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A long journey to normalize social, economic and energy systems

More than two months after the Great East Japan Earthquake/Tsunami, aftershocks are still felt in Tokyo and the vicinity although with diminishing magnitudes. Do-or-die missions to flood the damaged reactor cores have brought a temporal stability at the Fukushima Daiichi power station, but the nuclear reactors turn out to be in much more serious conditions than imagined as new information unravels. Tokyo Electric Power Company (EPC) released a timetable in April stating that it would bring the reactors to safe shutdown in six to nine months. However, it has become widely recognized that most of the nuclear fuel in the troubled reactors had melted down. Nevertheless, Tokyo Electric stated on May 16 that it would maintain the original restoration timetable, which is considered doubtful by many experts.

On May 6th, Japanese Prime Minister Naoto Kan requested suspension of all nuclear reactors at Hamaoka nuclear power station operated by Chubu EPC. He said that the plant sits in the middle of the area where a disastrous Tokai Earthquake is projected to occur with an 87% probability within 30 years (or 84% probability at plant site that is greater than Richter Scale 6 as shown in the table), being located perilously close to the metropolitan areas of Tokyo and Nagoya. Accepting the request, the two operating units at Hamaoka were shut down on May 15th. Although Mr. Kan said that Hamaoka is an exceptional case and he would not ask for the same for other nuclear plants, many units under regular check-ups and maintenance throughout Japan are facing difficulties resuming their operation as local governments seek clear-cut safety directives from the national government. Meanwhile, there is mounting concern about an imminent power shortage in the coming summer season, and people are trying hard to cut down on power consumption; electricity demand in eastern Japan is now 10 - 15% less than that of the year before.

Probability of earthquakes greater than Richter Scale 6 occurring within 30 years at nuclear plant sites

Power Station	Company	Probability %
Tomari	Hokkaido	0.4
Higashidori	Tohoku	2.2
Onagawa	Tohoku	8.3
Kashiwazaki-Kariwa	Tokyo	2.3
Fukushima No.1	Tokyo	0.0
Fukushima No.2	Tokyo	0.6
Tokai No.2	JAPC	2.4
Hamaoka	Chubu	84.0
Shika	Hokuriku	0.0
Tsuruga	JAPC	1.0
Mihama	Kansai	0.6
Ohi	Kansai	0.0
Takahama	Kansai	0.4
Shimane	Chugoku	0.0
Ikata	Shikoku	0.0
Genkai	Kyushu	0.0
Sendai	Kyushu	2.3
Monju	JAEA	0.5

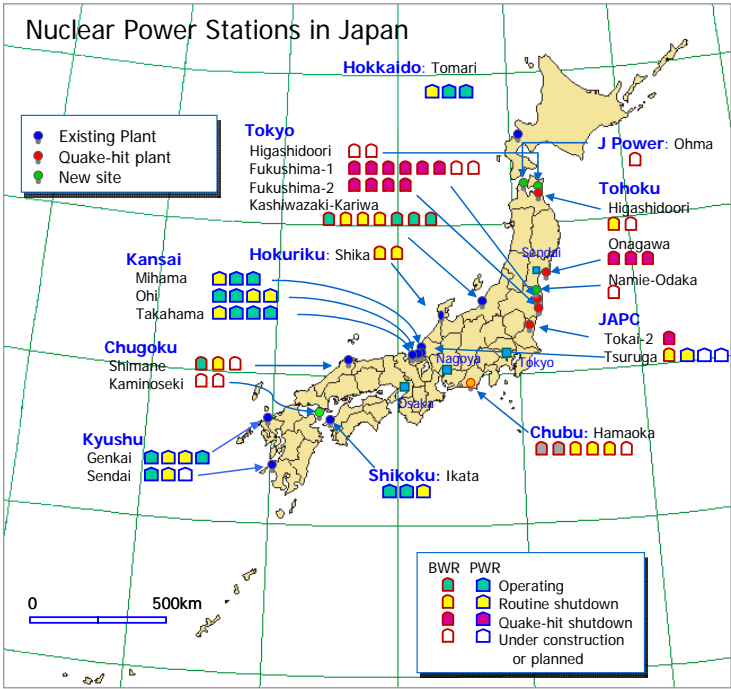
Released by the Fukushima Nuclear Plant Accident Response Headquarters, May 10, 2011

Prime Minister Kan said at a press conference on May 10th that his government would need to totally review and revamp the Basic Energy Plan, which was officially revised last year. The Ministry of Economy, Trade and Industry (METI) set up an expert committee on energy policies on May 12th following the Prime Minister’s decision.

As of May 11th, the number of people dead or missing stood at 24,829 and those sheltered at 117,085. There probably are several fold more evacuees not registered on the official rosters. The disaster has cut down production of manufacturing industries in Japan to a historic magnitude in March and April by eliminating major facilities in the Tohoku area. Meanwhile, a Reconstruction Design Council has been newly established as an advisory body to Prime Minister Kan with the task of working out a vision for rehabilitation. The Council is scheduled to produce a first set of recommendations in June, while the whole picture of damage and suffering has yet to be assessed. The starting point of a long journey for Japan toward restoring its social, economic, as well as energy systems, is still some way off.

