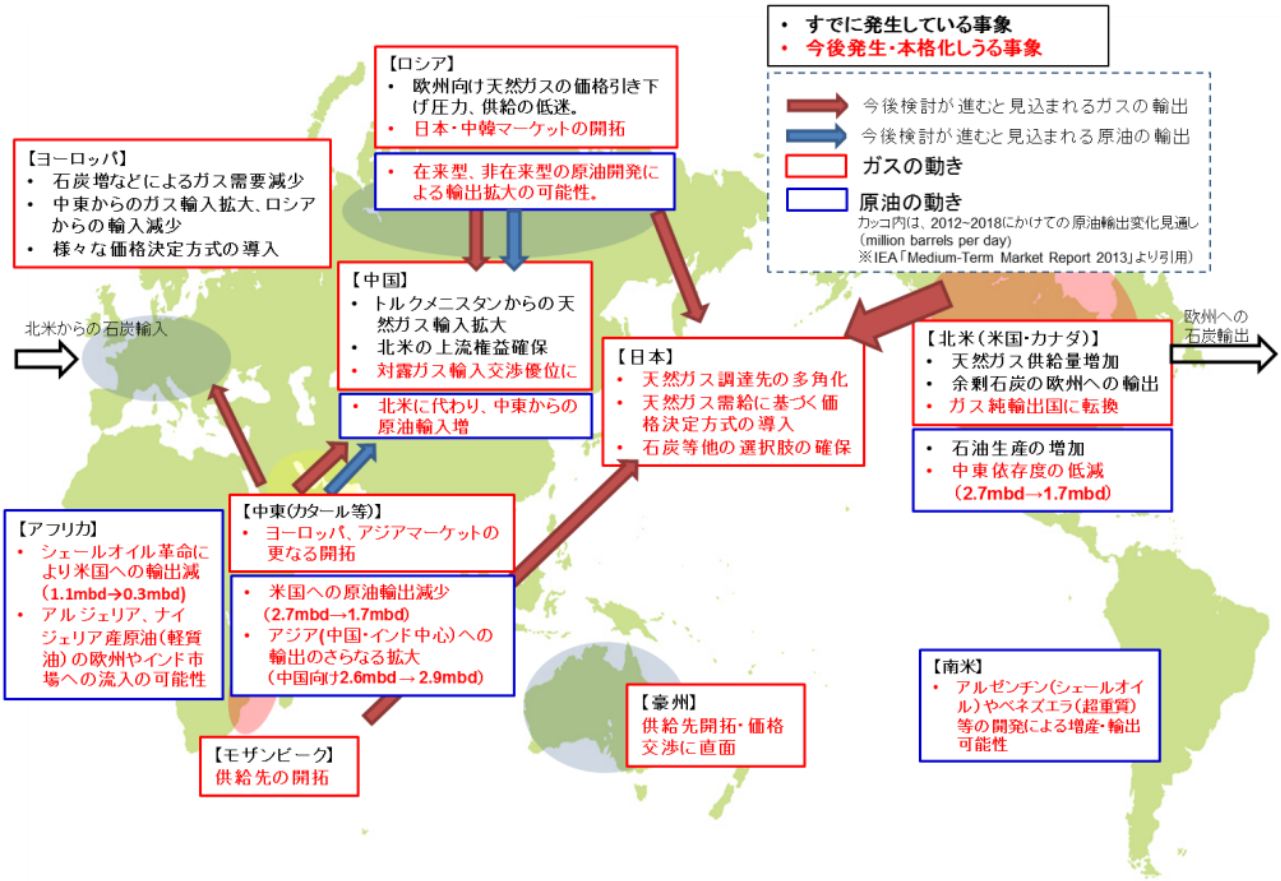
The United States, which accounts for a large percentage of the global energy demand, has been driving the self-sufficiency of energy supply including natural gas. The U.S. Energy Information Administration (EIA) expects that the U.S. will become a net natural gas exporter in 2018. Middle Eastern and African countries, which had anticipated exporting their LNG to the U.S., are now trying to expand their supply to Asian markets, looking for natural gas buyers who would make up for the lost market in the U.S.

Given its cheap natural gas prices, the U.S. is increasing the use of natural gas-fired thermal power, and at the same time decreasing the use of coal-fired thermal power. As a result, the export of American coal to Europe is increasing, and capitalizing on this opportunity, the U.K. and Germany are raising the percentage of coal-fired thermal power.

For European countries, the use of more coal coincides with not only the needs for cost reductions but also the strategic need for energy security that they will have to decrease the dependence on natural gas being supplied from Russia through pipelines. In addition, European countries are poised to sell their surplus LNG to Japan and other Asian countries where LNG market prices are higher.

On the other hand, amid the above-mentioned movement in Europe and the ongoing tension with Europe in the wake of Crimea absorption, Russia is exploring Asian markets as new natural gas buyers. As a result of its 10-year-long negotiations with China, Russia signed in May 2014 a contract to supply natural gas through pipelines at a rate of 38 billion cubic meters per year (approximately 28 million tons of LNG equivalent) for 30 years starting from 2018. Because of this development, China's LNG import in the future, which was expected to grow substantially, may stop at a certain level.

Impacts of the Shale Revolution on the international world



Although natural gas export from the U.S. requires approval from the U.S. Department of Energy (DOE), many in the U.S. are increasingly heightening their calls for natural gas export, backed by several concerns including the impact of Ukraine situation. Some companies in our country are already undergoing an approval process for projects bound by LNG purchase agreements. The export of LNG from the U.S. to our country is expected to start after FY2016. On the other hand, because exporting LP gas, an associated gas from shale gas production, does not require approval from the DOE, the U.S. also attracts our country's attention as a new LP gas exporting country. In addition, the Panama Canal now under extension work is scheduled to open in 2016. The completion of the canal might allow LNG and LP gas to be exported from the U.S. in larger quantity and at lower costs.

On the strength of increased shale oil production (which is expected to continue till the 2020s), the U.S. has been decreasing its crude oil import since 2008, and finally in October 2013, the volume of crude oil production exceeded the import volume of crude oil. On the other hand, having relatively light properties, shale oil is incompatible with some heavy oil-based refining facilities at U.S. plants. Nevertheless, based on the fact that imported crude oil contains an increasing amount of heavy oil component, many in the U.S. are seriously arguing that shale oil should be exported. With respect to lease condensate (light liquid hydrocarbons, a type of crude oil recovered from gas wells in liquid form) produced at oil wells and classified into "Crude Oil" for limited export, the U.S. Government recently articulated its approval to export it as a petroleum product, if some properties are modified. This movement in the U.S. as well as future trends in the export of crude oil and other associated products are also drawing our country's attention.

Shale Revolution had a great impact on energy prices as well. The decrease in energy cost would help the U.S. revive its manufacture industry, and at the same time would decrease the prices of shale gas-derived feedstock for petrochemical products such as ethylene, making it the source of improvements in global competitiveness, particularly for the chemical industry located in the U.S. The revolution also made a significant impact on Japanese industry, as exemplified by some chemical companies having built large-scale

chemical plants in the U.S.

In 2012, the average price of natural gas in the U.S. was one-quarter or less than the average price in Europe, and one-sixth of that in Japan. The comparison of industrial electricity prices shows that the price in the U.S. is about 50% of Japan and about 70% of Europe. IEA World Energy Outlook 2013 estimates that if the difference in energy price between Japan, the U.S. and the EU remains unchanged, only the U.S. will gain export share in energy-intensive industries (such as chemistry, aluminum, cement, steel, paper-making, glass, and petroleum refining), which account for 70% of the energy consumed by worldwide industrial sectors. The IEA study also estimates that Japan and the EU will lose by 2035 one-third of their corresponding current export shares.

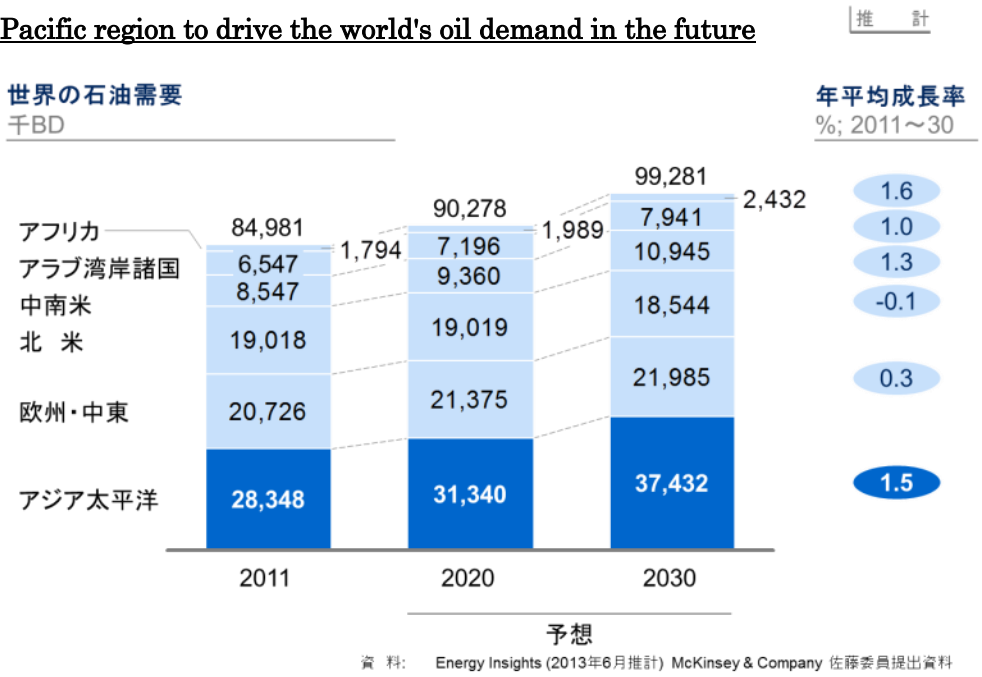
ii) Changes in global energy demand and supply structure driven by increasing energy demand in Asia

Backed by their economic growth, non-OECD countries centered on Asia are driving the increase in world energy demand. IEA World Energy Outlook 2013 estimates that world energy demand will increase to 1.3 times of 2011 levels by 2035, and non-OECD countries will account for 90% of that increase. As a result, the percentage of non-OECD countries in world primary energy demand is expected to grow from about 60% in 2011 to about 70% in 2035. The increase in energy demand is remarkable particularly in China and India, bringing about increases in crude oil and natural gas market prices. Crude oil prices have increased from around $30 per barrel in 2004 to the current $100 range (Nikkei Dubai). Natural gas prices have risen from $5/MMBTU in 2004 to $16/MMBTU today (Japan LNG Import Price). At the same time, Asian developing countries are aggressively participating in the battle for natural resources, and their government-owned oil companies are increasingly expanding investment in new resource-rich countries, such as in Africa and North America.

The majority of Asian countries (such as Japan, Korea, Taiwan, and India) are procuring LNG on a long-term contract basis. Because these prices are linked to crude oil prices, their procurement costs are increasing with rising crude oil prices in recent years. Furthermore, in the wake of nuclear power plant shutdowns, our country's LNG import volume rapidly increased, which is one of the reasons why LNG prices hiked.

The growth of Asian developing countries and the resulting increase in energy demand also represent the chance for our country to enter Asian energy sector for more business opportunities. There are already many such investment plans. In fact, petroleum refining and petrochemical sectors have announced many construction plans for oil refineries and petrochemical complexes, whose total capacity already exceeded the energy demand forecast in the Asian region. With respect to petrochemical products, it is expected that North American-made, shale gas-derived products will enter Asian markets in the future, making market competition in the Asian region tougher. It is not easy for Japanese companies to enter Asian petrochemical and energy markets in the future, and an ingenious strategic approach should be worked out.

Asia-Pacific region to drive the world's oil demand in the future



iii) Destabilizing international situation and increasing geopolitical risks in fuel procurement

The Middle East that our country depends on for most imported fossil fuels, and part of Asia on the fuel transportation routes, continue to be unstable in political situation.

In the Middle East, Jasmine Revolution that broke out in Tunisia in December 2010 had spilled over to other countries such as Libya, Egypt, Bahrain, and Syria, and so-called "Arab Spring" spread throughout the Middle East and North Africa regions. As a result, political and social structures became unstable in the whole region. The crude oil market has been frequently swayed on concerns that crude oil supply might run short. While crude oil export facilities in Libya finally began steps toward normalization, Egypt is still in an unstable situation and Syria today is in a state of civil war. Furthermore, the dispute between Israel and Hamas is intensifying, and the Iraq situation is becoming unstable due to the engagement between Sunni terrorist groups and Iraqi government troops. A path toward stabilization in these regions remains uncertain. As a result of Shale Revolution, the reduced dependence of the U.S. on fossil fuels from the Middle East might contribute to a gradual decrease in its involvement in the region. As the U.S. is decreasing its involvement there, how can Middle Eastern countries find ways for stabilization? It takes a long time to know a definite direction, and it is concerned that these unstable situations might continue for a long period of time.

With Japan's whole sea lanes put in perspective, besides geopolitical risks at choke points, such as the Strait of Hormuz and the Strait of Malacca, the recent heightening tension between China and Vietnam in the South China Sea over natural resources, and the expanded activities of Chinese maritime authorities in the East China Sea, might lead to our country's risks associated with fuel transportation routes.

After Russia had absorbed Crimea, European countries sharpened their stance against the dependence on Russia, resulting in Russia strengthening its ties with Asian countries, particularly with China. In May 2014, the two countries signed a contract for Russia to supply natural gas to China through pipelines. The strengthening tie between China and Russia like this may have impacts on geopolitical and associated risks in Asia.

(2) Energy demand and supply structure trends in Japan

i) High dependence on fossil fuels from the Middle East for, growing dependence on fossil fuels, and rising energy costs in its energy demand and supply structure

In our country that depends on import from overseas for most natural resources, the shutdowns of nuclear power plants in the aftermath of the Great East Japan Earthquake pushed up its dependence particularly on fossil fuels. As a result, fossil fuels now represent over about 90% of our primary energy (92% in FY2012) and about 90% of power supply mix (89% in FY2012). These percentages are higher than at the time of the first oil crisis (80% in 1973). In place of nuclear power generation, natural gas-fired thermal power increased its share in power supply mix, accounting for over 40% in 2013. (Note that the import volume of natural gas in 2013 was 87 million tons, about the same as 2012 levels, indicating that the import volume almost hit a peak.)

Our country depends on fossil fuels imported from the Middle East for the most part (80% of oil and LP gas and about 30% of natural gas), which poses an energy security concern, particularly with oil and LP gas. At the same time, our growing dependence on fossil fuels is increasing energy costs. Due to the increased import volume, increased oil and natural gas market prices, and the effect of weakening Yen, the total value of imported mineral fuels, such as crude oil, LNG, and coal, sored about 10 trillion Yen or 60% to about 27 trillion Yen in 2013 from before the Great East Japan Earthquake (2010). For this reason, our country's trade balance fell into the red in 2011 for the first time in 31 years. This led to a more serious situation where the trade deficit continued to increase into 2012, marking 11.5 trillion Yen in 2013, the largest trade deficit ever. Our current balance fell in the red for several straight months. The increase in energy costs is reflected in electricity rates, town gas charges, and petroleum product prices such as gasoline prices. The increase in energy costs is not just increasing the financial burden of companies and households in our country, but growing concern that the rise in raw material prices might encourage Japanese industries to accelerate the shift to overseas production, which would lead to domestic lost jobs.

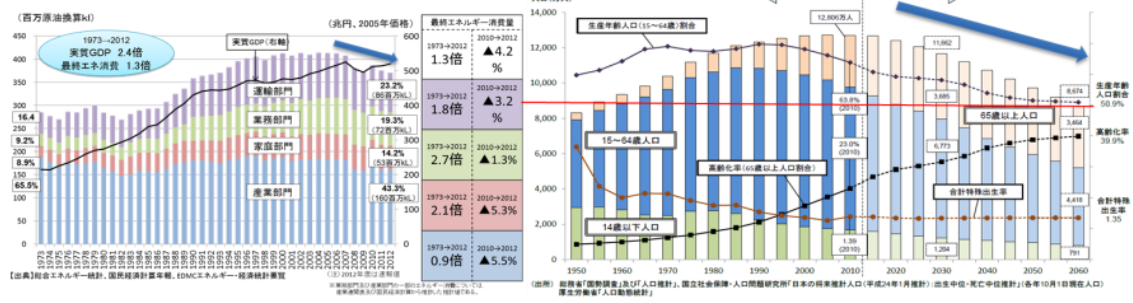
ii) Changes in energy demand and market structures

The population of our country is continuing to decline. The National Institute of Population and Social Security Research forecasts that the population in Japan will become 97,080,000 in 2050. The decline in population like this would lead to a structural reduction in energy demand. In addition, since the first oil crisis in 1973, our country has been striving for improved fuel efficiency and energy-saving home appliances, steadily improving energy efficiency. Total primary energy consumption has been on the decline in recent years, and it was particularly apparent after the Great East Japan Earthquake.

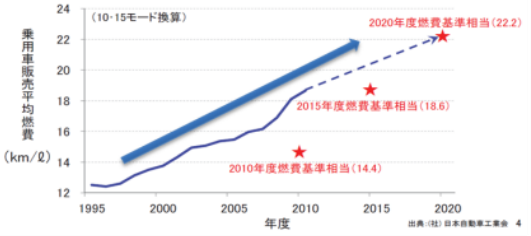
Energy demand in Japan

Energy demand is expected to be weakening due to (1) a decline in population and (2) improvements in energy-saving technologies

Population is forecast to decrease to the levels of 1955 by 2060



Average fuel economy in automobiles appears to be improving



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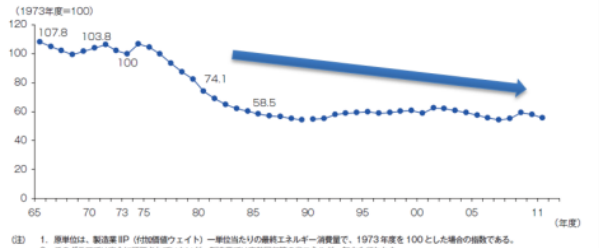


On the other hand, the liberalization of energy markets is taking place. Besides Electricity System Reform, a government initiative to fully liberalize retail electricity and power generation markets, Gas System Reform is studying the full liberalization of retail gas and the improvement in access to gas supply infrastructure through gas conduits. For this reason, it is anticipated that a variety of operators will be entering energy markets, and that some business models may be worked out to sell energy combined with other services. It is also anticipated that the development of fair and square competitive environments in energy markets would encourage energy companies to enter other companies' markets to compete with one another.

iii) Lessons learned from the Great East Japan Earthquake to rethink energy supply systems in emergencies

In place of electricity and town gas whose supplies were disrupted in the wake of the Great East Japan Earthquake, petroleum and LP gas worked well as last-resort transportable energy sources. The importance of these fuels was reconfirmed as energy least susceptible to crises. Petroleum products (such as gasoline, diesel oil, and kerosene) accounted for 30% of the emergency supplies the stricken areas wanted from the government, and oil refining and wholesale companies responded to the unprecedented crisis in a cooperative manner across affiliate companies. With respect to LP gas, while energy supply was disrupted in the wake of the disaster, people found it very useful to use LP gas from cylinders stocked under the eaves of their houses. This indispensable support helped the daily lives of many victims.

However, our experience after the Great East Japan Earthquake shed light on various issues that lay behind our country's energy supply systems in emergencies, calling for necessary measures. For example, since oil stockpile release had been applied only to supply disruptions overseas, the Oil Stockpiling Act was amended in 2011 to allow supply disruptions in domestic disasters. The same amendment to the Act also requires that petroleum and LP gas supply business operators prepare for each community the Plan for Joint-Operations of Oil Supply in Disasters, and that they also specify the locations of emergency petroleum product supply hubs as core gas stands (service stations). Core LP gas filling stations as well as core gas stands are now being set up nationwide. In addition,

the government has been providing necessary support of this initiative by installing in-house power generation units, upsizing storage tanks, and strengthening information-communication functions, so that these emergency supply hubs would work in the event of an emergency. Furthermore, the earthquake and tsunami in the wake of the Great East Japan Earthquake stopped operation at multiple oil refineries (three of which stopped operation for a long period of time), disrupted logistics infrastructures such as roads and ports, and damaged transportation means (road trucks, tank lorries, tankers, etc.) and logistics terminals (oil terminals). It is pointed out that these problems are attributable to the following issues: these situations had not been expected, relevant ministries and agencies had not sufficiently built collaborative relationships in terms of emergency oil supply support, and oil refining and wholesale companies were unfamiliar with activities across affiliate companies. In light of these issues, it is imperative to prepare for possible domestic disasters like Tokyo Inland earthquakes and Nankai Trough earthquakes, and further improve disaster prevention systems from the viewpoints of both hardware and software by inviting a wide range of parties concerned.

With respect to town gas, the disaster damaged LNG terminals and gas supply networks in disaster-stricken Sendai, disrupting gas supply in the region. By utilizing a gas pipeline from Niigata through Sendai, however, the presence of town gas supply facilities on the Sea of Japan side worked as a backup gas supply. Based on this experience, the viewpoint of maintaining stable supply of natural gas should be emphasized in our future studies, including gas transportation routes that connect the Pacific Ocean and the Sea of Japan sides, and the development of pipelines that connect LNG terminals in different regions.

2. Issues and directions of policies for natural resources and fuels based on future energy demand and supply

(1) Governmental targets and roles for policies for natural resources and fuels

i) Affirmed basic thoughts on energy policies

As basic viewpoints on energy policies, the Strategic Energy Plan affirmed the importance of ‘3E+S’, international, economic growth viewpoints. In the policies for natural resources and fuels, the most important issue for our country is maintaining sustainable energy supply. Toward the realization of the Plan, the government is going to execute these policies while taking other viewpoints into consideration. In addition, the promotion of strategic technical development, of which importance the Plan also proclaims, would make it possible to improve our country's energy demand and supply structure.

Reference: "Strategic Energy Plan" Basic viewpoints of energy policies (3E+S) (Excerpt)
(1) Basic viewpoints of energy policies (3E+S)
Energy is an infrastructure that supports every human activity.
One of the prerequisite conditions for our country to continue to prosper in the future is to build the energy demand and supply structure that would steadily supply energy without increasing social burden.
(...)
It is important to implement energy policies in a medium- and long-term perspective, by overviewing the whole energy supply chain, from production, procurement, to distribution, consumption, with basic viewpoints clearly defined.
On the premise of ensured safety, the key to successful energy policies is to focus on energy security first, improve economic efficiency, and then realize low-cost energy supply. At the same time, every possible effort should be made to protect the environment.
(2) Importance of international viewpoints
As a new global movement, the effects of energy on environmental changes are challenging not only our country but also many other countries. In the energy sector, there are an increasing number of cases where one country alone is unable to fully solve challenges that it faces.
For example, while individual countries and companies are fiercely competing with one another as rivals when they procure resources, the same resource consuming countries cooperate with each other to negotiate with resource supplying countries for better trading terms and conditions. By changing current buyer-supplier relations so that competition and cooperation can be flexibly combined, our country would be able to change natural resource trading to more reasonable one.

(...)
The increasing need for such an international perspective applies as much to the energy industry. Our country's energy supply structure depends heavily on natural resources from overseas. At the same time, domestic energy demand is expected to decline gradually. Given this circumstance, for the energy industry to prosper in the future by enhancing their business base, while contributing to the stability in our country's energy supply, they are asked to proactively globalize themselves, strengthen their overseas operations, and aggressively capture overseas demand as their own markets.
(3) Importance of economic growth viewpoints
Energy is used to support the infrastructure of various industrial activities. The stable supply and cost of energy, in particular, have a big influence on business strategies, such as the establishment of new business facilities as well as business operations.
As shown in the statement about basic viewpoints, the realization of stable energy supply and a reduction in environmental burdens, while supplying energy at low cost through continuous improvements in economic effectiveness, would keep existing business operations stay in Japan. This serves as the prerequisite conditions for our country to continue to grow its economy further. The "Japan Revival Plan (which was approved in a Cabinet meeting in June 2013)" strongly urges the government to strengthen the country's competitiveness as a business hub, where many companies would be able to operate more actively, move forward with various reforms in the energy sector, and then build the energy demand and supply structure that would overcome the supply constraint of, and at the same time, achieve the cost reduction in electric power and other energy sources.
The reforms of energy demand and supply structure would also encourage new business operators to enter the energy sector in various ways. As a result, these reforms may find business operators supplying energy in a more comprehensive, efficient manner, or creating new markets by integrating some non-energy markets.
These reforms would also provide opportunities for our country's energy industry to strengthen competitiveness and enhance its presence in the international market. As a result, it is expected that energy-related companies will contribute to an improvement in the country's trade balance by exporting high value-added, energy-related equipment and service overseas.
For this reason, when studying energy policies, the government should also estimate, as an important viewpoint, how much these policies would contribute to the country's economic growth.

ii) Three governmental targets and roles for policies for natural resources and fuels

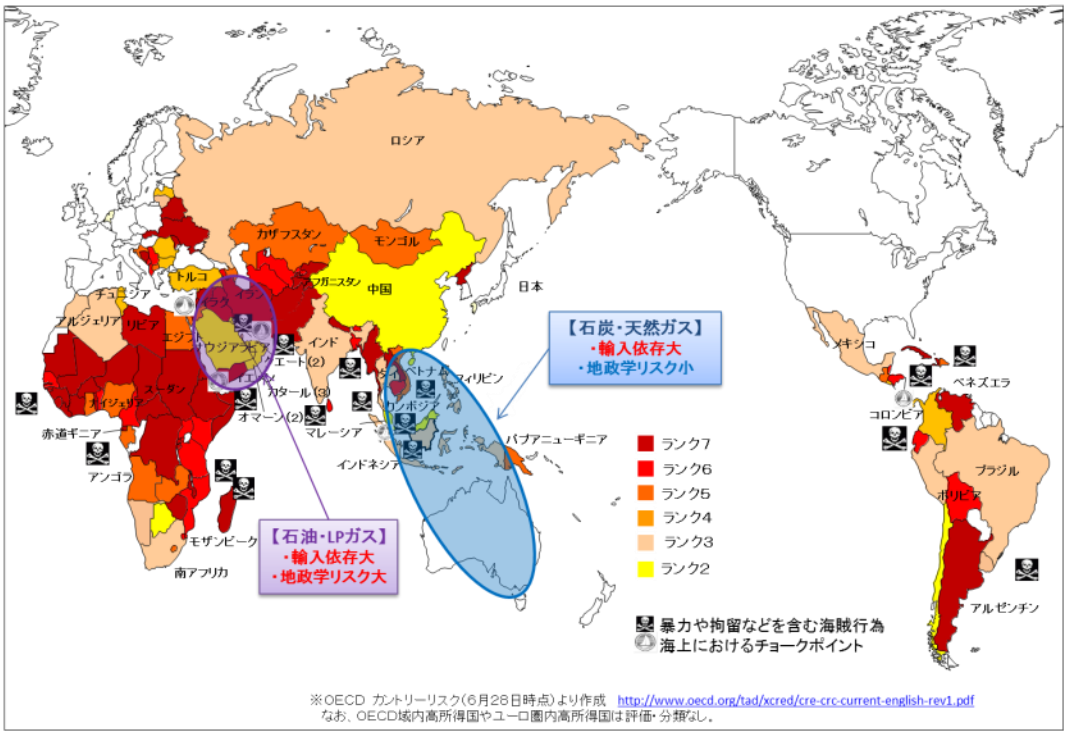
In light of basic thoughts on energy policies in the Strategic Energy Plan, the energy demand and supply structure surrounding our country, and energy market trends, the following three targets must be met to realize the maintaining sustainable energy supply, the most important issue in our policies for natural resources and fuels: 1) reducing and managing uncertainty in importing natural resources from overseas for the most part, 2) building system structures that allow our people to access natural resource and fuel supplies in the event of a domestic disaster, and 3) strengthening industrial infrastructures that support such system structures.

The government is committed to play a responsible role in achieving these three targets.

1) Responding to uncertainty in importing natural resources from overseas

Based on the risk of fuel supply disruptions in unstable international situations, the rising energy prices driven by the growing energy demand in Asia, and our country's high dependence on fossil fuels from the Middle East, the government is committed to pursue the steady procurement of energy resources at cheaper prices, the development of fuel stockpile systems on the assumption of possible supply disruptions, and the diversified use of fuels on the demand side, by diversifying supply sources, getting stakes in upstream resources, actively developing resource-seeking diplomacy, talking with resource producing countries, and cooperating with resource consuming countries.

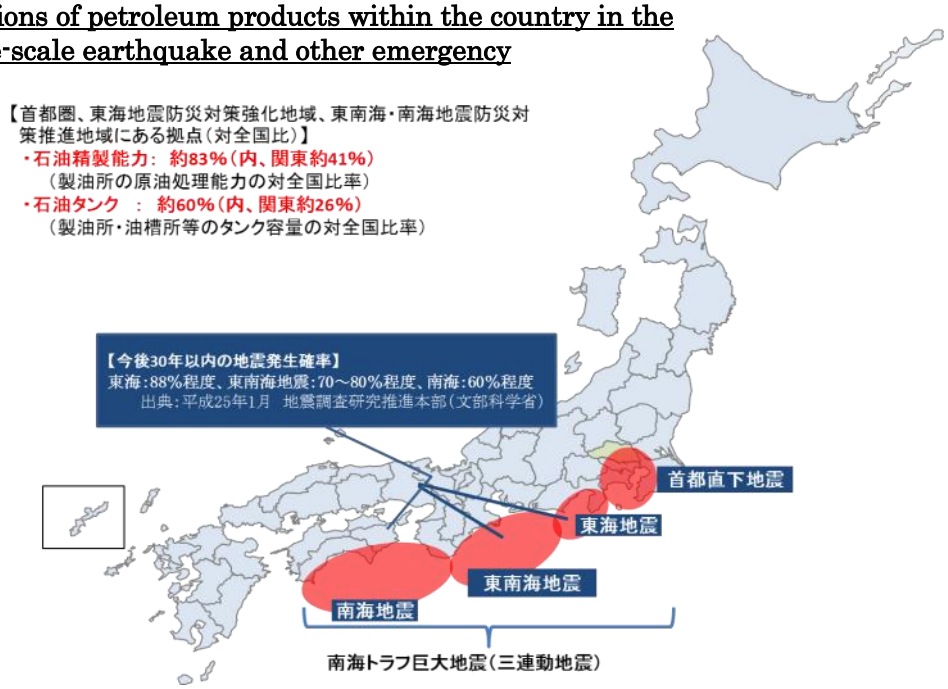
Country risk associated with major resource exporting countries



2) Ensuring energy demand and supply systems in preparation for disasters

Based on the lessons learned from the Great East Japan Earthquake, and in preparation for possible disasters, such Tokyo Inland earthquakes and Nankai Trough earthquakes, the government is committed to ensure robust emergency energy demand and supply systems through the hardware-based measures, such as fuel stockpiling-based emergency systems and the support of more quake-resistant energy supply facilities, and through the software-based measures, such as disaster drills and emergency energy supply operations that will be performed jointly by relevant ministries and agencies, local governments, and energy business operators.

Supply disruptions of petroleum products within the country in the event of a large-scale earthquake and other emergency

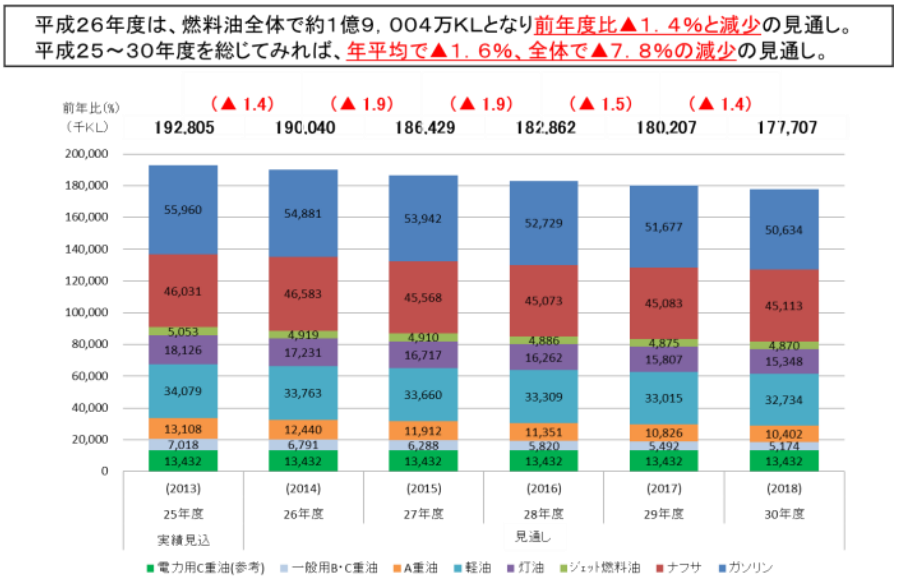


3) Business base restructuring for industries responsible for energy supply

In light of the decline in energy demand in the domestic market, progress in Electricity and Gas System Reforms, and the growing Asian markets driven by increasing energy demand in

the region, the government will encourage, on an as-needed basis, companies responsible for supplying energy to strengthen their business base, so that they would be able to supply energy stably through facility optimization and business restructuring, transformation to a total energy solution company, overseas expansion supports, technical development and measures for facility maintenance that support these efforts, human resource development supports, and other measures needed to form fair and transparent marketplaces.

Forecasted demand for oil products from FY2014 to FY2018 (type-C heavy oil for electric power generation side by side with other types of oil)



Based on the above, our future direction of policies for natural resources and fuels for each target is as follows.

