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Eastern Japan paralyzed by unprecedented earthquake

A dreadful earthquake (9.0 on the Richter Scale, the highest ever observed in Japan, with a multitude of M7 class aftershocks) and ensuing tsunamis hit the eastern Japan coastline in the afternoon of March 11, claiming the life of tens of thousands of people and devastating local cities, towns and villages. The tsunamis were extremely powerful and violent, as they were amplified by the saw-tooth coastline, a particular topographic feature of the area, rendering useless even the gigantic breakwater built after the lessons from the 1960 Chilean tsunami. The Tokyo Metropolitan area, approximately 300km away from Sendai, was temporarily paralyzed due to the complete stoppage of public transport, but was saved from major devastation.

Among energy facilities, nuclear power stations in the area were immediately shut down, but some of them not completely successfully (see later story). Two oil refineries, one in Sendai and the other in Chiba, caught fire and were disabled. The earthquake and tsunamis have caused serious disruptions to electricity and fuel supply in the wide expanse of eastern Japan, further exacerbated by the concerns over radioactive contamination from the wrecked nuclear plant. The post-disaster disturbance is likely to last quite a while longer before Japan can begin full-fledged restoration.

In the following sections of this issue, JEB will attempt to present the readers with a comprehensive picture on energy situations in the area as they are available as of this writing, and to analyze their impact and potential implications for Japan's energy policies in the future.

Energy supply situations

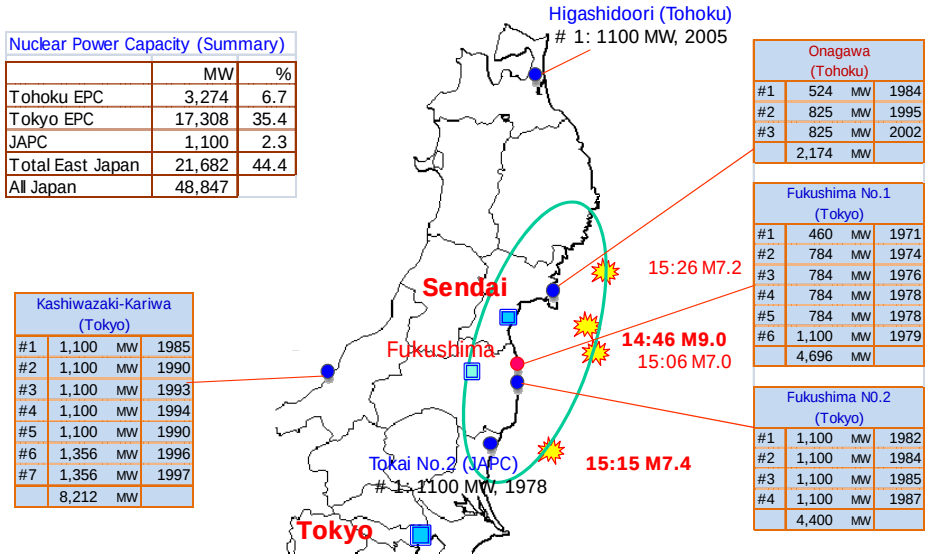
Electricity

Immediately after the earthquake, some 4.9 million electricity users in the Tohoku (northeastern) regions and several thousands in the Tokyo regions lost power supply. By March 18, however, electricity supply was restored in most of the affected areas except for about 270,000 users in the tsunami-stricken Tohoku regions where local communities were simply wiped out or buried under piles of debris. To cope with anticipated power shortages and to avoid a widespread blackout, Tokyo EPC (Electric Power Company) began planned

power cuts on a rotational basis. To control electricity consumption, trains were operated with a reduced number of services in the Tokyo and suburban areas. Tohoku EPC has also announced a similar power cut program but has not implemented this as yet.

There are five nuclear power plants with a total of 15 reactors and an aggregated generating capacity of 13.5 GW in the region (see Figure-1). At the time of the earthquake, four of them were off-line for maintenance and the remaining eleven in operation were immediately shut down. Eight plants were safely brought to cold (i.e. normal) stop conditions, but a serious incident occurred at the Fukushima No.1 nuclear power station.