Restart of nuclear plants after routine check-up faces problems

The earthquake forced 11 nuclear reactors to shut down in addition to 21 others already removed from service for routine inspections and maintenance, leaving only 22 out of 54 reactors in Japan in operation. Subsequently, Chubu EPC halted operation of Hamaoka #4 and #5 units, responding to Prime Minister Kan's request as discussed earlier. In addition, the Japan Atomic Power Company (JAPC) shut down its Tsuruga #2 unit on May 7th because of rising radioactive concentration in cooling water. As a result, only 19 or about one-third of Japan’s nuclear reactors are now in operation. To aggravate the matter, power companies are facing difficulties in restarting the reactors after routine inspections and maintenance as local governments are voicing their anxieties fueled by uncertainty on the process to resolve the Fukushima Daiichi situation and the rationale on shutting down Hamaoka alone at this time. Although Genkai #2 and #3 units of Kyushu EPC and Mihama #1 and Takahama #1 unit of Kansai EPC were all scheduled to come back online in either March or April, there currently is no definite timetable for resuming operation of those units. Hokkaido’s Tomari #1 and Shikoku’s Ikata #3 were just shut down on April 22nd and 29th, respectively, and scheduled to come back in early August, but they as well as others planned for routine inspections may not come back online as scheduled. In total, it is possible that as many as 42 nuclear units could be offline during this coming summer.



Power utilities in Japan are urgently taking measures to prevent accidents similar to Fukushima Daiichi: Kansai EPC announced on March 15th “deployment of mobile diesel pumps as a backup for the sea water pumps;” and Chugoku EPC reported on March 17th “installation of backup motors to drive sea water pumps of nuclear reactor auxiliary equipment.”

In addition, Shikoku EPC announced on March 18th “providing personnel training to properly respond to a station blackout.” This indicates that the utilities immediately realized the root cause of the Fukushima Daiichi incident to have been a total loss of all power supplies and subsequent loss of the final heat removal function or so called heat-sink.

The Nuclear and Industrial Safety Agency, NISA, announced on March 30th the following modifications to its safety regulations:

- All nuclear power stations must be prepared for “loss of all facilities providing AC power source, loss of all functions to cool the nuclear reactor facilities using sea water, and loss of all functions to cool the spent fuel pools” in the event of tsunami-induced emergencies.
- All nuclear power stations must be “prepared to perform activities to protect nuclear reactor installations when all power functions are lost” and accordingly provide security regulations and procedures. The activities include compiling emergency preparedness plans, allocating personnel, training personnel, furnishing required equipment and materials, and periodically reviewing these measures.

All owners of nuclear reactors submitted applications to revise their respective security procedures early April, and NISA authorized the proposed revisions on May 6th. NISA further instructed that the owners lay down measures to secure power supply to nuclear power stations by reviewing and analyzing reliability of AC power facilities, in response to the station blackout experienced at the Rokkasho reprocessing plant and Higashidoori nuclear power station during an M7.4 aftershock on April 7th. The above instructions are being complied with including the process of government authorizations. The suspended reactors, both scheduled and unscheduled, will at least need to implement the emergency safety measures before they are allowed to resume operations, although it is difficult to predict how long the permission process will take.

Measures to cope with power shortage during summer peak season

The Power Supply & Demand Task Force of the government (METI) on May 13th announced its decisions on targets and policies to deal with an imminent power shortage in the coming summer. The decisions are based on the estimation that Tokyo EPC has secured supply capacity of 53,800MW against the previous year peak load of 60,000MW and, for Tohoku EPC, 13,700MW of capacity against 14,800MW. The above indicates a potential power supply deficit of 6,200 MW or 10.3% and 1,100 MW or 7.4% respectively for the service areas of Tokyo and Tohoku EPCs. To cover the above deficits with an adequate amount of reserve capacity, the Task Force has decided the target for power use restrictions to be set at 15% of last year’s peak demand level. METI should prepare application rules of the restrictions based on Article 27 of the Electricity Business Act; the activation of the power restriction clauses is the first time in 37 years since the first oil crisis in 1974.

Following this, METI announced on May 25th the detail schedule of power use restrictions by category of users to be imposed this summer. The gist of the envisaged regulation is as described below:

- 1) The restriction will be imposed during 9 a.m. to 8 p.m. on week days starting on July 1st and ending on September 22nd for service areas of Tokyo EPC, and September 9th for Tohoku, respectively.
- 2) The 15% mandatory restriction from last year shall be applied to large consumers with a power purchase contract of 500 kW or more. Large power users failing this shall be penalized by law, while about 30 types of public services such as hospitals and railways,

as well as those operating in the disaster areas, are exempted or applied some mitigated restrictions. Power users will be allowed to form a "Consolidated Use Restriction Scheme" to jointly meet respective reduction targets.

- 3) Smaller users are requested to set up a power saving plan practicable in view of its business characteristics, and to publicize this plan. The government shall prepare a standard format to support compilation of voluntary action plans for power saving.
- 4) Households are requested to save as much power as possible, while the government will propose suggested power saving menus.
- 5) No rolling blackout will be implemented in principle. If demand surges to a level where such measures appear to be inevitable, a "blackout alert" will be issued through television, the Internet and other media.

In addition to the immediate responses above, the Task Force enumerated major medium-term objectives, such as (1) re-commissioning or new construction of thermal plants; (2) urgent reinforcement of frequency changing stations (Japan is divided into two different frequency zones, i.e. 50 Hz in eastern regions and 60 Hz in western regions.); (3) accelerated promotion of distributed energy sources and renewable energies; and (4) introduction of smart meters.