(2) Responding to uncertainty in importing natural resources from overseas (general statement)

Responses to uncertainty in importing natural resources from overseas are classified roughly into the following key points: i) appropriately diversified sources by diversifying essential fuels, ii) reduced risks for each essential fuel by diversifying supply sources, iii) procurement price stabilization by procuring fuels in a variety of pricing systems, and iv) all possible means to be taken to secure fuel supply in the event of a supply disruption.

The joint communiqué of the Energy Ministers Meeting held on May 6, 2014 endorsed the importance of diversifying energy and supply sources with respect to medium-term fossil fuels.

As stated in the Strategic Energy Plan, each energy source has strengths and weaknesses in its supply chain. There is no single energy source that can support stable, efficient energy demand and supply structures single-handedly. The government is going to realize demand and supply structures that would maximize the strengths of an energy source and get its weaknesses appropriately complemented by other energy sources.

Reference: How each essential fuel is positioned in "Strategic Energy Plan" (which was approved in a Cabinet meeting on April 11, 2014)
Petroleum:
Although the domestic demand has been on the decline, petroleum currently accounts for a little more than 40% of the total primary energy consumption in Japan. The advantage of petroleum is the wide variety of its applications, including fuels used in transportation, consumer, and electric power supply markets, and feedstock used for chemical products. The transportation sector, in particular, depends very heavily on petroleum. Petroleum plays an important role in the manufacturing sector as well. As compared with these applications, petroleum is not used as much for electric power supply applications. However, this fuel serves

a certain level of functions as peak power and regulated power supplies. Despite the highest geopolitical risk associated with procurement of all fuels, petroleum can take the place of other power sources in the event of a supply disruption, because of its high portability, established nation-wide supply networks, and abundance in stockpile. Petroleum is an important energy source that our country should continue to utilize in the future.
LP gas:
Because of its high dependence on the Middle East, the supply structure for LP gas has been vulnerable. However, due to the increasing procurement of cheaper shale-associated LP gas from North America, the geopolitical risk of LP gas is now on the decrease. As compared with other fossil fuels, LP gas emits relatively small amounts of greenhouse gases. For this reason, it is possible to use LP gas as middle load electricity in the power generation sector. Thanks to the existing well-developed supply system to final consumers and stockpiling system, LP gas has advantages in portability and ease of storage. LP gas, which supports people's lives and industrial activities at ordinary times, serves as a decentralized, clean gas energy source in the event of an emergency.
Natural gas:
Due to its high combustion effectiveness, the use of natural gas, which currently accounts for over 40% of Japan's total power consumption, is now on the increase. Although not imported from overseas through pipeline today, because its geopolitical risk is relatively low compared with petroleum, and because it emits the least amount of greenhouse gases among fossil fuels, natural gas is playing a central role as middle load electricity in the power generation sector. It is also likely that natural gas will become one of the major elements in hydrogen society. The effect of the Shale Revolution will allow natural gas to be priced in a competitive manner in the future. Such changes in circumstance are expected to encourage each sector to shift its energy source to natural gas. Therefore, natural gas is an important energy source in the sense that it will change and expand their roles in the future.

The figure below shows how procurement and consumption phases are diversified at present. In the procurement phase, the figure indicates that the percentage of petroleum is the largest, petroleum and LP gas highly depend on supplies from the Middle East where geopolitical risks are high, and natural gas and coal depend heavily on South East Asian countries and Australia where geopolitical risks are relatively low. In the consumption phase, on the other hand, the high dependence of the transportation sector on petroleum stands out, indicating that this sector is highly vulnerable to a single risk.

In both the procurement and consumption phases, one of the basic thoughts on risk reduction is to decrease the high dependence particularly on high-risk essential fuels. In the procurement phase, it is important to reduce supply risks by increasing import from resource-rich countries where geopolitical risks are low, while continuing to strengthen the relationships with Middle Eastern countries. In the consumption phase, the reform of demand structures particularly in the transportation sector is considered to be the most important target. In each demand sector, more diversified energy mix would offer more choices of energy available in the event of an emergency such as a disaster. This arrangement would ensure that more robust energy demand structures are set in place.

Fuel diversification in procurement phase (FY2011)

燃料種の分散

	石油（100%）	LPガス（100%）	天然ガス（100%）	石炭（100%）
1次エネルギー	40%	3%	22%	23%
中東	35%（87%）	2%（83%）	7%（30%）	―
アフリカ	1%（2%）	0%（1%）	2%（7%）	―
ロシア	2%（4%）	―	2%（9%）	2%（7%）
東南アジア オセアニア	3%（7%）	0%（10%）	11%（51%）	19%（81%）
北米	―	0%（1%）	―	2%（9%）

地政学リスク大 ↑ 調達国の分散 ↓ 地政学リスク小

Fuel diversification in consumption phase (FY2011)

エネルギー種の分散

	全体	石油	LPガス	天然ガス	石炭	電力
最終エネルギー消費	100%	45%	5%	11%	11%	23%
産業（100%）	43%	14%（34%）	2%（5%）	2%（5%）	9%（22%）	7%（17%）
業務（100%）	20%	4%（22%）	1%（5%）	5%（28%）	0%（1%）	9%（44%）
運輸（100%）	23%	22%（95%）	0%（2%）	0%（0%）	―	0%（2%）
家庭（100%）	14%	3%（18%）	1%（10%）	3%（21%）	―	7%（51%）

利用部門 ↕

注：エネルギー白書2013のデータ（2011年度分）から作成。四捨五入、化石燃料以外のエネルギー省略等の関係から必ずしも和が100%にならない。

Use of evaluation axes / formulas to assess energy security levels

Evaluation axes / formulas serve as tools that can quantitatively estimate the degree of multi-tier, overall stability in our country's energy demand and supply structures, based on the degree of diversification on supply sources in terms of essential fuels and geopolitical backgrounds, and based on the diversification on how energy is consumed in each demand sector. Even if the environment surrounding energy changes in a number of ways, the use of such tools would be useful in benchmarking what impacts the change would have on stable energy supply, and which policies would raise energy security levels to what extent.[1]

Reference: Use of evaluation axes to assess energy security levels
(Excerpt from the handouts of the 4th Natural Resource and Fuel Committee on January 31, 2014)
1) Diversifying essential fuels
- The diversification of essential fuels for energy generation would allow the use of other types of energy in the event of a disruption in one type of energy, helping to improve social resilience.
2) Diversifying energy exporting countries
- In diversifying energy exporting countries, it is necessary to look at the weighted geopolitical risk for a group of countries. Risks are relatively high in procuring fuels from countries with high geopolitical risk, or countries quite similar to each other in characteristics (e.g., from adjacent countries).
- However, it is necessary to understand that the types of risks can vary between neighboring countries depending on the geographical and other conditions.
- The diversification of energy sources mainly from countries with low geopolitical risk would reduce the possibility of a supply disruption in the event of a geopolitical happening. In this scheme, even when fuel supply from one country is disrupted, that supply can be purchased from other countries, ensuring steady energy supply.

i) Basic thoughts on how to realize appropriate diversification

- The excessive dependence on specific essential fuels would increase the risk of failing to steadily supply energy in the event of a disruption in fuel import from overseas. If the supply of a specific fuel is disrupted, the diversification of key essential fuels would allow this fuel substituted with other fuels, which reduces the overall risk. If the essential fuel has conventional and unconventional types fairly independent of each other, it is possible

[1] Back in 2000, "Energy Security WG," Coordination Subcommittee, Advisory Committee for Natural Resources and Energy, attempted energy security analysis first. Later on, "Energy White Paper 2010" introduced a similar analysis. Focusing mainly on the degree of diversified essential fuels, the degree of diversified exporting countries, and the levels of geopolitical risks in each exporting country, these past efforts analyzed the state of energy supply security in the procurement phase at that time.

to deal with them as two different essential fuels.

- On the other hand, if multiple essential fuels are imported from one country, attention should be paid to associated correlation risks. For example, if both oil and natural gas are imported from the Middle East, these two essential fuels would end up encountering the same regional risks. The diversification of supply sources would reduce the risk of supply disruptions and prevent multiple essential fuels from being exposed to the same risks.
- Likewise, the demand side should diversify the use of fuels so that it can construct a mechanism that allows the use of other fuels when the supply of a specific fuel is disrupted. Such a mechanism would reduce vulnerability to associated risks. In the transportation sector, for example, if essential fuels available on the demand side are diversified by the use of LP gas-powered vehicles, electric vehicles, and fuel cell-powered vehicles in addition to gasoline-powered vehicles, the essential fuels whose supply is disrupted can be substituted with other essential fuels.

ii) Basic thoughts on how to reduce the risks associated with essential fuels

- When looking at a specific essential fuel, the supply sources of this fuel should be diversified, because the impacts of a supply disruption of the fuel in one region can be mitigated by importing from multiple countries.
- Furthermore, an increase in the percentage of procurement from countries where geopolitical risks are low, and a decrease in that percentage from countries where geopolitical risks are high, could further reduce our overall vulnerability. For this reason, the expansion of procurement from such countries should be pursued.
- In cases where fuels are imported from the same country / region, if our country has a good relationship with that country, it is more likely that we will be given priority over other countries for receiving fuels in the event of a risk that surfaces there. Furthermore, if the import from that country is coming from the mining area where our country has its upstream stake, the likelihood of our receiving fuel supply becomes higher (with the increasing stake ratio). For this reason, the government is committed to strengthen our relationships with resource producing countries by actively developing resource-seeking diplomacy, and encourage Japanese companies to get new stakes in upstream resources and extend existing ones in order to increase the ratio of independent resource development.

Past resource-seeking diplomacy conducted to date by the Prime Minister and Cabinet ministers.

- Not to mention the high stability of domestically available resources, an increase in domestic resources has particularly important implications for our country, which depends on import from overseas for most energy resources. For this reason, the government is committed to systematically work on domestic resource developments, including technical developments for methane hydrate and other natural resources.
- If the essential fuel accounts for a high percentage of import from countries / regions where geopolitical risks are high, and the fuel is hardly be substituted with any other fuel, it is of great significant to stockpile fuels to secure domestic energy supply at least for a certain period of time in the event of a supply disruption from overseas. In preparation for a possible supply disruption of such fuels, the government will set up systems that implement private stockpile and national stockpile without fail and can release them in an expeditious and effective manner depending on the situation.

iii) Basic thoughts on how to reduce procurement prices

- As described above, the total fuel imports reached 27 trillion Yen in 2013, an increase of over 10 trillion Yen from three years ago. The sharp rise in fuel imports has been the worst contributor to our trade deficits, and escalating energy and other prices are threatening our country's industries and people's lives. This situation is not something our country can live with for a long period of time, and a reduction in fuel procurement price is an important factor for achieving the target to secure stable energy supply.
- To reduce energy prices, it is necessary to diversify supply sources first, urge competition between resource producing countries, make the market more competitive, and then enhance the buyer's negotiating power over the seller's. For example, when negotiating prices with countries from which some fuel is being procured for a high price, if the same fuel is being procured (or can be procured) from other countries as well but for a lower price, our country can use the fact as negotiation leverage over the negotiating partner.
- If the resource consuming country, which does not have enough bargaining power, is negotiating for cheaper prices individually, cooperation with other resource consumer

countries would enable this country to strengthen its bargaining power as the buyer over a resource-rich country, which has high production output and strong bargaining power as the seller.

- Likewise, because an expansion in procurement volume within our country would help enhance its bargaining power, the government would encourage new joint procurement through comprehensive alliance between energy companies . Furthermore, such an approach would enable strategic procurement and participation in upstream and midstream projects.
- Many long-term LNG contracts have a destination clause that limits the destination of the fuel to a predetermined location and prohibit resale. If domestic demand decreases, the resulting surplus LNG cannot be sold to other countries. If the destination clause is relaxed and surplus LNG is allowed to resell without major restrictions, cheaper fuel becomes available, capitalizing on volume purchase, which would eventually change the market to more flexible one.

iv) Basic thoughts on activities in preparation for fuel supply disruptions

- As described in Section 2. (2) ii), stockpiling essential fuels with high levels of geopolitical risk contributes to the security of energy supply for a certain period of time at the event of a supply disruption from overseas. In preparation for a possible supply disruption, the government will set up systems that are designed to implement private stockpile and national stockpile without fail, and are capable of releasing them in an expeditious and effective manner, depending on the situation. These systems would be able to reduce tangible risks.
- If the supply disruption of an essential fuel lasts for a long period of time, the government controls fuel demand and supply (under the Petroleum Supply and Demand Adjustment Act) to make "demand and supply adjustments." The government should clear its thoughts beforehand on how to prioritize domestic fuel supplies in the event that this situation is continuing further, so that it could avoid as many chaotic situations as possible.

(3) Building energy demand and supply systems in preparation for disasters (general statement)

In the event of a disaster in our country, a lack of smooth fuel supply in some regions might threaten people's lives and livelihoods as well as industrial activities. 1) The government should clear its thoughts beforehand on how to supply fuels and release stockpiles in the wake of a disaster-induced energy supply disruption. In addition, each relevant party should tackle both the following two measures as matters of self, keeping emergency situations in mind. Such efforts would prevent real problems in the event of a disaster as much as possible: 2) investments in measures that would minimize damage to energy supply facilities (hardware-based measures), and 3) the development of fuel supply operations that would restore key energy supply chains in an expeditious manner without interfering with people's livelihoods in the event of a disaster (software-based measures).

i) Building energy demand and supply systems in preparation for domestic supply disruptions

- Not only in the event of a supply disruption from overseas as described in Section 2. (2) iv), but when a supply disruption occurs in our country, the government should 1) release its stockpile and 2) control fuel demand and supply (under the Petroleum Supply and Demand Adjustment Act) to make "demand and supply adjustments," depending on the degree of the disruption.
- The government should put together thoughts on how to release stockpile in response to a domestic disaster, which particularly calls for swift action, thoughts on demand-side control,

and thoughts on which businesses / activities should be given priority for fuel supply during that period. The government should also share information and understanding widely among relevant public and private parties, and prepare for action in the event of an emergency. By doing so, it is possible to avoid chaotic situations even if a real disaster occurs.

- Even after a supply disruption as a result of a disaster, energy consumers responsible for socially important infrastructures, such as local governments (e.g., fire station, police, and water and sewer), hospital, broadcasting, and communication, and finance, will have to continue their activities in a self-sustaining manner. Impacts on people's livelihoods can be minimized, if these consumers are prepared to protect themselves, resume their operations and livelihoods shortly after an emergency occurs, and then keep their function operational until energy supply recovers.

ii) Enhancing disaster-resistant supply infrastructure (hardware-based measures)

- With respect to facilities related to energy supply, the government should develop hardware-based measures, such as steps against power outage, earthquakes, and liquefactions so that it could maintain a minimum amount of energy supply in the event of a disaster, building more robust energy supply chains. The government should also develop a series of infrastructures that would allow our country to receive fuel from overseas after a disaster occurs, transport it to the points of demand, and distribute it to consumers there.

iii) Facilitating logistics in emergencies (software-based measures)

- To allow concerned parties to organically function and smoothly conduct fuel supply operations in the event of an emergency, the government will sort out beforehand how to cooperate between relevant ministries and agencies, between wholesale companies and retail business operators, and between energy companies and local governments, and then develop software-based measures.
- More specifically, the government, in preparation for emergency fuel supply, will tirelessly develop and refine the supply coordination systems between business operators and the business continuity plans (BCPs). At the same time, the government will sort out how to cooperate and collaborate (on the levels of task forces and regulatory operations) with relevant ministries, agencies, and local governments with the aim of facilitating fuel logistics. Since desk plans tend to lack in effectiveness, the government will have to make sure how it should respond to a real crisis, through continuous training in which energy suppliers participate.

(4) Business base restructuring for industries responsible for energy supply (general statement)

Stable energy supply is not something that the government alone will and can accomplish. Absolutely necessary is the presence of energy companies whose business base is stable enough to take full responsibility for stable fuel supply in terms of both procurement from overseas and supply to our country. For this reason, it is necessary for these companies to work out business plans in consideration of overseas markets, without hunkering down in our country where energy demand is on the decline. Such companies should also strengthen their business base so that they could take advantage of their competitiveness. The government will encourage them to take speedy action for this challenge.

In the meantime, it is not necessarily easy for our country, whose population is continuing to decline, to sustain the industries and companies that steadily deliver fuel nationwide. Nevertheless, the government, in cooperation with local governments, is committed to support business operators that are striving for sound development.

In addition, excessive competition between energy business operators would threaten the revenue base of both wholesalers and distributors, making it difficult to steadily supply fuel in our country. For this reason, the government is committed to help build a sound competitive environment by forming a fair market environment and by making energy prices transparent.

3. Responding to uncertainty in importing natural resources from overseas (detailed statement)

(1) Diversifying essential fuels, reducing risks from importing each essential fuel, reducing procurement prices, and how to use fuels on the demand side

i) Petroleum

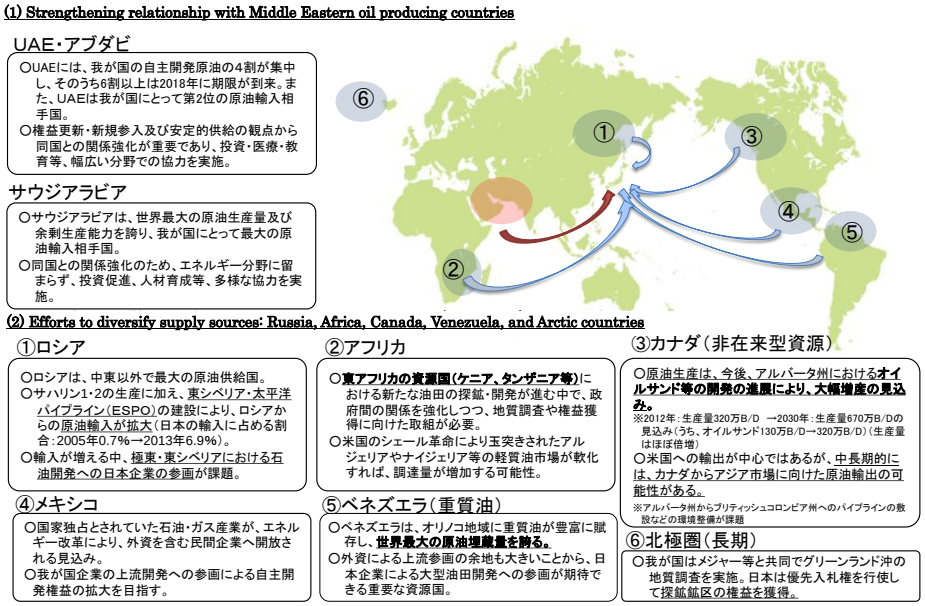
[Reducing procurement risks]

Diversifying energy exporting countries

- With respect to crude oil, based on experience from the oil crises in the 1970s, the government had increased import from Indonesia and other countries in the 1980s to diversify its supply sources, and decreased its dependence on the Middle East. Due to their increasing domestic oil demands in recent years, Asian countries began to allocate the crude oil that has been exported to other countries to their own consumption, resulting in a decrease in their total crude oil export. At the same time, our country's crude oil import from the Middle East has increased from urgent needs. As a result, our country's dependence on crude oil procurement from the Middle East is now increasing again. At present, our country depends on Middle Eastern countries (Saudi Arabia (31.8%), UAE (22.7%), Qatar (12.7%), and Kuwait (7.3%)) for nearly 80% of its crude oil procurement. Japan is importing most of such crude oil via the Strait of Hormuz.
- Given these situations, the government is committed to explore every possibility toward diversifying energy exporting countries, though there is a limit to crude oil supply from regions other than the Middle East. For example, to decrease its dependence on the Middle East, the government will urge Japanese companies to consider importing oil by themselves as a frontier-based exploration, support their participation in upstream resource developments, and start/expand fuel supplies from countries/regions that have the potential for promising resources, such as Russia, Africa, Mexico, and Canada.
- Taking advantage of its potential for abundant resources as well as geographical proximity, Russia, the largest crude oil exporter to our country except the Middle East (6.9%), is expected to increase crude oil production in the future. For this reason, Russia is important for our country to decrease the dependence on crude oil from the Middle East. The key is the participation of Japanese companies in oil development in the Far East and eastern Siberia. In light of the international situation surrounding Russia, the government will appropriately support these companies through JOGMEC and other institutions.
- As a frontier region, East Africa is pursuing the exploration and development of new oil fields in recent years. To support the participation of Japanese companies in oil exploration and development projects in Kenya and Seychelles, the government will enhance intergovernmental relations with these countries, and conduct geological surveys in the frontier region at the same time.
- Mexico, currently moving forward with new energy reforms, is expected to sell its oil and gas stakes to private companies including foreign. Depending on the details to be determined later, it is important for the government to provide necessary support through resources-seeking diplomacy and risk money supply, so that Japanese companies could participate in these energy reform programs.
- In collaboration with major oil companies, Japan conducted geological surveys in

Greenland in the Arctic Circle, exercised its preferential right to participate in bids, and acquired the stakes of some exploration mining areas. Because oil exploration projects in the frozen sea require large amounts of money, the government is committed to support the project through risk money supply and other assistance.

- The procurement of unconventional oil, such as oil sand in Canada, extra heavy crude in Venezuela, and shale oil in the U.S., may not only reduce procurement risk from diversifying energy exporting countries , but also have the same effect as from diversifying essential fuels. For this reason, the government is committed to support such procurement through risk money supply and other assistance.



Getting stakes in upstream resources through resource-seeking diplomacy (increasing the rate of independent development)

- As well as diversifying energy exporting countries, things that would contribute to the enhanced stability of crude oil supply even at the time of an emergency, during which the demand-supply balance becomes tight, are to strengthen the relationship with the oil producing countries that are currently exporting to our country, including Middle Eastern countries, and to get independently developed crude oil through the Japanese companies that acquired the upstream stakes to participate in oil development projects.
- Saudi Arabia is the world's largest crude oil producing country, and at the same time, the largest crude oil exporter to our country. In light of enhancing the stable supply of crude oil from the country, the government will strengthen the relationship with Saudi Arabia not only in the energy field but also through investment promotion and human resource development.
- With respect to getting stakes in upstream resources, to improve the rate of independent development, the government is committed to push along resource-seeking diplomacy, supply risk money to oil exploration and development which require large amounts of money, and support the Japanese companies in getting stakes in these developments.
- To make this happen despite our decreasing opportunities to get involved in oil exploration and development, the government will have to get new stakes in resources and extend existing ones. For example, 40% of our country's independently developed crude oil (equivalent to a little less than 10% of Japan's total crude oil imports) concentrates in the offshore mining areas in Abu Dhabi, over 60% of which will be due to expire in 2018. Toward the renewal of these stakes, the government will cooperate with the Abu Dhabi side in the energy, education, medical care, and other fields in which the partner is highly interested.

・The government will help build close relationships with oil producing countries, by conducting pilot tests for Enhanced Oil Recovery (EOR), also by developing the materials and equipment as well as the produced water treatment technologies used in the offshore (frozen and deep-water) sector.

Developing domestic resources

・The oil resource that exists in Japan is a domestic energy source having the lowest procurement risk.
・With respect to the development of oil fields, taking advantage of the 3-D seismic vessel SHIGEN owned by the Ministry of Economy, Trade and Industry (METI), the government is conducting 3-D geophysical exploration in the waters around our country at a pace of approximately 6,000km^2 per year. The government will conduct exploratory drilling surveys in the waters where the likelihood of success is high and continue similar efforts.
・Based on the survey results from SHIGEN, the government conducted in the past fiscal year exploratory drilling in deep water "southwest off Sado Island.". Although not having resulted in a noticeable discovery of oil and gas, the exploratory drilling identified trace amounts of oil and gas, and collected various geological data. These data will be utilized as base data conducive to future exploration and development around the waters.
・In the past fiscal year, JOGMEC and JAPEX jointly worked on shale oil development in Akita Prefecture, and started the commercial production of small amounts of shale oil at Ayukawa Oil and Gas Field, where demonstration tests had been conducted. Though still in limited production scale, the obtained results will be utilized for the development of domestic resources.

[Procurement price reduction]

Resource-seeking diplomacy

・Petroleum prices are determined in international oil markets, based on current and future demand and supply projections, geopolitical factors, and other fundamental data. The promotion of crude oil procurement for stable and reasonable prices would require globally sufficient supply capacity. To help secure globally sufficient supply capacity, our country will encourage oil producing countries with excess supply capacity, particularly Saudi Arabia, to allocate their supply capacity enough to satisfy our current demand, and will also urge Japanese companies to promote investment on upstream resources.
・For the purpose of controlling worldwide oil demand, as well as promoting energy saving in Japan, the government will support Asian and Middle Eastern oil producing countries, whose energy demand is rapidly increasing lately, in introducing energy saving and renewable energy.

ii) LP gas

[Reducing procurement risks]

Diversifying energy exporting countries

・In fact, our country depends on imports for about 80% of its LP gas procurement. And about 80% of the LP gas import depends on the Middle East. To reduce such a high supply risk, the government will continue to diversify energy exporting countries.
・Since the North American Shale Revolution, shale-associated LP gas has been produced as well as shale oil. Because this LP gas is less expensive in FOB price than that from the Middle East, and because North America is in a geopolitically stable region, the procurement of this gas is one of the options the government should continue to pursue further. Given this background, Japanese wholesale companies expect to import about 2.5 million tons of shale-associated LP gas in as early as 2016 (equivalent to about 19% of Japan's annual LP gas imports).

・While continuing to maintain good relationships with the gas exporting countries in the Middle East, the government will expand the procurement of North American shale-associated LP gas. Furthermore, by studying the possible procurement of LP gas from Africa and South America as an additional option, the government will continue to diversify energy exporting countries.

[Forecasted LP gas procurement from the U.S.]

○元売り各社は、シェールガスに随伴するLPガスの米国価格での調達を拡充する方向。
○米国からの調達は、2016年には248．8万トン（日本の年間輸入量の約18．8%）を越える見込み。
※昨年8月に米国からのLPガスが波方国家備蓄基地に搬入された。

（単位:万トン）

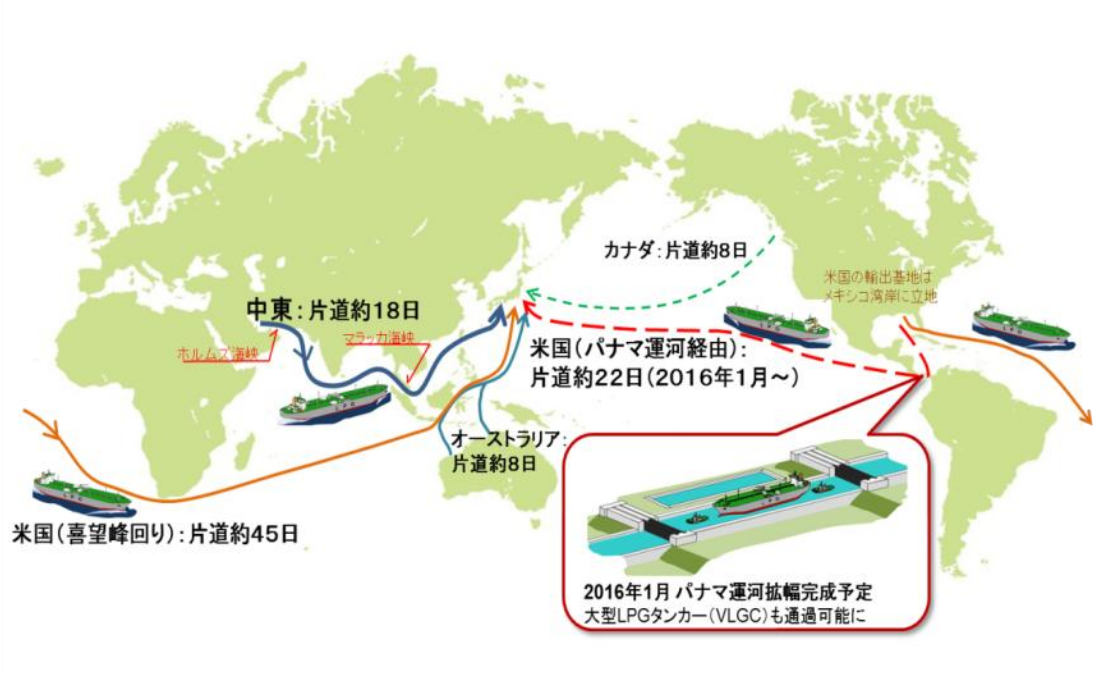
	2014年	2015年	2016年	2017年	2018年	2019年	2020年	2021年
A社	50	60	80	80	80	50	50	50
B社	20	30	30	30	30	30		
C社		70	70	70	70	70	40	40
D社		20	20	20				
E社	8.8	8.8	8.8					
F社	15	40	40	40				

出所：各社からヒアリング

[Procurement price reduction]

Promoting flexible LP gas markets

・LP gas procurement prices have been determined based on Saudi Aramco Contract Price (Saudi CP). But the prices of American shale-associated LP gas on Mont Belvieu Propane are lower than those on Saudi CP.
・In addition, as shale-associated LP gas today is imported around the Cape of Good Hope, it takes 45 days to transport the gas to Japan. If North American shale-associated LP gas can be transported through the Panama Canal, now under extension work due for completion in 2016, its travel time is cut in half to about 22 days. The freight is expected to decrease accordingly.
・By increasing the import of shale-associated LP gas from North America, the government will diversify the LP gas pricing structure to reduce its procurement prices. This could be leveraged to lower Saudi CP as an important strategy.
・There are new movements to try to restructure LP gas wholesalers, as exemplified by the four LP gas wholesale companies that recently started a feasibility study on a possible merger. LP gas wholesale companies are anticipated to move energetically, by pursuing joint procurement and restructuring efforts so that they would be able to enhance bargaining power.



iii) Natural gas

[Reducing procurement risks]

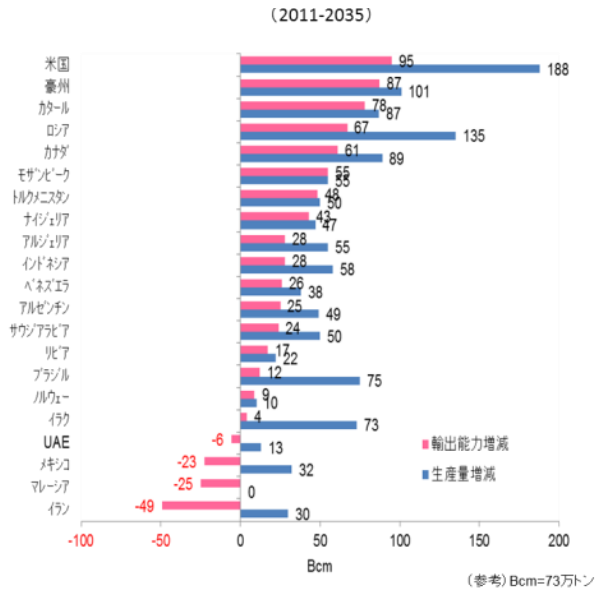
Diversify energy exporting countries

- Compared with petroleum, in general, natural gas is geographically less unevenly distributed (e.g., Australia (20.5%), Qatar (18.4%), Malaysia (17.1%), and Russia (9.8%)). At the same time, the geopolitical risk of natural gas is relatively low. Since the Great East Japan Earthquake, on the other hand, the increase in import from Qatar has raised our dependence on Middle Eastern natural gas from about 20% to about 30%.
- Through the participation of Japanese companies in upstream developments and LNG projects, the government will realize LNG supply from U.S., Canada, Russia, Mozambique, Australia, and Papua New Guinea to diversify its LNG supply sources. LNG from the North American and Oceanian regions will be supplied to our country, through the routes not passing points and waters with a high geopolitical risk, such as the Strait of Hormuz, the Strait of Malacca, and the South China Sea.
- It is important to realize the supply of shale gas and LNG from the U.S., where domestic natural gas production has been increasing since the Shale Revolution, which is likely to take place in FY2016 at the earliest. As a result of the government's proactive resource-seeking diplomacy, the U.S. Department of Energy (DOE) granted export licenses for all the five projects in which Japanese companies are involved. The government will continue to provide necessary support so that these projects would be able to start production as expected.
- In Canada, there are plans for multiple LNG projects in which Japanese companies will participate. These projects are anticipated to become the supply sources of shale gas-derived LNG. Compared with the U.S., Canada has less developed infrastructures such as gas pipelines. However, the number of days needed to transport LNG from Canada to Japan is about half the number of days American LNG takes to travel from the Gulf of Mexico through the Panama Canal, which offers a transportation cost advantage.
- Being geographically closest to our country, Russia is a promising gas producing country. From 2018 or later, Vladivostok LNG and Russian Far East LNG projects are expected to start production at a maximum production rate of 15 million and 5 million tons/year,

respectively. The details of these projects are being studied between Japanese and Russian business operators. On the other hand, the current international situation around Russia is so bad that it may have a large impact on the progress of these projects. The government will keep close watch on such movement. With respect to the talk about natural gas import from Russia through pipeline, given the intention on the Russian side and the current demand on the Japan side, there will be far more real problems ahead.

