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Japan Energy Brief

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Year 2012 begins with uncertainties about nuclear power supply

On New Year's Day, only six out of 54 nuclear power plants were operating in Japan, and they are due for routine maintenance before May. The Nuclear and Industrial Safety Agency (NISA) of METI presented on January 18 a draft appraisal on the stress-test reports for the O-i #3 and #4 nuclear plants of Kansai Electric to the committee of experts stating that the reports are "appropriate." Following the Fukushima Daiichi accident, the government had set the stress-test as a pre-condition for restarting nuclear reactors after regular maintenance. The draft will be revised in February taking into consideration comments presented at the meeting, as well as advice expected from the IAEA experts visiting Japan in January. The finalized report will be sent to the Nuclear Safety Commission of the Cabinet Office for their review, and the final decision will be made by Prime Minister Noda after consultation with heads of local governments. Fourteen stress-test reports have been submitted so far. However, this process would by no means be simple and straightforward; since nobody knows yet if and when any reactor will be allowed to restart. This summer, Japan is to again face extremely hot issues of severe electric power supply and demand problems.

Meanwhile, the Japanese government declared last December that Fukushima Daiichi nuclear power plants reached a state of cold shutdown and entered the second phase of containing the accident. Japan will have to walk a long and rough road of decontamination and decommissioning, solving a number of unknown and difficult challenges in terms of technological as well as social and economic aspects. The government announced on January 6 a plan to amend the Nuclear Reactor Regulation Law to explicitly stipulate the life of nuclear plants to be 40 years in principle making it imperative to review and restructure energy and environment strategies accordingly.

Fukushima Daiichi goes into the second phase

On December 16, 2011, Japanese Prime Minister Yoshihiko Noda declared at a government nuclear emergency response meeting that the Fukushima Daiichi nuclear power station had

reached a state of cold shutdown coming to the end of the accident response phase.[1] He stated that diversity and multiplicity of water injection systems are assured to keep the reactors sufficiently cool and that radiation at the plant boundary can be kept at low enough levels even in the event of "unforeseeable incidents." This declaration marked the transition from the first phase of stabilizing nuclear reactors to the second phase of decommissioning them.

Following this, a joint team of the government and Tokyo Electric announced on December 21 a "Mid-to-long term Roadmap" on decommissioning the Fukushima Daiichi reactors. The process is divided into three phases. In phase-1, removal of spent fuel from storage pools will be commenced within two years. In phase-2, removal of damaged fuel or fuel debris (re-solidified fuel and its cladding tubes after melt down) will start within ten years. In phase-3, decommissioning of the reactors and disposal of all radioactive wastes will be completed within 30 to 40 years. More specifically, they plan to start removing spent fuel from the storage pool at the Fukushima Daiichi #4 unit within two years, and finish the fuel removal step in the second phase. Reprocessing and storage procedures for the fuel will also be determined in the second phase. It is also necessary to decontaminate the nuclear reactor buildings, check and repair water leakage from the reactor vessels, and re-charge water in the vessels to start removing fuel debris around 2021. Advanced robots must be developed to perform these procedures as they will have to be carried out under prohibitive high dose environments. The reactors will be decommissioned after 10-15 years when they are cleared of all fuel debris. "We will proceed with the technology development by mustering all wisdom in the world and by the joint efforts of the government and the private sector," said Mr. Goshi Hosono, State Minister in charge of nuclear disaster. Such a statement was prompted by the fact that the experience from the Three Mile Island accident alone is insufficient because fuel canisters at Fukushima Daiichi did not stay within the reactor pressure vessels (RPV) as in the case of the TMI accident, but melted down and partly leaked into the pressure containment vessels (PCV).