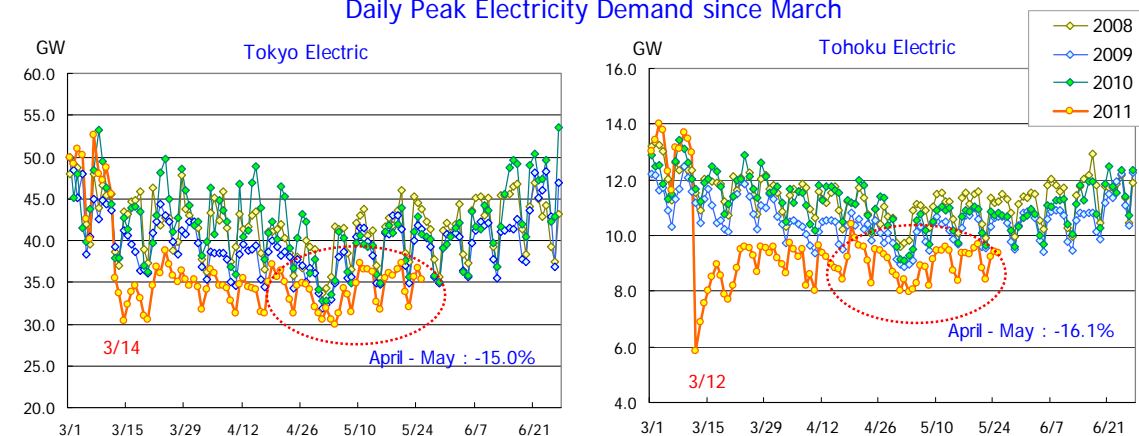
On May 13, Tokyo EPC released a somewhat rosier supply/demand picture based on its own projections. While the peak demand for summer is projected at 55,000 MW assuming roughly 10% of power saving from 60,000 MW of the peak demand observed last year, the company has secured a generation capacity of 55,200 and 56,200 MW at the end of July and August, which represent increases of 3,200 MW and 5,500 MW, respectively, over the previous estimates announced on April 15th. The additional capacity is obtained through gas turbine and other emergency power sources, resumption of operation of units at Hirono thermal power station (PS), utilization of pumped storage power stations, and through purchase of excess power from private power plants. While the suspension of Hamaoka nuclear PS has slashed 200 MW of support from Chubu EPC, Tokyo EPC plans to relieve Tohoku EPC for up to 1,400 MW of power.

Similarly, Tohoku Electric has secured its own generation capacity of 12,300 MW, up 200 MW from the previous announcement, through installation of a number of gas turbine generators at Niigata and Hachinohe power stations. The company also intends to increase power purchase from independent power producers and private power plants. Including relief supply from Tokyo EPC, Tohoku has secured supply capacity of 13,700MW for the summer.

Chubu electric has also increased its supply capacity with various measures to secure 1,260MW or 5% of reserve capacity over an estimated peak demand of 26.3GW for July. In order to help level out the peak demand during work days, the Toyota group of companies will shift weekend holidays to Thursdays and Fridays during July through September.

As of mid-May, power consumption in eastern Japan is about 15% lower than a year ago, reflecting weak economic activities due to the disaster and power savings by businesses and households. The Tohoku EPC is experiencing particularly weak demand as many power users are stricken by the disaster. In an attempt to prepare for an imminent power shortage, many businesses are taking measures to cut power consumption by rationalizing lighting and air conditioning, shifting plant operation to nights and weekends when power demand is lower, rolling operation loads, and extending holidays. A growing number of enterprises are installing private power generation facilities, further suppressing power demand on the grid.

Daily Peak Electricity Demand since March



Fossil fuel requirement for thermal power will increase significantly

In the following sections, IEEJ attempts to estimate the additional fossil fuel requirement in 2011 to make up for the decreased power supply by the quake-hit nuclear power stations. Because of the frequency barrier dividing the Japanese electricity markets, the power deficiency in eastern Japan could be relieved only slightly by boosted power generation in western Japan. Moreover, there would be certain impact of the natural disaster in the west as all units at the Hamaoka nuclear power station have been suspended in response to the request of the Prime Minister, and the nuclear power stations under routine inspections may well face stricter scrutiny before re-starting operations.

While a one month delay is assumed for start-up of these plants in the analysis below, such an assumption appears to be somewhat too optimistic given the general public perception about nuclear power today. If no nuclear power stations are to return from their routine turnaround, all nuclear plants in Japan will have gone offline by autumn next year, having significant impact on the fossil fuel requirement, although the remaining thermal power's capacity to accommodate incremental requirements is limited. It should also be noted that this calculation is yet to consider decrease in electricity demand due to slower economic activities.

Coal for thermal power

While coal ought to be the main alternative power source together with LNG, major coal-burning power stations in eastern Japan were hit by the tsunamis and their marine facilities were seriously damaged. They include Haranomachi PS of Tohoku, Hitachinaka PS of Tokyo, Shinchi PS of Soma-Kyodo and Nakoso PS of Joban-Kyodo EPCs; with a combined generating capacity of 6.08 GW; so far, only Joban-Kyodo has partly resumed receiving coals transshipped by coastal vessels. Accordingly, coal consumption in eastern Japan will decrease sharply by 10.2 million tons in 2011 compared with that of 2009. In the western region, power companies will increase coal consumption by 8.9 million tons from 2009 to cope with the suspension of Hamaoka nuclear power stations as well as delays in resumption of other units under routine maintenance. Overall, the Japanese coal consumption for power generation will decrease slightly by 1.3 million tons in FY2011 compared with that in FY2009, the latest year for which detailed statistics by fuel are available.