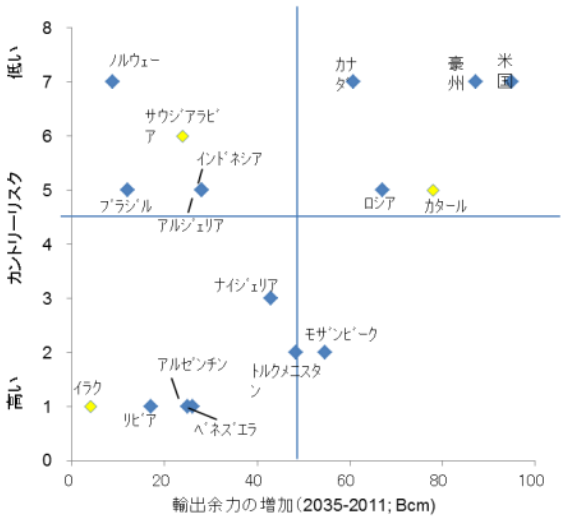
- In its Rovuma Offshore Area 1 LNG Project, Mozambique discovered natural gas reserves estimated at a maximum of 65Tcf. The project is expected to produce at least 10 million tons/year of natural gas in 2018 or later. The government looks forward to the project as a long-term, stable LNG source.
- In Australia, "Ichthys," the first large LNG project led and operated by a Japanese company, will start production in 2016, supplying approximately 6 million tons/year of natural gas to Japan. Given other multiple new projects will start to supply to Japan, the LNG export volume from Australia to Japan on a private contract basis is expected to increase to a maximum of approximately 36 million tons/year by 2019.
- In its PNG and LNG projects, Papua New Guinea started production and shipment for Japan in April and May 2014, respectively. The country is expected to ship approximately 3.3 million tons/year to Japan from now on.
- According to the estimate of the U.S. Energy Information Administration (EIA), Mexico has the world's sixth largest shale gas reserves. If its new energy reforms and shale gas development progress well, Mexico may become an LNG supply source to Japan in the future.
- The government will keep close watch on emerging frontier regions including their technical requirements, such as 1) shale gas in countries other than the U.S. such as Europe, South America, and China, 2) the development of unconventional gas like coal bed methane, and 3) movement toward the use of gas fields containing a high concentration of CO_2. At the same time, the government will support the strategic use of FLNG from small- and medium-sized floating gas fields.

[Forecasted natural gas production volume and potential export capability]



出典：IEA WEO2013 及び日本エネルギー経済研究所アウトルック、事業者公表資料等より作成

[Potential natural gas export capability and associated country risks]



※OECD Country Risk：国ごとの経済・金融情勢や政治情勢等に基づき評価
※中東諸国は黄色で表示
出典：IEA WEO2013 及び日本エネルギー経済研究所アウトルック、
OECD Country Risk Classification(2014)、事業者公表資料 等より作成

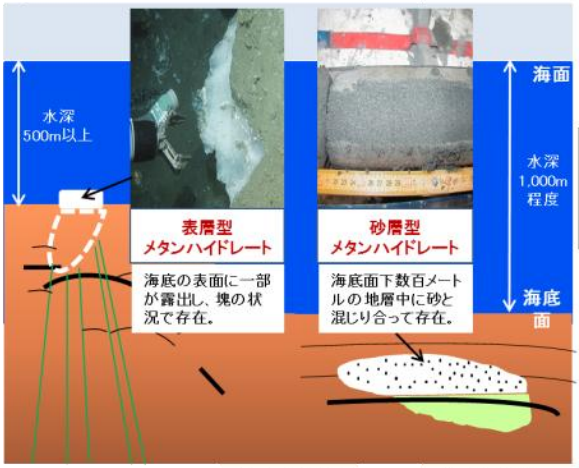
Getting stakes in upstream resources through resource-seeking diplomacy (increasing the rate of independent development)

- Similarly to petroleum procurement as mentioned above, as well as diversifying energy exporting countries , things that would contribute to the enhanced stability of natural gas supply even at the time of an emergency, during which the demand-supply balance becomes tight, are to strengthen the relationship with the gas producing countries that are currently exporting to our country, and to get independently developed natural gas through the Japanese companies that acquired the upstream stakes of gas projects.
- With respect to getting stakes in upstream resources, to improve the rate of independent development, the government is committed to push along resource-seeking diplomacy, supply risk money to natural gas exploration and development, which require large amounts of money, and then support the Japanese companies in getting stakes in these developments.
- For example, Qatar is an important LNG exporting country for Japan. From the viewpoint of enhancing the stable supply of natural gas from Qatar, the government will expand proactive resource-seeking diplomacy to further strengthen the relationship with the country, not only in the energy field but also through medical cooperation.
- The government will build close relations with gas producing countries, through the development of evaluation techniques for shale gas production, the GTL technologies established mainly by JOGMEC, and human resource development in the petroleum and natural gas fields.

Developing domestic resources

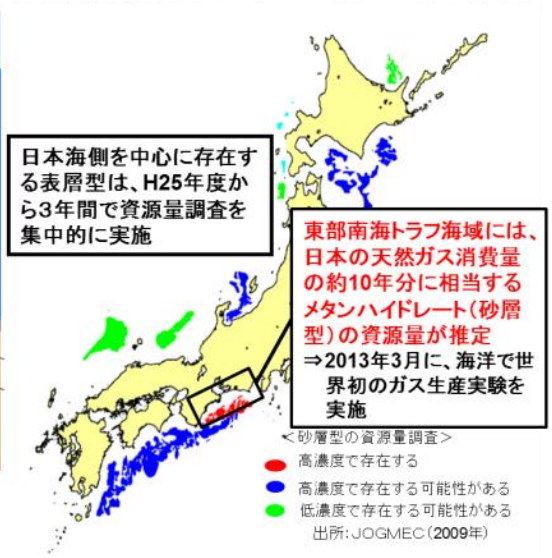
- Similarly to crude oil as mentioned above, the natural gas resources that exist in Japan, such as methane hydrate, are domestic energy sources having the lowest procurement risk.
- With respect to sand-layer methane hydrate, in a gas production experiment in March 2013, the government successfully produced approximately 120,000m^3 of the gas in about six days, using an offshore decompression method for the first time in the world. Based on the results of this production experiment and others, the government will conduct longer-term offshore production tests, and then develop a necessary technical base toward commercialization by 2018. The government will proceed with technical development, by monitoring the international situations carefully, so that projects led by private companies for commercialization would be able to start some time between 2023 and 2027.
- With respect to near-surface methane hydrate, the government will conduct necessary large-scale distribution surveys for about 3 years starting from FY2013, and then glean geological samples from promising points in FY2014 and FY2015. Based on the results of these surveys and the discussion over future direction scheduled for around the end of FY2015, the government will start the full-scale survey and research and development of technologies needed for resource recovery.

Existing forms of methane hydrates



※メタンハイドレートは、メタンガスと水が低温・高圧で結晶化した氷状の物質で、「燃える氷」ともいわれる。

Methane hydrates present in the sea



- With respect to the development of domestic natural gas, taking advantage of the 3-D seismic vessel SHIGEN owned by the Ministry of Economy, Trade and Industry (METI), the government is conducting 3-D geophysical exploration and surveys at a pace of approximately 6,000km^2 per year around Japan. The government plans to conduct exploratory drilling surveys in the waters where the likelihood of success is high, and will continue similar efforts.
- In this circumstance, the government will try to understand the importance of developing natural gas fields in Niigata and other areas. At the same time, the government will promote the development of water-soluble natural gas fields including South Kanto natural gas fields. With respect to their development of water-soluble natural gas fields, the government will study the direction for the new technical development that would enable environmentally friendly natural gas development.

[Procurement price reduction]

Diversifying energy exporting countries

- Diversifying energy exporting countries would not only reduce procurement risks but also urge resource producing countries to compete with each other, making the market more competitive to help reduce procurement prices. For this reason, the government will realize LNG supply from U.S., Canada, Russia, Mozambique, Australia, and Papua New Guinea, through the participation of Japanese companies in upstream developments and LNG projects. It is expected that particularly the U.S., where domestic gas prices are decreasing as a result of the Shale Revolution, will supply LNG to Japan in and after FY2016 at about 20 to 30% cheaper prices compared with supply from conventional LNG projects on a current market basis. It is also expected that the increase in excess supply capacity from new natural gas projects will loosen natural gas demand-supply balance and help control price increases.

Cooperation with consumer countries

- Through LNG Producer-Consumer Conferences since 2012, resource consuming countries, under the initiative of Japan, have been jointly talking to gas producing countries and major oil companies how important it would be to reduce LNG procurement prices. The government will continue this type of approach in the future. By leveraging the past achievements of Japan-Korea talks on gas, Japan-India talks on energy, joint Japan-EU research programs, and other multinational efforts, the government will pursue cooperation with major gas consumer countries.

・In their talks on energy, Japan and India agreed that they would explore the possibility of the joint upstream developments in petroleum and natural gas and the cooperation in joint LNG purchase. As a result, an Indian government-owned company and a Japanese company have signed a MOU to step up their joint efforts over the two countries.

New joint procurement through comprehensive alliances

・The government will try to enhance its bargaining power through new joint procurement through comprehensive alliances involving utility companies.
・Under this circumstance, Tokyo Electric (TEPCO), in its New Comprehensive Special Business Plan (approved by the METI Minister in January 2014), is set to scale up its natural gas procurement from current 20 million tons/year up to 35–40 million tons/year, through a comprehensive alliance with an alliance partner, on the premise that both partners will share strategies and capital in their whole supply chain from upstream fuels through power generation. As a result, on top of the improvements in the current purchase conditions, such as relaxed destination clauses, Tokyo Electric is set to slash its cost by a total of about 650 billion Yen/year in the future, compared with today's levels.

Promoting flexible gas markets

・Our country has been importing natural gas under the price structure that is linked to oil prices. Taking the opportunity to start importing North American LNG, however, the government is going to incorporate price structures that are linked to market prices, such as Henry Hub Natural Gas Price in the U.S. The government will try to diversify natural gas price structures and stabilize LNG import prices. At the same time, our country will import North American LNG to reduce procurement prices.
・To promote the cooperation among domestic and foreign business operators, the government will improve flexibility in trade practices relating to LNG contracts, such as relaxed destination clauses. The joint communiqué of G7 Energy Ministers Meeting in May 2014 and G7 Summit Conference in June 2014 agreed that the destination clauses should be relaxed, and that gas markets should be made more flexible through more talks between gas producing and consuming countries. While continuing to cooperate with other gas consumer countries, the government will encourage gas producing countries to relax the destination clauses in bilateral talks with them.
・Given these international movements, some contracts that allow reselling gas within Japan, and some FOB contracts that allow reselling to other countries began to be seen in the market recently. In addition to the appearance of these contracts, the government supporting American LNG trades, which do not require destination clauses, is thought to make the LNG market more flexible in the future.

[New joint development and procurement activities through comprehensive business alliances] around Japan

→価格面での優位性だけでなく、契約の柔軟性や上流権益の確保等にも交渉力を発揮していくため、新しい形態での共同調達等を戦略的に活用することが有効。

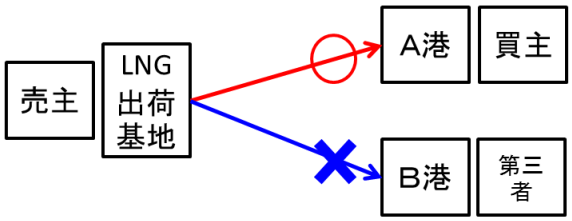
①代表購入・卸売型	大規模な需要者が小規模な需要者の必要量も含め代表して交渉・購入し、各社に卸売り。
②共同交渉型	共同で交渉を行い、調達規模のメリットを活かす一方で、契約は個別に実施。
③組合型	複数事業者間で調達機能を外部化し、組合形式で共同調達のプラットフォームを構築。LNG調達に向けた大きなポートフォリオを組成。調達機能を集約化。
④包括事業アライアンス型	上流・中流事業への進出、LNGの調達、輸送面等を含めたLNGサプライチェーン全体を俯瞰した上で、複数事業者間で包括的な事業アライアンスを締結。

※生産段階での連携の例
・2014年1月、三井物産とONGC(印)は石油・ガス上流事業における共同での取り組み強化に関する覚書に署名。分散投資と開発資金の負担軽減が可能。

※消費・物流段階での連携の例
①中部電力とKOGAS(韓)は、2013年5月から2017年12月までに合計28隻分のLNGをENI(伊)から共同購入。共同購入したLNGは、両社間で融通可能。
②中部電力とGAIL(印)は2014年3月、LNGの共同調達の協力について基本合意し、覚書を締結。
③東京電力の新しい総合特別事業計画(2014年1月経産大臣認定)において、「他企業との包括的なアライアンスを通じ、ガス調達規模の拡大と、バーゲニングパワーの強化により燃料調達コスト削減を図る」ことに言及。

[Deletion of destination clause in FOB LNG contracts]

→内外の事業者連携を促進するためにも、FOB契約(本船渡し契約)における仕向地条項の撤廃などLNG契約の商慣行を弾力化していく環境整備が必要。



※多くのLNG売買契約では、契約で規定された仕向地以外では受け渡しをせず、買主が第三者に転売することを認めない「仕向地条項」が付されている。
契約によっては、仕向地条項が規定されている場合でも、買主が売主の事前同意を得ること、転売の際の利益折半をすること等を条件に仕向地条項が緩和されるものもある。

※欧州では、FOB契約における仕向地条項が撤廃されつつある。
今後、北米から日本向けに輸出されるLNGについては、仕向地条項は課されていない。

・If Electricity and Gas System Reforms encourage new energy business operators to enter the markets, the need for LNG spot markets is expected to increase accordingly. If other types of power supplies are introduced into Japan in the future, it may render LNG supply excessive. At the same time, because our country has many gas heavy users around, such as Korea and Taiwan, the government will study the possible introduction of an LNG spot market in Asia. Depending on the progress of these studies, the government will also look at the development of LNG futures markets. With these efforts, the government aims at creating an environment that would allow users to satisfy their seasonal needs at lower prices, or sell surplus stock smoothly. As part of these efforts, for a better understanding of the dynamics of LNG spot trading, the Ministry of Economy, Trade and Industry (METI) started in April 2014 to summarize and publish LNG spot trading data such as prices of Japanese companies.
・While improving the transparency of such price indexes for LNG spot trading, the government is now creating an environment for over-the-counter LNG trading, as a step toward the foundation of an LNG futures market in our country, the world's largest LNG importing country. The government expects key market players to proactively get involved in the initiative that would drive this over-the-counter LNG trading. At the same time, smooth clearing procedures are important to get this mechanism to work. The government should study how it works by taking international cooperation into consideration. The government expects that these efforts would lead to active over-the-counter LNG trading (and the development of an LNG futures market later on), adequate price formation based on the LNG demand and supply, and appropriate risk hedging at each LNG user company.

Possible underground storage by utilizing depleted gas fields

・By taking advantage of the seasonal difference in LNG spot prices, underground storage facilities that utilize depleted gas fields would have the potential for reducing LNG procurement cost. The government will deepen its legal and technical considerations, so that it would be able to take necessary measures at the point the maximum storage capacity of a gas field has increased to a considerably high level.

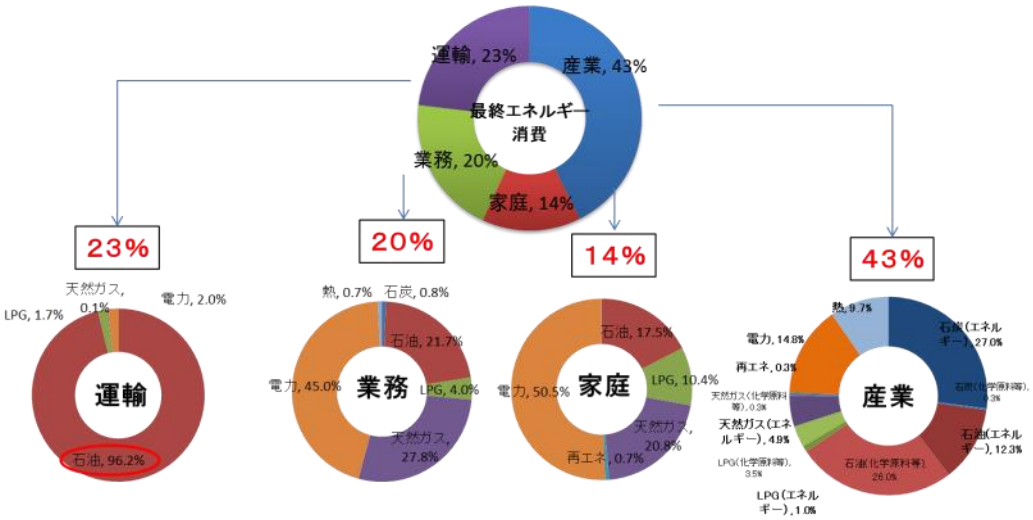
iv) How to use fuels on the demand side

Final energy consumption at present

・As already described in Section 2. (2) I), if each of the industrial, business, household, and

transportation sectors has an environment that allows the use of multiple types of energy, that sector can use the other types of energy in the event of a supply disruption in one type. This approach would be effective in terms of the ability to respond to emergencies. In the particularly important social infrastructure, only if a demand structure with a reduced geopolitical risk can be set up, the risk of an energy supply disruption during the initial response to an emergency can be decreased.

・In terms of final energy consumption by sector, the energy mix in the industrial sector is well distributed except for feedstock use. On the other hand, the transportation sector depends on petroleum for over 90% of its final energy consumption. Although each of the household and business sectors depends on electric power for about 50% of its consumption, the risk of a fuel supply disruption is controlled by electric power supply diversification.



Thoughts on how to diversify the fuels used in the transportation sector

・ The transportation sector depends on petroleum-based fuels for over 90% of its energy consumption. Therefore, it is important to try to diversify fuels by increasing the number of LPG-powered, CNG-powered, electric, fuel-cell-powered, and GTL-based diesel-powered vehicles mainly for the use that would play a critical role particularly in the event of a supply disruption (such as for emergency vehicles and the trucks and buses that transport supplies and people). In the medium- and long-term, the introduction of electric and fuel-cell-powered buses and trucks, which are capable of supplying electricity for other purposes, may contribute to local governments from a disaster prevention standpoint. However, it is necessary to introduce such vehicles in ways that would not leave the community with excessive financial burdens, and based on how well the existing infrastructure is developed, population size, and regional characteristics in the community.

(2) Constructing the system of energy demand and supply against the disruptions of energy from overseas

i) Oil

1) Concept of stockpiling

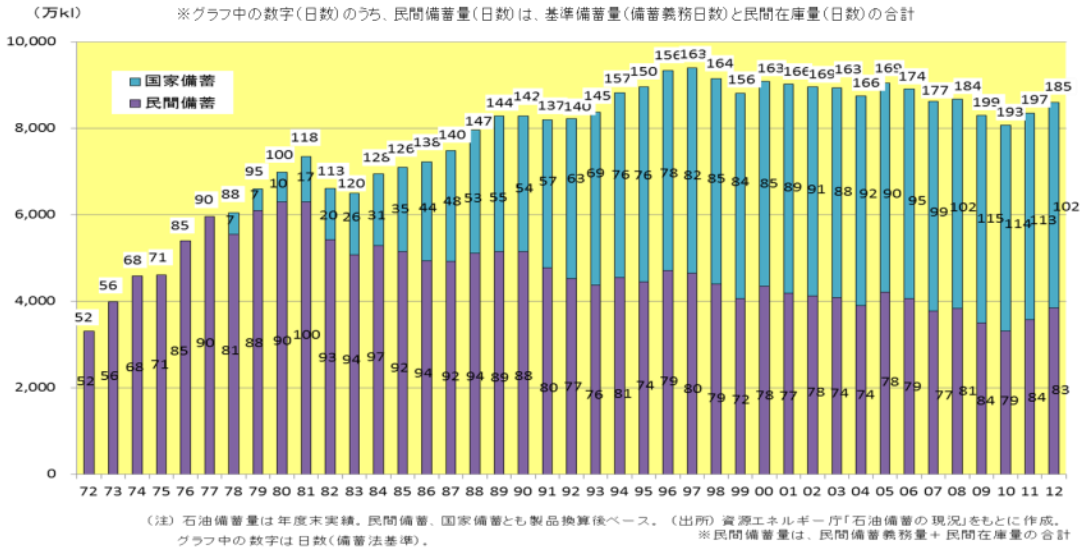
Contents of “national stockpile” and “private stockpile” and past activities

• There are two types of oil stockpiling stipulated in the Oil Stockpiling Act, namely, national stockpile and private stockpile. The national stockpile oils are stored at the national oil stockpiling bases as well as leased private oil tanks (e.g., at oil refineries) (crude oil: 49.1 million kL, oil products: 1.3 million, as of the end of May 2014 (equivalent to 91 days of

domestic oil demand as the IEA standard, or 111 days as the Oil Stockpiling Act standard)). Meanwhile, it is stipulated that oil refiners, wholesalers, trading companies, etc. are required to stockpile oils beyond their commercial stock, and the private stockpile oils are stored at oil refineries and oil tank facilities of such companies (crude oil: 19.18 million kL, oil products: 18.8 million kL, as of the end of May 2014, as a summation of the standard stockpiles and the commercial stocks (equivalent to 73 days as the IEA standard, or 86 days as the Oil Stockpiling Act standard)).

- Japan's oil stockpiling system commenced with possession of the private stockpile under administrative guidance, which became legislated by enactment of the Oil Stockpiling Act in 1975. Possession of the national stockpile commenced in 1978; possession reached 50.0 million kL in 1997 and since has been maintained at the similar level. The private stockpile requirements were initially determined to be 90 days of domestic oil demand on commencement of the system, in order to fulfill the requirements by the IEA. Once the national stockpile was increased to a certain level, the standard stockpiles were reduced by the amount equivalent to 4 days of domestic oil demand each year from 1989. The standard stockpiles became equivalent to 70 days of domestic oil demand in 1993 and since has been maintained at the similar level.

National and private oil stockpiles



- The Minister of Economy, Trade and Industry can instruct release of stockpiled oils (release of the national stockpile or easing on the private stockpile requirements (reduction of the standard stockpiles)) when a situation arises where oil supply (import) from overseas has become or is likely to become short or where oil supply has become or is likely to become short for certain areas due to emergence of domestic disasters (Oil Stockpiling Act). IEA member countries are to undertake cooperative release when a situation arises where oil supply crisis has occurred or is likely to occur at all or certain member countries, and Japan participates in the framework.
- To date, the Japanese government made decisions to release stockpiled oils for the following 5 cases (*) where oil supply crises occurred or was likely to occur. In each case, it was handled by easing on the private stockpile requirements, and there is no past record of handling such issues by utilizing the national stockpile or the Joint-Stockpiling with Oil Producing Countries (JSOPC) that is to be described later. As a side note, cooperative release by IEA member countries was determined for 3 cases out of the said 5 cases, and Japan conducted cooperative release in accordance with the framework.

(*) Past record of release of stockpiled oils in Japan
(Each case was handled by easing on the stockpile requirements for the private stockpile (reduction of the standard stockpiles).)

(1) Release as cooperative release by IEA member countries

1991 Gulf War: Reduced by the amount equivalent to 4 days of domestic demand
2005 Hurricane Katrina: Reduced by 3 days equivalent
2011 Crisis in Libya: Reduced by 3 days equivalent

(2) Release conducted by Japan alone (not as cooperative release by IEA member countries)

1979 Oil shock: Reduced by 5-25 days equivalent for each company
2011 Great East Japan Earthquake: Reduced by 25 days equivalent in stages (by 3 days equivalent first then by 22 days equivalent)

Past activities for Joint-Stockpiling with Oil Producing Countries

- Since 2009, Japan has been promoting JSOPC projects with United Arab Emirates (UAE) and Saudi Arabia (both are major oil exporters to Japan)[2]. JSOPC is a framework to lease Japanese private oil tanks (Kiire, Okinawa) to the national oil companies of UAE and Saudi Arabia. At ordinary times, this system allows such national oil companies to commercially use the tanks as relay or storage bases of crude oil supply to East Asian countries. At the time of oil supply crisis, this system enables prioritized supply of crude oils to Japanese oil companies from the oils stored in the tanks. The present system not only contributes to enhancing Japan's energy security but also has various significance (e.g., strengthening of relationship with oil producing countries, Okinawa etc. becoming crude oil supply bases for East Asian countries). In the past the placement of stockpiled oils under the current framework in the Japan's oil stockpiling policies remained unclear; which was clarified to be the "third stockpile" under the national stockpile and the private stockpile by the "Strategic Energy Plan" which was approved by the Cabinet in April 2014.

Role division of national stockpile, private stockpile, and Joint-Stockpiling with Oil Producing Countries

- In response to the JSOPC stockpile positioned as the "third stockpile" by the Strategic Energy Plan, roles of the "national stockpile", "private stockpile", and "JSOPC stockpile" under Japan's oil stockpiling policies are reviewed and designated as below.
- The national stockpile plays a role to replenish the private stockpile during the process of releasing the private stockpile by oil companies from oil refineries etc. at the time of oil supply shortage. The national stockpile also plays the role of last resort.
- The private stockpile is stored at oil refineries etc. and therefore possesses a high mobility to swiftly supply oil products to the market from oil refineries etc. at the time of crisis. For that reason, the private stockpile plays a role to provide major contributions from the "initial responses" including the Coordinated Emergency Response Measures (CERM) by the IEA.
- The JSOPC stockpile is stocks of oils by oil producing countries where a supply of oils to Japanese oil companies at the time of crisis is guaranteed. Similar to the national stockpile, the JSOPC stockpile plays a role to constantly replenish the private stockpile that becomes lower at the time of oil crisis. This not only contributes to enhancing Japan's capability to handle oil crisis but also contributes to strengthening relationships with oil

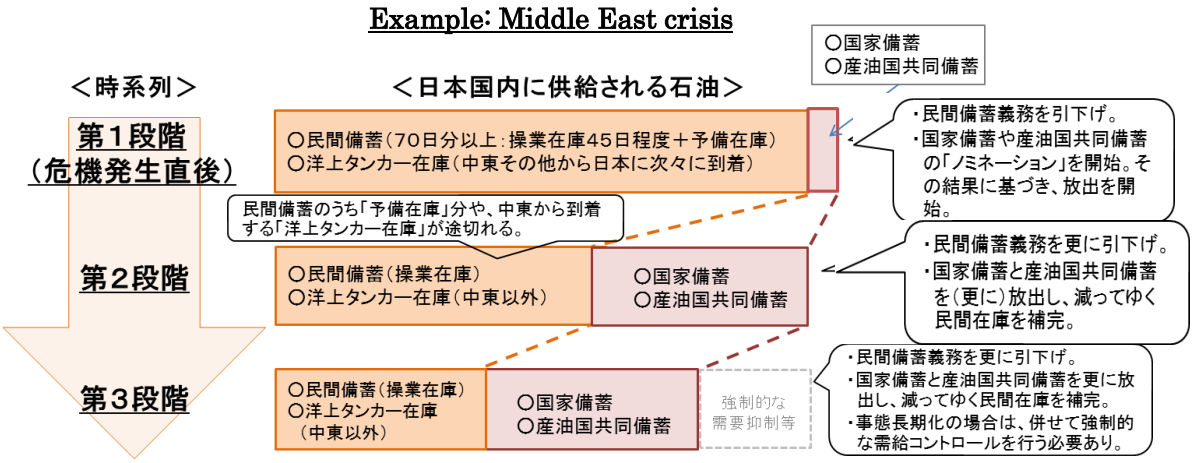
[2] A project with the Abu Dhabi National Oil Company (ADNOC) was started in December 2009 at the Kiire Terminal of the JX Nippon Oil & Energy Corporation located in Kagoshima Prefecture. A project with the Saudi Aramco was started in February 2010 at the Okinawa CTS Corporation located in Okinawa Prefecture.

producing countries by assisting their business expansion in East Asia. Future expansion of the relevant projects (both expansion in the quantity and expansion of the projects to other oil producing countries) require: a) careful considerations on tank capacity in Japan as well as on cost sharing with oil producing countries; and b) securement of crude oil shipping capability from stockpiling bases, taking into account situations where proper-sized domestic tankers become unavailable.

Release operation in crisis (Example case: Import disruption due to Middle East conflict)

- On occurrence of oil supply crisis (e.g., disruption of import due to Middle East conflict), the significance of the issue is to be judged and stockpiled oils are to be released in stages accordingly. Even in emergency situations, oils circulate around via the normal oil supply chains starting from oil refineries. Therefore, in principle, the private stockpile oils are to be released first, and the national stockpile and the JSOPC stockpile play a role to replenish the reduction in the private stockpile oils.
- During the first stage (immediately after occurrence of an oil crisis), tankers sailing east of the Hormuz Strait will keep arriving at oil refineries in Japan for approximately 3 weeks. Meantime, the Japanese government will call for self-imposed restriction on the unnecessary use of oils (voluntary reduction of demand), prepare for oil release through "reduction of the private stockpile requirements" and "nomination of oil companies towards the release of the national stockpile and the JSOPC stockpile (hearing of the desired type and quantity of oils to be released from oil refiners and wholesalers[3] and allocation thereof)", and start releasing oils accordingly.
- During the second stage (the period where oil tankers cease to arrive (i.e. using up of all offshore tanker stocks)), the Japanese government will determine "reduction of the private stockpile requirements" and "(additional) release of the national stockpile and the JSOPC stockpile", where the private stockpile is replenished by the national stockpile or the JSOPC stockpile.
- During the third stage (the period where the supply disruption has become prolonged), the Japanese government will be required to conduct oil demand and supply management through invocation of the Petroleum Supply and Demand Adjustment Act etc., in addition to enhanced "reduction of the private stockpile requirements" and "additional release of the national stockpile and the JSOPC stockpile".
- In order to minimize confusions in the life of the people due to energy supply issues, it is important to bring peace of mind to the people without inflaming public anxiety. For that purpose, it is recommended to organize a detailed and thorough risk communication system from ordinary times that enables prompt dissemination of unified information at a proper timing with taking into account the consumer psychology of general public. There was a comment made concerning the possibility of dissemination of such information inducing unnecessary confusions among the people. For instance, if the Japanese government announces it is ready to release the national stockpile during the initial stage of an oil crisis where the situation is not yet serious, even if the announce was made for the purpose of bringing peace of mind to the people, the people may instead take the announcement as an implication of the situation being so imminent as to be requiring release of the national stockpile. Like this example, dissemination of information in emergency situations requires careful considerations and thorough advance preparations.

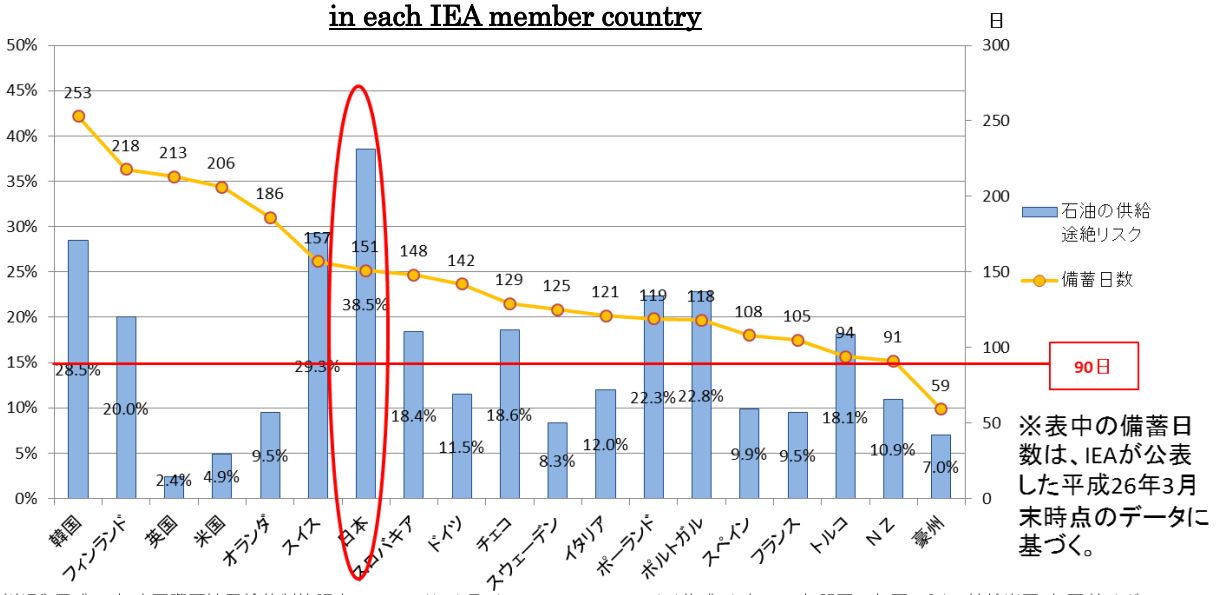
[3] Oil refiners and wholesalers in this context refer to Oil Refiners and Specified Oil Distributers stipulated in the Oil Stockpiling Act.



Domestic and overseas situations concerning oil stockpiling

- The dependency of Japan's primary energy supply on the "oils supplied from specific regions" ("percentage of oils in the primary energy supply" × "dependency on imports for supply of oil" × "import region dependency") is relatively high compared to that of net oil importers among IEA member countries. Therefore, while Japan's total oil stockpiles (summation of the national stockpile and the private stockpile) are greater than the average stockpiles of net oil importers among IEA member countries, it is essential to keep implementing careful and thorough measures against oil supply disruption risks.