On December 28, Minister Hosono proposed a plan to construct interim storage facilities for contaminated soil in Futaba-gun near Fukushima Daiichi power station to facilitate the radiation cleanup activities. Soil at Futaba is exposed to 100 micro Sievert per hour (μSv/h) or more of radioactivity making it difficult for inhabitants to return early to the area. The Japanese government's idea understandably invited intense anger and resistance from the local community. Prime Minister Noda visited Fukushima prefecture on January 8 and asked for acceptance, but obtaining the consent seems extremely difficult. Decontamination may not proceed as planned and return of evacuees will be further delayed if the interim storage sites are not determined. A consensus with significant implications for the local people must be formed in order to get the green light to nuclear decontamination.

Life of nuclear reactors to be set at 40 years or 60 years

At a press conference on January 6, Minister Hosono outlined amendments to the Atomic Energy Basic Act and the Nuclear Reactor Regulation Law, which stipulate severe accident management conditions, drawing upon lessons from the Fukushima Daiichi accident. The government will set up a new "Nuclear Safety Agency" under the Ministry of the Environment this April as well. The gist of the amendments is as follows;

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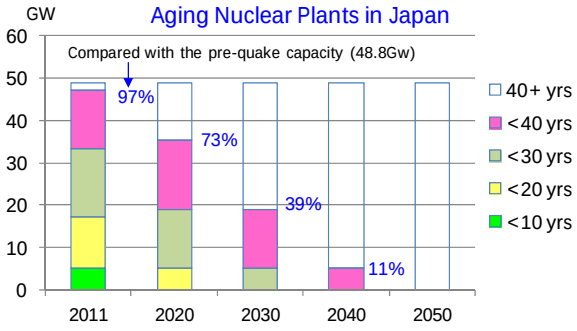
[1] As of December 20, 2011, temperatures at the bottom of the nuclear reactor vessels are: 31.4 degree centigrade at #1 unit, 62.8 at #2, and 61.5 at #3. The #4 units have no nuclear fuel in its reactor vessel. Temperatures at the spent fuel pools are reported to be 10-20 degree centigrade at #1 to #3 units and 20-30 at #4 unit.

1) Impose a 40-year cap on the operational life of a nuclear power plant. Extension may be given in an extraordinary case, upon request by a power company, and if it poses no problem.
2) Introduce a "back-fit" scheme to make the existing nuclear plants comply with the latest standards.
3) Legislate for accident management, which is now a voluntary process at power companies, and clearly provide in the law that power companies are primarily responsible for taking safety measures.
4) Introduce a framework for an emergency measures in order to protect life and health of the public during a disaster including orders to stop operation of nuclear power stations.
5) Integrate safety regulations on nuclear power stations stipulated in the Electricity Business Act into the Nuclear Reactor Regulation Law.

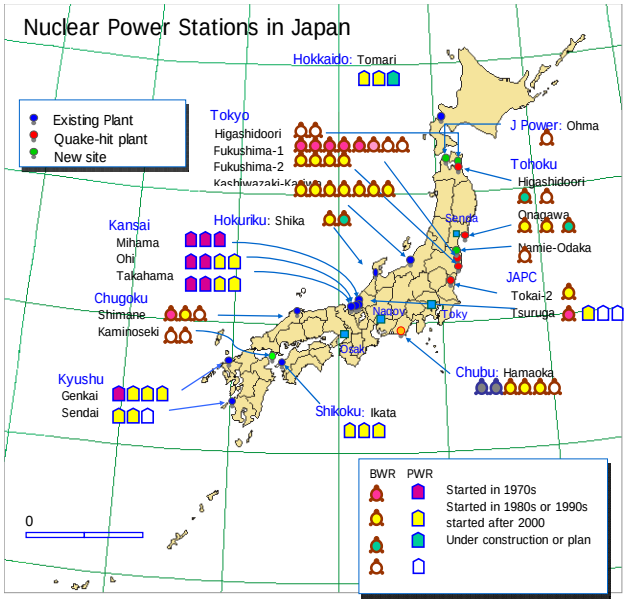
The Nuclear Reactor Regulation Law already requires utility companies to appraise technical safety of 30-year-old nuclear stations in light of "anti-aging measures." After that, NISA will examine the safety of the nuclear stations every 10 years, while no limit is currently imposed on the operational life of nuclear reactors. The operational life will be stipulated in a law for the first time in Japan, and Mr. Hosono emphasized at the press conference "We will thoroughly apply the policy of no safety, no nuclear."