Figure-1 Nuclear power stations in eastern Japan



At first, the emergency procedures at the station were successfully in progress using its emergency power system. However, after one hour from the initial shock, unexpectedly strong tsunamis surged and destroyed the auxiliary power system. The monster tsunamis were more than 14 m in height while the power station was designed against an earthquake of M7.9 and a tsunami with maximum height of 5.4m. In addition to the Unit Nos.1, 2 and 3 immediately shut down operation, Unit No. 4 under maintenance kept a substantial amount of used fuel rods in its internal storage that need to be cooled down. Without power supply, these plants (all are of BWR model) were out of control and cooling water began to evaporate to expose the fuel rods above the water level. Under the extraordinary heat, the zirconium alloy covering the fuel rods produced hydrogen. Plant buildings shrouding the nuclear reactors exploded one after another, most likely from explosions caused by the hydrogen that had somehow seeped into the housing. The buildings were seriously damaged and higher-than-normal levels of radioactive contamination were observed around the plant site. More than 100,000 people in the 20km radius from the site were evacuated and those within 30km were asked to stay inside buildings. After various and desperate trials to cool down the fuel rods using helicopters and special fire pumps, the Tokyo Municipal Firefighting Team succeeded over the night of March 19-20 to pour more than 1,000t of sea water onto the Unit No.3. Emergency power lines for the units were connected on March 22. These reactors are considered to have narrowly averted a criticality incident as of March 24. After they have been brought under control, then equally serious and difficult challenges need to be addressed concerning how to demolish these contaminated plants.

At the initial shock of the earthquake, thermal power plants with an aggregated generation capacity amounting to 14.5 GW in Tohoku and Tokyo area were also immediately shut down.

Together with the nuclear power plants, Tohoku EPC lost 39% of the generating capacity and Tokyo EPC 32% (see Table-1). While many of these units resumed operations in a relatively short time, both Tohoku and Tokyo EPCs have lost about 15% of their respective generating capacities for a longer duration. Seriously damaged power plants include Sendai #4 (446MW, Gas), New-Sendai #1 (350MW, Oil and Gas), #2 (600MW, Gas), Haranomachi #1 and #2 (both 1,000MW, Coal) of Tohoku EPC and Hirono #2 (600MW, Oil), #4 (1,000MW, Oil) and Hitachinaka #1 (1,000MW, Coal) of Tokyo EPC. Detailed status of IPPs is yet to be assessed.

Table-1 Generating Capacities (Summary)

Power company		Tohoku EPC	Tokyo EPC
		MW	MW
Own Facilities	Hydro	2,422	8,987
	Thermal	10,630	38,189
	Nuclear	3,274	17,308
	RE	224	3
	Total	16,550	64,486
Purchase	IPP	1,158	6,533
	PPS	3,436	6,570
	Others	20	102
	Total	4,614	13,205
Grand total(a)		21,164	77,691
Affected by earthquake			
Own	Thermal	6,146	8,350
	Nuclear	2,174	10,196
IPP	Thermal		5,025
	Nuclear		1,100
	Total	8,320	24,671
		39.3%	31.8%
Seriously damaged			
Own	Thermal	3,396	2,600
	Nuclear		4,696
IPP	Thermal		3,625
	Total(b)	3,396	10,921
		16.0%	14.1%

Electricity shortage will be mitigated gradually as power stations presently under maintenance service are brought back on line one by one. However, a power shortage is definitely anticipated for the summer cooling demand season as well as next winter, according to Tokyo EPC.

Oil

Six oil refineries in the region were affected by the earthquake and tsunamis. Among them three were seriously damaged, while the other three resumed operation shortly after. The Sendai refinery of JX Nippon Oil and Energy was directly hit by the tsunami and seriously damaged. JX Energy's Kashima refinery was also damaged; its marine facilities and refining plants are considered to require some time for repair. At the Chiba refinery of Cosmo Oil, LPG tanks caught fire after the earthquake, giving rise to a gas leakage. Because of the earthquake, 30% of Japan's active refining facilities were immediately shut down, although a half of them resumed operations in a week or so.

Table-2 Oil refineries affected by the eqrthquake.

Prefecture	Company	Refinery	Capacity	Condition
			bpd	
Miyagi	JX Energy	Sendai	145,000	Washed by the tsunami. Land loading facility caught fire, but this was extinguished at 14:30 on March 15. Partly resumed land shipping on March 21.
Ibaragi	JX Energy	Kashima	252,500	Emergency shut-down. Marine facilities and plants were damaged by the earthquakes and the tsunamis. Land shipping resumed on March 18.
Chiba	Cosmo Oil	Chiba	220,000	LPG tanks exploded. The fire continued for more than a week before being extenguished on March 21. Preparing for marine shipping.
	Kyokuto Oil	Chiba	165,000	Emergency shut-down. Resumed operation on March 22.
	Idemitu	Chiba	220,000	Regular inspection shut-down. Shipping is in normal operation.
	Fuji Sekiyu	Sodegaura	140,000	Operating
Kanagawa	Tonen-General	Kawasaki	335,000	Emergency shut-down. Recovered operation on March 18.
	Toa Oil	Kawasaki	185,000	Operating
	JX Energy	Negishi	270,000	Emergency shut-down. Resumed shipping on March 14 and production on March 21.
Longer shut-down			617,500	13.7%
All Japan			4,516,424	

As a result, about 14% of the 4.5 million barrels per day (BPD) of the Japanese refining capacity need to be repaired over a longer time (see Table-2). Facing this grave situation, METI invoked reduction of the mandatory oil stockpiling level on private companies from 70 days to 67 days equivalent of average consumption on March 14 and further reduced it to 45 days on March 21, enabling oil suppliers to draw down their inventories for emergency relief. As the Japanese oil demand is running slightly below four million BPD this year and some refineries have room to physically increase the nameplate refining capacity, a 15% loss of the

refining capacity would not cause a serious shortage of petroleum supply as a whole.