Relationship between risks and days of oil stockpiling in each IEA member country



※表中の備蓄日数は、IEAが公表した平成26年3月末時点のデータに基づく。

（出所）平成25年度国際石油需給体制等調査、IEA webサイト及びOil Infomation 2013より作成。なお、IEA加盟国29か国のうち、純輸出国3か国（カナダ、デンマーク、ノルウェー）、データのない7か国（オーストリア、ベルギー、ギリシャ、ハンガリー、アイルランド、ルクセンブルク、エストニア）を除く）

- Meanwhile, according to the oil demand forecast, the demand for oil products in Japan is to decrease by 8.4% by FY2018[4]. Applying this forecast, if the current level of the national stockpile (crude oil: 49.1 million kL, oil products: 1.3 million kL, a total of 50.4 million kL as of the end of May 2014) is maintained, the quantity of national stockpile counted on a "day" basis is to gradually increase each year inversely proportional to the decrease in the oil demand, reaching near 100 days equivalent (approximately 98 days equivalent) in FY2018. If there will be such a significant surplus in the oil asset in the future, handling of the surplus portion will have to be thoroughly discussed. (Note that the private stockpile stipulated to be 70 days equivalent is expected to decrease on the "quantity' basis with a decrease in the oil demand.)

[4] Demand forecast for type-C heavy oil (for power generation) is assumed to be constant and not included.

Structure and concept of total oil stockpiles in the future

- Japan will maintain the quantity of oils equivalent to 90 days of domestic oil demands (the requirement by the IEA to its member countries) as a summation of the national stockpile, private stockpile, and the JSOPC stockpile. Regarding the JSOPC stockpile, the Japanese government is planning to conclude an agreement with oil producing countries that binds the counties to maintain oil stocks for at least half of the capacity of oil tanks leased from the Japanese side. Based on that, the oils equivalent to the half of the tank capacity is positioned as “quasi-national stockpile”. Therefore, the above stated 90 days equivalent oils should be secured by a summation of stockpiles that play a role as replenishment for the private stockpile that will be decreased at the time of oil crisis, namely, “national stockpile” and “JSOPC stockpile (the quantity equivalent to half of the capacity of leased tanks)”. Additionally, from the perspective of secondary effects etc. including strengthened relationship with oil producing countries, considerations should be given to increasing the quantity of JSOPC stockpile.
- Further, if there will be a significant surplus in the oil-related assets (e.g., oils, oil tanks) due to reduced demands for oils in the future (i.e. those exceeding the quantity equivalent to 90 days of domestic oil demands), considerations should be given to all possible measures to effectively utilize the surplus. Such measures may include use of the surplus for enhancing oil stockpiles in Asian countries (who are not members of IEA) where demands for oils are expected to increase in the future.
- Even in emergency situations, oils circulate around via the normal oil supply chains starting from oil refineries. Additionally, it will require a certain number of days for the released national stockpile to be actually injected into the market. Therefore, the initial response to an oil crisis (e.g., CERM by the IEA conducted at the time of oil supply disruption from the Middle East) will be in principle managed by easing on the private stockpile requirements. Therefore, taking into account such an important role of the private stockpile, the Japanese government should carefully consider various viewpoints to determine whether it needs to revise the standard stockpiles of private stockpile (which is stipulated to be “70 days equivalent” by the Oil Stockpiling Act and relevant enforcement regulations). The viewpoints to be considered include, 1) the effects of the revision on the sustainable domestic supply network under the current situation where the nationwide expansion of the supply network (e.g., oil terminals, gas stands) depends on the oil company and is not uniform (i.e. the possibility of escalating the shortage of gas stands), and 2) the effects on oil companies’ financial situation, business restructuring (e.g., changing the use of oil refineries) and their international competitiveness.

Improving the mobility of national stockpile release

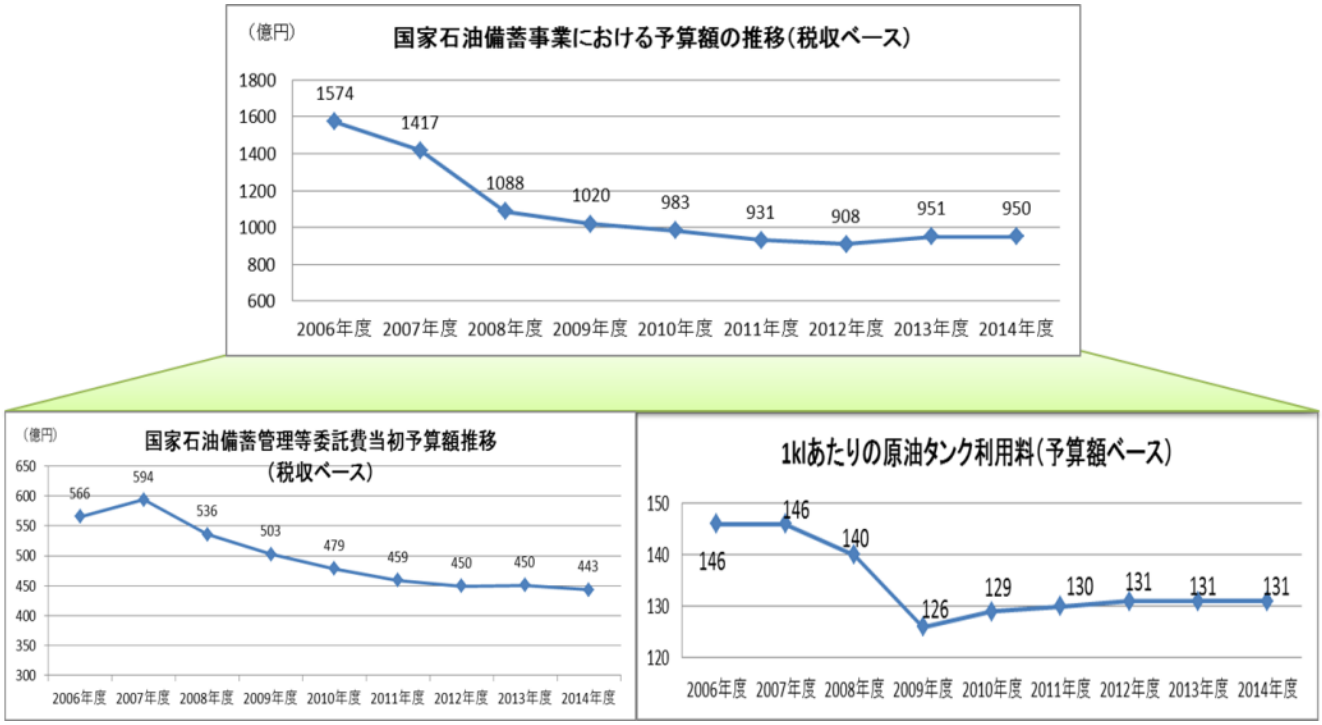
- The national stockpile oils play a role to replenish the private stockpile that will decrease when import of crude oil is disrupted. Therefore, it is necessary to continuously improve the “mobility” pertaining to release of oils (capability to efficiently release a large quantity of oils in accordance with the needs of oil companies etc. who supply energy using crude oils). To that end, from the “quantitative perspective” (perspective of efficiently releasing a large quantity of oils), it is necessary to promote “securement of tanker transportation capability”, “continual exercises”, and “improving the capability of oil bases”. From the “qualitative perspective” (perspective of releasing oils in accordance with the needs of oil companies etc.), the oil type rearrangement should be accelerated where the oil type composition of crude oils (heavy oil, medium-gravity oil, and light oil) stocked as the national stockpile is rearranged to suit the characteristics of refining facilities of oil refineries in Japan. Additionally, the oil type rearrangement should be utilized as an opportunity for conducting exercises through contrivances, for instance, by scheduling oil type rearrangement works to coincide with the period for major inspections of stockpiling bases. Therefore, considerations need to be made on measures to solve the difficulties in

securing “tankers qualified for domestic oil shipping” that has been the bottleneck of oil type rearrangement operations (and of expansion of JSOPC projects, etc.). It is highly recommended to commence the considerations as early as possible and in cooperation with the Ministry of Land, Infrastructure, Transport and Tourism.

- Furthermore, as a measure to counter shortage of fuels for petroleum-fired thermal power generation at the time of disasters, a suggestion was given to the Japanese government to replace part of the crude oils stored as the national stockpile with low-sulfur crude oils for power generation. While in principle a stable supply of power is to be managed by power companies, if the placement of petroleum-fired power generation in Japan’s future power generation becomes clearer, the Japanese government will be required to consider the proposed suggestion accordingly, taking into account additional financial burdens including costs involved with procurement and storage of low-sulfur crude oils.

Enhancing the safe and efficient national stockpile oil management system

- The Japanese government has endeavored to perform proper execution of budget, and the outsourcing expenses for managing the national stockpile oils have been trimmed down especially for the property insurance costs, administrative costs, indirect costs, and repair and maintenance costs. As a result, the outsourcing expenses were reduced from approximately 63.6 billion yen (FY2004) to approximately 44.3 billion yen (FY2014) since the succession of national stockpile oils from the former Japan National Oil Corporation. The Japanese government should further optimize management of the national stockpile oil storage bases (10 bases in total) that take up a substantial amount of national budget every year. For the optimization of management, it is considered appropriate to 1) refer to the management methods etc. of private oil companies, and 2) apply the best cost reduction practice cases that were already implemented in some oil bases to other oil bases (e.g., implementation of construction management contracting, development of local construction contractors etc. with high cost competitiveness, unification of the management divisions of operation service companies that manage the national stockpile bases).
- In addition, it is required to consider implementing various methods for reducing costs including financial compensation (e.g., incentive compensation system) for cost reduction efforts by “operation service companies”, in addition to active use of general competitive bidding for selecting such “operation service companies”.
- Further, a prioritized investment is required to be made in important measures against various potential risks threatening the national stockpile bases, including measures against earthquake damages, tsunami damages, and facility deterioration.
- The Japanese government has also endeavored to trim down subsidies for the oil stockpiling projects (private tank leasing charge) that are used for storing the national stockpile oils at oil refineries and oil terminals. Continuous efforts should be made on improving the transparency concerning the unit prices and the efficiency of the projects, with referring to the comments made in the Budget Execution Audit 2014 conducted by the Ministry of Finance.

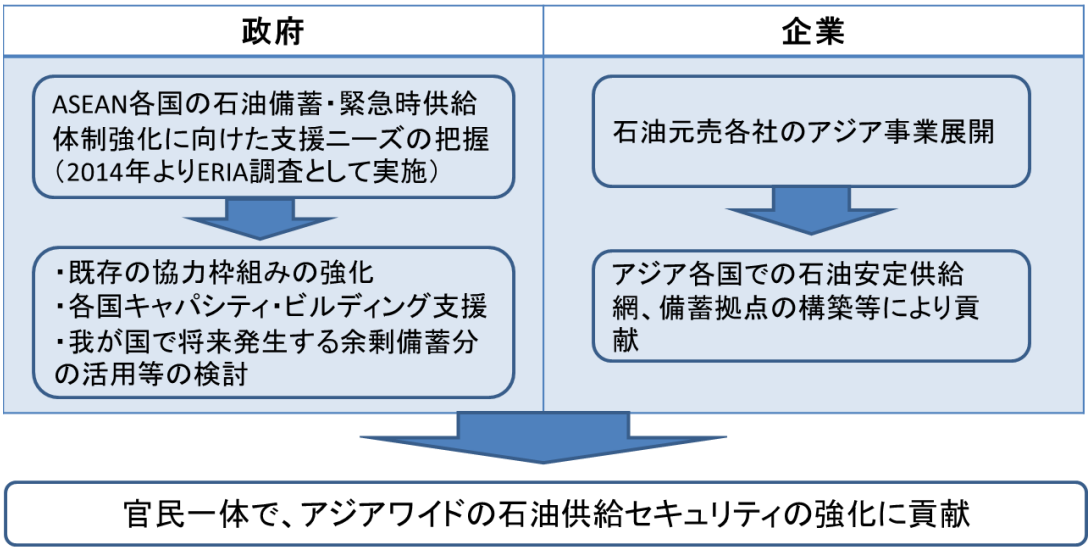


Support for building Asia-wide energy security

- Demands for oils in non-OECD Asian countries (non-IEA members) are expected to keep rising in the future. Not only Japan but also such Asian countries will face an oil crisis if worldwide oil supply disruption occurs due to Middle East conflict etc. Therefore, improving the crisis management capability and thereby preventing emergence of panics for all Asian countries is an important factor for improving Japan's energy security. To that end, it is important to establish oil stockpiling systems, emergency oil supply systems, and regional intercountry oil accommodation systems in non-IEA countries in Asia.
- As multinational frameworks that support Asia-wide energy security, there already exist energy ministers' meetings at ASEAN+3 (13 countries), East Asia Summit (EAS, 18 countries) and Asia-Pacific Economic Cooperation (APEC, 21 countries) as well as other related frameworks.
- Regarding enhancement of the stockpiling system for ASEAN member countries, the Oil Stockpiling WG (secretariat: JOGMEC) was established under the ASEAN+3 Energy Ministers' Meeting based on the "Energy Cooperation among Japan, China, Korea and ASEAN (Hiranuma Initiative)" proposed by Japan in 2002, and considerations were given to the "Oil Stockpiling Roadmap" which summarizes long-term oil stockpiling action plans. While the "Oil Stockpiling Roadmap" specifies voluntary and non-binding non-disclosed goals, the Roadmap was approved in the ASEAN+3 Energy Ministers' Meeting 2010 and each member country has been making efforts to achieve the goals.
- Though these activities the importance of improved energy security has been shared among ASEAN member countries. However, only some counties have stockpiled oils, and the amount of stockpile is far smaller than the 90 days requirement by the IEA. Additionally, while the ASEAN Petroleum Security Agreement (APSA; agreement for ASEAN countries to voluntarily and commercially accommodate petroleum to each other on disruption of oil supply) was ratified among all ASEAN member countries in 2013, no detailed operation procedures have been established yet.
- Based on the current situations described above, the Agency for Natural Resources and Energy (ANRE) is planning to conduct investigations for identifying and solving the problems in securing the effectiveness of APSA, which is the bottleneck of improving oil

stockpiling in ASEAN countries, in cooperation with the Economic Research Institute for ASEAN and East Asia (ERIA)[5]. According to the results of the investigations, the Japanese government should take the initiative in discussing (1) bilateral cooperation (e.g., sharing of Japan's knowledge and technology in oil stockpiling), (2) active utilization and activities for ensuring the effectiveness of existing multinational frameworks at the governmental level, and (3) cooperation in capacity building etc. in ASEAN countries, while encouraging the IEA to take part in these activities. Additionally, it is also important to maintain a viewpoint to take every opportunity (e.g., fuel accommodation by Asian countries including Japan to a disaster-hit country who fell into a local oil supply disturbance) in enhancing and expanding cooperative emergency responses in Asia.

- In the future, it will become possible to conduct unified management of cooperative stockpiling projects via intergovernmental frameworks and business development of private companies in Asia, by providing support for Japanese private companies in developing oil refinery and sales business in Asia and for effective utilization of overseas oil tanks at the private sector level. Such activities will further extend the possibility of mutual oil use in emergencies, and therefore the Japanese government should consider and pursue the feasibility of methods to fully utilize such multi-layered cooperative relationships among Asian countries in gaining maximum mutual benefits for all countries involved.



2) Supply prioritization and demand restraint in urgent situations

Preparation for management of energy demand and supply in urgent situations

- When an event that is deemed emergent (e.g., disruption of supply from overseas) has happened, even if it does not accompany supply shortage, it is important to maintain orderly distribution of oil products and avoid inducing unnecessary confusions among the nation, through (i) provision of accurate information on the prices, stocks, supply condition of crude oils and oil products to the people, and (ii) requesting the oil industry to cooperate in refraining from speculative stocking and opportunistic price hike.
- When the situation has become worse and if supply shortage of crude oils or oil products is inevitable and likely to become prolonged, it will be required to minimize the hindrance to the life of the people through (i) mild demand restraint by calling for practicing calm consumption activities and energy-saving activities as well as refrain from unnecessary

[5] A policy research and proposal institution established in 2008 for the purpose of promoting economic unification in East Asia. The Headquarters is located in Jakarta (Indonesia). Members are ASEAN (10 counties), Japan, China, South Korea, India, Australia, and New Zealand (16 countries in total).

use of oils or LP gas to the people, and (ii) release of stockpiled oils in accordance with IEA cooperative action or the Oil Stockpiling Act.

- If the situation falls into significant supply shortage and the above measures cannot negate continuing physical supply shortage of oils, the Japanese government will be required to consider performing enforced demand and supply adjustment by invoking the "Petroleum Supply and Demand Adjustment Act" (PSDAA). It is stipulated that PSDAA is to be applied "when significant disturbance to the stability of the people's life and to the smooth operation of national economy has occurred or is likely to occur, due to the occurrence or likeliness of a major shortage of oil supply from overseas or the occurrence or likeliness of a major shortage of oil supply caused by domestic disasters."
- PSDAA was enacted and came into effect in 1973 (i.e. after the first oil shock) along with the "Act on Emergency Measures for Stabilization of National Life" as part of legislative development concerning oil demand and supply and oil prices in urgent situations. There is no past record of announcing disaster response measures based on PSDAA. The invocation requirement of PSDAA is "occurrence or likeliness of a major shortage", and thus the occasion of PSDAA invocation is rarer than the Oil Stockpiling Act which can be invoked when there is "occurrence or likeliness of a shortage".

<u>System of energy demand and supply management and supply prioritization under PSDAA</u>

- PSDAA stipulates invocation of the following measures, in accordance with a notification on implementation of measures by the Prime Minister (Article 4, Paragraph 1).

(Demand restraint)
- Restriction of oil use (Article 7)
- Obligation to make efforts in reducing oil use according to oil use reduction target (Article 8)

(Supply control)
- Oil supply target setting by the Minister of Economy, Trade and Industry (Article 5)
- Formulation and submission of oil production, import, or sales plans by oil refiners etc. (Article 6)
- Restriction on the method of sales to oil distributers (Article 9)
- The Minister of Economy, Trade and Industry can instruct storage of oils for the amount equivalent to that for instructing selling of oils from specified oil retailer to business operations and activities that are essential for protecting people's lives, bodies and properties or securing the public interest. (Article 10)
- The Minister of Economy, Trade and Industry can instruct oil retailer to supply oils to general consumers, small- and medium-sized enterprise operators, agriculture, forestry, fishery, and business operation and activities with a significant publicness (e.g., railways, communication, medical services). (Article 11)

- If these measures are not able to improve the emergency situation, decisions can be made on matters required for allocation and rationing of oils and restrictions or banning of oil production, use, transfer, and acceptance. (Article 12)
- Additionally, Articles 10 and 11 of PSDAA further stipulate implementation of oil supply prioritization along with oil demand restraint as a governmental policy. The Japanese government is required to establish a system to enable such implementation as early as possible, with hearing opinions on the interpretation and actual execution in emergencies from both the supply side (e.g., the oil industry) and the demand side.
- For instance, the concept of prioritized fuel supply on the perspective of minimizing the impact on the life of the people may include:

- Fuel supply for physical distribution (transportation of commodities etc.) takes priority over fuel supply for human distribution (sightseeing, recreational activities, etc.);
- Fuel supply to facilities that manufacture consumer products takes priority over fuel supply to recreational facilities;
- Fuel supply to public transportation takes priority over fuel supply to private use vehicles; and,
- Fuel supply to medical institutions takes priority over fuel supply to other institutions.

However, the actual implementation of prioritized supply shall flexibly accommodate the given case, taking into account the actual situations.

- Additionally, the Japanese government should engage in activities from ordinary times to enable sharing of information among the relevant ministries, municipalities and business operators on (1) the practical implementation method of demand and supply optimizing policies that come into effect in urgent situations, and (2) the method of obtaining and sharing information on the types and quantity of oils required by private households and for important infrastructure operation. The thereby obtained concept of prioritization of oil supply should be widely shared among the people in order to obtain their understanding on the concept. Such activities may greatly contribute to minimizing confusions on oil supply in urgent situations.
- Further, advanced diversification of oils for vehicles that play important roles in urgent situations from ordinary times, for instance, may enable maintaining the transportation functions even at the time of supply disruption of oils with high geopolitical risks.

[Number of Automobiles by type (Including Emergency Vehicles) and Fuels Used]

緊急車両の数は、全四輪車数（約7600万台）の0.08％程度。

車種		保有台数（千台）	年間総走行距離（百万km）	主な燃料	年間総燃料消費量（各数量単位）	7日分の燃料消費量
緊急車両	救急自動車	6 ※1	116 ※5	ガソリン	38,667kℓ ※5	742kℓ
	消防ポンプ自動車	17 ※1	34 ※6	軽油	34,000kℓ ※6	652kℓ
	警察用車両【白バイ除く】	34 ※7	612 ※8	ガソリン	61,200kℓ ※8	1,174kℓ
公共交通	バス	226 ※2	6,027 ※4	軽油	1,637,869kℓ ※4	31,411kℓ
	タクシー（乗用車の内数）	243 ※3	10,069 ※4	ＬＰＧ	1,006,939t ※4	19,311t
トラック	普通車【大型トラック】	2,267 ※2	54,585 ※4	ガソリン	226,478kℓ ※4	4,343kℓ
				軽油	14,377,426kℓ ※4	275,731kℓ
	小型四輪車【小型トラック】	3,673 ※2	46,360 ※4	ガソリン	2,465,436kℓ ※4	47,282kℓ
				軽油	2,537,953kℓ ※4	48,673kℓ
	軽四輪車	8,896 ※2	76,684 ※4	ガソリン	6,258,197kℓ ※4	120,020kℓ
乗用車	普通車	17,294 ※2	168,580 ※4	ガソリン	17,815,854kℓ ※4	341,674kℓ
				軽油	596,624kℓ ※4	11,442kℓ
	小型車	22,869 ※2	192,915 ※4	ガソリン	16,602,281kℓ ※4	318,400kℓ
				軽油	332,977kℓ ※4	6,386kℓ
	軽四輪車	19,258 ※2	151,305 ※4	ガソリン	11,533,256kℓ ※4	221,186kℓ

※１：消防庁「消防白書」（平成25年版）
※２：国交省「自動車輸送統計調査」（平成24年12月分）
※３：日本自動車会議所「数字でみる自動車」（平成26年版）
※４：国交省「自動車燃料消費量統計年報」（平成24年度分）。なお、主な燃料以外の燃料を利用する車両分については考慮していない。
※５：救急自動車の燃費を3km/ℓ（関東学園大学「太田市における救急サービスについて」（平成24年度））、年間出動回数を約580万回（消防庁「消防白書」（平成25年版））、一回の出動距離を20kmと仮定し試算。
※６：消防ポンプ自動車の燃費を1km/ℓ（関東学園大学「太田市における救急サービスについて」（平成24年度））、年間燃料消費量を約2,000ℓ/台（海老名市「災害時における燃料備蓄計画」（平成24年11月））と仮定し試算。
※７：警察用車両数（白バイ含む）を約42,500台（警察庁「警察白書」（平成25年版））、白バイ数を約8,500台（警察用車両数に占める白バイの割合を 約20%（警察庁「警察白書」（昭和51年版））と仮定し試算。
※８：警察用車両（白バイ除く）の燃費を10km/ℓ、年間走行距離を18,000km（秋田県警HP）と仮定し試算。

ii) LP gas

1) Concept of stockpiling

Contents of the national petroleum gas stockpile and private petroleum gas stockpile and past activities

- Similar to oils, Japan stores petroleum gases as the national stockpile and the private stockpile, based on the Oil Stockpiling Act. The national stockpile petroleum gases are stored at 5 national petroleum gas stockpiling bases in Japan (842 kt as of the end of May 2014, equivalent to 27 days of domestic gas demand as the Oil Stockpiling Act standard). Meanwhile, storage of the private stockpile petroleum gases in tanks at private import bases etc. is secured by obligating oil importers (wholesalers, trading companies, etc.) to possess petroleum gas stocks exceeding their commercial stocks (18.6 kt as a summation of standard stocks and commercial stocks as of the end of May 2014, equivalent to 61 days as the Oil Stockpiling Act standard).
- Japan's petroleum gas stockpiling system commenced with possession of the private stockpile under administrative guidance, which became legislated by amendment of the Oil Stockpiling Act in 1981. Possession of the national stockpile commenced in 2005, and currently in the process of filling gases. Meanwhile, the standard stockpiles of private stockpile was initially determined to be 50 days of domestic gas demand, and has since been maintained at the same level to date. Currently the national stockpile is being increased.
- Similar to oils, based on the Oil Stockpiling Act, the Minister of Economy, Trade and Industry can instruct release of stockpiled LP gases (release of the national stockpile or easing on the private stockpile requirements (reduction of the standard stockpiles)) when a situation arises where the domestic petroleum gas supply network was been hindered or likely to be hindered due to shortage of petroleum gas supply from overseas or emergence of disasters. IEA member countries are to undertake cooperative release of oil etc. when a situation arises where oil supply crisis has occurred or is likely to occur at all or certain member countries, and Japan participates in the framework.
- Japan's past participation in the cooperative release by IEA has all been carried out by release of crude oils. When the Great Eat Japan Earthquake occurred, the Japanese government released the national stockpile gases in a form of reduction and trading of the private stockpile requirements.

Concept of national stockpile

- For stockpiling of oils, both the national stockpile system and private stockpile system have been already established. For stockpiling of LP gas, on the other hand, while the private stockpile system has been established, the national stockpile system is in the stage of filling the national stockpile bases with a capacity of 1,500 kt (equivalent to the quantity of approximately 40 days of importing).
- While LP gas demands are in a downward trend in late years, the import quantity has fluctuated every year. The quantity equivalent to approximately 40 days of importing has fluctuated between approximately 1,450 kt and 1,250 kt in the last several years.
- According to the "Forecast of Oil Product Demand from FY2014 to FY2018" by the Oil Product Demand Forecast Committee, the LP gas demands in FY2018 will increase by 2.9% compared to that in FY2013, and the quantity equivalent to 40 days of importing will become approximately 1,350 kt. Import of LNG (shale gas) from the U.S. that is to be used as the city gas will commence in FY2017. However, the calorific value of shale gas is low, and as a result the demand for LP gases for carburation of the shale gas is expected to increase from FY2018. The demand for LP gas used for industrial application is also expected to rise to a certain degree due to changeover from type-A heavy oil etc.
- Import of shale gas will become regularized from FY2019 and the demand for LP gas for

carburation of shale gas that is to be use as city gas may further increase. The demand for LP gas used for industrial application is also expected to keep increasing due to fuel switchover.
- As above, the quantity equivalent to “40 days of importing” may keep increasing in the future. Therefore, regarding the national stockpile, the amount of LP gas will be continuously increased up to 1,500 kt. At the same time, further efforts will be made on rationalization of the management cost.
- Additionally, stockpiling standards will be reviewed when deemed necessary, in accordance with the trend and forecast of gas demand and import.

Concept of private stockpile
- In reality, it will require a certain number of days for the released national stockpile to be injected into the market. Therefore, the initial response to emergencies will in principle be managed through release of gas by reducing the private stockpile.
- Taking into account the important roles of private stockpile, there is a possibility in the future for allowing review of the standard stockpiles for private stockpile which is currently stipulated to be 50 days by the Oil Stockpiling Act. The factor that may allow such a review is new procurement of LP gas from low geopolitical risk countries (e.g., LP gas originating from shale gas), resulting in an increase in the probability of securing the required quantity without relying on stockpiling. Stable supply of LP gas for the quantity equivalent to 50 days of stockpiling is practically essential for giving considerations on such a review process. Specifically, consideration will be given to the past records of new procurement from low geopolitical risk countries and the degree of reduction in the amount of LP gas refined in Japan.
- Actual review of the standard stockpiles for private stockpile postulates that (1) business operators have established a trustable system, solid business plan, etc. that maintain sustainable supply of gas to Japan in emergencies, and (2) reduction in the stockpiling cost at the petroleum gas importer side is assuredly reflected on the distribution prices. Such issues will be carefully investigated during the consideration stage.

2) Supply prioritization and demand restraint in urgent situations
- LP gas demand and supply management shall be conducted based on the above-described concept for oils. If the situation falls into significant and continuous supply shortage, PSDAA shall be invoked and decisions can be made on matters required for allocation and rationing of oils and restrictions or banning of oil production, use, transfer, and acceptance.
- Prioritized supply under oil demand restraint policies based on PSDAA shall also follow suit the case for oils, and the system is required to be established by discussing with both the supply side and the demand side on its interpretation and execution.
- Additionally, the Japanese government will engage in activities from ordinary times to enable sharing of information among the relevant ministries, municipalities and business operators on (1) the practical implementation method of demand and supply optimizing policies that come into effect in urgent situations, and (2) the method of obtaining and sharing information on the types and quantity of gases required by private households and for important infrastructure operation.

iii) Natural gas

Establishing LNG procurement environment in preparation of emergencies
- Regarding natural gas, diversification of energy exporting countries is currently in progress. Efforts will be continuously made on further diversification and reduction of the risk of supply disruption from overseas, thereby establishing an environment that enables procurement of a sufficient amount of natural gas in urgent situations.

Points at issue concerning stockpiling

- As described above the reliance of natural gas supply on the Middle East is increasing, while it still remains at approximately 30% due to advanced diversification of energy exporting countries. Therefore, when supply of natural gas from a major supplying country or region is disrupted, there is a higher possibility of procuring it from other countries, compared to procurement of oils or LP gas. Additionally, approximately 70% of demand for natural gas is attributed to the use for power generation, which can be replaced by other fuels. Natural gas is difficult to store in a gas form and requires to be stored in a form of LNG. Therefore, stockpiling of natural gas requires a relatively large amount of additional costs including the cost involved with energy consumption for storage itself and cost for establishing new infrastructure (e.g., stockpiling tanks).
- Utilization of depleted natural gas fields as underground gas storage facilities has already been put into practice by private business operators for storing domestic natural gas as a measure against seasonal fluctuations. Natural gases stored at such underground gas storage facilities may be used as part of the private stockpile. With viewing further expansion of natural gas use in the future, detailed legislative and technical considerations will be given on taking necessary steps for using such facilities as private stockpile, by the time where a wide-area natural gas pipeline network is built to a certain level in a mid- to long-term view and integral establishment with underground storage facilities becomes envisaged.
- In any event, stockpiling of natural gas requires careful considerations taking into account its feasibility and economic efficiency.

4. Constructing the structure of energy demand and supply preparing for disasters (details)

(1) Constructing the system of energy demand and supply against disruption by domestic disasters

i) Oil

Allocation and effective release of national stockpile in a form of oil products (e.g., gasoline) and risk communication

- The Great East Japan Earthquake inflicted widespread damage upon oil facilities (e.g., oil refineries, oil terminals) and physical distribution facilities (e.g., roads, railways, ports, tank trucks), resulted in a substantial amount of time required for establishing an oil supply system and inability to swiftly supply oils to disaster-hit areas. Based on the experience, the Japanese government has amended the Oil Stockpiling Act and enhanced the national stockpile in a form of oil products (national stockpile of oil products), in order to drastically strengthen systems for supplying oils to disaster-hit areas at the time of large-scale disasters.
- As a result, the quantity of national stockpile of oil product has reached the quantity equivalent to approximately 4 days of national demands for gasoline, light oil, kerosene, and type-A heavy oil, which are all ready for mobile release in disaster situations. In the future, continuous balancing of stored quantity among regions will be required to achieve stockpiling approximately 4 days of demand for each block (the nation is divided into 10 blocks for formulating the Plan for Joint-Operations of Oil Supply in Disasters (Oil Stockpiling Act)).
- Discussions shall be continued on measures against domestic supply shortage at the time of disasters as well as the method and concept of releasing the stockpile.
- Additionally, based on the lessons learned from the Great East Japan Earthquake, there was a comment made stating that “small-scale gradual easing on the private stockpile requirements (e.g., reduction by 3 days equivalent) at the time of disasters merely becomes hindrance to oil companies in swiftly and flexibly supplying oils to disaster-hit areas, and thus major easing should be conducted immediately after occurrence of disasters if there is no risk of oil supply disruption from overseas and prompt supply of oils to disaster-hit areas is required”. Taking into account such comments, careful considerations from ordinary times will be required.
- Further, similar to those described in “3. (2) Constructing the system of energy demand and supply against the disruptions of energy from overseas”, careful considerations need to be made on the method for disseminating information on release of stockpile etc. in emergency situations. It is important to organize a detailed and thorough risk communication system from ordinary times that enables prompt dissemination of unified information at a proper timing and thereby brings peace of mind to the people without inflaming public anxiety, with taking into account the consumer psychology of general public.

Establishing Core Gas Stands

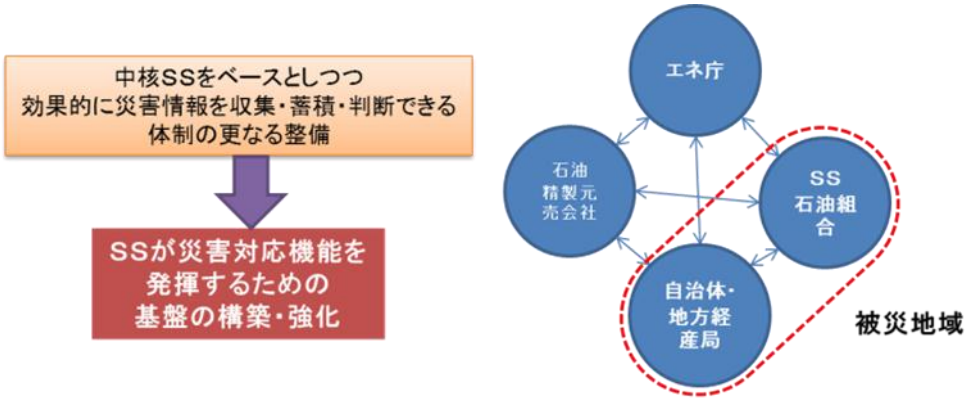
- The Great East Japan Earthquake induced disruption of meter operation mainly due to power loss on top of the above-mentioned disruption of oil supply, which resulted in difficulties in refueling at gas stands and hindering oil supply to disaster-hit areas.
- In order to prevent recurrence of such situations, the Oil Stockpiling Act was amended to require establishment of disaster-tolerant Core Gas Stands throughout the nation which are equipped with private power generation facility, large tanks, etc., and to conduct prioritized oil supply to emergency vehicles in disasters. Based on the Act, approximately 1,700 sites were designated as disaster-tolerant Core Gas Stands throughout Japan, and

the Japanese government has been providing support for building necessary functions.