Under the new legislation, an electric utility company may submit an application for extension of the operational life of a 40-year or older nuclear plant. The government may approve the extension as an exception after examining the utility's technological ability to evaluate long-term degradation and to ensure safety. The extension is allowed only once for each reactor and the extension period must be specified on the application. Specific examination standards are yet to be developed, but a Cabinet Office official on January 17 disclosed a plan to limit the extension to a maximum of 20 years. This explanation has brought about another dispute among stakeholders, as the maximum life of a nuclear plant could reach 60 years, as had been discussed before the Fukushima Daiichi accident.

How to deal with replacement of aging nuclear power stations

Four Japanese nuclear plants are now 40 years or older, with a total capacity of 1,657 MW. Operation periods of 21 units including the above with 15,631 MW in total capacity will exceed 30 years within 2012, accounting for 32% of the current generation capacity, 48,847 MW, of 54 nuclear plants. By 2030, 15 more units or 14,303 MW will pass the 40 year mark, leaving only 18 units totaling 18,913 MW of capacity or only 39% of current capacity. All nuclear units in Japan will be older than 40 years by 2050.



The Fukushima Daiichi accident has led us

to undertake a fundamental reappraisal of the Basic Energy Plan. Those opposing nuclear energy are strongly pushing for denuclearization, but the majority of the Japanese populace probably would think that practical options should inevitably include nuclear energy to sustain the Japanese economy. It is impractical or unacceptable for society to overkill the economy and bring down quality of life simply to press for reduction or elimination of nuclear energy. Imposing a cap on operational life of nuclear plants eventually calls for us to restart constructing new nuclear plants or at least replacing aged ones. It is going to be a heavy and difficult task to form a national consensus on when and how we should initiate this process.

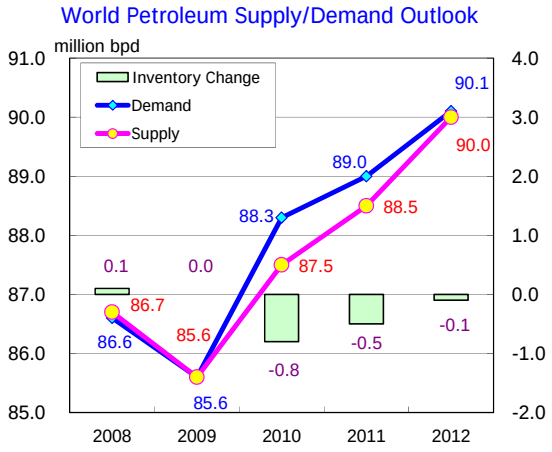
IEEJ Energy Outlook for 2012

The Institute of Energy Economics, Japan (IEEJ) announced its outlook for 2012 at the Energy Symposium held on December 22. Dr. Ken Koyama, Managing Director of IEEJ, presented his views that the crude oil price for 2012 in terms of the WTI futures would continue to be volatile at around $90 – 110/Bbl. Mr. Shigeru Suehiro, Group Manager, the Energy Data and Modeling Centre of IEEJ, explained that the Japanese economy would recover in 2012 from the disaster caused by the 2011 earthquake. However, in a case where no nuclear power generation is assumed to come back on line soon ("Restricted Nuclear Case"), economic growth remains minimal with increased payment for fossil fuel imports; and while primary energy consumption will be slower, CO_2 emissions may increase by up to 11.3% compared to the case where no restriction is imposed on availability of nuclear power generation ("Unrestricted Nuclear Case").