LNG for thermal power

Current natural gas-fueled generation capacity run by Tohoku and Tokyo EPCs combined is

approximately 32 GW, and almost all of these plants are operating. To cope with the power shortages anticipated for this summer, operation of these gas thermal plants is likely to be raised closer to their capacity. Also, Tokyo EPC plans to construct approximately 1.1 GW of new gas turbine facilities as an emergency power source, of which 780 MW is expected to be installed by August. Chubu EPC, where all of its nuclear plants at Hamaoka have been suspended, will fully activate its gas plants of 15 GW.

All in all, LNG demand by power companies will increase by approximately 8.9 - 11.3 million tons in FY2011 over FY2009 to a total of 49.3 - 51.6 million tons. Of this, additional demand by Tohoku and Tokyo EPCs will account for 5.9 - 8.25 million tons. This additional demand will be procured through spot and short term contracts, Upward Quantity Tolerance (UQT) of the existing long-term contracts¹, and LNG sharing. Additional supplies have been announced by various LNG suppliers; an annual four million tons from Qatar and one million tons from Indonesia have been announced and additional supplies are being arranged with other countries such as Russia and Australia.

For the fiscal year 2011, the world LNG demand including additional requirement by Japan will be about 220 million tons, while 240 million tons of supply is expected. Japan's incremental demand may have a certain effect on the world LNG market, but it would not significantly change the lax market condition in these years, at least for FY2011. There would not be major problems in purchasing additional quantity of LNG. However, the LNG fleet would not be sufficient to accommodate the increased cargos; spot charter rates for standard ships of 145,000 m³ class are rising. Good news is that Qatar has a large number of 210,000-260,000 m³ class ultra large LNG carriers, but their operating rates are relatively low due to limited compatibility at receiving terminals. The three power companies - Tohoku, Tokyo and Chubu EPCs - all have experiences of receiving these large ships so that Qatar can be the primary source of the additional supply.

Oil for thermal power

The incremental oil demand for power generation caused by the disaster may amount to 140,000-160,000 barrels per day (bpd) for FY2011. The direct increase at Tokyo and Tohoku EPCs will be 70,000 - 90,000 bpd assuming plant utilization factors of 45 -50%, which may be applicable for middle-load oil thermal power stations. Other power companies may also increase oil consumption for thermal power because of shutdown of Hamaoka and delayed recovery of Genkai and other nuclear plants. The incremental oil consumption may amount to 60,000 bpd or so in FY2011 over FY2009. In addition, industrial users with private power plants may increase their operations. However, these industrial users have been switching to natural gas since 2004 when oil prices started to soar. IEEJ estimates that the incremental oil demand in this category will be limited and may be in the range of 10,000 bpd or so over the level in FY2009.

One anxiety is shortage of domestic tankers because the domestic dirty fuel fleet has been significantly reduced in the past ten years as oil consumption has been reduced to less than ten percent of the thermal power generation. Another anxiety is emergency relaxation of fuel standards (sulfur content) to be required if the Japanese oil industry could not supply an adequate amount of high-quality fuel oils.

¹ UQT or DQT is the upward or downward flexibility in the quantity to be lifted under an LNG sale/purchase contract, which allows increase or decrease of annual lifting quantity generally by 5-10%.

Oil and gas industries have been mostly restored to normal operations

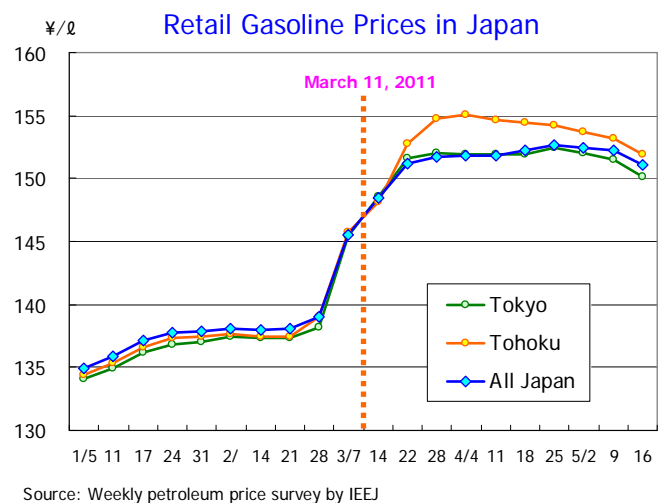
Oil industry

The supply chains of petroleum products for Tohoku and greater Tokyo districts have almost recovered from the disruption by the earthquake. By the end of April, 25 out of 29 oil terminals in seven prefectures -- six prefectures in Tohoku plus Niigata -- had restored their shipping facilities, and substantially improved oil distribution in the Tohoku disaster areas. Oil companies have been providing assistances for service stations on matters such as leakage tests of tanks and piping, inspections and required repairs of buildings to ensure safety. As a result, 2,904 service stations out of 3,070, or 95%, have come back into operation. In the areas where service stations are still inoperable, small temporary service facilities are set up to supply gasoline and other oil products.