- The oil supply chains that supply oils to the Core Gas Stands are required to be sturdy and resilient so that the Core Gas Stands can properly function in disasters. For that purpose, “Affiliate Company BCP” (details are described later) stipulates prioritized oil supply to the Core Gas Stands of affiliate companies. It also requires formulation of a disaster oil supply coordination plan and establishment of a system which enables supply of oil products (e.g., gasoline) across the boundary of companies.
- Various advance preparations are desirable so that fully-established Core Gas Stands can effectively support the initial restoration and reconstruction activities carried out by municipalities immediately after occurrence of disasters. Such advance preparations include, 1) accumulation of know-how on disaster response activities within the Core Gas Stands by participating in disaster response exercises described below, 2) enhancement of oil product stockpiles at the Core Gas Stands, and 3) activation of activities by the whole region in cooperation with municipalities. The Japanese government will provide support and recommendations for such activities.

<u>Constructing the system for prompt response</u>

- 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, gas stands, and relevant ministries. Meanwhile, gathering of information on the operational status and stocks of gas stands, for instance, required calling each individual gas stand. 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.
- As the said experience indicates, prompt gathering of information on the disaster damage and stocks of gas stands is the major premise for taking urgent and appropriate disaster response action. To that end, based on the concept similar to the centralized monitoring system for on-the-premises stocks by LP gas users, the existing system employed by the Petroleum Association will be utilized in establishing advanced systems and frameworks that enable more comprehensive and detailed information gathering on the operational status and stocks of local gas stands.
- Specifically, wholesalers, oil retailer and the Japanese government will jointly discuss methods to gather information on stocks that is not covered by the current system, i.e. information on non-affiliate gas stands etc. Eventually, a system will be built which enables 1) prompt gathering of information on the operational status and stocks of both affiliate and non-affiliate gas stands in disaster-hit areas, and 2) prompt responses including emergency delivery of oil products and opening up of roads accordingly.

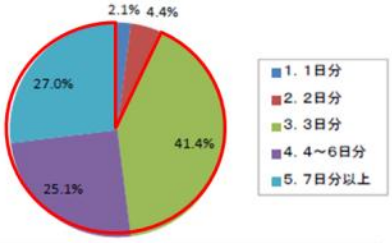


Promoting self-stockpiling at the user's side

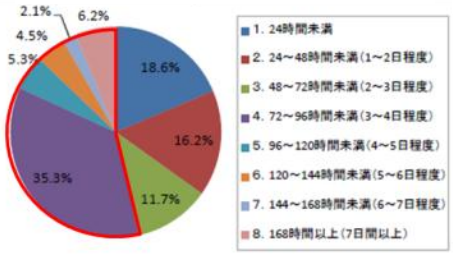
- Massive earthquakes, if occurred, will destroy the transport infrastructure network (e.g., roads, sea routes), and restoration will require several days at least. It is not practical to expect supply of oils to disaster-hit areas via tankers and tank trucks to be realized immediately after occurrence of massive earthquakes. Even under such conditions, facilities of local municipalities that are part of the "socially important infrastructure" (including firefighting, police, and water services), medical institutions, broadcasters, communicators, financial institutions, etc. are required to continue their business operations. Therefore, it is essential in the future to promote sufficient and appropriate self-stockpiling of fuels used for operating private power generators at such facilities and institutions in terms of the quality and the quantity, so that they can autonomously continue their business operations until the logistics network recovers to a usable state.

- According to the results of research conducted by ANRE, facilities that hold "3 days or more" of fuel for private power generation are only about half (53.4%) of the facilities related to broadcasting, communication and financing and disaster base hospitals (699 facilities in total). Additionally, it was revealed that many facilities of the socially important infrastructure that were in the process of "self-stockpiling" were (1) stockpiling type-A heavy oils (which are prone to deterioration), and (2) not practicing regular replacement, use, or quality check of stocked oils. These facts raise a concern over a possibility for causing troubles in normal operation of private power generators by using aged fuels, even if fuels are stockpiled during ordinary times.

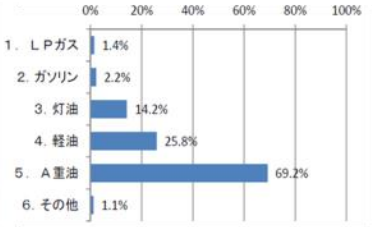
● Days of stockpiling petroleum and LP gas considered sufficient even in the event of a supply disruption of electricity or city gas when a disaster or emergency occurs



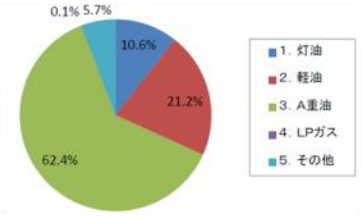
● Days of stockpiling fuel oils for the private power generators installed in private and government buildings that accommodate head offices and headquarters, and other socially important facilities, to be ready for possible disasters.



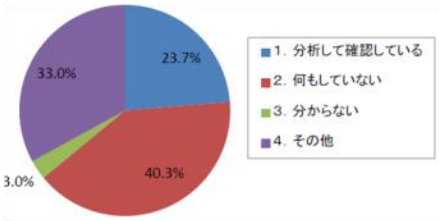
● Types of fuel oils stockpiled
"Type-A heavy oil" accounts for about 70% of all stockpiled fuel oils



● Fuel oils used for private electric generators
Fuel oils for private electric generators are made up of about 60% of "type-A heavy oil," as the largest piece, followed by about 20% of "light oil" and about 10% of "kerosene."

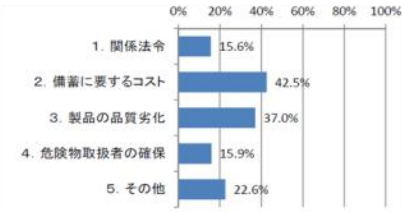


● Quality control
With respect to quality control, about 40% of private electric generator owners "do nothing," about 20% "are checking and analyzing its qualify data," and about 30% "are inspecting quality of fuel by actually operating it," by "replacing fuel at regular intervals and taking other measures (which are classified into the item "others").



【「その他」の主な管理方法】
・自家発電機を稼働させることで、燃料の品質維持を確認。
・定期的に燃料の入替え(交換)を実施。
・常用燃料と併用。

● Issues in stockpiling fuel
About 40% of specific hurdles and challenges in stockpiling fuel have something to do with "stockpiling cost" and "degradation in fuel product quality."



【「その他」として挙げられた主な課題】
・備蓄場所、スペースの確保。
・ビル所有者との調整。
・震災時の燃料補給が不透明であることから効率的な備蓄量の試算が困難。

- The relevant ministries of the Japanese government are required to work together in promoting quality control activities as well as increasing the quantity of self-stockpiling at the socially important infrastructure, by providing necessary information including the results of researches on measures against quality deterioration. ANRE has already conducted research on quality deterioration of oil products. The research results should be widely disseminated to the user's side, while investigations and experiments on extending the lifetime of oils for stockpiling is continued following the quality deterioration research. The oil industry etc. is expected to actively engage in discussions on running a new business that

supports the self-stockpiling at the socially important infrastructure, according to the investigation results. Examples of such new business are, practical use and supply of light oils etc. that has extended lifetime (e.g., by increasing the quantity of antioxidants mixed in), quality control services, and oil replacement services.

- 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, 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.
- It has to be noted that stockpiles will be no use if appliances that use the stockpiled fuels become out of order due to power loss. Therefore, the Japanese government will also promote and support installation of independent appliances equipped with batteries (e.g., ecofeel (high-efficiency oil-fired hot water system)) at public facilities (e.g., schools, medical institutions, community centers) and households.

<u>Determining the concept of prioritization for emergency oil supply request</u>

- If a catastrophic disaster occurs, the Japanese government will direct emergency oil supply operation in response to emergency supply requests received from disaster-hit prefectures. In so doing there arises an issue, namely, how the Japanese government will “prioritize” the supply of oils among a large amount of supply requests the government will assumedly receive.
- This issue was recently addressed in the “Fundamental Plan for National Resilience” (cabinet decision in June 2014) as “the concept of prioritization shall be determined in advance on the premise that there will be limits in the suppliable quantity after disasters”.
- It must be noted that prioritization through inflexible uniform criteria may induce harmful effects. Additionally, extra attention needs to be paid on the possibility of the prioritization losing its meaning if there are too many facilities ranked high in the priority list.
- Taking into account these points above, the following cases may be given as examples of prioritization concept in terms of contribution to emergency recovery from disasters:

  - Fuel supply to disaster-hit areas takes priority over fuel supply to other areas
  - Fuel supply to Core Gas Stands takes priority over fuel supply to general gas stands
  - Fuel supply to emergency vehicles takes priority over fuel supply to general vehicles
  - Fuel supply to public facilities that serve as collective shelters takes priority over fuel supply to other public facilities
  - Fuel supply for disaster response operations by designated public institutions and designated local public institutions takes priority over fuel supply for business continuation of general corporations

- The concept of prioritization should not be axiomatic but flexibly accommodate various factors including the location of disaster (e.g., isolated areas, isolated islands), season, and the level of damage, and should be reviewed in accordance with the actual situations. Accumulation of prioritization cases in the future may result in systemization of prioritization concept to a certain degree, and the thereby obtained prioritization concept should be widely shared among the people in order to obtain their understanding on the concept. Such activities may greatly contribute to smooth fuel supply in urgent situations.

Energy demand and supply management and prioritized supply under PSDAA

- Even at the time of domestic disasters, PSDAA will be invoked when the situation falls into "significant supply shortage" of oils in Japan and likely to have a serious impact on the people's life. Energy demand and supply management and prioritized supply under PSDAA will be carried out on the concept similar to that described in Section 3. (2) i) 2).
- However, in case of catastrophic disasters, different from the concept of prioritized supply on disruption of supply from overseas, prioritized supply will be required for disaster relief activities by the Japan Self-Defense Force etc., heavy machinery for opening up and restoring disaster-hit infrastructure (e.g., roads, ports), and for alternative power sources if there is disruption in the supply of electricity and city gas. Therefore, interpretation and execution of prioritized supply stipulated in PSDAA require sharing of information and understanding among relevant parties taking into account these aspects.

ii) LP gas

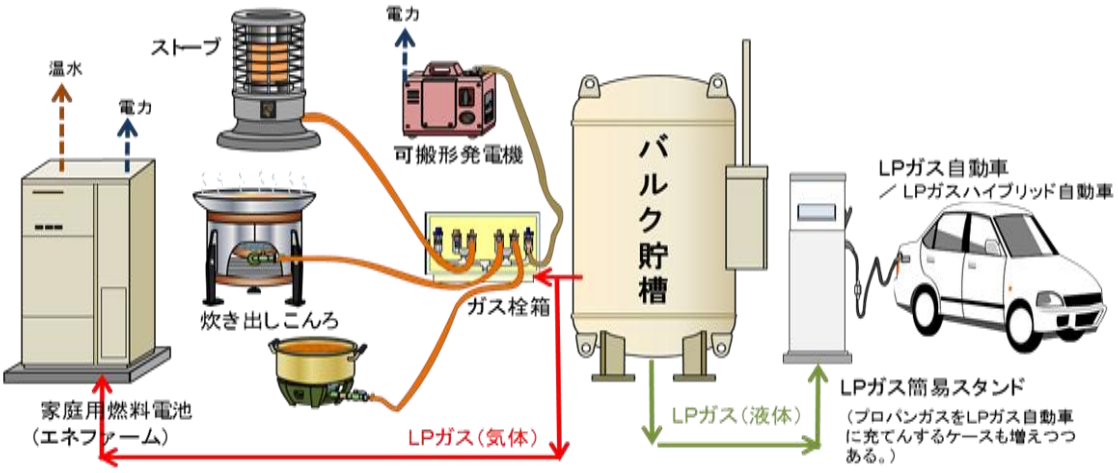
Securing the effectiveness of Plan for Joint-Operations of LPG Supply in Disasters

- Regarding the Core LP Gas Filling Stations (independent filling stations), 344 stations have been established to date in Japan. Securing the effectiveness of Plan for Joint-Operations of LPG Supply in Disasters centering on the Core LP Gas Filling Stations requires securing the prioritized energy supply from LP gas wholesalers in disasters. Additionally, the Plan for Joint-Operations of LPG Supply in Disasters will be reviewed to improve the disaster management capability of areas where Core LP Gas Filling Stations are in short supply, for instance, by encouraging participation of filling stations whose functions are equivalent to the functions of the Core LP Gas Filling Stations.

Promoting self-stockpiling at the user's side

- Massive earthquakes, if occurred, will likely destroy the transport infrastructure network (e.g., roads, sea routes) and restoration will take time, resulting in severing of the energy supply network. Therefore, promoting "self-stockpiling" of fuels is considered to be an effective method to ensure autonomous business continuation for several days after occurrence of disasters.
- LP gas has several advantages over other sources of energy, including ability to use on-the-premises stocks and long-term storage because LP gas does not undergo deterioration. These advantages of LP gas exerted significant power when the Great East Japan Earthquake occurred. Therefore, in a way, it can be said that LP gas users among general households practice "self-stockpiling" in the form of on-the-premises stocks. Similar to such "self-stockpiling" at individual households, the scale of stockpiling will be increased at facilities that can be called as the "socially important infrastructure" (e.g., national governmental buildings, municipal buildings, communicators, broadcasters, financial institutions, base hospitals, schools) and facilities that serve as shelters in disasters. Furthermore, from the viewpoint of diversifying the variety of energy sources, implementation of LP gas storing facilities (e.g., disaster-tolerant LP gas bulk storage) will be promoted.
- Stockpiling of LP gas requires regular maintenance of equipment, consideration on security obligations, and meticulous responses in accordance with the facility scale, business category, business conditions, etc. Therefore, promotion of self-stockpiling needs to be conducted in cooperation with municipalities and LP gas retailers.

Bulk storage + disaster-resistant equipment
(such as ENE-FARM, emergency food cooking packs, and LP gas-powered vehicles)



Supply prioritization and demand restraint in urgent situations

- Even at the time of domestic disasters, PSDAA will be invoked when the situation falls into "significant supply shortage" of petroleum gas in Japan and likely to have a serious impact on the life of the people. Supply prioritization and demand restraint under PSDAA will be carried out on the concept similar to that described in Section 3. (2) ii) 2).
- However, in case of large-scale disasters, different from the concept of prioritized supply on disruption of supply from overseas, prioritized supply will be required for public facilities that serve as shelters and facilities where many occupants will find it difficult to evacuate in disasters (e.g., hospitals, nursing homes). Therefore, interpretation and execution of prioritized supply stipulated in PSDAA require sharing of information and understanding among relevant parties on cases like the following examples:

- Fuel supply to shelters takes priority over fuel supply to other facilities
- Fuel supply to Core Filling Stations takes priority over general filling stations

iii) Natural gas

Maintaining supply through mobile gas generation facility or temporary manufacturing facility

- Utilization of mobile gas generation facilities is effective in maintaining supply of gas in disasters. The necessity of mobile gas generation facilities was pointed out after the 1993 Kushiro-oki earthquake, which was then specified as gas facilities by the Gas Business Act in March 1995 to be preferentially used for disaster-hit socially important facilities (e.g., medical institutions, welfare facilities).
- In case of inability to cope with emergency situations by facilities owned by disaster-hit business operators in large-scale disasters, in 2008, the Japan Gas Association (JGA) formulated "Guidelines for Mobile Gas Generation Facility Accommodative Operation in Large-scale Disasters". The Guidelines stipulates a rule to accommodate approximately 2,000 mobile gas generation facilities owned by JGA throughout Japan, among disaster-hit business operators, relief operators, the head office of JGA, and local groups of JGA.

	空気吸入式 （PA式）	圧縮ガス式 （CNG式）	液化ガス式 （LNG式）
主な特徴	LPGボンベからの発生ガス圧力を利用し、エジェクターにより大気中の空気を吸引し、LPGと混合して都市ガス（天然ガス）と同グループのプロパンエアー（PA）ガス（低圧）を発生させる。	天然ガススタンド等で、CNGボンベ・カードルに20MPa程度に圧縮・充填された熱調・付臭済のガスを、減圧（低圧又は中圧）して供給する。	LNG充填所等で、LNG低温用容器に充填された液熱調・液付臭済液化ガスを気化して供給する。
設備例			

- For the purpose of enabling early recovery from damage inflicted on LNG satellite bases, JGA has established a system to widely accommodate temporary production facilities as a voluntary activity of business operators. JGA is planning to commence implementing the system within this fiscal year.

Autonomous use of fuel at the user's side

- It is difficult to store natural gas at the user's side, and disruption of natural gas supply will be handled by restoring the supply infrastructure as described above. Meanwhile, if supply of natural gas is maintained even when electric power is lost, electricity and heat can be supplied from independent ene farms equipped with batteries designed for households or gas cogeneration systems for the industrial and business sectors. Promoting adoption of such systems is important for enabling continuous operation in disasters.

(2) Enhancing energy supply facilities' resilience (hardware-based measures)

i) Oil

Enhanced resilience of oil refineries and oil terminals (steps against earthquakes, liquefaction, lateral flow, etc.)

- Assuming Tokyo Inland earthquakes or Nankai Trough earthquakes, the following risks need to be taken into consideration for oil refineries established at the disaster-threatened areas:

1) Possibility of operation suspension period becoming prolonged if damage is inflicted on oil refining facilities (oil refining facilities automatically suspend their operation and it will require approximately 7 days to complete inspections etc. for resuming the operation even when there is no damage to them);
2) Possibility of damage inflicted upon onshore/offshore oil product receiving and shipping facilities of oil refineries due to soil liquefaction, lateral flow of soils, etc.; and,
3) Possibility of losing system power supply (for operating the facility) and requiring time for restoration.

- It is important to take thorough and prudential advance measures for completely suspending operation of oil refining facilities, minimizing damage to oil product receiving and shipping facilities, and recovering receiving and shipping functions (function to paying out the stocks stored in the oil refinery with receiving backup from other areas) as early as possible by the use of emergency power supplies.
- To that end, the Ministry of Economy, Trade and Industry conducted assessment of the ground for the possibility of soil liquefaction and thorough inspections of facilities for their earthquake resistance etc. at 25 business sites (oil refineries, chemical plants, and steelworks) located at the industrial complex districts that are assumed to be affected by Tokyo Inland earthquakes or Nankai Trough earthquakes, by the end of FY 2013 (the end of March 2014).[6] The said assessment and inspections were carried out in a form of self-inspections commissioned by the Ministry of Economy, Trade and Industry. The companies who carried out the self-inspections were those that (1) were taking measures against earthquakes in observance of the current laws and regulations (e.g., the Fire Service Act, High Pressure Gas Safety Act), and (2) agreed with the purport of daring to carry out risk assessment assuming the seismic motions that are beyond the required standards stipulated in the current laws and regulations.
- Especially, regarding oil refineries, each oil refiner carried out thorough inspections assuming the following seismic motions that were published by the Cabinet Office (Central Disaster Management Council) as the latest data at the time of inspections (May 2013), in accordance with the “Procedures for Evaluating Earthquake Resistance etc. of Oil Refineries etc. (March 26, 2013)”[7] jointly prepared by ANRE, academic experts, and representatives of the industry:
  - Tokyo Inland earthquakes (Hypothetical seismic motion data published in 2005. M7-class earthquakes assumed to hit the northern Tokyo Bay and the fault groups of Miura Peninsula. Those that occur several times prior to M8-class earthquakes that occur in a cycle of 200-400 years.)
  - Nankai Trough earthquakes (Hypothetical seismic motion data published in 2012. Earthquakes of the maximum assumed scale, with the incidence rate of once in 1000 years or rarer.)

1) Liquefaction evaluation of the ground

Liquefaction evaluation was conducted for the whole area of business sites using the seismic response analysis results for the “ground surface layer” under the sites and the “PL method (*)”, etc., that are commonly employed as simplified soil liquefaction evaluation methods. The evaluation results are shown below.[8]

[6] Conducted under the “Industrial and Energy Infrastructure Resilience Investigation Project” financed by the FY2012 supplementary budget (carried forward to FY2013).

[7] “Procedures for Evaluating Earthquake Resistance etc. of Oil Refineries etc.” are published as FY2012 Survey on the System etc. of Petroleum Industry (survey of methods for evaluating earthquake resistance of oil refineries and oil terminals in Japan) report.
URL: http://www.meti.go.jp/meti_lib/report/2013fy/E003798.pdf

[8] Evaluation sites were oil refineries and petrochemical plants. Steelworks were not included.

	PL=0	0<PL=<5	5<PL=<15	15<PL	合計
首都直下地震 東京湾北部地震、三浦半島断層郡M7クラスの地震（200～400年周期で発生するM8クラスの地震の発生前に数回発生）。2005年内閣府公表の震度想定データを用いた。					
東京湾等関東地区	370地点	914地点	836地点	707地点	2，827地点
南海トラフ巨大地震 想定される最大規模であって、千年に一度或いはそれより低い発生頻度の地震。2012年内閣府公表の震度想定データ等を用いた。					
伊勢湾等中部地区 大阪湾等近畿地区 中国・四国地区 九州・沖縄地区	589地点	540地点	757地点	1，441地点	3，327地点

(*) Evaluation method by PL values (liquefaction index)

Method used as an indication of possible liquefaction damage to the whole nearby ground. PL values and the liquefaction categories are generally identified using the classification proposed by Iwasaki et al. in 1980.

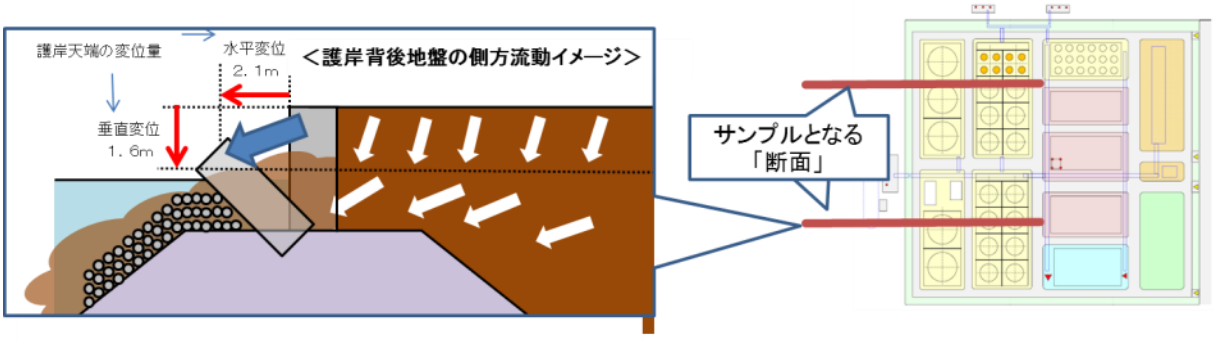
PL = 0	Liquefaction risk is extremely low. No detailed investigation on liquefaction is required.
0 < PL ≤ 5	Liquefaction risk is low. Detailed investigation is required for specifically important buildings.
5 < PL ≤ 15	Liquefaction risk is high. Detailed investigation is required for important buildings. In general, measures against liquefaction are needed.
15 < PL	Liquefaction risk is extremely high. Detailed investigation on liquefaction and measures against liquefaction are essential.

(Source: T. Iwasaki, F. Tatsuoka, K. Tokida, S. Yasuda, Estimation of degree of soil liquefaction during earthquakes, Tsuchi-to-Kiso, Vol.28, No.4, p23-29, 1980)

2) Lateral flow evaluation of the ground rearing revetments

Multiple “cross sections” were hypothesized for each business site, and detailed evaluation was conducted on the potential degree of lateral and vertical deformation (movement) for the revetment on the “cross section” and its rearing soil that may occur due to soil liquefaction. The evaluation results are shown below.

	評価する断面数	0～1m未満変形する断面数	1～3m未満変形する断面数	3m以上変形する断面数
首都直下地震 東京湾北部地震、三浦半島断層郡のM7クラスの地震（200～400年周期で発生するM8クラスの地震の発生前に数回発生）。2005年内閣府公表の震度想定データを用いた。				
東京湾等関東地区	45	（水平変位）10 （鉛直変位）33	（水平変位）24 （鉛直変位）12	（水平変位）11 （鉛直変位）0
南海トラフ巨大地震 想定される最大規模であって、千年に一度或いはそれより低い発生頻度の地震。2012年内閣府公表の震度想定データ等を用いた。				
伊勢湾等中部地区 大阪湾等近畿地区 中国・四国地区 九州・沖縄地区	45	（水平変位）27 （鉛直変位）38	（水平変位）12 （鉛直変位）5	（水平変位）6 （鉛直変位）2

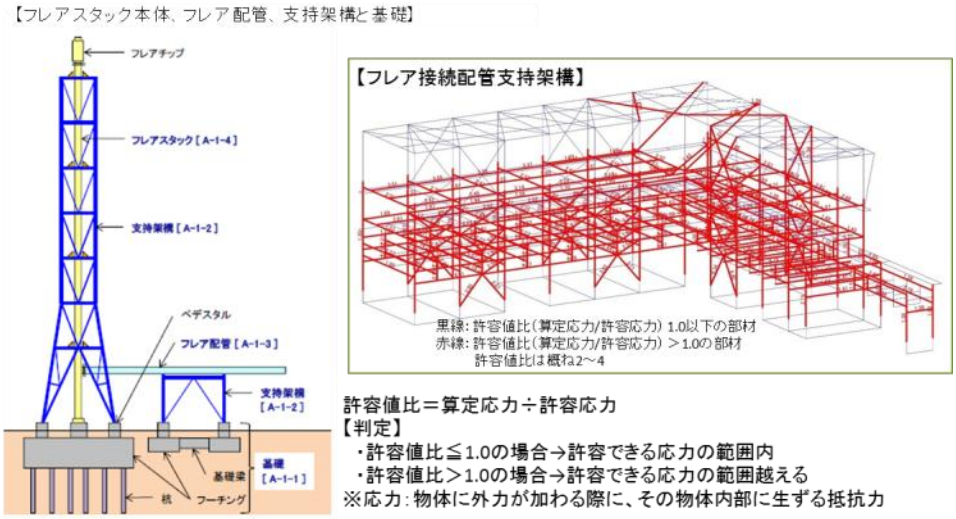


3) Earthquake resistance evaluation of facilities etc.

a) Facilities etc. required for assuredly stopping operation of oil refining facilities (example of evaluation results)

Flare stacks (facility for incinerating surplus gas (off gas) that is generated at oil refineries) are necessary for safely and assuredly carrying out emergency shutdown of oil refining facilities on occurrence of earthquakes. For that reason, earthquake resistance evaluation was conducted for flare stacks at various oil refineries. The evaluation results are shown below.

地震動	評価基数	評価対象部位数	許容範囲内の応力がかかると評価された設備部位数
首都直下地震	東京湾等関東地区の15基	102部位（本体63部位、基礎39部位）	59部位（本体37部位、基礎22部位）
南海トラフ巨大地震	伊勢湾等中部地区以西の5基	54部位（本体38部位、基礎16部位）	34部位（本体28部位、基礎6部位）



b) Facilities etc. potential to cause large-scale secondary disasters (example of evaluation results)

From the perspective of preventing large-scale secondary disasters, some facilities are required to possess earthquake resistance that ensures (1) no leakage of facility content, and (2) no collapsing of the facilities. The results of earthquake resistance evaluation of LPG tanks against stress that may apply to the tanks, for example, are shown below.

地震動	評価基数	評価対象部位数	許容範囲内の応力がかかると評価された設備部位数
＜LPG球形タンクの例＞			
首都直下地震	東京湾等関東地区の23基	89部位（本体61部位、基礎28部位）	57部位（本体41部位、基礎16部位）
南海トラフ巨大地震	伊勢湾等中部地区以西の10基	125部位（本体45部位、基礎40部位）	115部位（本体45部位、基礎38部位）
＜LPG低温平底タンクの例＞			
首都直下地震	東京湾等関東地区の2基	45部位（本体29部位、基礎16部位）	38部位（本体27部位、基礎11部位）
南海トラフ巨大地震	伊勢湾等中部地区以西の1基	38部位（本体31部位、基礎7部位）	26部位（本体22部位、基礎4部位）

c) Facilities etc. pertaining to storing and receiving/shipping oil products (example of evaluation results)

Earthquake resistance evaluation was carried out on facilities etc. that are required for early restoration of gasoline etc. payout functions at oil refineries when affected by disasters.

- Facilities etc. involved with storage: Connecting pipes and foundation of oil product tanks
- Facilities etc. involved with receiving and shipping: Tank truck/car depots, loading arms, quays, shipping pump building, etc.
- Others: Firefighting facilities, power supply facilities, electric rooms, instrument panel rooms, substations, pump room foundation, etc.

Of which, evaluation of “quays” was conducted for almost all business sites. The results of earthquake resistance evaluation of quays against stress that may apply to the quays, for example, are shown below.

地震動	評価基数	評価対象部位数	許容範囲内の応力がかかると評価された設備部位数
首都直下地震	東京湾等関東地区の18基	182部位（本体182部位）	111部位（本体111部位）
南海トラフ巨大地震	伊勢湾等中部地区以西の20基	202部位（本体174部位、基礎28部位）	157部位（本体132部位、基礎25部位）

4) Tsunami resistance evaluation

Inundation depth etc. evaluation was conducted for the premises of business sites, referencing the latest data on inundation areas etc. pertaining to Tokyo Inland earthquakes and Nankai Trough earthquakes (data on the depth of tsunami inundation for the land near the business sites subject to evaluation) published by the Cabinet Office (Central Disaster Management Council), tsunami inundation maps issued by local public organizations, and the maximum tsunami height observed in the past earthquakes. The evaluation results are shown below.

	想定地震	最大津波高（m）	出典	敷地内浸水深（m）	備考（影響等の一例）
東京湾等関東地区	南海トラフ巨大地震 慶長型地震	+1.28～4.134 +3.71～4.57	内閣府 神奈川県	0～0.63 1.2～5.5	沈下量が大きい護岸付近は浸水深大
伊勢湾等中部地区	南海トラフ巨大地震 東海・東南海・南海	+3.52～3.6 +3.24	内閣府 三重県	2～2.376 0～4	津波は護岸、地盤面を超えないが液状化、側方流動による地盤沈下を考慮した場合は、一部で浸水
大阪湾等近畿地区	南海トラフ巨大地震	+1.61～10	内閣府	0～5	護岸近傍で浸水深が高く、製造設備エリアは浸水無し
中国・四国地区	南海トラフ巨大地震	+3.3～4	内閣府	0.15以下	
九州・沖縄地区	南海トラフ巨大地震 南西諸島海溝（琉球海溝）側、南海トラフ側、八重山地震（15断層）	+3.3 +2.6～6.6	内閣府 沖縄県	1 2～5	護岸の沈下により護岸天端高さが最大津波高さより低くなり浸水

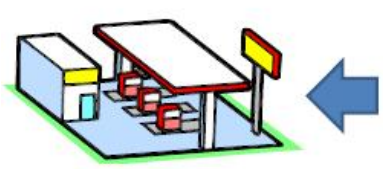
- For the present investigation, business operators first submitted documents summarizing soil information for their operation sites. Then, supplementary boring survey was conducted for areas that were not covered by the submitted documents, and analysis was carried out for the combined soil information. This approach enabled comprehensive understanding of potential risks for the whole area of oil refineries including areas along with revetments etc. where soil data were in short supply. According to the investigation results, further efforts should be made in the future through public-private cooperation on enhancing the resilience of oil supply infrastructure in order to enable continuation or early restoration of oil shipping functions at oil refineries for their own stocks or backup stocks supplied from other oil refineries, even when oil refining facilities are shut down for a long period of time due to large-scale earthquakes.
- To that end, it will be required for oil refiners to formulate multi-year oil refinery resilience enhancement plans for the purpose of enabling safe shutdown of oil refining facilities etc. and damage minimization and early functional restoration of oil receiving and shipping facilities at oil refineries, based on the results of thorough inspection. It will also be required to progress construction works according to the resilience enhancement plans as

soon as possible through public-private cooperation. Specifically, attention should be paid on emergency safety shutdown measures for facilities at oil refineries, including reinforcement of emergency shut-off valves in pipes and augmentation of automatic undocking equipment for tankers. Attention should also be paid on preparations for improving earthquake resistance of receiving/shipping facilities for oil products, implementing measures against soil liquefaction, augmenting backup functions, and achieving early functional restoration. Such preparative activities may include, (1) reinforcement of quays, backing revetments, and pipes on the premises, (2) augmentation of receiving/shipping pumps, tank truck departing lanes, etc., and (3) allocation of materials and equipment that contribute to swift functional restoration in disasters. Additionally, the base of emergency oil receiving/shipping systems should be established by building the “three-piece emergency set”, namely, (1) emergency power generators for operating shipping facilities at oil refineries, (2) emergency communication systems for securing communication methods, and (3) oil drum filling and shipping facilities for shipping oil products to areas etc. where refueling at gas stands is difficult.