Oil price volatility has increased significantly in 2011, while the WTI futures have hiked by $15 per barrel year-on-year with its average for 2011 at $95.0 per barrel as of December 16. In the background of this movement are the turmoil in the Middle East and North Africa (MENA), European financial crisis and other risk elements on top of the increasing oil demand. With growing tension on the Iranian situation, oil price movement needs to be watched carefully. On the other hand, the natural gas market is calm with increasing supply of unconventional gas, although gas demand trends in emerging countries and Japan after the nuclear trouble are the factors to be watched carefully.

The Reference scenario for this outlook is developed based on the following assumptions.

1) The world oil demand will increase by 1.0 – 1.1 million bpd reaching 90.1 million bpd in 2012 reflecting moderate growth of the world economy. This demand increase will occur mainly in China, India and the Middle East, the magnitude of which will have a decisive impact on the world oil supply/demand balance.
2) Non-OPEC oil production will increase by 0.9 – 1.0 million bpd mainly in the US, Russia and Canada. In particular, the market movement in the US should be closely monitored, such as unconventional oil production at Bakken Shale and other sites, while a decreasing trend may appear in oil demand.



As a result, the requirement for OPEC oil will decrease by 0.4 million bpd to 30.0 million bpd,

which will be supported by the production ceiling (30.0 million bpd) agreed at the 160th General Meeting. Thus, the present market balance will be maintained.

Under the circumstance, oil price in terms of WTI futures may continue to be around $100 (± 10) per barrel in 2012. Despite the temperate prospect, uncertainty is increasing in the market. Tension could rise on the tightening Iranian economic sanction versus potential threats to the Hormuz Straight oil transit. The European financial crisis may develop further leading to down-grading of government bonds of major countries and to conservative attitudes by financial institutions, giving a substantial downward pressure on the economy as well as oil demand. Thus, under the High Price scenario where geopolitical risks upsurge, oil price could go up to $120/Bbl. However, under the Low Price scenario where the European economic crisis spills over worldwide, oil price could plunge to $70/Bbl. The present price differential between the WTI and Brent, which has narrowed from $27/Bbl to $10/Bbl with recovering production in Libya and improved pipeline transport in the US, may be maintained in 2012.

Natural gas demand has been growing worldwide, by +7.4% in 2010, based on its advantages of being a clean fossil fuel with stable supply. In particular, LNG recorded a 23% increase in 2010. This expanding trend may continue further, with a downward possibility discussed for the Low Price scenario as above. The world gas market is separated into three regional sectors, namely, the US, European, and Asian markets, where gas prices significantly differ among them; around $4/MMBTU for the US market, $9/MMBTU for the European market and $16/MMBTU for the Asian market. The natural gas price in the US may remain weak and stable thanks to the Shale Gas Revolution. On the other hand, Asian gas demand will continue to be strong with the temporary demand increase from Japan on top of the growing demand in emerging countries. The Asian gas price is expected to be stable as it is already very expensive and the LNG supply capacity for the region is being expanded. However, as the Asian LNG prices are linked to crude oil prices, LNG prices may soar when geopolitical risks push up oil prices as discussed above for the High Price scenario.

Economy slowdowns and emissions increase without nuclear power

The 2011 earthquake and tsunami had significant impact on the Japanese economy devastating its production facilities and supply systems widely while depressing consumer attitude. Economic activities are recovering from the disaster gradually. However, resumption of operation of nuclear power stations is still uncertain for 2012. If no restriction is imposed on the electricity supply (Unrestricted Nuclear Case), the Japanese economy will show a substantial pace of recovery of about +1.9% in real GDP from the earthquake-hit low in 2011. However, if nuclear power generation is not resumed before the summer peak demand season (Restricted Nuclear case), the electricity supply deficit could amount to 12.2% after considering a 5% reserve margin. Industrial production would be hampered again. A substantial amount of fossil fuels will be imported to supplement the deficit in the electricity generation. Thus, Japanese economic growth for 2012 could be suppressed to almost nil.