Three refineries have been shut down for a prolonged period. One of them, the Kashima Refinery of JX Nippon Oil & Energy Corporation (252,500 bpd) will come back on stream in June. JX Energy's Sendai Refinery (145,000 bpd), although it resumed product shipping in May, will resume crude oil processing only in 2012 due to severe damage to the refining units. Cosmo Oil is working hard to restore its Chiba Refinery (220,000 bpd) by the year-end, where several LPG tanks caught fire when the earthquake hit.

Recovering from the initial shock, supply capacity of oil products seems to have more than recovered. Oil industry is now experiencing distinct demand distribution on oil products. After the earthquake, there have been widespread voluntary restraints in Japan on many facets of daily life to depress spending, and as a result, demand for gasoline has clearly declined.

All oil companies have frozen wholesale prices after the Earthquake for three to four weeks starting from the third week of March, although they were in the process of passing the crude price hike through to consumers. Some wholesalers, however, raised their prices after the second week of April, pointing out that supply of oil products nearly recovered to a normal level and the market was stabilized. But the retail prices started to soften at the end of April and are showing a continuing decline in May reflecting consumers' conservative attitude, according to the Weekly Petroleum Price Survey by the Oil Information Center of IEEJ.



Overall impact on the oil demand is yet unclear. The shut downs of nuclear power plants will produce strong oil demand for power generation, including diesel for gas turbines, heavy fuel oil and crude oil for thermal power plants. Strong demand will also be expected on kerosene and light fuel oil for factories and hospitals, as well as diesel gas oil for heavy machines working in the disaster areas. However, sluggish economic activity is apparently depressing oil demand as a whole as discussed in the latter sections. The current situation still poses challenges for the Japanese oil industry in managing supply and demand balance. The industry may also face another problem as to the means to maintain oil supply chains in rural villages, with apparently decreasing population after the natural disaster at this time.

City gas industry

The Japan Gas Association announced on May 3rd that the restoration work has been completed on repairable 401,976 houses and buildings damaged by the Great East Japan Earthquake in its 16 member enterprises' service areas. Around four thousand engineers dispatched from city gas companies all over Japan worked hard to successfully restore gas service to 99% of customers by April 20th. Gas services in the areas where houses and buildings were more severely damaged by the earthquake and tsunamis will be restored later when reconstruction plans for the areas are implemented. The Japan Gas Association had disclosed earlier that 460,407 houses and buildings were affected by the disaster. In other words, as many as nearly 60 thousand houses and buildings were lost or so severely damaged as not to be repairable.

There is a sudden surge in demand for gas engines and gas co-generation systems to cope with potential power shortages. The existing generators at private facilities will be operated fully this summer pushing up gas demand to some extent. However, a quick boost in production of generators seems difficult because some parts-manufacturers are stricken by the disaster and unable to operate as yet. As a result, the new gas demand will become more tangible in 2012.

Basic Energy Plan will be reviewed totally afresh

Prime Minister Naoto Kan said at a press conference on May 10th that the existing Basic Energy Plan should be overhauled in view of the Fukushima incident; the plan was revised last year. In response, METI set up on May 12th an expert committee on energy policies. The current Basic Energy Plan stipulates "... construct 14 nuclear power plants, increase their capacity utilization to 90%, and boost the ratio of nuclear power to the total electricity output to 50% or more" putting "the Nuclear Renaissance" in the center of its strategy on energy security and counter global warming. The Fukushima Daiichi accident, however, rendered it impossible to implement this. The ambitious target to "reduce greenhouse gas emissions by 25% compared to the 1990 level", pledged by the former Prime Minister Yukio Hatoyama to the world in 2010, must be revisited as well.

"Energy policies will play a significant and important role in shaping the future of Japan," said Mr. Banri Kaieda, METI Minister, when he kicked-off the meeting. However, it is not easy to find effective and viable policies. Naturally, such discussions will have to develop into transformation of the fundamental structures of Japanese economy, society, and industries. Immediate agenda may include: (1) whether it is possible to increase renewable energy supply beyond the current plans of 10% to 20%; and (2) how we are going to deal with global warming while we need to depend more on thermal power plants. Curbing peak demand and investigating the role of distributed energy systems will also be discussed. The committee is to produce its first report by July.

The Reconstruction Design Council of the government also calls for fundamental revision of future energy policies in an "interim report on major opinions" it produced in early May. It remains to be seen, however, if the government can set up effective and viable policies replacing the current plan structured around nuclear energy. While it is encouraging to learn that businesses and people are now keen on saving electricity and energy after the disaster, we need some more time to quantitatively measure their effects.

Meanwhile, the Ministry of the Environment (MOE) estimates that CO₂ emissions of Japan will increase by 10% compared to the 1990 level if all 14 nuclear reactors that were shut down

because of the disaster were mothballed, no new nuclear reactors will be started by 2020, and the electricity deficit should be made up solely by thermal power. Consumption of fossil fuels will naturally increase if we augment thermal power generation to make up for the absence of nuclear power. Japan has to find a way, a narrow way, to combat global warming without resorting to nuclear power.