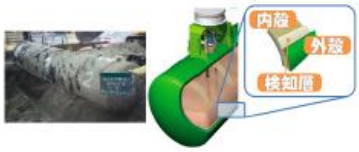
- Additionally, regarding high pressure gas facilities, there is a possibility of massive earthquakes causing catastrophic damage to oil refineries if accidents are induced at high pressure gas facilities installed on the premises of oil refineries (an example is the accident occurred at an oil refinery in Chiba Prefecture during the Great East Japan Earthquake). Since it is assumed that large-scale earthquakes with the level beyond the past imagination (e.g., Tokyo Inland earthquakes, Nankai Trough earthquakes) may occur in the future, the Japanese government should support and promote activities for improving earthquake resistance of existing facilities as measures against catastrophic earthquakes.
- Further, regarding the national stockpile bases, the Japanese government is promoting enhancement of their oil releasing capability (i.e. reinforcement of quays and performance improvement of work barges), measures against earthquakes and soil liquefaction (i.e. enhancement of earthquake resistance of core facilities and soil liquefaction investigation), and measures against tsunami (e.g., relocation of emergency power sources to higher grounds). On top of that, the Japanese government is promoting maintenance of facilities that enable swift release of national stockpile through replacement of deteriorated facilities (e.g., replacement of power panels used for central substations and oil receiving/paying pumps). It will be required to continue conducting such activities in the future.
- It is essential to enhance the resilience of oil shipping functions throughout Japan by continuing the activities described above. In so doing, it is important to take effective measures with referring to the future trend of cooperation etc. among oil refineries and oil terminals.

<u>Further improvement of disaster management capability for the whole oil supply chains including gas stands</u>

- Regarding the Core Gas Stands mentioned above, it is important that the Core Gas Stands become core supply bases of oil products for locals in disasters. To that end, approximately 1,700 Core Gas Stands in Japan designated under the Oil Stockpiling Act are provided with financial support for the cost involved with enhancing their disaster management capability (e.g., replacement or enlargement of underground tanks, implementation of private power generators).
- Additionally, regarding gas stands who are not the Core Gas Stands yet are willing to play a role to support the stable supply of oil products in disasters, support will be provided for them to enhance their business bases.



【災害対応型ＳＳ】



・鋼製一重殻タンクの撤去及び
大型二重殻タンクの設置

・自家発電機の導入

ii) LP gas

Enhancing earthquake resistance of LP gas import bases

- In response to an explosion which occurred at a spherical reservoir during the Great East Japan Earthquake, the earthquake resistance standards of spherical reservoirs were tightened and brace standards were newly established. Based on these changes, regarding existing spherical reservoirs of the same model as that involved with the accident, business operators are asked to carry out earthquake resistance evaluation on the tanks, and the Japanese government has provided support if the business operators were to perform systematic improvement of the earthquake resistance.
- The Japanese government will continue to support business operators, in the future, in systematically updating earthquake resistance etc. of LP gas import bases conforming to the latest earthquake resistance standards assuming catastrophic earthquakes such as Tokyo Inland earthquakes and Nankai Trough earthquakes.

Establishing Core LP Gas Filling Stations

- When the Great East Japan Earthquake occurred, the communication networks were severed and communication among supply bases or with non-damaged areas for sending out support requests or support instructions (which were to be carried out by business operators) became impossible. As a result, it became difficult to share information such as the situation of disaster damage, originally required support, and measures required for prevention of secondary disasters. Additionally, there arose a situation where refilling of LP gas at filling stations became impossible due to loss of power required for operating pumps.
- Based on the lessons learnt, for the perspective of nationwide disaster prevention and mitigation, the Oil Stockpiling Act was amended to strengthen the disaster management capability of local LP gas supply chains, similar to measures taken for oils. From the aspect of sustainable LP gas supply, 344 Core LP Gas Filling Stations (equipped with LP gas driven private power generators, satellite communication facilities, LP gas vehicles, etc.) have been established throughout Japan as a measure against communication line severing, power loss, or loss of information gathering methods. At the same time, steps were taken to issue a notification to designate operators of the Core LP Gas Filling Stations as the Specified Petroleum Gas Retailers, and to obligate them to participate in the Plan for Joint-Operations of LPG Supply in Disasters.
- Additionally, for areas where the Core LP Gas Filling Stations are in short supply and the ability to take adequate disaster responses is questionable, filling stations that possess functions equivalent to the functions of Core LP Gas Filling Stations will be appealed to participate in the Plan for Joint-Operations of LPG Supply in Disasters so that such filling stations take roles of the Core LP Gas Filling Stations in disasters.

Enhancing disaster management capability at the user's side

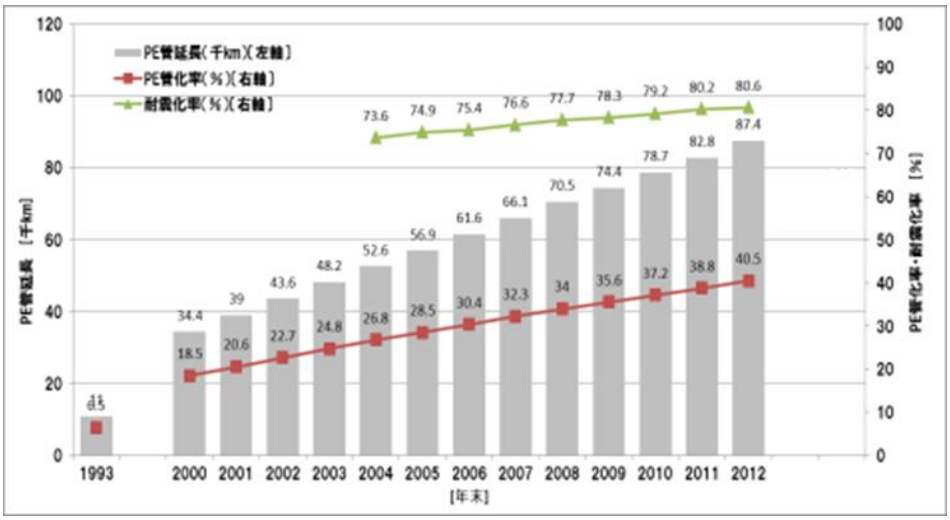
- As described above, implementation of LP gas storing facilities (e.g., disaster-tolerant LP gas bulk storage) at public institutions that serve as shelters in disasters and important facilities (e.g., hospitals) will be continuously promoted, since LP gas does not deteriorate with time and has a wide variety of applications (e.g., cooking at soup kitchen).
- Procurement of LP gas accompanied by shale gas from North America has developed, and efforts are continuously made on reducing the risk of LP gas procurement. However, it is

still important to ensure that transportation functions are maintained especially for emergency vehicles even under supply disruption of oils with high geopolitical risks. To that end, wider adoption of LP gas automobiles will be promoted as part of fuel diversification step in the transportation sector. Additionally, in order to enable continuous supply of energy even when the utility power is lost, support for introducing independent ene farms equipped with batteries into households will be continuously promoted.

iii) Natural gas

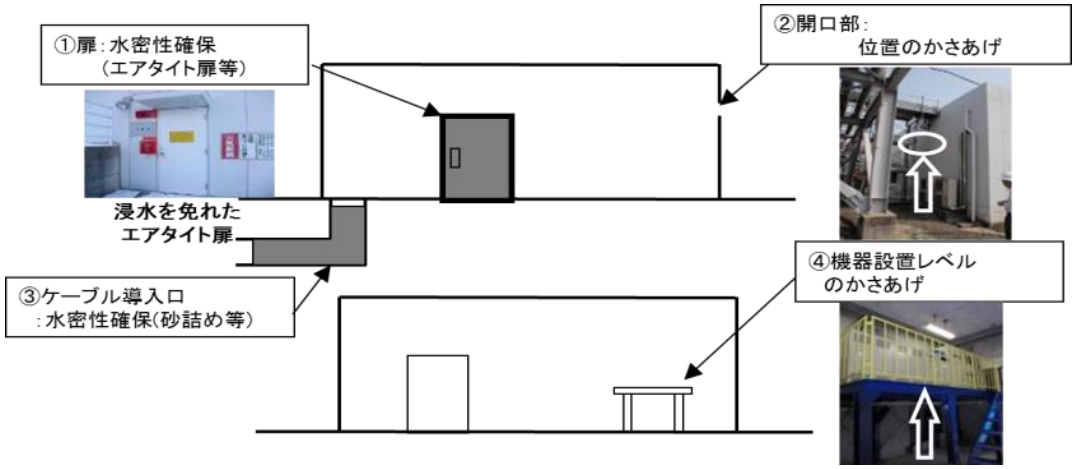
Improving earthquake resistance of gas pipes

- Earthquake resistance of low pressure gas pipes can effectively be improved by replacing them with polyethylene pipes, since polyethylene exhibits excellent stretching capability, high anti-corrosiveness and semi-permanent lifetime. In 1982, polyethylene was newly specified as material for low pressure gas pipes in the technical standards of the Gas Business Act, and switchover of gas pipes to polyethylene has been progressed since 1990s. As of the end of 2012, polyethylene pipes account for 40.5% of the total length of main and branch gas pipes. Including other earthquake-resistant pipes (e.g., ductile iron pipes where fastener-equipped mechanical joints are used), as much as 80.6% of the total length of main and branch gas pipes has been replaced with earthquake-resistant pipes as of the end of 2012. It is required to further increase the rate of earthquake-resistant pipes in gas pipes in the future.



Enhancing measures against earthquakes and tsunami for LNG bases

- Based on information on the damage of the Great East Japan Earthquake and responses made by business operators, in March 2012, the Disaster Risk Management WG of Gas Safety Subcommittee, Urban Heat Energy Committee, Advisory Committee for Natural Resources and Energy prepared a report pertaining to future steps against earthquakes and tsunami. Especially, regarding steps against tsunami, tsunami resistance requirements for facilities were newly stipulated for different tsunami levels, and each business operator is requested to take steps against tsunami in accordance with the expected tsunami level.
- In response to the report, in 2013, JGA formulated guidelines for steps against tsunami including detailed steps, such as steps against inundation of buildings and houses, raising of electricity facilities, and installation of emergency generators. Based on the guidelines, business operators have taken steps against tsunami, such as enhancing the water tightness of buildings at important facilities and elevating the position of equipment and apertures.

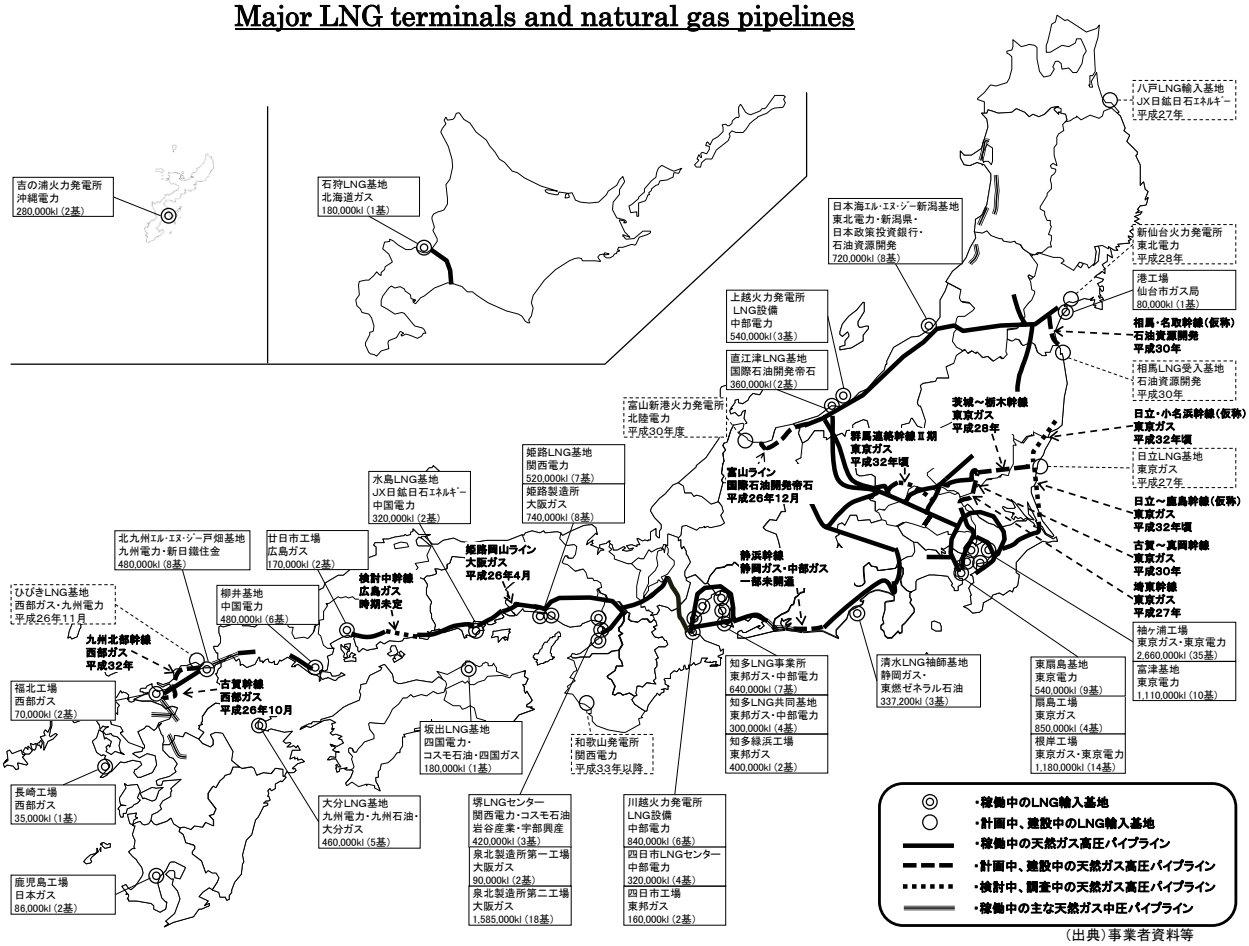


An example of countermeasures against tsunami disasters (electric equipment building)

Strengthening the supplementation system among LNG bases

- Establishment of natural gas pipelines etc. for building a supplementation system among LNG bases is important from the viewpoint of enhancing the resilience of supply system. Therefore, the Strategic Energy Plan has set forth the policy to progress discussions on establishment and functional enhancement of bases, establishment of traffic channels between the Pacific Ocean side and the Sea of Japan side, and establishment of natural gas pipelines. A report issued by the Subcommittee on the Establishment of Infrastructure for a Natural Gas Shift in June 2012 made a recommendation for the Japanese government to formulate basic establishment policies for overall optimization of wide-area natural gas pipelines. The report then pointed out the necessity to scrutinize the cost involved, business profitability, social influence, etc. in formulating the basic establishment policies.
- In response to the said recommendation, the “Workshop on Evaluation Methods for Establishment of Wide-area Natural Gas Pipelines” was held. Then, in March 2013, practical methods to evaluate the business profitability, social influence, etc. of pipelines were summarized, which will become the basis of basic establishment policies.
- Additionally, investigation was conducted for the purpose of promoting establishment of resilient natural gas supply systems, and the investigation results were summarized in March 2014. In this investigation, domestic and overseas legal regulations and technical standards pertaining to construction of pipelines etc. including submarine routes were compiled, and deregulation items deemed effective for reducing construction cost were identified. The cost reduction effect was quantitatively verified based on the results of field surveys conducted in Japan. For instance, it was identified that construction cost of submarine pipelines is expected to be reduced by approximately 10% compared to that of overland pipelines under the current standards, and by about 15-25% if deregulation is implemented.
- Bearing full liberalization of gas retailing in mind and taking into account the demands and establishment cost, consideration will be given on ideal and detailed steps including basic establishment policies, in order to build gas business systems that autonomously promote establishment of necessary infrastructure including natural gas pipelines.

Major LNG terminals and natural gas pipelines



(出典)事業者資料等

(3) Facilitating logistics of energy supply in emergency situations (software-based measures)

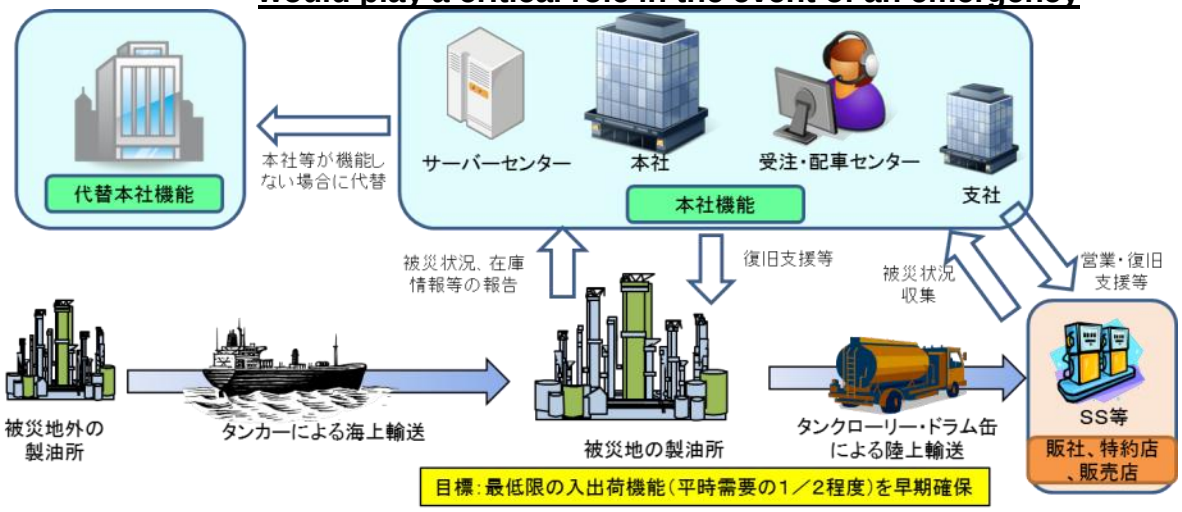
i) Oil

Establishing "Affiliate Company BCP", ranking and raising the level of oil refiners and wholesalers[9]

- The oil supply network stands on coordination among various business operators who form affiliation yet are not necessarily under capital ties. Such business operators include "oil refiners and wholesalers" who carry out refinement and wholesale of oil products by using oil refineries etc., "carriers" who transport oil products to gas stands etc. using tankers, tank trucks, etc., and "sales subsidiaries (of oil refiners and wholesalers), special agent retailers, and retailers" who sell oil products at gas stands. Early recovery of oil supply after massive earthquakes requires united efforts by business operators in restoring various functions as early as possible, including (1) demand and supply adjustment function and tank truck deployment function at the head offices of oil refiners and wholesalers, (2) oil receiving/shipping function at oil refineries and oil terminals, and (3) logistics and sales function of carriers, sales subsidiaries, special agent retailers, and retailers (affiliate gas stands). To that end, assuming the potential damage from Tokyo Inland earthquakes and Nankai Trough earthquakes, oil refiners and wholesalers formulated "Affiliate Company BCP (Business Continuity Plan)" covering the whole supply network of affiliate companies from oil refineries to gas stands, based on the guidelines formulated by the Petroleum Association in 2013.

[9] Oil refiners and wholesalers in this context refer to Oil Refiners and Specified Oil Retailers stipulated in the Oil Stockpiling Act.

Image of collaborative work within a petroleum refining and wholesale company, which would play a critical role in the event of an emergency



- As a response, in March 2014, ANRE established “Affiliate Company BCP Ranking Committee” consisting of external knowledgeable persons, and examined each company’s Affiliate Company BCP by the committee members interviewing the company representatives. This occasion’s examination was the first attempt and was placed as a “trial”, where examination was carried out focusing on “support system by the whole company instead of solely by the disaster management division”, “feasibility”, etc., not on “quality as a document”.
- This occasion’s ranking was considered as a “trial”, where BCPs were evaluated into three grades (“Excellent”, “Good”, and “Fail”) for a maximum of 18 “individual items” (number of items varies depending on the business form of the company). Overall assessment was then given to each company based on the total number of “Excellent”, “Good” and “Fail”. While there were some companies with many outstanding activities (“Excellent”), a majority of companies were limited to ordinary activities (“Good”). The level of BCPs needs to be raised for the entire industry. Companies that participated in formulation of Affiliate Company BCP are expected to further improve their emergency response measures, by reviewing the issues of their own BCPs that were identified during the examination process. These activities should be continued to contribute to raising the level of BCPs for the entire industry.

Distribution of comprehensive evaluation scores

評価ランク	条件	会社数
A	個別項目の評価のうち、「優良」が5割以上を占め、かつ「不可」がない。	0社（該当なし）
B＋	個別項目の評価のうち、「優良」が5割未満だが一つ以上あり、かつ「不可」がない。	5社
B	個別項目の評価が「良」のみ。	1社
C	個別項目の評価のうち、一つでも「不可」がある。	2社

Distribution of individual evaluation scores

	「優良」の項目数	「良」の項目数	「不可」の項目数	
a社	8	10	0	
b社	7	11	0	
c社	2	16	0	B+
d社	2	16	0	
e社	1	16	0	
f社	0	15	0	B
g社	0	17	1	
h社	0	10	3	C

Outline of “Affiliate Company BCP” examination

[Evaluation results of main individual items]

(1) Supply recovery target

For the “target time” required for restoring functions to receive/ship gasoline etc. at oil refineries (example: recover to 50% of shipping quantity at ordinary times within 48 hours), two companies assessed “Excellent” were setting future “step-taken case (ideal state)” with clearly recognizing the expected time under “as-is case (current state)”.

(2) Head office functions

While three companies assessed “Excellent” had already established alternative head office functions (e.g., business continuation at the second head office) in case of difficulties in business continuation at the head office buildings due to long-term disruption of infrastructure or severing of communication networks, other companies required establishment of such systems urgently.

(3) Order reception and vehicle allocation functions

Two companies assessed “Excellent” had taken a redundancy measure for information systems (maintaining backups) that are required for tank truck allocation operation in response to orders for supplying gasoline etc. and a redundancy measure for business operation (e.g., building ability for switching to manual operations at alternative bases), and also had conducted verification of their effectiveness through exercises. While consideration was in progress at other companies, steps had not been established and acceleration of the whole process was required.

(4) Alternative supply function

While all companies had formulated basic response policies for increased production at local oil refineries or enhanced external procurement from other companies or overseas, there remained an issue of improving the effectiveness through detailed simulations and exercises.

(5) Early recovery function of oil refineries

It was identified that all companies had formulated disaster mitigation measures (measures to reduce disaster risks) assuming Tokyo Inland earthquakes or Nankai Trough earthquakes and were undertaking practical construction works with utilizing subsidy from the Japanese government. However, no company was found to have taken steps for accelerating the process of restoration after disasters (e.g., stockpiling of materials and equipment required for early recovery), which needs to be addressed in the future.

(6) Tank truck securement function

One company assessed “Excellent” had formulated specific measures for securing tank trucks in disasters, and had performed effectiveness verification (e.g., checking BCPs of associated carriers, prior consultation, joint exercise). The reliability of operation restoration at associated carriers should further be increased through reification and effectiveness verification of support systems for associated carriers etc.

(7) Sales support function for affiliate gas stands

All companies presented the policy for prioritized supply to disaster-tolerant affiliate gas stands including the Core Gas Stands. Two companies assessed “Excellent” were (1) a company who possessed a system that enabled summoning of support personnel immediately after occurrence of disasters (there was a past record of dispatching a large number of people) and (2) a company who designated support personnel from ordinary times and had transport methods available, regarding dispatching a sufficient number of support personnel to gas stands of affiliate groups located at disaster-hit areas. Among those assessed “Good”, there was a company who overly narrowed down gas stands as targets of support. Issue identification and effectiveness enhancement through simulations and exercises assuming large-scale wide-area damage will be required.

Cooperation with relevant ministries and municipalities, public-private cooperation, etc. for facilitating logistics of energy supply in disasters

- There will be various urgent tasks that need to be addressed for oil refiners and wholesales to smoothly supply oils to disaster-hit areas. Such tasks include early opening of sea routes and roads that connect to oil refineries and oil terminals (e.g., clearing of rubbles, recovery of passable conditions), identification of tank trucks as emergency traffic vehicles and issuance of special permit for using long/underwater tunnels, and cooperative transportation of filled oil drums to areas that are experiencing difficulty in refueling. Needless to say, cooperation among relevant ministries is essentially important in performing these tasks.
- Specifically, the Cabinet Office, Ministry of Internal Affairs and Communications, Fire and Disaster Management Agency, Ministry of Land, Infrastructure, Transport and Tourism, Ministry of Defense, National Police Agency, etc. should urgently establish a framework of cooperation based on the program of “National Resilience Policy Principles (decision by National Resilience Promotion Headquarters in December 2013)” etc., for the purpose of facilitating oil supply in disasters. The ministries and agencies should then work together in solving the issues like those shown in the figure below according to the framework. In so doing, it is necessary from ordinary times to tabulate and share among relevant parties the information of adjustments on various issues (e.g., management of actual working units, special application of regulations) that are required in disasters as well as the direction of such adjustments. It is also important for relevant parties to continuously undertake exercises pertaining to decision making and actual operation at the time of actual emergencies, based on the information shared.
- Additionally, oil refiners, wholesalers, gas stands, relevant ministries and municipalities should work together in continually undertaking practical exercises for the fields where cooperation among relevant organizations in disasters plays an important role. Such exercises include 1) exercise for the “Plan for Joint-Operations of Oil Supply in Disasters” based on the Oil Stockpiling Act and 2) joint exercise pertaining to fuel transport between ANRE/oil industry and the Ministry of Defense/Self-Defense Force (Joint Exercise Rescue (JXR), details are described below) which commenced in 2014.

Examples: Issues to be solved early on in cooperation with relevant ministries, agencies, and local governments

Early opening of sea routes and roads that connect to oil refineries and oil terminals

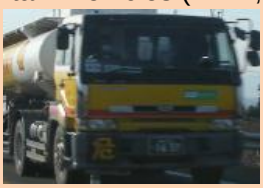
• Prioritized opening of sea routes and roads (rubble clearing, restoration) that connect to oil supply infrastructure (oil refineries, oil terminals) at disaster-hit areas (MLIT)

Cooperative oil transport to areas that are facing refueling difficulty

• Cooperative transport of filled oil drums to areas that are facing difficulty in refueling at gas stands (MOD)

Facilitation of traffic for tank trucks and railway vehicles

• Early sharing of traffic info in disasters (MLIT)
• Speeding-up of identification of tank trucks as emergency traffic vehicles (CAO, NPA)
• Special permit for tank trucks to use long/underwater tunnels (MLIT)
• Increased fuel transport by temporary railway tank vehicles (MLIT, JR)



Establishment of local oil supply environment

• Sharing of Core Gas Stand information (NRA)
• Establishment of a system for refueling cars, jerry cans, etc. from oil drums brought into disaster-hit areas (municipality, local society)

(Reference) Joint exercise on transport of oils between ANRE/oil industry and Ministry of Defense/Self-Defense Force

When the Great East Japan Earthquake occurred in March 2011, transportation of oils became difficult and many regions faced difficulty in refueling. Amid such situations, in response to a request from ANRE, the Self-Defense Force provided support on oil supply for consumer use by filling oil drums with light oils etc. and transporting them to disaster-hit areas. In so doing there emerged various adjustments that required addressing. At the same time, it was recognized anew that disasters to oil supply infrastructure could affect the securement of fuels by the Self-Defense Force required for conducting rescue operations.

Reflecting the lessons learnt from these experiences, ANRE and the Ministry of Defense have discussed measures against future crisis, and held the first practical joint exercise using an oil refinery (Sakai Refinery of COSMO OIL Co., Ltd.) in preparation of wide-area large-scale disasters. The aims of the exercise were (1) facilitation of oil supply to the Self-Defense Force engaged in rescue operations etc. and (2) strengthening of the system for cooperative transport of oils for consumer use by the Self-Defense Force. The exercise was conducted as part of “Heisei 26 Joint Exercise Rescue (26 JXR)” by the Ministry of Defense. (Note: “Heisei” is the present era name in Japan. Heisei 26 stands for year 2014.)

Specifically, the exercise was conducted on Thursday, June 5, 2014, using facilities at the Sakai Refinery of COSMO OIL Co., Ltd. located at Sakai, Osaka, assuming occurrence of Nankai Trough earthquakes. The main premise of the exercise was (1) efficient replenishment of fuels required for the Self-Defense Force to carry out rescue operations, and (2) alternative transport of oils for consumer use by the Self-Defense Force in place of disaster-hit oil refiners or wholesalers. Based on this approach, trucks of the Self-Defense Force entered the premises of a private oil refinery, and participated in exercise on the procedures of securing and shipping oils using the “drum filling facility” (*) of the oil refinery. The oil shipping procedure was established according to the exercise.

(*) Since its use in ordinary times is limed, ANRE is promoting establishment of such facilities at all oil refineries and main oil terminals as a subsidized project.

Loading oil-filled drums to a Self-Defense Force vehicle at the Sakai Refinery

(Picture: From website of COSMO OIL Co., Ltd.)

Placement of oil refiners and wholesalers in the Disaster Countermeasures Basic Act

- Different from electricity operators or gas operators, oil refiners and wholesalers are not designated as “designated public institutions” (lifeline operators) in the Disaster Countermeasures Basic Act. For that reason, no specific arrangements (e.g., “advance registration of tank trucks as emergency vehicles”, “permit for using the Central Disaster Management Radio Communications Network”) are made for their disaster relief activities.
- As a result, identification of tank trucks as emergency vehicles took time when the Great East Japan Earthquake hit Japan, and many tank trucks fell into a situation of not being able to reach the disaster-hit areas in a timely manner. For the purpose of removing such hindrances to oil refiners and wholesalers in exerting their prompt emergency management capability, relevant ministries should promote discussions on designated oil refiners and wholesalers as “designated public institutions”.

Benefits provided and obligations imposed to a petroleum refining and wholesale company designated as a "public institution"

Benefit	Obligation
* Access to the Central Disaster Management Radio Communications Network. Increased opportunity for sharing information with the Japanese government and other designated public institutions. * Advance registration of oil transporting vehicles (e.g., tank trucks) as emergency traffic vehicles (vehicles that are allowed to traffic immediately after occurrence of large-scale disasters (the first stage)). * Exemption from various procedures stipulated in the Environmental Impact Assessment Act for disaster recovery operations (e.g., consideration during the planning stage, determination of target business operations, determination of assessment methods, practice of assessment, hearing on assessment results).	* Formulation (*1) and disclosure of the "Disaster Management Operation Plan" for own business operations. * Practice of disaster emergency responses (to the necessary level) and necessary cooperative activities such as provision of documents and information, according to the instructions by the director-generals disaster control headquarters. * Practice of disaster prevention activities (*2), disaster emergency responses (*3), and disaster management activities. *1 It is stipulated that regional disaster management plans formulated by prefectural governments shall not interfere with the "Disaster Management Operation Plan" formulated by designated public institutions (Article 40). *2 Establishment and maintenance of the system, education and training, stockpiling, allocation, and inspection of commodities and materials, etc. *3 Sending out warnings and evacuation instruction, temporary repair/restoration of facilities and equipment, information gathering and reporting of disaster damage situations, etc.

Improving local disaster management capability

- The Petroleum Association (industrial organization of oil refiners and wholesalers) and prefectural governments etc. have been strengthening their cooperative relationship from ordinary times. Even when there was an emergency oil supply request sent from disaster-affected prefectures, if basic information (e.g., contact number, premises diagram, oil filler port of tanks, tank capacity) were not obtained in advance for important facilities that require delivery of oils, there may be a chance of hindering fuel supply for reasons like "Can't contact the facility", "Can't find the tanks", or "The pipe doesn't fit the oil filler port". The Petroleum Association had already concluded an agreement with the Tokyo metropolitan government before the Great East Japan Earthquake and has been sharing basic information of important facilities from ordinary times. After the Great East Japan Earthquake, the Petroleum Association concluded memorandums for sharing information of important facilities in disasters with other 24 prefectural governments and 3 governmental organizations, and in the process of accelerating the activity. It is anticipated that such activities will be continuously promoted in the future.