In 2011, the Japanese economy experienced an annual decline of 0.3% due to the earthquake and the soaring exchange rate. In particular, its manufacturing industry was hit seriously and the industrial production declined by an annual 1.7%. Energy intensive industries were more seriously affected as shown in Table-1, and Japan's primary energy consumption dropped by an annual 3.7%. However, oil import increased by 4.1 million KL and LNG 13.9 million tons to run thermal power stations extensively, thereby increasing CO_2 emissions by 2.1%.

In 2012, for the Unrestricted Nuclear Case, the Japanese economy is expected to recover from the disaster and industrial production should increase by 5%. This will push up energy

consumption in the industrial sector by 2.7%, while that in the transport sector will decrease by 1.1% reflecting improvement in the vehicle energy efficiency. Energy consumption in the residential and commercial sector remains at an annual growth of 0.4% with consumer's energy saving behavior initiated from the 2011 experience. CO_2 emissions will decrease by 5.3% reflecting lower consumption of fossil fuels at thermal power stations and private electricity generation plants.

Table-1 Short-term Energy Outlook of Japan

		FY2009	FY2010 (Actual)			FY2011 (Estimation)			FY2012 (Forecast)	
			1st Half	2nd Half	Total	1st Half	2nd Half	Total	Nuclear Power Suppl	
									Available	Restricted
Economic Indicators	GDP (2005 price billion Yen	**495,417** (-2.1)	**252,961** (4.9)	**258,031** (1.5)	**510,992** (3.1)	**249,895** (-1.2)	**259,335** (0.5)	**509,230** (-0.3)	**519,012** (1.9)	**509,957** (0.1)
	Private Demand	**364,657** [-3.1]	**187,200**	**188,475**	**375,675** [2.2]	**185,736**	**189,268**	**375,003** [-0.2]	**379,730** [1.1]	**378,040** [0.7]
	Public Demand	**118,037** [0.9]	**57,189**	**61,514**	**118,704** [0.1]	**58,226**	**63,563**	**121,789** [0.6]	**124,453** [0.6]	**124,441** [0.6]
	Overseas Demand	**11,673** [0.2]	**8,635**	**8,189**	**16,825** [0.8]	**6,240**	**6,973**	**13,214** [-0.8]	**14,839** [0.1]	**7,878** [-1.1]
	Corporate Goods PI (2005=100)	**102.6** (-5.2)	**102.9** (0.1)	**103.7** (1.4)	**103.3** (0.7)	**105.6** (2.6)	**105.5** (1.8)	**105.5** (2.2)	**105.9** (0.4)	**105.8** (0.3)
	CPI (2005=100)	**100.5** (-1.5)	**100.0** (-0.9)	**99.8** (-0.4)	**99.9** (-0.6)	**99.8** (-0.2)	**99.4** (-0.3)	**99.6** (-0.2)	**99.2** (-0.4)	**99.2** (-0.4)
	IIP (2005=100)	**86.1** (-8.8)	**94.6** (17.4)	**93.1** (1.7)	**93.9** (9.1)	**90.3** (-4.5)	**94.2** (1.2)	**92.3** (-1.7)	**96.9** (5.0)	**93.8** (1.6)
	Crude Steel (1,000t)	**96,449** (-8.6)	**55,424** (27.9)	**55,369** (4.2)	**110,792** (14.9)	**53,312** (-3.8)	**54,265** (-2.0)	**107,576** (-2.9)	**110,550** (2.8)	**108,191** (0.6)