MOE report: Wind Power is the most promising renewable energy

On April 21, Ministry of the Environment (MOE) released the “Study on Potential of Introducing Renewable Energy: FY2010.” This study was launched in 2009 to investigate the potential of power generation by renewable energy sources based on photovoltaic power (non-residential), wind power, mini-hydro power (smaller than 30MW) and geothermal power.

The study provides estimates of renewable energy resources naturally endowed, which is theoretically calculated from the size of area suitable for system installation, mean wind velocity, river flow rate and other elements, and “introduction potential” considering constraints on applicable lands as inclination, legal restrictions, present land use, and distances from residential areas. It also estimates “feasible introduction amounts under various scenarios,” such as introduction of feed-in-tariff (FIT) system and subsidies, and enhanced technology progress.

Non-residential photovoltaic power generation is estimated to have an introduction potential of 150GW utilizing roofs, walls and other surfaces of public buildings, such as schools and city halls, power stations, factories, warehouses, and abandoned farmlands which have become woodland or wasteland.

Potential of Renewable Energy in Japan (Ministry of Environment; March 2011)

	Potential	Scenarios			
		FIT	FIT+ Technology Progress	FIT+ Subsidy	FIT+TP+S
	GW	GW	GW	GW	GW
Photovoltaic (Non-residential)	150	0	0.2 - 72	0 - 26	69 - 100
Wind Power	1,900	24 - 140	410	130 - 590	1,500
Mini-Hydro (Smaller than 30MW)	14	1.1 - 3.0	4.3	2.7 - 5.4	7.4
Geothermal	14	1.1 - 4.8	5.2	1.5 - 4.3	4.6

However, it is estimated that no photovoltaic power could be introduced under the present FIT system as of 2011 (electricity purchase price at JPY40/kWh). However, under the “FIT + Technology Progress” scenario assuming improvements are achieved so that system costs are reduced by one-half or two-thirds and applying a slightly reduced purchase price of JPY36/kWh for fifteen years, introduction potential will increase up to a maximum of 72GW. Further, if an additional subsidy is offered to cover one-third of the project cost, installation of photovoltaics as much as 100GW would be possible.

Wind power offers the largest potential and expected to contribute 140GW under the FIT scenario, and a maximum of 410GW under a scenario where system costs are halved and engineering costs are reduced by one-fifth while power purchase price is JPY20/kWh applicable for fifteen years. Located along the jet stream path, northern Japan is abundant in wind power resources; under the FIT scenario, Hokkaido has the potential to provide 8.0-62GW, the Tohoku region 9.8-40GW and the Tokyo region 0.2-2GW. If the maximum potential estimated for both the Tohoku and Tokyo regions – a total of 42GW – could actually be installed, 88 billion kWh of power can be generated annually assuming a capacity factor of 24 percent. This is equivalent to 15GW of base-load thermal power stations operating at a 70 percent capacity factor. However, it will take considerable time to fully utilize this potential, as it is necessary to install regional power interconnections and backup capacities of a significant scale to deal with the intermittency of wind power, and also to develop reasonable power trade system and software to accommodate intermittent power into the electricity grid.

Offshore wind power, although it is an apparent global trend, still remains expensive

compared to other energy sources and has yet to substantially lower its costs. If substantial cost reduction is realized and a subsidy covering one-third of the project cost is introduced, offshore wind power would offer a huge potential of 1200GW. Even with a capacity factor of 24 percent, it will account for well over 204GW, or Japan's total installed capacity today, in terms of base-load nuclear or thermal power stations. In order to convert intermittent wind power into stable electricity, however, it is necessary to reform the Japanese power supply system completely. In the case of offshore wind power, high potential is also found in northern Japan, namely Hokkaido, Aomori and Iwate. Same issues with onshore wind powers should be overcome; they also need power interconnections and back-up systems. In addition, fishery rights are another issue to be resolved before construction.

The study found mini-hydro power generation using rivers, water streams and agricultural irrigation channels, and geothermal generation to offer introduction potential of 14GW each. Although these sources appear to have limited potential compared to photovoltaic and wind energy, they are valued for their predictability of power generation volume and relatively high output controllability.

Energy Committee Highlights

JEAC starts to review the role of atomic energy

The Japan Atomic Energy Commission (JEAC) of the Cabinet Office held a meeting on May 17 to initiate a review of the role of atomic energy with recognition that the trust of nuclear safety has been totally ruined by the accident of Fukushima Daiichi. The meeting started with the review on critical elements of the accident citing twelve items including earthquake, tsunami, station blackout, total loss of the cooling system, accident management, hydrogen explosion, spent fuel pools, safety inspection, safety regulations and design, organization and crisis management, information disclosure and safety control in emergency. A representative of the Atomic Energy Society of Japan (AESJ) made a presentation on preliminary findings on these elements and conceivable counter measures, which are composed of urgent ones to be implemented within a year as well as medium term measures to be implemented in two to three years after prudent consideration. AESJ will from time to time review and improve the proposal.

Professor Hajime Yamana of Kyoto University made a presentation on the role of nuclear power in the energy structure of Japan proposing a change of energy pathway to discreet use of nuclear power preconditioned on stringent risk management. He proposed eight important policy actions in the course of an emergency situation and moving to restoration of quality of life and environment on a long term basis.