Nevertheless, since the Sendai Refinery of JX Energy was the only major refinery operating in the Tohoku district, and many oil terminals facing the Pacific Ocean were damaged by the tsunamis, product delivery to the disaster area has been seriously hindered. Self Defense Force soldiers worked hard to clear a tremendous amount of debris off the roads connecting the seacoast towns destroyed by tsunamis. Idemitsu Kosan reopened its Shiogama terminal on March 21 substantially improving the logistics in the Sendai area. Oil products delivery to the disaster areas began to resume gradually a week after the dreadful Friday.

City Gas

According to the Japan Gas Association, 460,000 gas users lost city gas supply due to the earthquake and tsunamis, and the situation has not improved even after a week. The Sendai LNG receiving and regasification terminal, located next to the JX Energy's Sendai refinery, was seriously hit by the earthquake and a 10-meter high tsunami. The LNG tank was safe but regasification plant, piping and fittings were damaged; it may take more than one month to repair. The City Gas Bureau plans to resume gas supply by connecting its systems to the Niigata-Sendai gas pipeline operated by Japex; gas will be received from the Niigata LNG terminal some 260 km away from Sendai. Recovery operation of the delivery network has started on March 16 with supporting teams of gas companies from other regions, but it will take more than three weeks to complete the house by house, check-and-restart operations for 390,000 users in Sendai city alone, excluding the areas that were totally destroyed by the tsunami. Status of users in the tsunami washed towns has yet to be assessed.

Petrochemicals

Almost a quarter of the Japanese ethylene production capacity totaling 1.8 million tons per year (TPA) was stopped by the earthquake. Among them, Kawasaki plant (440,000TPA) of JX Oil and Energy was not hurt and is preparing for restart-up within March. However, damages at the Kashima plant (No.1 and No.2 units totaling 828,000TPA) of Mitsubishi Chemical are significant at marine and other offsite facilities. It is anticipated to take more than two months to resume operation according to the company. The alcohol-ketone plant of the Chiba plant of Maruzen Petrochemical (525,000TPA) caught fire from the earthquake, this was soon extinguished. However, whole plants were shut down and their recovery is considered to take time.

Medium/long term issues to be addressed

Needless to say, the immediate and urgent challenges for Japan are to rescue the victims of earthquakes and tsunamis, as well as to control and safely dismantle the ill-fated nuclear power plants. Hundreds of thousands of people are reported to have been evacuated from their home towns, many of them have lost family members and relatives, houses and working places. Many towns are completely destroyed and many others have lost important social infrastructure such as power and energy supplies, communication systems, railways, roads, water/sewage services, schools, hospitals, and too many more to list. The restoration work will need a huge amount of funding and a longer time.

Setting aside the comprehensive restoration plans, the natural disaster has revealed several serious issues in the field of energy, which Japan will have to closely review. They are:

1) Security of electricity supply,
2) Safety of nuclear power plants, and

3) Policies to counter global warming, which has assigned nuclear the central role.

In its history, energy security issue in Japan has been discussed mainly in terms of security of energy import but not of the domestic supply system or its reliability. However, the earthquake has revealed an Achilles' heel in the Japanese electricity supply system. This issue was discussed in the wake of the Chuetsu earthquake in 2007 that stopped all seven nuclear units at the Kashiwazaki-Kariwa power station in Niigata Prefecture facing the Japan Sea, and instantly slashed 8.2 GW or 10.6% of Tokyo EPC's power supply capacity. However, as these units were restored one after another, the incident gradually faded in people's minds. To compound the matter further, the Japanese power grid is divided into two zones of differing electricity supply due to a difference in frequency inherited from the historical electricity development, i.e. 50 Hz for eastern Japan and 60 Hz for western Japan. The existing relief connection system can accommodate only up to 1,000 MW, or equivalent to less than 2% of the electricity demand on both sides of the border, a meager help compared with the 15% loss sustained this time by Tohoku and Tokyo EPCs to a more permanent extent. Like oil stockpiling, electricity supply security must be reinforced significantly.