	Ethylene (1,000t)	**7,219** (10.7)	**3,327** (-5.3)	**3,671** (-0.9)	**6,999** (-3.0)	**3,293** (-1.0)	**3,384** (-7.8)	**6,677** (-4.6)	**6,942** (4.0)	**6,692** (0.2)
	Exchange Rate (Yen/$)	**92.8** (-7.6)	**88.9** (-6.8)	**82.5** (-8.6)	**85.7** (-7.7)	**79.8** (-10.3)	**77.5** (-6.0)	**78.6** (-8.2)	**77.5** (-1.4)	**77.5** (-1.4)
	Crude Oil CIF ($/Bbl)	**68.9** (-23.5)	**78.6** (27.5)	**89.5** (17.4)	**84.0** (21.9)	**114.0** (45.0)	**110.0** (23.0)	**112.0** (33.3)	**110.0** (-1.8)	**110.0** (-1.8)
	Heating Degree day	**952** (6.1)	**77** (122.4)	**998** (8.8)	**1,075** (12.9)	**53** (-31.1)	**946** (-5.2)	**999** (-7.1)	**980** (-1.9)	**980** (-1.9)
	Cooling Degree Day	**329** (-17.5)	**560** (70.6)	**0** (-75.0)	**560** (70.5)	**472** (-15.7)	**2** (1600.0)	**474** (-15.4)	**425** (-10.4)	**425** (-10.4)
Energy Indicators	Total Primary Energy (10^10kcal = KTOE)	**491,315** (-4.0)	**250,850** (8.5)	**262,902** (1.1)	**513,752** (4.6)	**236,308** (-5.8)	**258,561** (-1.7)	**494,869** (-3.7)	**500,063** (1.0)	**495,824** (0.2)
	Final Energy Consumption (10^10kcal = KTOE)	**331,043** (-2.4)	**164,813** (7.1)	**177,925** (0.4)	**342,738** (3.5)	**155,468** (-5.7)	**173,874** (-2.3)	**329,342** (-3.9)	**332,895** (1.1)	**328,734** (-0.2)
	Industry	**155,327** (-3.2)	**78,625** (8.3)	**82,480** (-0.3)	**161,105** (3.7)	**75,375** (-4.1)	**80,816** (-2.0)	**156,191** (-3.1)	**160,339** (2.7)	**157,168** (0.6)
	Residential/ Commercial	**92,901** (-1.7)	**43,574** (9.0)	**54,468** (2.9)	**98,042** (5.5)	**39,658** (-9.0)	**52,319** (-3.9)	**91,976** (-6.2)	**92,309** (0.4)	**91,854** (-0.1)
	Transport	**82,815** (-1.7)	**42,614** (3.3)	**40,977** (-1.4)	**83,591** (0.9)	**40,435** (-5.1)	**40,739** (-0.6)	**81,174** (-2.9)	**80,247** (-1.1)	**79,712** (-1.8)
	Electricity (billion kWh)	**889.4** (-3.4)	**476.0** (9.1)	**466.1** (2.9)	**942.1** (5.9)	**439.7** (-7.6)	**452.6** (-2.9)	**892.3** (-5.3)	**917.7** (2.8)	**905.5** (1.5)
	City Gas (million cm/10,000kca	**33,837** (-1.9)	**16,574** (8.3)	**18,710** (0.9)	**35,283** (4.3)	**16,380** (-1.2)	**18,995** (1.5)	**35,375** (0.3)	**36,252** (2.5)	**35,828** (1.3)
	Petroleum Products (1,000kl)	**195,122** (-3.0)	**92,031** (2.4)	**103,917** (-1.3)	**195,948** (0.4)	**88,605** (-3.7)	**107,174** (3.1)	**195,779** (-0.1)	**188,199** (-3.9)	**199,380** (1.8)
	CO_2 (Energy source) (million t-CO_2) (FY1990=100)	**1,075** (-5.5) **101.5**			**1,122** (4.3) **105.9**			**1,146** (2.1) **108.2**	**1,086** (-5.3) **102.5**	**1,209** (5.5) **114.1**

Source: Various Japanese statistics. Forecast is made by IEEJ.

Note: 1. Numbers in parentheses show annual growth rates, while those for GDP show contributions.
2. Sectoral GDP will not necessarily add up to the total.
3. Energy consumption of the industiral sector includes non-energy use.