He advocated that restoration of the nuclear disaster area should be implemented under a national unity, where the longer term environment restoration plan should be based on radiation at a level lower than 5 milli-Sievert per year (mSv/y), or hopefully lower than 1mSv/y, rather than the interim criterion of 20mSv/y currently applied as emergency response. He indicated importance of putting the nuclear power plants back online upon completion of regular maintenance to cope with the increasing power demand toward summer. For this, the government should indicate clear criteria to evaluate and justify continued operation of nuclear plants with reinforced safety, and support power companies to obtain agreements from local communities.

With regard to safety regulation, he proposed a review on safety administration system

including consolidation of the Nuclear Safety Commission of Cabinet Office and Nuclear and Industrial Safety Agency of METI, in order to improve technical expertise of the evaluation team. He also mentioned that basic study on nuclear technology should be enhanced under support of Ministry of Education, Culture, and Science, in view of the fact that priorities have so far been given to expansion of nuclear plants without due consideration of proper promotion of fundamental knowledge base.

On the longer term prospect, if all the existing nuclear plants were to be demolished without replacement after the lapse of currently assumed plant life of 45 years, deficit of power generation capacity may reach 38GW by 2030 and 64GW by 2050. As it is rather unlikely to maintain the present construction plan of 14 units simply as is, it is natural to assume that the current level of nuclear dependence will need to be maintained for the medium term. However, it is necessary to re-establish a national consensus if nuclear should be still kept as the core energy source in Japan's energy supply mix, reviewing every aspect of issues relating to nuclear technology and safety, laws and regulations, feasibility of renewable energy development, environmental restoration of the Fukushima district, etc. In addition to Professor Yamana's discussion as above, many elements such as security of electricity supply, improved economics and efficiency of fossil fuels, roles of distributed power sources, possibility of energy conservation, etc., need to be reviewed extensively before defining the role of nuclear to be played in rehabilitating the Japanese energy system.

Meanwhile, Mr. Masahiro Sakane, vice-president of the Business Federation of Japan or Keidanren, disclosed his view at a May 16 meeting of the Vision Team of Rehabilitation Commission of DPJ headed by Mr. Masayuki Naoshima, former METI minister. He said that, from the viewpoint of the potential of renewable energies, it is unlikely to replace the nuclear power solely with these energies. It is necessary to maintain the existing nuclear power stations as well as to make substantial technical breakthroughs. He also mentioned a vision to make the Fukushima district a base for renewable energy development.

Energy News in Japan & Asia

2010 Oil demand remains strong while Russia becomes fifth largest supplier for Japan

Japanese oil demand recorded a sharp decline in March reflecting the disaster-hit economic downturn. Compared with March last year, gasoline and diesel oil consumption decreased by 4.5% and 8.5%, respectively, while kerosene increased by 2.3% reflecting colder weather. Overall, refined product consumption in March decreased by 5.3%, though crude oil burnt for power production nearly doubled from 286 thousand kiloliters (KL) to 550 thousand KL in order to cover power shortages caused by shutdown of quake-hit nuclear and thermal power stations.

In early May, crude oil processing came down to a level of 85% of that of the previous year after all oil companies had rushed for full operation of their refineries until the middle of April, while inventory at refineries are now higher than the previous year by more than 10%. Oil demand seems to have shrunk significantly in April because of particularly slow economic activities and protective consumer psychology after the quake/tsunami disaster.

Table-1 Japanese Oil Demand

	FY2010	FY2009	Change
	1,000KL	1,000KL	%
Gasoline	58,202	57,464	101.3
Naphtha	46,668	47,320	98.6
Jet Fuel	5,154	5,283	97.6
Kerosene	20,340	20,056	101.4
Diesel Gas Oil	32,867	32,388	101.5
Fuel Oil A	15,412	16,043	96.1
Fuel Oil C	17,330	16,434	105.5
Fuel type total	195,973	194,988	100.5
Crude Burning	4,687	3,762	124.6
Grand Total	200,660	198,750	101.0

Source: METI

In terms of a year-on-year comparison, oil consumption for the fiscal year 2010 showed a slight increase after seven consecutive years of declines, although it is only 75.5% of the peak

demand recorded in 1995. Notably, Fuel Oil C and crude oil for thermal power generation increased because of the hot summer. Meanwhile, crude oil processed remained 0.4% or 1,249 thousand KL below that of the previous year, and the incremental demand was mostly supplied by product imports, mainly of naphtha (+1377 thousand KL) and fuel oil (+883 thousand KL). As discussed elsewhere in this issue of JEB, oil consumption is expected to rise significantly in 2011 to make up for the power deficit caused by shutdowns of nuclear power stations.

In Japan’s crude oil import mix of fiscal year 2010, Russian crude oils jumped to the fifth position overtaking Kuwait. Since the Kozmino export terminal was commissioned in December 2009, ESPO Blend, a blended grade of Siberian crude oils transported via the East Siberia to Pacific Ocean pipeline, has been increasingly imported into Japan in preference to other east Russian grades such as Sokol of Sakhaline-1 and Vityaz of Sakhaline-2. Japan imported about one third of the 15 million tons of ESPO Blend exported last year.