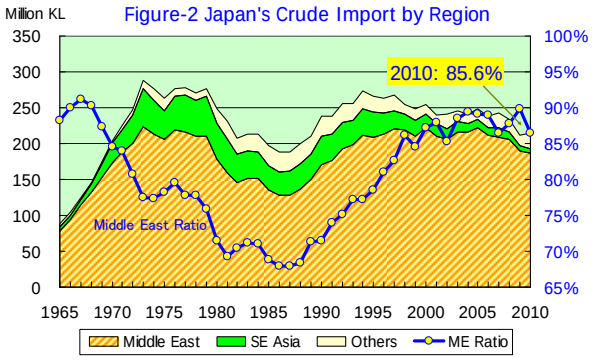
Some of the candidate solutions may include: 1) to unify the power frequency system nationwide, 2) to construct convertible power stations with a flexible frequency control system along the frequency border, 3) to develop substantial capacities of distributed power sources, and so on. Among them, unification of frequency appears to be most effective, but in reality almost impossible to implement as it requires inordinate efforts to change an astronomical number of electric appliances on either side of Japan. An increase in the distributed power supply source will mitigate dependence on the grid power supply but would not solve the problem to an effective extent. Convertible power stations may be the most realistic answer although this also will require a huge amount of investment.

The magnitude of the earthquake experienced this time was so gigantic that it is said to occur once in thousand years. Nevertheless, after we have encountered what we could not conceive the real world, no one can say for sure that it would not come again tomorrow. We need to establish a much more reliable fail safe system. We should also develop simple and clear-cut technology principles which everybody could understand. By not doing so, it may take not years but decades for people to regain their confidence in technology.

In the above context, the Basic Energy Plan of Japan assigning to nuclear power a central role of shouldering 40% to 50% or more of electricity will have to be revisited. It would not be very difficult for Japan to supplement the 4.7GW generation capacity lost at the Fukushima No.1 plant since, for example, construction of one or two LNG power plants will suffice. However, construction of additional nuclear capacity under the Basic Plan is most likely to encounter extreme difficulty given the bankruptcy of the so-called "Safety Myth" and the people's confidence in technology going down the drain.

On the other hand, Japan has been watching with bated breath the recent upsurge of democratic movements in the Middle East and North Africa, not only the immediate outcome of the fighting in Libya. Japan imported 86.5% of crude oil and 22.5% of LNG from the Middle East in 2010. Oil held 45.8% and natural gas 17.5% of its primary energy supply in 2009. In summary, Japan depends 44% of the primary energy supply on the Middle East. While the

Figure-2 Japan's Crude Import by Region



Source: MOF Statistics

Basic Energy Plan stipulates reduction of fossil fuel dependence, oil ought to supply 30% and LNG 16% of the primary energy in 2030 even when nuclear and renewable energies are developed in line with the ambitious plan. Increasing Russian crude import from new Pacific coast ports has decreased Japan's dependence on the Middle East by 4% from 89.5% in 2009 to 85.6% in 2010. The Russian share may increase another 5% or so when the trans-Siberian pipeline fully completes in 2012. Nevertheless, the Middle East will remain the primary energy suppliers for Japan for the foreseeable future. With more than 170 days of oil in stockpile, Japan is anxiously watching the evolution of the democratic movements giving a substantial impact on its energy security.

As discussed above, one of the core policies of the Basic Energy Plan is in danger of infeasibility, and hence the environmental policy to fulfill Japan's pledge in its measures to counter global warming. The emission reduction target and policies set out by the DPJ Administration in 2009 were already under severe criticism. In formulating the rehabilitation plan, energy security and environmental policies ought to be totally overhauled so that Japan could make this tragedy a cornerstone to build a safe and green society, through a solid pathway supported by practicable and reliable measures, realizing great breakthroughs in technology and socio-economic system.

Energy conservation, gasification and heat-pumps are top measures to counter global warming

The Institute of Energy Economics, Japan (IEEJ) announced the result of a survey on the use of natural gas by corporate energy users in Japan, at the third meeting of the "Working Group on the Advanced Utilization of Natural Gas and Fuel Conversion" held on January 31. The Working Group was established in November last year within the "Study Group on the Desirable Gas Utility Business in a Low-Carbon Society" which had been set up following the policy of promoting the industrial sector's shift to natural gas based on the revised Basic Energy Plan of June 2010. In this large scale survey, a questionnaire covering a wide range of items was mailed to randomly selected 4,000 industrial consumers and 1,200 business consumers, including hotels, hospitals, and sports facilities with collection rates of 60.5% and 35.7%, respectively.

Table-1 Measures to reduce CO_2 Emissions

	Already Adopted	Studying Planning	Total
	%	%	%
Energy Conservation	93.3	5.5	98.8
Shift to Natural Gas	33.9	14.0	47.9
Introduce Gas-Cogeneration	7.7	7.1	14.8
Introduce Renewable Energies	7.1	24.8	31.9
Introduce Heat-pumps	26.7	26.9	53.6
Purchase Green Electricity	2.3	18.6	20.9
Purchase Carbon Credits	1.7	13.7	15.4

From a query concerning measures being practiced or contemplated for reducing their CO_2 emissions, as seen in Table-1, "Energy Conservation" turned out to be the most popular measure, with 93.3% of the respondents already adopting and 5.5% studying or planning some kind of energy saving measure. Introduction of heat pumps and a shift to natural gas followed, gathering about half of the respondents' favorable answers. About 15% of them also chose the introduction of gas cogeneration, which, together with a shift to natural gas, illustrated high interest in the use of natural gas. In contrast to the popularity of these physical measures, only 1–2% of the companies adopted the recently introduced soft measures such as purchasing green electricity or carbon credits, and the respondents who were studying or planning such measures did not reach 20%. At the forefront of energy use, the physical measures to reduce GHG emissions are still prevalent among energy users.