Status of Petroleum Association of Japan, prefectural governments and other institutions signing MOUs on sharing information about socially important facilities in the event of a disaster

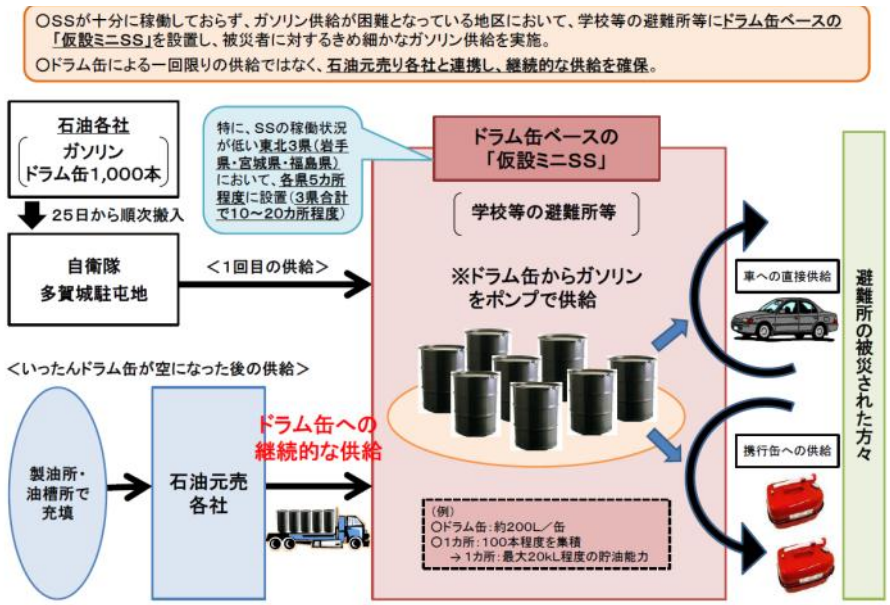
No	自治体名	覚書締結時期	No	自治体名	覚書締結時期	No	自治体名	覚書締結時期
※	東京都	2008年11月	10	鹿児島県	2013年3月	20	秋田県	2014年3月
1	埼玉県	2012年3月	11	京都府	2013年3月	21	鳥取県	2014年3月
2	山形県	2012年10月	12	大阪府	2013年3月	22	新潟県	2014年4月
3	群馬県	2012年11月	13	岩手県	2013年6月	23	富山県	2014年4月
4	青森県	2013年1月	14	北海道	2013年7月	24	茨城県	2014年4月
5	佐賀県	2013年2月	15	栃木県	2013年8月	政府機関		
6	和歌山県	2013年2月	16	徳島県	2013年10月	1	四国地整局	2013年3月
7	宮城県	2013年2月	17	広島県	2013年11月	2	九州地整局	2013年9月
8	神奈川県	2013年3月	18	千葉県	2014年11月	3	北陸地整局	2014年2月
9	静岡県	2013年3月	19	岡山県	2014年2月			

Source: Document prepared by the Petroleum Association

- Some local governments have commenced stockpiling of fuels on their own terms based on the various lessons learnt from the Great East Japan Earthquake.
  - The Tokyo metropolitan government has established a system to stock 2 kl each of gasoline and light oil at 122 Core Gas Stands in Tokyo for the purpose of supplying them to logistics vehicles inside Tokyo in emergencies.
  - Miyazaki Prefecture and some cities (Yokohama, Fujisawa, Hadano, and Ebina) of Kanagawa Prefecture are in the process of establishing private gas stands.
- Additionally, the number of prefectural governments who concluded a Disaster Fuel Supply Agreement with local Petroleum Commercial Unions is increasing. As of now, 42 out of 47 prefectures (approximately 90%) 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 gas stands 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 will promote municipalities’ activities in facilitating regional securement of fuel stocks in emergencies and strengthening cooperative relationship between prefectural governments and petroleum unions.
- Additionally, when the Great East Japan Earthquake occurred, some disaster-affected areas faced difficulty in supplying petrol specifically, because gas stands failed to operate properly due to tsunami damage or blackouts. At such areas, “temporary mini gas stands” were established by bringing oil filled drums to shelters etc. (e.g., schools) and oils were

supplied from such temporary gas stands. 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 gas stand sector, volunteer firefighters) as part of emergency drills hosted by local governments.

Filling fuel directly from drums in the wake of the Great East Japan Earthquake (conducted at a total of 10–20 locations in Three Tohoku Prefectures (Iwate, Miyagi, and Fukushima))




(Source: Iwate Nippo website)


(Source: NPO Neosu website)

- Training and exercise have been conducted for Core Gas Stands in all prefectures since 2013, supported by ANRE. Past activities mainly concentrated in training on the methods of avoiding confusions at gas stands in disasters. In order to make the exercise more practical, it is planned to operate private power generation facilities installed at Core Gas Stands during each exercise session in this fiscal year.
- Practical exercises through cooperation between Core Gas Stands and local governments have also been held in many areas.
  - Last fiscal year, the Tokyo Petroleum Commercial Union conducted an emergency communication exercise for Core Gas Stands in Tokyo as part of Tokyo metropolitan general emergency drills, in cooperation with the Tokyo metropolitan government.
  - At a Core Gas Stand in Akiruno City, an exercise on prioritized oil supply for emergency vehicles was conducted by using actual police vehicles.
  - The Gunma Petroleum Commercial Union also conducted a practical exercise on supplying fuel to police vehicles at Core Gas Stands, jointly with the Gunma prefectural government.

  Functions of Core Gas Stands will further be enhanced by continually conducting such disaster exercises etc. in the future.

Reviewing the relevant laws

- Regarding security on the temporary storage and handling of dangerous goods in accordance with the experiences from the Great East Japan Earthquake, the Fire and

Disaster Management Agency has held review meetings and arranged notifications and guidelines. However, there was a comment, for instance, pointing out the possibility of further expanding practical activities for oil supply using mobile storage tanks. Therefore, regarding adjustments of the said issue with relevant laws such as the Fire Service Act, inspection by relevant parties will be continued on the actual legislative issues that may arise in emergencies, taking into account the balance between the request for maintaining safety and request for disaster management.

Determining the necessity of "Push Type Supply" system in emergencies

- The "Plan for Joint Operations of Oil Supply in Disasters" based on the Oil Stockpiling Act is designed as a "Pull Type Supply" framework on the premise of support requests received from disaster-affected municipalities. Basically, disaster oil supply systems are "Pull Type Supply" systems that have been established based on the lessons learnt from the Great East Japan Earthquake.
- Meanwhile, there is a possibility of disaster-affected municipalities falling in a situation of not being able to gather information on the disaster situations or fuel needs, due to damage to the municipal facilities or personnel, complication of information, etc. Such a situation will most likely cause delays in support requests sent from the disaster-affected municipalities. Such cases can only be properly dealt by "Push Type Supply" systems that allow providing direct support to disaster-affected areas without receiving procurement request from disaster-affected municipalities. Therefore, the Japanese government is required to recognize the necessity of "Push Type Supply" systems, albeit extraordinary support system, and consider establishment of such systems, with undertaking activities to broadly gather information on the fuel demand and stocks at each region. The "Push Type Supply" systems should aim for supplying not only oils but also other relief supplies, from the viewpoint of simplifying the administrative and physical procedures in emergencies.
- However, petroleum is a dangerous substance and establishment of Push Type Supply systems will require careful legislative arrangements for the receiving, storing, maintaining, and supplying systems (e.g., temporary storage and handling of dangerous goods) compared to those required for other relief supplies. On top of that, there are other issues such as requirements for commencing support and management of payoffs; such issues will be closely discussed by relevant ministries and municipalities.

ii) LP gas

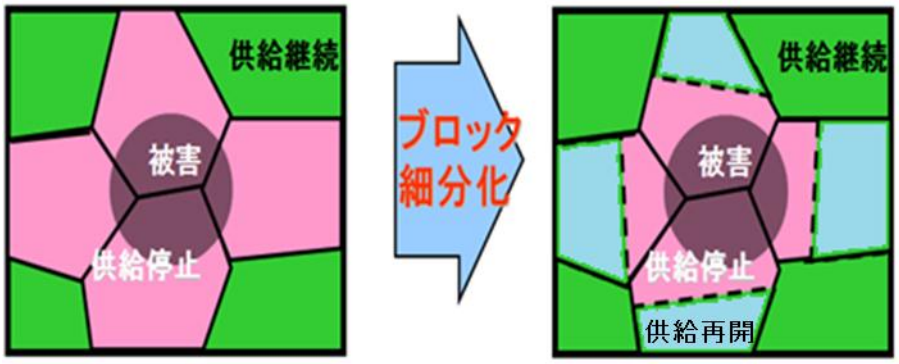
- While Core LP Gas Filling Stations have been actively established throughout Japan, their distribution is not even for some regions. Therefore, for the purpose of achieving appropriate placement and distribution of filling stations as a whole, the Japanese government will appeal business operators and filling stations located at areas with fewer Core LP Gas Filling Stations to participate in the project.
- Emergency drills for Core LP Gas Filling Stations based on the Plan for Joint-Operations of LPG Supply in Disasters should include hands-on exercises for the overall LP gas supply chains (from LP gas import bases, through Core LP Gas Filling Stations, to the end users) in addition to emergency communication exercises. Through such exercises, supply systems that property function in disasters will be established.
- Additionally, in order to maintain the effectiveness of supply systems, the following activities will be promoted, 1) further expansion and enrichment of disaster agreements between LP Gas Associations and municipalities (e.g., advance sharing of energy-related information with LP Gas Associations on important facilities etc. designated by municipalities), and 2) clear placement in the regional disaster management plan and in the National Resilience Regional Plan that is to be established in the future.
- Establishment of Core LP Gas Filling Stations, participation in the Plan for Joint-Operations of LPG Supply in Disasters, and activities toward enhancing disaster management capability (e.g., regional distribution of supply bases) have been conducted mainly by and

for major operators. The Japanese government will support the activities to make facilities of small-scale operators to function as supply bases, for instance by encouraging them to participate in the Plan for Joint Operations.

iii) Natural gas

Building the supply system that enables early recovery

- In case of disasters, it is important to prevent secondary disasters by promptly stopping the gas supply in disaster-hit areas as well as to minimize the areas where gas supply is stopped. To that end, gas operators have been establishing systems to divide the pipeline network into blocks and to separately stop gas supply for individual blocks. Subdivision of such blocks is considered effective to achieve earlier restoration of gas supply.



"Image of subdivided pipeline blocks"

- Additionally, regarding the criteria for stopping gas supply, the above-mentioned “report pertaining to future steps against earthquakes and tsunami by the Disaster Risk Management WG of Gas Safety Subcommittee, Urban Heat Energy Committee, Advisory Committee for Natural Resources and Energy” (March 2012) proposed revision of the criteria. In the report, a special condition for allowing continued supply was newly added to the primary emergency stop criteria, that is, “when damage to gas pipes etc. can be deemed minor for blocks where a seismograph recorded the SI value (seismic motion index) exceeding 60 kines (= 60 cm/s)”.

Enhancing the wide-area cooperative system in disasters

- For the purpose of activating wide-area cooperation in disasters, in 1968, JGA enacted “Outline of Disaster Relief Measures for Earthquakes and Flooding”. According to the Outline, if a business operator affected by a large-scale disaster is unable to conduct appropriate response activities by itself, GJA is to request other business operators to carry out disaster relief activities. Under this rule, a maximum of 3,700 persons per day was dispatched from a total of 155 business operators after the Great Hanshin-Awaji Earthquake and a maximum of 4,100 persons per day from a total of 58 business operators after the Great East Japan Earthquake, contributed to early resumption of gas supply in less than 2 months except for the most severely damaged areas. Efforts will be continuously made on enhancing wide-area cooperative systems.

5. Reconstruction of the business condition of industries which are responsible for supplying energy sustainably in Japan (details)

(1) Enhancing the international competitiveness of the oil industry and changes to Total Energy Solution Companies

In late years, the profitability of oil companies has remained sluggish. Domestic oil demands are predicted to further decrease in the future due to improved fuel efficiency and fuel source change in automobiles, population decline, and improved energy efficiency. The competitive environment of oil companies may become tougher if they remain focusing on the domestic oil product market, raising a concern over maintenance of stable oil supply in Japan such as 1) maintenance of the nationwide supply network and 2) maintenance of supply systems in disasters.

Avoidance of such situations will not only require improvement of the profitability through restructuring and efficiency improvement but also require promotion of direct investment or product export to growing markets and fields in Asia etc. and business expansion to highly profitable sectors such as upstream or petrochemical sectors. To achieve that, oil companies need to develop highly internationally competitive business base or investment capability. To that end, it has become essential to improve the profitability and to enhance the business strength including reorganization and unification of the oil business.

Needless to say these reformations are to be conducted by individual business operators on their own initiative decisions. The key to the success will be for the operators to search for a method to optimize the use of their business resources including human resources, by clarifying the business sectors that are highly affinitive to their own strength or business. However, taking into account the gravity of situation, there is no much time left for reformations and the Japanese government will promote taking necessary steps speedily. Additionally, mutual market entering by energy enterprises is expected to occur in the future due to progress in the reformation of electricity and gas systems. Therefore, the changeover of such companies into Total Energy Solution Companies through cultivation of new markets and formation of alliances with other energy enterprises may also be included in the whole picture.

In fact, regarding procurement of LP gas and natural gas, reorganization and cooperation among business operators have already been initiated for the purpose of enlarging the procurement scale and exerting stronger bargaining power in relation to the resource producing countries. It is expected that further advancement in the cooperative activities across the boundary of business operators will lead to obtainment of much stronger bargaining power, and will become one of triggers for forming new Total Energy Solution Companies.

i) Enhancing international competitiveness of refinery industry

1) The current situations and issues of oil refinery industry

- In the result report of a research conducted by ANRE (“Report of the Research of the Oil Refinery Market Structure” (based on the Article 50 of the Industrial Competitiveness Enhancement Act) (June 30, 2014), hereinafter referred to as “Article 50 Research”), the current situations and issues of the oil refinery industry are summarized as below[10].
- Japanese oil refiners have repeatedly undergone corporate reorganization, resulted in consolidation into 13 companies (8 groups) currently. Oil refineries were also consolidated into 23 sites through business restructuring (e.g., unification, closure, functional conversion).

[10] URL: http://www.meti.go.jp/committee/sougouenergy/shigen_nenryo/pdf/008_02_02.pdf

- While the oil refinery industry is a mammoth industry with the total sales[11] of approximately 25 trillion yen for the whole industry (FY2013 settlement), the total operating profit remains at approximately 149.1 billion yen (FY2013 settlement). The ratio of operating profit to sales[12] averaged over 13 companies[13] was approximately 0.7% (FY2013 settlement).[14] Especially in FY2013 there was a loss in the demand and supply balance of gasoline (note: gasoline accounts for over 50% of the shipment of oil products in the oil refinery industry (in 2012)) and the trend in domestic market became worse from the beginning of spring, resulted in major damage to the profits of oil refineries.
- The oil refinery industry is an industry that is expected to support the nationwide oil supply network in ordinary times and to function as the last resort of energy supply in disasters when there emerges disruption to supply of electricity and gas. Therefore, stabilization of the revenue base of oil refinery industry through improved international competitiveness is a significantly important issue which directly relates to the national energy security, beyond the benefits for individual companies.

List of Japanese oil refiners (as of the end of June 2014)

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	36.1%
	Kashima Oil Co., Ltd.	Kashima Refinery		
	Osaka International Refining Co., Ltd.	Osaka Refinery		
TonenGeneral Group	Tonen General Sekiyu K.K.	Kawasaki Refinery, Sakai Refinery, Wakayama Refinery	708,000	17.9%
	Kyokuto Petroleum Industries, Ltd.	Chiba Refinery		
Idemitsu Kosan Co., Ltd.		Hokkaido Refinery, Chiba Refinery/Plant, Aichi Refinery	555,000	14.1%
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	11.3%
	Showa Yokkaichi Sekiyu Co., Ltd.	Yokkaichi Refinery		
	Seibu Oil Co., Ltd	Yamaguchi Refinery		
Fuji Oil Company, Ltd.		Sodegaura Refinery	143,000	3.6%
Taiyo Oil Co., Ltd.		Shikoku Operations	118,000	3.0%
Nansei Sekiyu K.K.		Nishihara Refinery	100,000	2.5%

- Profits of oil refiners are influenced by the “sales amount” and “refining margin” of oil products (e.g., fuel for transporting such as gasoline and light oil). “Improving the refining margin” will become an important task for improving the profit of oil refiners in the future.

[11] Sales include petroleum-related taxes (e.g., petroleum and coal tax, gasoline tax).

[12] Crude oil cost accounts for approximately 90% of the manufacturing cost of oil products. Automatically, the ratio of operating profit to sales in the oil refinery industry is affected by the crude oil price. Therefore, evaluation of the ratio of operating profit to sales in the oil refinery industry requires to take account of the long-term upward trend in the crude oil price and to include the petroleum-related taxes in the sales amount.

[13] This is a simple average, in order to envisage the level of ratio of operating profit to sales regardless of the business scale of each company.

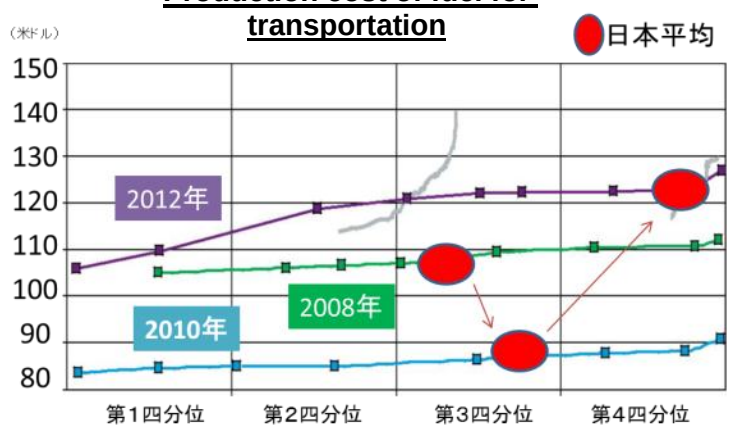
[14] The Industrial Competitiveness Enhancement Act uses ratio of operating profit to sales as an index for judging whether a specific industry type is in excessive supply or not. The oil refinery industry uses, albeit different among companies, the net D/E ratio, ROE, CCS combined ordinary profit, as management indices.

"Refining margin" is the difference between the "wholesale prices" and the "production cost" (including crude oil procurement cost) of oil products. Therefore, improvement of refining margin requires approach from both sides, namely, "reduction of production cost" through improved productivity of refineries and "optimization of wholesale prices". (Additionally, attention needs to be paid to the logistics and marketing network costs that incur after shipping oil products out of oil refineries.)

a) "Reduction of production cost" through improved productivity of refineries etc.

- In FY2013, ANRE entrusted the Japan Petroleum Energy Center in carrying out a research with the cooperation of and based on the framework of HSB Solomon Associates LLC (hereinafter referred to as "Solomon Research"[15]). According to the Solomon Research, Japanese oil refineries are classified higher (third quartile, fourth quartile) in terms of the transport fuel production cost, compared to oil refineries in other countries (Transport fuel production cost = (crude oil cost + operating cost – profit from byproducts) / (production quantity)). It is necessary to further promote various efforts including reduction of crude oil cost through strategic procurement of crude oils, reduction of operating cost through improved productivity of oil refineries, and increasing the profit from byproducts.

Production cost of fuel for transportation



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

b) Optimization of wholesale prices (price level, price formative function)

- Throughout FY2013, the indicator price used by oil refiners as a standard in determining wholesale prices was set lower than the actual market price. As a result, the refining cost could not be fully reflected on the wholesale prices. This is considered to be the cause of poor refining margin and thereby reduced profit for oil refiners.
- It is assumed that there were oil refiners who sold oil products at cheap prices amid the falling oil demand in Japan, by producing oil products with maintaining a high operation rate that was far beyond the actual demand.
- Some issues were pointed out to be the factors behind such activities, including "existence of excessive refining capacity" identified in the market and "failure of wholesale price formative function". It is essential to resolve these issues.
- According to the "Forecast of Oil Product Demand from FY2014 to FY2018" issued by ANRE, the domestic demand for each oil product is predicted to decrease due to factors such as (1) population decline and (2) improved fuel efficiency. Specifically, the demand is predicted to decrease by 1.6% per year, by 7.8% in total, over to FY2018.[16] Additionally,

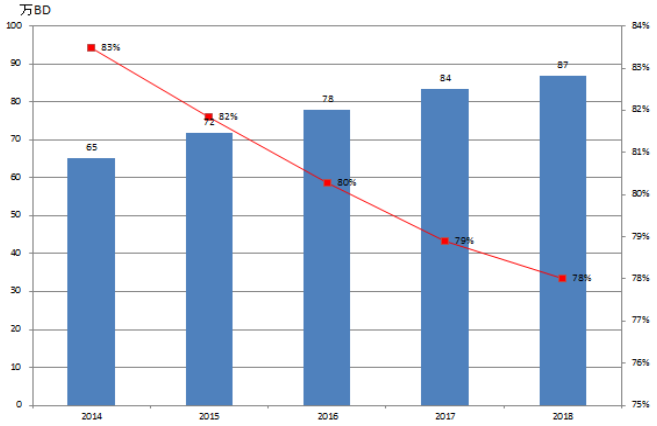
[15] "Report on International Comparison, Analysis, etc. of the Competitiveness of Japan's Oil Refinery Industry of FY2013": The framework of the HSB Solomon Associates LLC is one of various investigation methods, and therefore it has to be noted that the resultant opinions derived using the framework is merely one of various potential opinions.

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

while the demand for oil is predicted to increase for the whole Asia (i.e. the major destinations for exporting of oil products from Japanese oil refineries), the refining capacity in Asia has already exceeded the demand. The difference between the demand and refining capacity is expected to keep increasing in the future.

- If the current crude oil processing capacity of 3.95 million BD is maintained, the domestic demand-supply gap will become 0.78 million BD in FY2016 (facility operation rate is 80%). The gap will further widen to 0.87 million BD in FY2018 (facility operation rate is 78%), and the market will most likely become sluggish due to excessive refining capacity as experienced in FY2013.

Forecast of domestic demand-supply gap and operation rate (FY2014-FY2018)



（出所）2014年度～2018年度の「石油製品需要見通し」等より作成。需給ギャップは、精製能力と国内石油需要（燃料油）の差。
2018年度まで395万BD体制が維持されると仮定し、定期修理、輸出や輸入は考慮していない。

- Extending export of oil products to other Asian regions is potentially one of ways to narrow the demand-supply gap in Japan. However, the demand-supply gap is widening throughout Asia, and many refineries in Japan are not designed as exporting refineries and thus do not possess sufficient facilities etc. required for exporting. Therefore, it is unlikely for such refineries to increase the quantity of oil export without injecting large capital investment.
- Japan's refinery industry is currently in a state where the large domestic demand-supply gap is temporarily narrowed. It is expected that the domestic demand for oils will decrease and the excessive supply will become more common throughout Asian in the future. Amid such a situation, while some oil refineries with export competitiveness may extend its export business, in general, Japan's oil refinery industry is expected to again fall in the state of possessing major "excessive refining capacity" if the current refining capacity is maintained.

2) Tasks for improving the international competitiveness of oil refinery industry (from "Article 50 Research")

a) Improving the productivity of oil refineries

Resolving the excessive refining capacity (establishing production systems that match the actual demand)

- Oil refineries are required to maintain high facility operation rate and improve the profit, under a refining capacity that flexibly changes in accordance with given situations (e.g., reduction in the domestic oil demand, change in the overseas demand and supply environment) and matches the actual 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.

Optimizing facilities through integrated operation

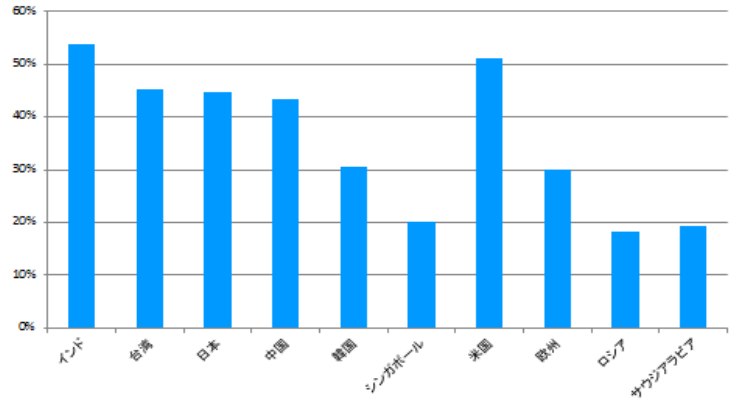
- In so doing it is required to promote major unification and integrated operation of oil refineries in and out of industrial complexes, instead of individual companies gradually reducing the refining capacity of refineries and as a result reducing the efficiency of the refineries. There are areas where oil refineries of multiple oil refiners are located in one industrial complex, and areas where multiple refineries are established individually yet close to each other. It will be required to promote various forms of business restructuring within an industrial complex or for adjacent regions, 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. Such activities will lead to overcoming the disadvantage of "economies of scale" that is caused by lower refining capacity per refinery.

Increasing added values (improving residual oil processing capacity, improving yield of petrochemical products etc.)

- Additionally, 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 is affected by the "Complexity" of the facility. One of indices of the complexity is the equip rate of "residual oil cracking units"[17] ("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.

[17] 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".

- 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.

Improving the operational reliability (facility maintenance) that supports high facility operation rate

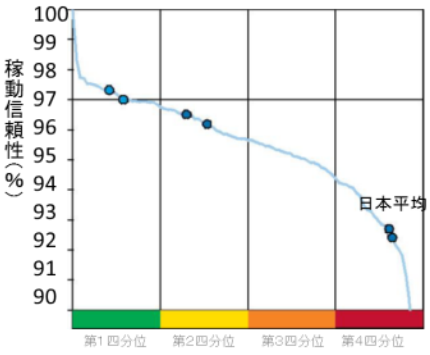
- It is said that Japan's oil refineries have issues in the "operation rate" to take advantage of the "complexity" of the facility and in the "operational reliability" that supports the operation rate. Generally speaking, higher operation rate of oil refineries results in lower fixed cost per product unit and lower operating cost. However, the facility operation rate of Japanese oil refineries is at a poor level on a global scale.[18]
- In order to maintain high facility operation, the period of facility outage due to facility malfunctioning or unplanned repairs needs to be shortened. In other words, the "operational reliability"[19] of the facility needs to be improved. Among medium-scale oil refinery groups (the scale of approximately 100,000-250,000 BD) in the world, the highest ranked groups exhibited the operational reliability of approximately 97%. Meanwhile, the operational reliability of Japan's oil refineries was pointed out to be as low as 92.7%.
- 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 region. It has been pointed out that the outage period of Japanese oil refineries is relatively long for any and every cause, including regular repairs, irregular repairs, and process halting.[20] It will be required to promote improving the efficiency of maintenance costs as well as sufficient facility maintenance that supports stable operation, in addition to consideration on legal regulations. 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.

[18] 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 86.6% 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)

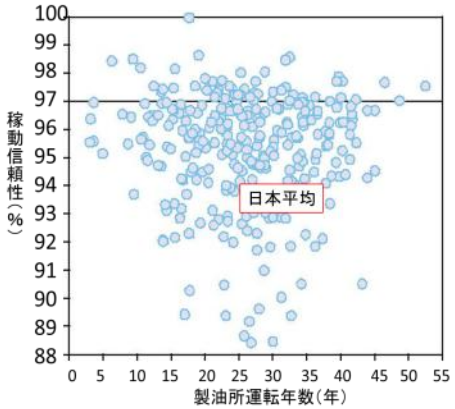
[19] An index that exhibits the operability of each equipment at oil refineries within the year. For instance, if the "operational reliability" is 90%, the refinery was in an operable state for 328.5 days and in an inoperable state for 36.5 days in the year.

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

Distribution of operational reliability indexes



Relationship between refineries' service years and operational reliability indexes

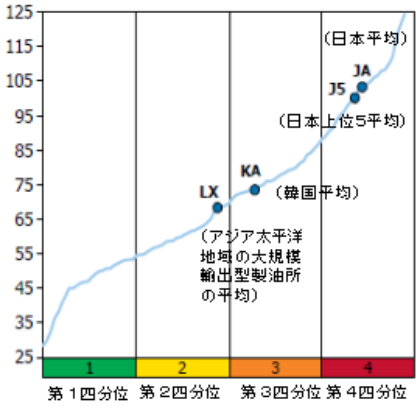


Source: “Report on International Comparison, Analysis, etc. of the Competitiveness of Japan’s Oil Refinery Industry”

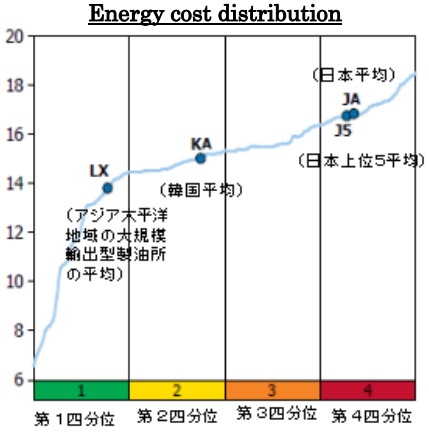
Improving the energy efficiency

- 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 out 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 the operation frequency of heating furnaces, and fuel use for generating steam is also having a negative influence. Steps to improve the energy efficiency should be taken, including communization of utility facilities within industrial complexes.

Operating cost distribution



Energy cost distribution



〈出所〉「我が国石油精製業の競争力の国際比較・分析等に関する調査報告書」より

b) Strategic procurement of crude oil

- Considering the high percentage of crude oil price in the fuel production cost, 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. Such efforts will also contribute to improving the productivity of oil refineries as described in **a)** above.

c) Building a fair and transparent pricing mechanism etc.

- Oil refiners have adopted the “market-linked pricing system” where spot trading prices etc. are used as indices. Price indicator is an important public function 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 levels of stocks). One of future tasks is to build an 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 network that lay beyond shipping of oil products out of oil refineries, with paying attention to maintenance of the nationwide sustainable oil supply systems.

d) Growing 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 refiners will likely face further difficulties in gaining stable profits only from the domestic oil product market, if the current situation persists. Therefore, from now on, strategic activities to transform oil refineries into international "Total Energy Solution Companies" will be needed. Such activities include expansion and enrichment of 1) upstream business (resource development business for oil, natural gas, metal ores, etc.), 2) highly liberalized domestic electricity and gas business, and 3) overseas oil refinery and petrochemical business.
- In order to allocate enough operating resources to such future growth strategies, it is essential to establish sustainably profiting 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.

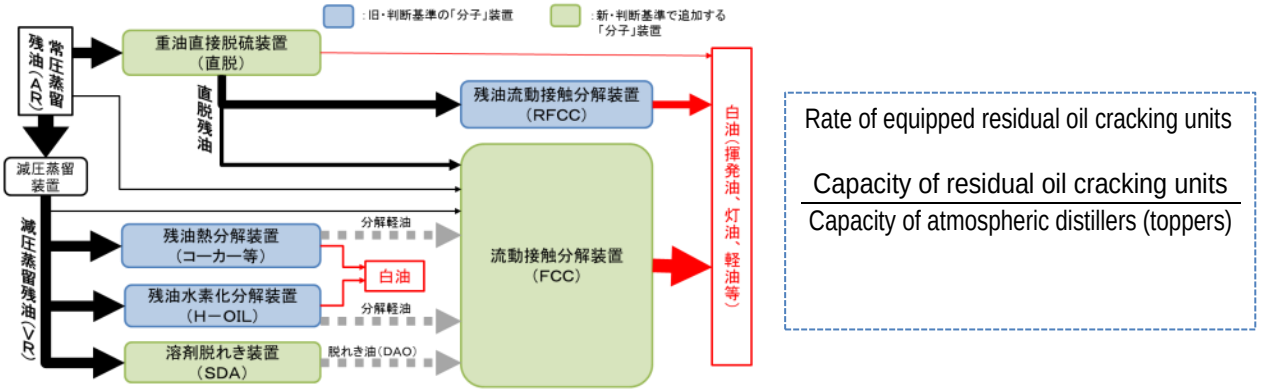
3) Activities to be promoted for improving the international competitiveness of refinery industry

Bearing **2)** above in mind, additional activities to be promoted for improving the international competitiveness of the oil refinery industry are described below.

(a) Formulating and implementing the new standard (Notification) of the Act on the Promotion of Development and Introduction of Alternative Energy

- The new standard (Notification) that encourages oil refiners to practice effective use of crude oils etc. based on the "Act on the Promotion of Development and Introduction of Alternative Energy" should be formulated on the basis of the following directionalities.
- The new standard (Notification) should aim at improving the rate of equipped "residual oil cracking units" (ratio of the capacity of residual oil cracking units to that of atmospheric distillers), for the purpose of promoting "effective use of crude oils etc. (i.e. extracting many clean oil products per crude oil unit)", while conforming to the changes in business environment (e.g., crude oil market) that occurred since the implementation of old standard (Notification).

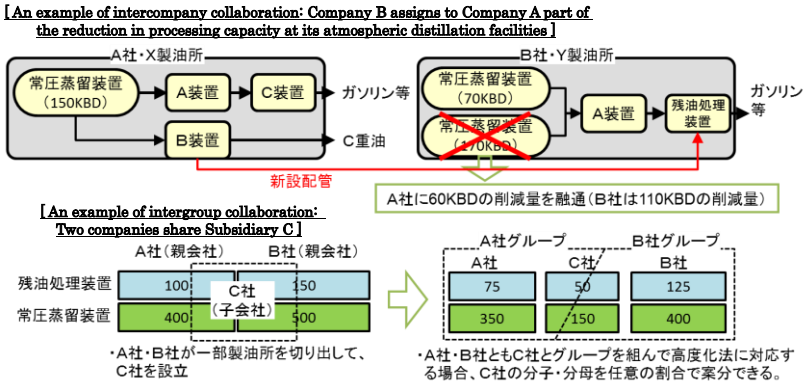
Flow of residual oil in refining process



Rate of equipped residual oil cracking units

$$\frac{\text{Capacity of residual oil cracking units}}{\text{Capacity of atmospheric distillers (toppers)}}$$

- “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).
- The rate of equipped residual oil cracking units for the entire Japanese oil refinery industry is approximately 45% as of March 31, 2014. It is considered appropriate to aim for raising the equip rate to about 50% taking into account the predicted future demand, and to assign individual improvement target to each business operator accordingly. 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 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.
- While the target completion date is set to be March 31, 2017, oil refiners should conduct activities (including staged activities) to reach the goal as early as possible. Oil refiners should be required to formulate and submit 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. Oil refiners should be required to review the contents of the plan as necessary, and to periodically report the state of activities and status of achievement to the Minister of Economy, Trade and Industry in regard to facility optimization.
- Oil refiners will 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 1) practical effects in improving “effective use of crude oils etc.” and 2) sustainable supply of oil, through establishment of “flexible production systems” (e.g., production switching system for oil products and petrochemical products), should be newly added as requirements. Regarding “reducing the denominator” (reduction of the number of atmospheric distillers), reviews in accordance with the current state of refinery management (e.g., reduction of the nominal capacity) should be carried out.
- Additionally, it is expected that oil refiners are to 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 new standard (Notification) should introduce 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 regional 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.