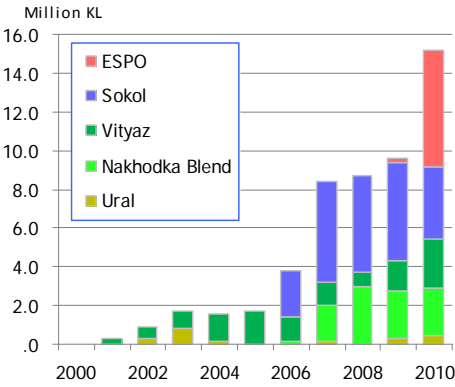
Table-2 Japan's Crude Oil Import

	Source	FY2010 Kbpd	Share %
1	Saudi Arabia	1,078	29.2
2	UAE	771	20.9
3	Qatar	429	11.6
4	Iran	361	9.8
5	Russia	261	7.1
6	Kuwait	257	7.0
7	Iraq	120	3.3
	Total	3,693	100.0

Source: METI

With the above surge, the share of Russian crude oil in the Japanese crude oil import reached 7.1%, which was more than twice the crude oils imported from Southeast Asia (7,381 thousand KL) and China (now a mere 123 thousand KL) combined. As a side effect, Japan’s dependence on the Middle Eastern crude oils dipped by almost three percentage points from 89.5% in 2009 to 86.6% in 2010. When the second section of the ESPO pipeline connecting Skovorodino and Kozmino is completed at the end of 2012, expanding the export capacity to 50 million tons on top of the 30 million tons to be branched out to China at Skovorodino, the Russian presence in the Northeast Asian oil supply map will be uplifted significantly. One question that remains is whether East Siberia will be capable of producing the huge amount of oil sufficient to fill up the expanded export capacity.

Russian Crude Import to Japan



Source: Ministry of Finance

Electricity demand fell sharply by 6.5% in April

Federation of Electric Power Companies (FEPC) reported that electricity demand for ten major power companies recorded a significant decline by 6.5% on year-on-year basis in April, which is the largest decline for the month of April exceeding a 5.1% decline recorded in 2009. Among ten companies, the quake/tsunami-hit Tohoku and Tokyo electric power companies recorded the largest decreases by 20.3% and 13.8%, respectively, while other companies also recorded stagnant demand.

The effect was more seriously seen in the electricity consumption of large industrial users. In this category of demand, Tohoku Electric suffered a sharp 28.9% decrease year-on-year and Tokyo Electric 13.4%, while western power companies obtained 3 -4% increases. Apparently, industries having a nation-wide network have shifted production to non-affected factories in the west to make up the deficit by the quake-hit plants. Nevertheless, the national demand for this category recorded a sharp decline of 6.2%, mainly in chemicals, non-ferrous metal and machineries.

On the supply side, nuclear power generation decreased 23.9% year-on-year. Hydraulic

power generation also recorded 27.5% decrease because of lower water availability at 84.5% compared to a normal year. To supplement these, thermal power generation increased by 6.3%. LNG consumption increased by 7.0% from 3,199,120 tons to 3,423,768 tons, while crude oil burning increased more than twice that of the previous year from 180,863 KL to 385,954 KL. Consumption of coal and fuel oil remained almost at the same level. After May, fossil fuel consumption will increase substantially to accommodate increasing demand along with higher temperature and recovery of power stations hit by the tsunamis.

APERC Letter

In May, APERC published reports on Peer Review on Energy Efficiency (PREE) conducted in Peru and Malaysia on our website: <http://www.ieej.or.jp/aperc/PREE.html>. They were the sixth and the seventh APEC PREE, respectively. APEC PREEs have previously been conducted in New Zealand, Chile, Viet Nam, Thailand and Chinese Taipei.

APEC Peer Review on Energy Efficiency (PREE) in Peru

The Peer Review on Energy Efficiency (PREE) for Peru was conducted from November 8 to 12, 2010. A Review Team visited Peru and conducted interviews with a range of stakeholders from government institutions, private companies, non-governmental organizations and academia. The Review Team was composed of energy efficiency experts from Indonesia, Malaysia, Mexico, Thailand, United States and APERC.



The Review Team was impressed by the efforts taken by the Peruvian government to improve the energy efficiency of the economy. The Peruvian government has actively pursued energy efficiency since the 1980s.

Through the investigation, the Review Team found that it is of critical importance to build up public support for energy efficiency measures and programs initiated by the government, organizations and enterprises so as to create an energy efficiency culture throughout the entire economy. The Review Team found that Peru should in particular focus on energy efficiency in the transport sector. In order to manage future high energy demand, energy efficiency policies should be coordinated more coherently among relevant ministries of energy, transport, environment and finance.

The review report including 51 recommendations was endorsed by the 41st APEC Energy Working Group Meeting in Vancouver, Canada on May 11-12, 2011.

APEC Peer Review on Energy Efficiency (PREE) in Malaysia

The Peer Review on Energy Efficiency (PREE) for Malaysia was conducted from November 29 to December 3, 2010. The Review Team visited Malaysia and conducted a series of interviews with a range of stakeholders. The team was composed of nine energy efficiency experts from Indonesia, Singapore, Chinese Taipei, Thailand, United States, and APERC.



In summary, the Review Team found that Malaysia is making energy efficiency one of the important elements of its energy policy framework. Its commitment of reinforcing energy efficiency policy framework and institutional setup and enhancing actions is the evidence that Malaysia is significantly scaling up its energy efficiency efforts. The Review Team compiled recommendations aimed at filling gaps with practicability with adjustments to the strategies and programs on energy efficiency under the current plan.

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