When asked about the challenges they were facing in working on the reduction of CO_2 emissions, by far the highest percentage (44.3%) of respondents said that "The national policy

on measures and institution for CO_2 reduction is unpredictable". Last year, a policy was adopted to raise the Petroleum and Coal Tax, effectively creating an environmental tax, but at the same time it was decided to shelve the study for formulation of emissions trading. The survey result shows that the GHG reduction target and specific measures for achieving it are becoming increasingly unclear. Other major challenges included a "Clouded business outlook of the company" (23.9%) and a "Murky energy price outlook" (11.1%) that either prevent or hamper decisions on a large-scale investment. The respondents also voiced strongly that the system to be used to measure the amount of CO_2 reduction is unclear because of too broad a range of assessment and support systems in place. To sum it up, the survey results showed that the largest challenge that energy consumers face when working on CO_2 reduction is the lack of clarity about what the future system will turn out.

When asked about the types of fuel they were using, 1,244 of 2,847 respondents answered natural gas, whereas 950 respondents were not using natural gas even though they were in the area where natural gas was available. Such respondents were mostly using LPG and Fuel Oil A (a gas oil type low sulfur light fuel) followed by kerosene. Very few were using coal or Fuel Oil C (Heavy Fuel Oil) as these make it difficult to satisfy the strict environmental regulations over SOx, NOx, and others in Japan.

Figure 1 Fuels used by Industrial/Business Users

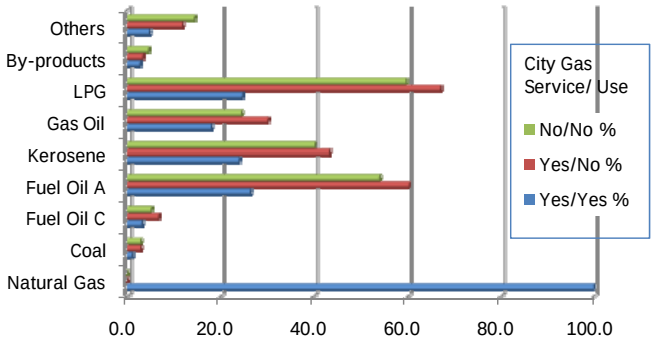


Table-2 Age of Non-gas Facilities

Built in	Industry	Business	Total
	%	%	%
Before	10.9	6.5	10.3
1970s	13.6	11.0	13.2
1980s	19.0	23.9	19.7
1990s	28.0	32.4	28.6
2000s	28.5	26.2	28.2
Total	1,959	309	2,268

On the other hand, as shown in Table-2, three quarters of facilities that use fuels other than natural gas are over 10 years old, and 43% over 20 years. These facilities will be replaced in the years to come, while petroleum products are becoming increasingly costlier due to the rise in crude oil prices, together allowing more room for a switch to gas in the future.

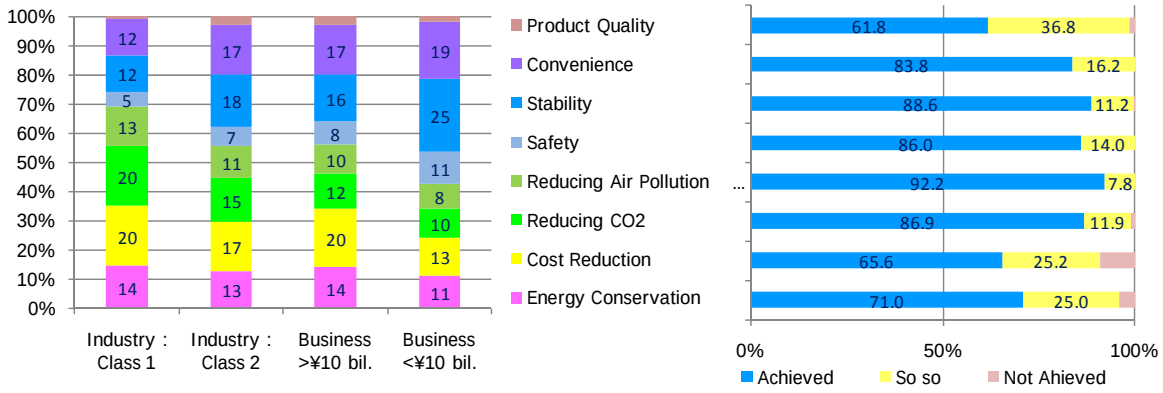
Looking at what the respondents who were not yet using natural gas thought the challenges were, a couple of issues stood out: (1) The cost of introducing or remodeling facilities is high, (2) A gas delivery line is not available (Laying a new gas line is expensive.) The former garnered 71.8% and the latter 68.7%. (The question asked to choose the three most applicable answers.) In short, the largest obstacle for adopting natural gas is the cost of initial investment. Other obstacles include (3) expensive gas rates (19.2%) and (4) lack of know-how and/or support regarding a shift to natural gas (17.4%). Understandably, 76.9% of the respondents answered financial support for initial cost as an effective measure to assist their shift to natural gas. Other measures listed, such as technical support for fuel change (8.2%) and financial support for running cost (8.0%), do not make up a large portion.