On the other hand, if operation of nuclear power stations is not resumed in 2012, economic activities will be severely restrained during the summer demand season. The growth of industrial production will be suppressed to an annual 1.6%, which is lower than the 2010 level, and the production of energy intensive industries will be affected substantially. The primary energy consumption will be lower than that in the Unrestricted Nuclear Case, while fossil fuel consumption will be much higher. In the Unrestricted Nuclear Case, fossil fuel import for 2012 is expected to decrease slightly from the 2010 level; -5 million tons for coal, -8 million KL for oil but +7 million tons for LNG. For the Restricted Nuclear Case, however, this may change to substantial increases; +6.3 million tons for coal, +15.1 million KL for oil and +20 million tons for LNG. With an energy price hike in the international market, the amount of fossil fuel import is expected to increase by 2.6 trillion Yen (US$35 billion) for the Unrestricted Nuclear Case. This amount will increase to 4.6 trillion Yen (US$61 billion) for the Restricted Nuclear Case. With the increased import payment, GDP growth will be depressed to almost nil for 2012. On the other hand, CO_2 emissions will increase by 11.3% from 1,086 million tons to 1,209 million tons.

Table-2 Outlook of Primary Energy Supply

	FY2009	FY2010 (Actual)			FY2011 (Estimation)			FY2012 (Forecast)	
		1st Half	2nd Half	Total	1st Half	2nd Half	Total	Nuclear Power Supply	
								Available	Restricted
Primary Energy Supply (10^10Kcal)									
Coal	**107,939** (-7.8)	**60,457** (20.1)	**59,760** (3.8)	**120,217** (11.4)	**58,532** (-3.2)	**60,660** (1.5)	**119,192** (-0.9)	**117,106** (-1.8)	**124,083** (4.1)
Oil	**209,848** (-6.1)	**99,689** (2.5)	**112,590** (0.0)	**212,279** (1.2)	**96,239** (-3.5)	**119,750** (6.4)	**215,989** (1.7)	**204,938** (-5.1)	**226,089** (4.7)
Natural Gas	**90,259** (-2.6)	**45,888** (8.6)	**49,618** (3.4)	**95,506** (5.8)	**51,699** (12.7)	**61,927** (24.8)	**113,626** (19.0)	**104,677** (-7.9)	**121,522** (6.9)
Hydro	**16,964** (1.0)	**10,824** (12.1)	**6,561** (-10.3)	**17,385** (2.5)	**10,515** (-2.9)	**6,388** (-2.6)	**16,904** (-2.8)	**16,058** (-5.0)	**16,058** (-5.0)
Nuclear	**58,876** (8.4)	**30,245** (7.1)	**30,415** (-0.7)	**60,660** (3.0)	**15,796** (-47.8)	**5,751** (-81.1)	**21,547** (-64.5)	**49,161** (128.2)	**28** (-99.9)
Others	**7,429** (-2.9)	**3,747** (7.9)	**3,958** (0.0)	**7,705** (3.7)	**3,528** (-5.9)	**4,084** (3.2)	**7,611** (-1.2)	**8,124** (6.7)	**8,044** (5.7)
Total	**491,315** (-4.0)	**250,850** (8.5)	**262,902** (1.1)	**513,752** (4.6)	**236,308** (-5.8)	**258,561** (-1.7)	**494,869** (-3.7)	**500,063** (1.0)	**495,824** (0.2)

Among energy sources, the final demand for oil products will decline significantly for the Unrestricted Nuclear Case reflecting the vehicle efficiency improvement and shift away from oil demand to other energy sources. However, it will increase in the Restricted Nuclear Case, as fuel demand for private generation plants will increase, while city gas demand will decrease reflecting lower economic activities[2].

Japan's GHG emissions increased 3.9% in 2010 with economic recovery

The Ministry of the Environment (MOE) announced on December 13, 2011 that Japan's GHG emissions increased by 3.9% to 1,256 million tons (preliminary estimate) in FY2010 (from April 1, 2010 to March 31, 2011). The CO_2 emissions increased 8.5% in the industrial sector following the economic recovery after the Lehman Shock, while electricity consumption increased in all sectors during the unusually hot summer and cold winter.