(b) Promoting facility maintenance measures toward improved operational reliability of the facility

- ANRE has conducted on-site investigations (Causal Analysis of Accidents at Refineries in Japan) to 5 randomly selected oil refineries during the period from December 2012 to March 2013. Comprehensive measures to resolve the issues identified in the investigations should be progressively taken under public-private cooperation, for the purpose of preventing industrial accidents and improving the operation reliability that is essential for improving the productivity of oil refineries.

a) Issues with facility management (e.g., management decisions, limitation in testing techniques)

- Oil refiners 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 continued 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 corrosions” 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.

b) Issues with utilizing information or preceding cases (e.g., utilization of data on 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 dairy 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 technical 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.

c) Issues with HRD system

- In the future, generations with no experiences in “establishing or launching oil refineries” and little experiences 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 refiners should divert themselves from the past HRD methods, and should consider and promote support using advanced technologies, such as introduction of plant simulators that uses conditions similar to actual machines and introduction of IT-based operation support tools.

(c) Promoting technical development

- In late years, the Japanese government has promoted various commissioned and subsidized projects for the purpose of providing support to R&D in the petroleum industry. Such projects include, (1) technical development for cooperating with other refineries in the industrial complex or with different types of industries (Refinery Integration for Group-Operation (RING)), (2) development of technologies for advanced oil refining process (measures for heavy crude oils and unconventional crude oils, such as petroleomics[21]), and (3) development of hydrogen supply technologies for fuel cells.
- From now, the public sector and the private sector have to work together in narrowing down the priority subjects and promoting technical development for selected subjects, especially for the perspectives of (1) “noble use of oil” such as improving the yield of high added value products per crude oil unit, (2) improvement of “operational reliability” that supports sustained high operation rate of facilities, and (3) development of the “strength” in expanding oil refinery business to Asian countries in the future. Technical development has been focused on petroleomics to date through a basic technology development project, which is going to be completed in FY2015. Once the project completes, outcome verification and summarization of the petroleomics R&D are to be conducted. At the same time, discussion on the future R&D field that is to be promoted through public-private cooperation needs to be commenced, including cooperation with relevant industries such as the automobile industry, based on comprehensive consideration on the future business strategy and technical development strategy of oil refiners.
- Petroleomics has a potential to become an innovative base technology in the future. Future development of petroleomics will require accumulation of “small results” and “useful results” that meet the operation strategy of oil companies or needs of 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.

4) International expansion of LP gas industry

- Some LP gas operators, albeit small in number, are conducting business operations with envisaging overseas business expansion.
- Similar to oils, no major increase in mid- to long-term domestic demand is expected for LP gas. Amid such a situation, it has a significant meaning for gas operators to utilize the technologies and business know-how they developed to date in expanding their business overseas.
- In recent years, interest in products made by Japanese LP gas equipment manufacturers is increasing in emerging countries especially those in 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.

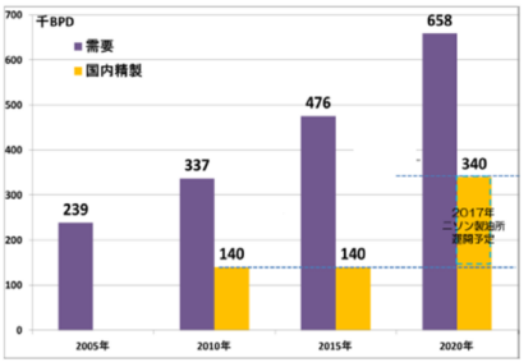
[21] Petroleomics is a methodology to analyze and predict the reactions of crude oils in the refining process through molecular-level structural analysis of the oils. Oil refining technology is a technology that have been developed on empirical knowledge without undergoing molecular-level analysis or reaction prediction of the raw material (crude oil). By adding objective analysis and theory to the empirical oil refining technology, the existing facilities may be technically advanced in a short period of time without requiring large-scale capital investment.

- For instance, there is a possibility for developing a package business from supply of LP gas to implementation of cogeneration systems, as a service to provide distributed energy sources at non-electrified regions of emerging Asian countries.
- In the future, information will be gathered on the maintenance regulations and the actual conditions of LP gas equipment and LP gas safety devices in such countries, and discussion will be held among the private and public sectors including ideal regulations in the relevant countries. Additionally, Japan's LP gas equipment and LP gas safety devices will be promoted in international conferences on LP gas, etc. Through such activities, international expansion of the Japanese LP gas industry will be promoted.

ii) Becoming Total Energy Solution Companies

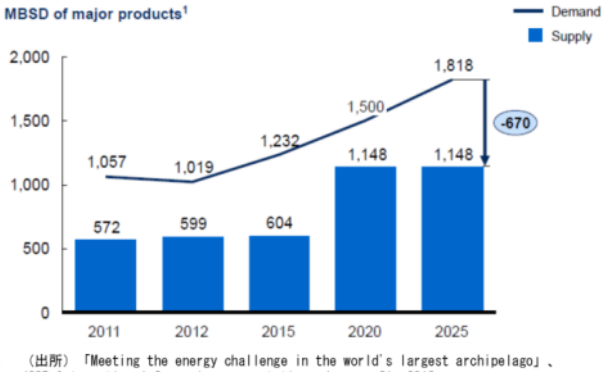
- It will become difficult in the future for oil refiners to picture growth strategies through domestic oil business only. Therefore, strategies for them to grow into international "Total Energy Solution Companies" will be needed, by cultivating upstream business (resource development), expanding mid-reach and downstream business (oil refinery, sales, petrochemical) at local areas in Asian countries, and developing highly liberalized domestic electricity and gas business further.
- While the excess in oil supply capability is predicted to extend in Asia as a whole, the oil demand and supply environment is different from country to country. There are countries who are expected to have high demand on new or additional construction of oil refineries, such as Vietnam and Indonesia. 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 soon 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.

Forecasted demand for oil products in Vietnam



（出所：出光興産株資料より資源エネルギー庁作成）

Forecasted demand for oil products in Indonesia



（出所）「Meeting the energy challenge in the world's largest archipelago」、JCCP International Symposium presentation, January 31, 2013

- Direct investment for expanding the mid-reach and 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 least developed countries (e.g., Myanmar), it will be valuable 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 gas stands as well as formulation of necessary legal regulations), instead of restricting themselves to individual participation in refinery building projects. It will also become important to make efforts in facilitating project financing from the project implementation stage, for the purpose of smoothly carrying out the projects.
- Additionally, in regard to direct investment into countries with resources, it has to be noted that the upstream sector is not receiving much attention from Japanese oil refiners in terms

of investment. Therefore, it is desirable to extend participation of Japanese oil refiners 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.

- As pointed out by the Article 50 Research, oil refiners are expected to actively undertake business restructuring etc. beyond the “capital boundary” or “geographic boundary” in order to promote the activities above. While it goes without saying that such business restructuring etc. of oil refiners is 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. made by oil business operators.

(2) Oil retail businesses as entities responsible for local life and economy

Current situations around the oil retail business

- The oil retail business is responsible for the endpoint supply of oil products to users at the forefront of oil supply chain, and plays an important role in stable supply of oil products.
- However, the environment of oil retrial business is becoming severer. One of major causes is the trend of reduced sales amount, which automatically translates into reduced profits. Oil retailers are now required to repair their underground tanks, as stipulated in the amended Fire Service Act, which is incurring extra cost. Furthermore, there exist individual issues such as facility deterioration and lack of successors.
- Partially due to such issues, the number of oil retailers is continuously decreasing. While the number of gas stands was approximately 60,000 in FY1994, it was reduced down to approximately 35,000 in FY2013.

Market structure that directly affects oil retailers

- Since the crude oil price has been increasing and remaining high, the retail price of gasoline is transitioning in an upward trend since 2009. Currently, the crude oil cost is accounted for approximately 40% of the retail gasoline price, and tax component (e.g., gasoline tax) for approximately 40%. These two elements are accounted for more than 80% of retail gasoline price (approximately 80% for light oils, and approximately 75% for kerosene), and refinery business and distribution business are trying to secure profits from the remaining limited margin.
- Oil companies play important roles in stable oil supply, and it is essentially important for them to continue their business amid the situation of assumedly reducing domestic demand for oil products. To achieve that, appropriate level of margin needs to be secured for maintaining and improving the profitability of the entire industry, 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. Securement of appropriate margin will enable making necessary reinvestment as well.

Direction of response by oil retail business

- Amid such a severe situation, the oil retail business is required to undertake various activities to secure appropriate level of margin through subjective business judgment, taking into account the current situation and future outlook. Such activities may include, 1) rationalization of distribution (e.g., communization of kerosene delivery), 2) investment that contributes to saving energy etc. for ensuring business continuity of gas stands, 3) business judgment based on verification of advantages and disadvantages of affiliate trading (trading between affiliate companies) or non-affiliate trading (trading between

non-affiliate companies), and 4) enhancement of communication with wholesalers for improving the clarity of prices and the actual status of distribution.

- Meanwhile, some gas stands are receiving stronger requests for continued business from locals, as fuel suppliers that supports local communities. Various activities are carried out for such gas stands, including 1) provision of a variety of services related to automobiles, 2) installation of recharging stands for electric vehicles, 3) joint establishment with grocery stores and post offices at underpopulated areas, and 4) utilization as bases of regional revitalization projects through cooperation with municipalities.
- Additionally, many oil retailers are already dealing with LP gas retail business, and some retailers are engaged in activities such as sales of solar power systems and participation in power generation business. For taking responsibility in supplying energy in local areas, it is also expected for them to consider forming alliance with other energy businesses that are unrelated to oil products, for instance, at underpopulated areas.
- Oil retail business has the strength in having a direct connection with users. Therefore, one measure to stabilize the business base of oil retailers is to pursue the roles in supporting the local infrastructure, with understanding the consumer needs in each area.
- At areas where gas stands are in short supply, more locals have become aware that functions of gas stands are essential for the local community. While gas stands are required to proactively make business efforts to reply to the requests by locals, local residents and governments also have to work together in supporting continued operation of gas stands as an Essential Infrastructure for Local Communities. The Japanese government is required to establish frameworks that assist such local activities.

<u>Possibility of new business (ideal hydrogen supply system)</u>

- Toward realization of a hydrogen community in the future, the “Strategic Road Map for Hydrogen and Fuel Cells” (June 2014, Council for a Strategy for Hydrogen and Fuel Cells, formulated based on the “Strategic Energy Plan”) stated a target, “Establish approximately 100 hydrogen supplying sites within FY2015, mainly at the four metropolitan areas”.
- The cost for establishing a hydrogen station currently is approximately 400-500 million yen, which is significantly higher than the cost for establishing a general gas stand at less than 100 million yen. The operation cost of hydrogen stations is also known to be high. Additionally, while fuel cell cars are planned to be placed into the market in FY2014, the operation rate of hydrogen stations will remain low during the initial stage where not many people use fuel cell cars. For that reason, it is currently not easy for oil retailers to participate in the hydrogen station operation business, especially for medium- and small-sized companies who make up the majority of oil retailers.
- The above Road Map proposed various measures against these issues pertaining to establishment and operation of hydrogen stations, including 1) review of regulations related to hydrogen stations, 2) specification establishment and technical development of hydrogen stations with the scale that is appropriate for the adoption rate of fuel cell vehicles, 3) proactive utilization of space-saving and low-cost package-type hydrogen stations or mobile hydrogen stations, and 4) use of fuel cell buses at the Tokyo Olympics and Paralympics that will be held in 2020.
- The role of oil retailers in the coming hydrogen society will be discussed in the future from the mid- to long-term viewpoint, taking into account the progress of such measures and the adoption rate of fuel cell vehicles.

<u>Measures against gas stand shortage</u>

- As described above, the number of gas stands in Japan is continuously decreasing since 1994. Accordingly, the number of municipalities with no greater than 3 gas stands is increasing every year, and has reached 265 as of the end of March 2014. As a result, the “issue of areas where gas stands are in short supply” has become actualized, where people are experiencing difficulties in purchasing gasoline for cars or diesel for farming

equipment or in delivery of kerosene for elderly people in winter. The majority of such areas are underpopulated areas specified in the Act on Special Measures for Promotion for Independence for Underpopulated Areas (Underpopulation Act).

- In such areas where the structural problem of oil product market is becoming serious, there emerged cases where local residents or governments proactively conduct activities for maintaining gas stands for the purpose of protecting the gas stands as the infrastructure of local life and economy, in response to withdrawal of private business operators or JA (Japan Agricultural Cooperatives).[22]
- ANRE has conducted demonstration projects over three years from FY2011 to FY2013, in order to establish a supply system at areas where gas stands are in short supply that meets the actual circumstances of each area. The projects identified the directionality of activities such as converting gas stands 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 gas stands.
- Based on these findings, in FY2014, the rate of subsidy for replacing underground tanks at gas stands or for installing simple meters corresponding to the demand trend was increased, for cases where cooperation between oil retailers and local governments is identified (e.g., placing the measures for maintaining stable supply of oil products in the municipal plans based on the Underpopulation Act). This is a conversion of framework; in the previous framework the Japanese government was the sole provider of support for gas stands, while in a new framework local public organizations engage in providing support for gas stands and the Japanese government provides assistance for maintaining functions of gas stands deemed necessary by the locals.
- There are comments stating that some business operators are requesting partial revision of regulations if they meet certain requirements, for the purpose of reducing operating cost of gas stands in underpopulated areas. If there are cases where the current regulations hinder activities to rationalize delivery or operating cost reduction of gas stands in underpopulated areas, the possibility of taking necessary measures will be discussed by relevant parties, including discussion on details of the requirements.
- In order to maintain the functions of gas stands in areas where gas stands are in short supply, it is essential for the relevant parties to have the common awareness on the necessity of gas stands, 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 will make efforts in inducing commitment of local people and in providing support for strengthening the business base of gas stands 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 business operators.

<u>Supporting isolated islands</u>

- While oil products are important sources of energy, their prices are expensive in isolated

[22] Cases where municipalities proactively operate gas stands

- At Toyone, Aichi, the village purchased a gas stand immediately after it was closed, and commissioned a third-sector company to manage it as one of village-managed businesses.
- At Shichikashuku, Miyagi, the town received a gas stand (which was planned to be closed) free of charge, and lent it to an automobile maintenance company free of charge.

Cases where municipalities subsidize business operators

- At Hinoemata, Fukushima, the village grants a fixed-amount subsidy (around 12 million yen per year) for gasoline and kerosene at the request of villagers.
- Local residents operate gas stands on their own initiative at Minakami (Gunma), Yasuoka (Nagano), Achi (Nagano), Koga (Shiga), Kamikawa (Hyogo), Tsuyama (Okayama), Maniwa (Okayama), Akitakata (Hiroshima), Shimanto (Kochi), and Yusuhara (Kochi).

islands due to extra costs (e.g., transport cost) added on. Reduction of oil prices and establishment of stable supply systems for isolated islands are ongoing issues to be resolved. The Japanese government will continue to grant appropriate and certain level of subsidies equivalent to the transport cost, depending on the actual state of isolated islands. Additionally, in order to gather information on the actual state of each isolated island, the Japanese government will encourage relevant parties (e.g., retailers, users, local governments) to actively engage in issue identification and discussion and practice of detailed steps for each area and island.

Utilizing the LP gas supply network

- It is understandable that enterprises are hesitant to put new business investment into depopulating areas including areas with advanced depopulation.
- Meanwhile, approximately 24 million households (slightly less than 50% of all households) use LP gas in Japan, and the LP gas supply chain has already spread throughout the nation including semi-mountainous areas in the form of transport of gas cylinders. Use of these existing infrastructure and supply chains will reduce the initial investment for new business. Additionally, as described above, LP gas is useful not only in ordinary times but also in emergencies for its high portability and storability.
- Development of business that meets the local needs by utilizing the supply network and advantages of LP gas will lead to strengthening of the business base for LP gas retailers.
- For instance, there are cases of local governments utilizing a LP gas central monitoring system (which is introduced in many places for improving the security etc.) in the local society as a system of elderly monitoring service. Efforts will be made in the future to further promote cooperative relationships between retailers and municipalities.

(3) Forming a fair and transparent market (establishment of fair and transparent price formative mechanism etc.)

i) Improving transparency of the oil distribution structure and setting fair trading conditions

Importance of forming a fair and transparent market

- 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. There have been voices raised requesting improvements in pricing issues, including 1) the gap in wholesale prices crippling the price competitiveness of affiliate gas stands, and 2) non-transparency of the calculation basis related to wholesale prices and sale-related cost proposed by wholesalers to affiliate gas stands. There also is a comment stating that the presence of subsidiaries of wholesalers in the market is increasing in late years and the competition within affiliate companies has also become severe. Such issues can be effectively resolved by improving the transparency of the actual state of distribution and prices in trading and thereby realizing fairer trading structure, which should be promoted through cooperation and collaboration of oil 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.

The current situations and issues of affiliate trading and non-affiliate trading

- Sales of gasoline by general special agent retailers used to account for a large majority of domestic sales, but has fallen below 60% in FY2012. Meanwhile, sales by gas stands of subsidiaries of wholesalers has increased to approximately 20%, and sales by trading companies has increased to approximately 15%.
- There have been voices raised from affiliate gas stands of wholesalers, stating 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*[23] 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, the Japanese government has been conducting quarterly hearing from wholesalers since July 2013, for the purpose of identifying the actual distribution status of non-affiliate trading. It was found that in general the gap in the wholesale prices between affiliate trading and non-affiliate trading widened from the middle of year 2013 (from 3.7 yen/l in June 2013 to 4.9 yen/l in September 2013), yet then it has been in a trend of narrowing down (3.6 yen/l as of March 2014). Accordingly, the percentage of shipping amount for non-affiliate companies in the total shipping amount is

[23] Gyoutengyoku (Gyoushakan Tenbai Gyoku): Inter-supplier resale oil products. Refers to gasoline that circulates through non-affiliated routes.

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 acts that may violate the Anti-Monopoly Act (Act on Prohibition of Private Monopolization and Maintenance of Fair Trade) like sudden and one-sided suspension of trading or raising of wholesale prices to affiliated special agent retailers simply because they handled cheap *Gyoutengyoku*.

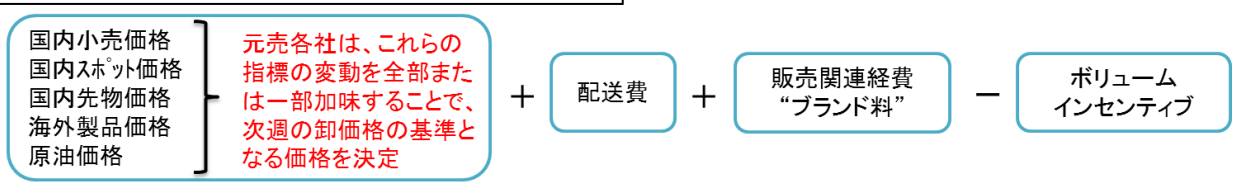
Implementing the Certificates of Oil Products Distribution

- Distribution of oil products involves with multiple layers of trading from wholesalers to finally be sold to the consumers at gas stands. Usually trading individually completes by itself 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)[24] 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, and COPD was officially implemented in April 2014 as a voluntary initiative of the oil industry. Through COPD, gas stands 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 the future, the adoption rate of COPD and its effects will be verified by relevant parties, and the system will be reviewed as necessary.

Revising the mechanism for deciding wholesale prices

- From October 2008 onward, wholesalers changed the mechanism for deciding wholesale prices to a market-linked pricing system. However, in 2013, the market-linked pricing system did not properly reflect the increase in crude oil prices on the spot prices (which was the practical indicator on deciding wholesale prices), and there arose a concern over the propriety of spot prices 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 in the market-linked pricing system is inherited, the mechanism will now observe various indicators including domestic retail prices, spot prices, overseas oil prices, and crude oil prices, instead of relying solely on the domestic spot prices.

Image of a new wholesale pricing system



（出所）石油元売8社に対するヒアリングから資源エネルギー庁作成

- Such changes of the mechanism for deciding wholesale prices require recognition

[24] COPD aims at securing the transparency on distribution (commercial and physical distribution) of oil products, by enabling gas stands to clearly identify the commercial and physical distribution (from the shipment out of oil refiners or oil terminals to the delivery to the gas stands) of gasoline they procured.

sharing among special agent retailers and general retailers as well as ensuring the predictability of wholesale prices (e.g., setting and implementation of standard prices to prevent ex-post price adjustment). Furthermore, in regard to indicators that are referred on deciding the standard prices of wholesale prices, activities to improve their reliability will be required after overcoming the issues each indicator possesses.

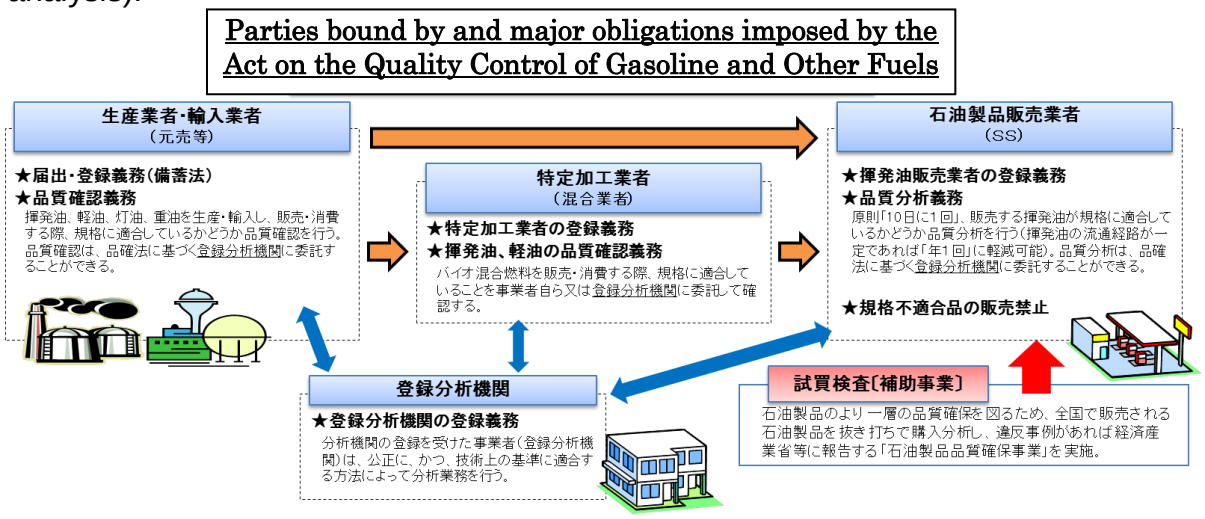
Cooperation and collaboration between oil wholesalers and oil retailers

- Above mentioned steps for establishing a fair and transparent market essentially requires cooperation and collaboration between oil wholesalers and oil retailers. It will be required for relevant parties to maintain close communication and continuously engage in activities for resolving various issues of the oil industry pertaining to the distribution of gasoline, such as maintenance of fair competitive environment.

ii) Activities toward quality assurance of oil products

Activities related to the current quality assurance of oil products

- Regarding quality assurance of oil products, the “Act on the Quality Control of Gasoline and Other Fuels (hereinafter referred to as QC Act)” stipulates the quality standards for gasoline, light oils, kerosene and heavy oils, and enforces (1) prohibition of sales of gasoline, light oils, kerosene, or heavy oils that do not conform to the quality standards, (2) obligation to check the quality by producers and importers, (3) obligation to register and analyze the quality by volatile oil retailers, and (4) obligation to register and check the quality by mixers (e.g., operators who sell gasoline, light oils, etc. after mixing bio fuels into them).
- Various inspective activities are carried out based on the QC Act, including confirmation of sales of gasoline etc. with appropriate quality, on-the-spot inspection for the purpose of protecting the consumer benefits, and test screening (unannounced purchase and analysis).



System of specific processing under the QC Act

- Obligation to register and check the quality by operators who sell gasoline, light oils, etc. after mixing bio fuels into them (system of specific processing) was implemented in 2009. For 5 years since the implementation, the present system is functioning effectively through guidance via test screening and on-the-spot inspections, since there has been no operators identified to be engaged in repeated violation of the quality standards. According to questionnaires to specified processors, the processors generally understand the necessity of the current system for protecting the consumers. Therefore, regarding the system of specific processing, it is important to appropriately keep operating the

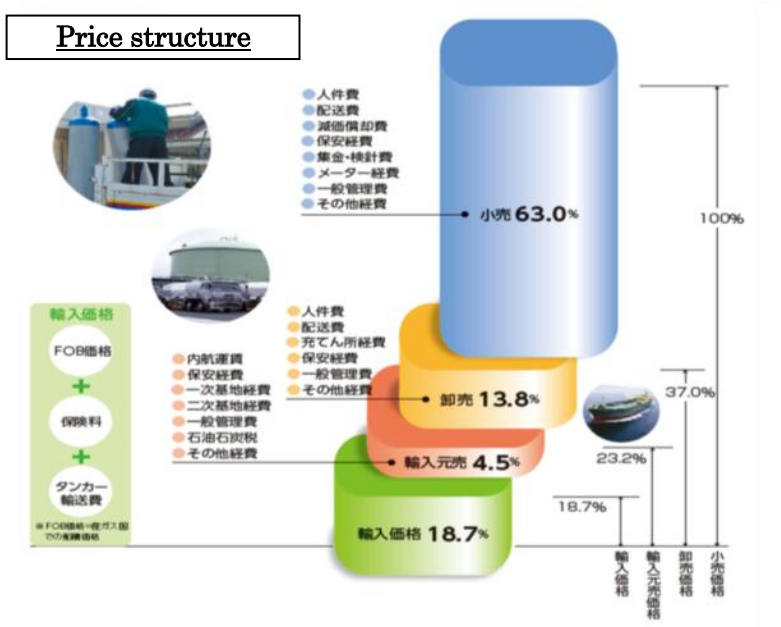
current framework.

Quality assurance planning system under the QC Act (system to decrease the times for quality specification)

- The QC Act has a clause that stipulates easing of the obligation to carry out quality analysis at gas stands from once every 10 days to once every year if the Japanese government identifies fulfillment of the requirement “distribution route of gasoline from the wholesaler is fixed”, 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 current system, the above clause does not apply to gasoline purchased by affiliate special agent retailers from those other than wholesalers or affiliate special agent retailers, because in such occasions the distribution routes are not identifiable as fixed.
- It is considered irrational that the system to decrease the times for quality specification does not apply to gasoline regarded same as affiliated oil products through COPD etc. at the request by JFTC. Therefore, the system will be reviewed to enable wholesalers and retailers to jointly take the responsibility in guaranteeing the quality of gasoline to the consumers.

iii) Promoting rationalization of LP gas distribution and improved transparency of prices

- The majority of consumers’ comments received at LP gas customer service offices established inside LP Gas Associations at each prefecture are about “LP gas price” (comparison with regional average price or city gas, rate breakdown being unclear, rate being higher than other retailers). LP gas retailers are requested by the users to ensure the transparency of prices and to reduce the prices.
- The “Strategic Energy Plan” states “Diversification of utility forms will be promoted by reducing the costs through research and information provision on retail prices by the Japanese government for improving the transparency as well as improvement in the supply structure by business operators”. LP gas retailers have to make business efforts in gaining trust from consumers, for instance by ensuring the transparency of prices and reducing the prices.



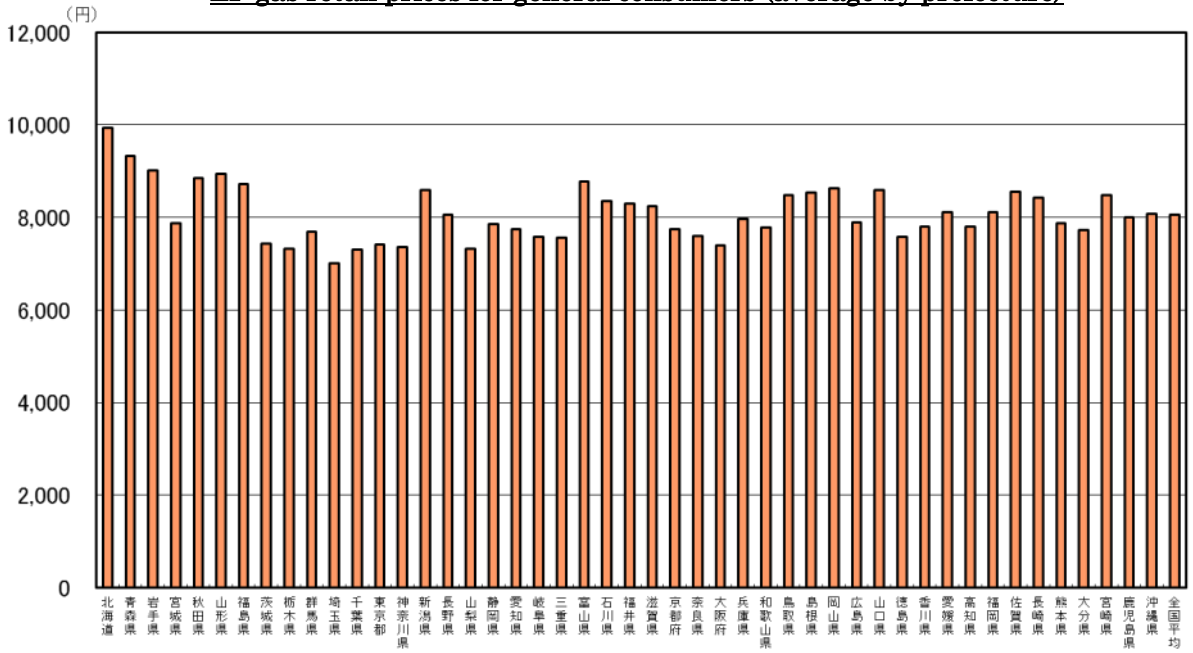
(Research by Liquefied Petroleum Gas Center)

- In accordance with the request by the Japanese government, in June 2010, the LP gas industry revised the “LP Gas Sales Guidelines” and is making efforts to have the

Guidelines known to all LP gas retailers. The Guidelines requests retailers to actively provide information to consumers, stating, “Periodically review the rate level, and on altering gas rates, issue an LP gas rate table in advance and make efforts in explaining the details of revised rates to gain understanding by consumers”.

- The high price of LP gas is pointed out as a cause of sluggish growth in the demand. Users attribute the 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 wide-spread user locations. Especially the consumer retail prices of LP gas for households have a wide gap among regions, due to the cost structure specific to distributed energy that is affected by the local sales and delivery issues.
- In order to assist the reviewing of rate level for gaining understanding by users, the Japanese government will promote activities for further improving the supply system of LP gas retailers, including rationalization of the delivery system through consolidation of refilling stations and will promote activities beyond the boundary of affiliations that are carried out by private unions etc.
- Additionally, the Japanese government will assist realization of fair competition through improved transparency of retail prices and wider choices for consumers. Such activities include nationwide expansion of disclosure of retail prices and standard prices on the company website (which is conducted by some LP gas retailers proactively), and gathering and disclosure of information on the available LP gas retailers for each region.
- Lately, there have been observed cases where consumers experience some form of difficulties after changing LP gas retailers, due to insufficient information given or forceful inducement perpetrated by switching mediators. Such inappropriate deeds damage the society’s trust in the LP gas industry. There even are pernicious cases that may be identifiable as deceptive solicitation that is banned by the “Act on Specified Commercial Transactions”. The Japanese government will take necessary and appropriate measures against these issues as soon as possible in cooperation with relevant ministries.

LP gas retail prices for general consumers (average by prefecture)



* There are differences in the retail prices due to regional factors, for instance the prices tend to be higher in Hokkaido due to high transport and security costs
(Source: “Household Liquefied Petroleum Gas Market Research (June 2014)” by Oil Information Center)

6. Conclusion

The present Report set forth the basic principles and future directions of policies for natural resources and fuels focusing on the maintaining sustainable energy supply, based on the past discussions held in the Petroleum and Natural Gas Subcommittee. Changes in the domestic and overseas environment surrounding the energy sector will undoubtedly bring difficulties in achieving the three main factors for maintaining sustainable energy supply in Japan, namely, sustainable procurement of resources, establishment of disaster response and management systems, and development of a resilient business base for energy-related industries.

However, when looked from a different angle, such environmental changes can be considered as providing an excellent opportunity for the Japanese energy and resource industries to change themselves for the betterment. Transition in the international situations and change in Japan's electricity composition after the Great East Japan Earthquake raise concerns over sustainable procurement of resources from overseas. However, at the same time, such changes brought opportunities for Japan to rebuild its energy strategy, including measures to reduce procurement cost and development of domestic resources. Additionally, experiences of earthquakes and heavy snowfall enabled Japan to visualize realistic and practical emergency fuel supply systems in disasters, and fostered a national movement to build more resilient disaster management systems with assuming situations that were beyond imagination in the past. Furthermore, the current condition of receding domestic energy demand enabled the Japanese energy sector to realize that over-competition within the domestic market would not benefit anybody in a long run and thus business operators had to look into the overseas market with taking advantage of their business strength. Such a trend is also encouraging business operators to form alliances for the purpose of further improving their business strength and international competitiveness. There may be no simple "equation for success", but there still is a chance to flourish. Each energy company should grab the chance by making swift business decisions amid the tough business environment and by searching for growth plans that take full advantage of individual strength. The Japanese government will encourage energy companies to make swift decisions by improving their business environment with mustering all necessary policy measures.

There remain various issues that still require careful consideration, such as the current state of energy security in other countries and indicators that are useful for judging the quality of energy security measures, which are not fully covered in the present Report. The Japanese government will summarize such issues in the future and will continue to take appropriate measures in accordance with the ever-changing domestic and international situations.