As for a desired investment recovery period, a majority of the respondents (69%) from Type 1 Designated Energy Management Factories for industrial use that consume large amounts of energy (i.e. annual energy consumption of 3,000 kl oil equivalent or 12 million kWh or more) answered five years or less, while less than 30% of those in industries of less fuel consumption had the same answer, with another 34–42% wanting 5–10 years, making up the largest portion. It was learned that companies whose energy consumption accounts for a large portion of their total cost tend to be cost-conscious, while others whose energy expense is small over the total

cost are placing high hopes for gas as an environmentally friendly and convenient energy with a stable supply.

Another question asked the respondents for objectives and achievements for which natural gas has been adopted. As for the objectives, "Cost Reduction" and "Reducing CO_2" garnered the highest percentage of responses (20% respectively) from natural gas users in Type 1 Factories for industrial use. They were followed by "Energy Conservation" (14%), "Reducing Air Pollution" (13%), "Stability" (12%), and "Convenience" (12%). In contrast, the proportion of "Convenience" is noticeably high at Type 2 Factories for industrial use (annual energy consumption of 1,500 kl oil equivalent or 6 million kWh or more) and small-sized businesses (Annual sales less than 10 billion yen).

Figure-2 Objectives and Achievements of Gas Switching



Maintaining and spreading these advantages of natural gas is essential to gaining more popularity. Asked whether the objectives of adopting natural gas were achieved, the highest percentage of users saw an effect in "Reducing Air Pollution" (92.2%), followed by "Stability" (88.6%), "Reducing CO_2" (86.9%), and "Safety" (86.0%). On the other hand, "Cost Reduction," ranked high in the objectives of adopting natural gas, was achieved only by 65.8% of respondents; therefore, it is learned that natural gas is not fully meeting the users' expectations in price. The reason behind this result is thought to be the increase in the price of LNG in recent years as well as a failure to carry out operations with high efficiency.

Table-3 Introduction of Co-generation

	Installed	Planning	Studying	Total
	%	%	%	%
Industry : Class 1	11.8	0.0	5.0	16.8
Industry : Class 2	2.7	0.1	2.9	5.7
Business >¥10 bil.	27.6	1.7	3.4	32.7
Business <¥10 bil.	11.2	0.3	5.5	17.0
Total	11.9	0.4	4.2	16.4

In terms of efficient utilization of natural gas, adoption of cogeneration is expected to bring about great effect. In fact, Mr. Tsutomu Yamada of Asahi Breweries, Ltd. reported at the committee meeting on the same day that they had saved fuel by 8–12% through the introduction of cogeneration to the company's three factories. In this survey, however, it was revealed that the penetration rate of cogeneration was still around 12% and that few were planning or studying its adoption as well. Many natural gas users have adopted a high performance boiler equipped with an economizer, producing a high penetration rate of 50%, while the same rates for a recuperator and a regenerative burner stood only at 13.7% and 5.4% respectively. Japan is said to be one of the most advanced countries in terms of energy saving. However, this survey shows that the use of BAT (Best Available Technology) is not yet widespread and that there is still room left for further promotion of energy saving in Japan.

On the basis of this survey, the Study Group intends to put together challenges against and measures for fuel conversion to natural gas and its advanced utilization (adoption of high

performance facilities) by placing stress on the following.

1) Infrastructure development for industrial consumers in the area where natural gas is not available.
2) Reinforcement of engineering support for mid- and small-sized industrial users.
3) Incentives for fuel conversion to natural gas and its advanced utilization.

In addition, promotion of natural gas cogeneration will be further delved into with the expectation of bringing about a great effect on energy saving and reduction of CO_2. However, it should be noted that the assessment on natural gas cogeneration will produce widely different results between application of an "average emission factor" incorporating all power sources as recommended by electric power companies and "marginal emission factors" that most likely be represented by the emission factor of thermal power generation. This issue will continue to be controversial till finalization of the institution.

At the committee meeting on the same day, Mr. Yasue Furuta, a Study Group member from a power company argued that thermal efficiency of 150% can be achieved through a CCGT (Combined Cycle Gas Turbine Generation) at 1,500 degrees Celsius (assuming thermal efficiency of 53%) with a heat pump (thermal efficiency of 300%) and that the effect of "High Efficiency Cogeneration" under study should be clearly defined. At Tokyo EPC, its latest 1,600 degrees Celsius CCGT has achieved a thermal efficiency of 60%, while the coefficient of performance (COP) of the latest model of air conditioners that are popular in the market exceeds 600%. Right now, much discussion is needed as to what kind of systems should be designed in order to realize a low-carbon society with assured supply security. The good news is that Japan, a developed country in energy saving, still has ample room for further development in energy conservation, as this survey revealed.

Energy Committee Highlights

First-to-file principle of Japanese Mining Act to be amended

Established in December 1950, the Japanese Mining Act has been becoming increasingly outdated in many respects, particularly in the context of the industrial, technological, and international developments that occurred during the 60 years of its existence. On February 10, 2011, the Joint Working Group of Mining and Petroleum Committees under the Advisory Committee for Natural Resources and Energy compiled a report proposing amendments to the Mining Act on the following four points.

1） Establish criteria for licensing
2） Abolish the first-to-file system
3） Establish a permit system for exploration activities
4） Review standards for setting mining areas

The Japanese Mining Act was established during the post-WWII confusion and employs the unique system of a "notification and first-to-file principle" that is unmatched anywhere in the world as the basis for mining permits. Under the present system, a person or an entity who files an application ahead of the others gets the priority right to explore and develop the area. The above led to a situation where a large number of applications were filed to just pre-empt mining rights without any definite intention to explore the acreage for the foreseeable future, or without owning proper business capabilities, thereby blocking the entry of others with real intent to explore and develop. Although the Act mandates that the mining right holders commence projects within six months of authorization, it also provides that the obligation can

be postponed or suspended by filing an application. As a result, out of 8,200 mining rights presently granted, some 6,600 lots are left suspended or have not commenced projects. The report, therefore, proposes an amendment to abolish the application of the first-to-file principle for mineral resources that are vital to the national economy including oil and seafloor hydrothermal deposits, and to grant mining rights to those entities considered to own adequate capabilities for carrying out the best exploration/development plans on a fair and equitable basis determined through qualification and bidding systems.

The current law has no provisions concerning pre-drilling activities such as geological surveys or geophysical exploration. In other words, the government has no power to control impacts on the environment, people, and businesses in the neighboring areas resulting from such operations. Furthermore, Japan has no laws regulating exploration by oceanographic ships belonging to other countries operating in the Japanese exclusive economic zone. The report, in view of the above, calls for an amendment to mandate a prior approval for conduct of geophysical, magnetic, electrical and other surveys that are normally deemed as exploration activities of natural resources. It also calls for an amendment to extend the first period of exploratory drilling permit to four years upon registration, with two allowed extensions for two-years each, or a maximum of eight years total. The permission period is currently set at two years with two (or three for oil) permitted extensions.

The upper limit for one mining block is presently set at 350 hectares for all minerals, irrespective of the onshore or offshore locations. The limit is one of the causes for bothersome procedures where an applicant must file an exceedingly large number of applications to cover a vast prospective area, in particular for offshore exploration. The report, therefore, proposes an amendment to abolish the upper limit, allowing the government to assign substantially larger mining blocks as appropriate.

The report summarizes the basic mining policies of Japan for the future as follows. Domestic mining in Japan has lost economic viability during the ages of brisk economic growth and internationalization after the World War II, consequently diminishing the interest in mining legislation. However, the Mining Act should provide a foundation to prescribe how a nation ought to be constituted and must be addressed from that viewpoint. In addition, international tensions have been building up in the fierce competition over natural resources, calling for a new mining legislation compatible to the new world order and paradigms. For Japan, new frontiers of oceanic resources are now developing fast such as oil and gas, methane hydrate, seafloor hydrothermal deposits, and cobalt-rich crusts. The mining legislation, at its central structure, must provide the foundation for proper development of domestic resources while protecting mineral resources as the common national assets of Japanese citizens.

Energy News in Japan & Asia

JX Nippon Oil and Energy to commercially launch world's first SOFC

Following its release of ENE-FARM product, a home cogeneration system based on the PEFC (Polymer Electrolyte Fuel Cell) in 2009, JX Nippon Oil and Energy Cooperation announced a plan to begin commercial sale of SOFC (Solid Oxide Fuel Cell)-based cogeneration systems for residential use starting October of this year. JX Energy is the world's first company to introduce the SOFC system into the commercial market, although other energy firms and equipment manufacturers are also trying to develop similar products and have so far announced demonstration models and test operations.

SOFC systems are proposed for households with relatively high electricity demand, while

PEFC systems are for those with high hot water demand for floor heating, etc. The company states that generating electricity at home can eliminate transmission losses and utilize the heat produced in the electricity generation for hot water supply or heating, yielding higher overall energy efficiencies.

The system announced at this time can operate on both city gas and LPG and will be sold for 2.7 million yen per unit. The sales price of the current PEFC model will also be lowered to the same level. With a power output of 700W, the SOFC system has accomplished a power generation efficiency of 45 percent, 10 percent higher than the current PEFC model, and a heat recovery efficiency of 42 percent. It has also been more compactly designed to better fit Japanese residences; the power generation unit has been downsized by 46 percent compared with the current model, and the hot water storage by 36 percent.

The SOFC system runs 24 hours a day, handling demand for standby electricity for refrigerators and other electric appliances during the night. The hot water storage unit has a gas-fired backup boiler that replenishes water when it is short of hot water from the power generation. The system can cover 70 percent of electricity consumption in a family of four living in a single-family detached-home and can reduce CO_2 emissions by 40 percent compared to conventional systems that employ a typical gas-fired hot water heater and grid electricity.

MHI's Eco-LNG Carrier Features 15% Enhancement in Fuel

Mitsubishi Heavy Industries, Ltd. (MHI) has announced that it received an order from Nippon Yusen Kabushiki Kaisha (NYK) for an LNG carrier capable of substantially reducing fuel consumption. The vessel is the first of its kind to adopt MHI's "Ultra Steam Turbine" (UST), a newly designed main propulsion plant having an approximately 15% higher fuel efficiency than conventional steam turbines.

Scheduled for delivery in 2014, the vessel weighs about 123,000 gross tonnage and measures 288 m in overall length, 49 m in breadth and 26.8 m in depth, with a loading capacity of 145,400 m^3 of LNG into four MOSS type spherical storage tanks. The ship is also designed with other environment-friendly features such as a capability to burn low sulfur fuel oil.

The UST is a marine propulsion steam turbine technology commercialized by MHI. It adopts a medium- pressure turbine, in addition to high- and low-pressure turbines used in conventional steam turbine engines. After the steam from the boiler drives the high-pressure turbine, the exhaust steam is returned to the boiler and reheated for driving the medium-pressure turbine, and subsequently the low-pressure turbine. Such cascaded use of thermal energy enables a marked reduction in fuel consumption.

Presently, as part of measures to fight global warming, reductions in CO_2 emissions are vigorously sought also in the area of marine transport, and the International Maritime Organization (IMO) has been preparing a framework for a CO_2 emissions convention. (From MHI Press Release, 1 March 2011)

APERC Letter

Annual conference discussed energy efficiency

APERC's annual conference was held on March 7 and 8, 2011, at the Keio-Plaza Hotel, Tokyo. This year, the conference focused on energy and environment issues to counter global climate change. A total of 27 presentations were given by invited speakers and delegates during the

two day conference over three sessions. Among them was Dr. Fatih Birol, Chief Economist of IEA, who discussed the 2020 IEA World Energy Outlook.

At the conference, Session-1 discussed the subject of "energy efficient transport for smart communities" with a view to examining best practices for integrating energy-efficient transport, buildings and power grids into low-carbon urban developments, following the agreement of the APEC Leaders meeting held in November, 2010, in Yokohama. Session-2 discussed "promoting low carbon supply" for participants to share ideas on the opportunities and challenges of promoting low-carbon/low-emission energy sources including renewables, nuclear, and fossil fuels with CCS. Session-3 discussed "fulfilling climate change mitigation action pledges." This session was intended to consider how pledges made by APEC economies to take some kind of action to mitigate climate change should or could be fulfilled in the real world, and how APERC should best model these scenarios for the 5th edition of the *APEC Energy Demand and Supply Outlook* due compilation next year. In Session-4, Dr. Ralph L. Samuelson and Dr. Weerawat Chantanakome presented study plans and current work progress at APERC. Constructive comments and suggestions were made by participants, which will be incorporated in the work plans, in particular the ongoing model building for the next edition of the *Outlook*.

APEC Energy Overview 2010 will be available soon

APERC is preparing for the release of a report on "APEC Energy Overview 2010" in April, with overviews on the basic structure of energy demand and supply, and current status of energy policies for all 21 APEC economies.

In the Part-1 "Introduction", the basic features of the economic situation are explained for each economy. In the Part-2 "Energy Supply and Demand," the results of primary energy supply and final energy consumption for the year 2008 is reviewed. The Part-3 "Policy Overview" discusses issues such as (a) Energy Policy Framework, (b) Energy Markets, (c) Fiscal Regime and Investment, (d) Energy Efficiency, (e) Renewable Energy, (f) Nuclear and (g) Climate Change. The Part-4 "Notable Energy Developments" deals with current energy issues and important energy development in each APEC economy in addition to policy issues discussed in Part-3.

The "APEC Energy Overview 2010" will become available at the APERC website (http://www.ieej.or.jp/aperc) in April.

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