[2] The Japanese version of the report is available at the IEEJ website (members only).http://eneken.ieej.or.jp/data/pdf/111222teireiken408.htm

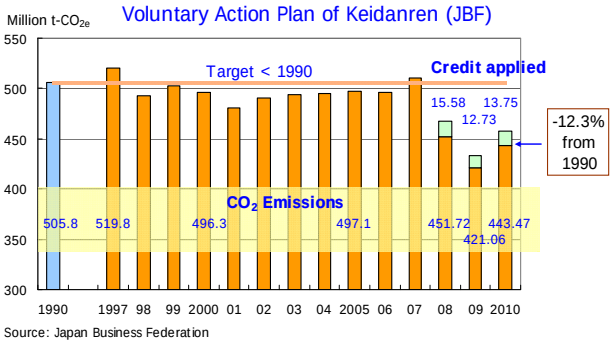
However, the total GHG emissions were down by 0.4% from the base year under the Kyoto Protocol.[3] Emissions of CFC alternatives have been reduced significantly in recent years, resulting in a 45% decrease in emissions of GHGs other than CO_2. Thus, CO_2 now accounts for 95% of the total GHG emissions. The amount of CO_2 emissions from non-energy origin was down 19% with decreased cement production and improved energy efficiency in chemical industries. The emissions from energy use were also down by 13% in the industrial sector reflecting energy saving efforts, while they were up by more than 30% in the services and household sectors and by nearly 20% in the energy transformation sector to accommodate the increased electricity demand.

Japanese GHG Emissions by Sector

	Base Year	2009	2010	vs 2009	vs Base Year
	Million ton	Million ton	Million ton	%	%
Industry	482	388	421	8.5	-12.7
Transport	217	230	232	0.9	6.9
Services	164	215	217	0.9	32.3
Household	127	162	173	6.8	36.2
Transformation	68	80	80	0.1	18.0
Fuel CO_2	1,059	1,075	1,122	4.4	5.9
Non-Fuel CO_2	85	69	69	-0.7	-19.3
Total CO_2	1,144	1,144	1,191	4.1	4.1
Other GHG	117	64	65	1.1	-44.6
Total GHG	1,261	1,209	1,256	3.9	-0.4

The Base Year is 1995 for HFC_3, PFC_3 and SF_6, and 1990 for others.

On the same day, Keidanren (Japan Business Federation) also announced a "Follow-up Report 2010" of its Voluntary Action Plan on the Environment. The report says that CO_2 emissions from the general industrial and energy transformation sectors (a total of 34 industries participating in the campaign) were up by 5.3% year-on-year to 443 million tons in FY2010, which translates into a 12.3% decrease from the 1990 levels. Back in 1997, Keidanren set out a counter-global warming chapter of its Voluntary Action Plans as its social commitment, namely, reduction of the annual CO_2 emissions by its member industries to below the 1990 levels as an average for the period between 2008 and 2012. The amount of CO_2 emissions by the participants stood at 505.8 million tons in 1990, accounting for about 83% of CO_2 emissions from the industrial and energy transformation sectors (612.3 million tons) or 44% of Japan's total CO_2 emissions.



Source: Japan Business Federation

According to the Keidanren report, the production activity index (represented by an index most closely related to each industry's energy consumption, such as cement or car production) was up by 8.0% year-on-year, and the CO_2 emission coefficient (CO_2 emissions per fuel consumption) up by 0.1%, while the energy intensity per production was down by 2.7%—which amounts to a 5.3% increase in the overall CO_2 emissions.[4] Compared with the 1990 levels, the production index was up by 5%, while the CO_2 emission coefficient was down by 1.5% resulting from a shift to low-carbon fuels, and the energy intensity was down by 15.8% reflecting improved energy efficiency, or a 12.3% decrease in overall CO_2 emissions. Figures for 2008 and beyond take into account the use of the Kyoto Mechanism credits by the electric power companies; the figure for FY2010, for example, accounts for 3.1% (deduction) of the total CO_2

[3] For the reduction targets under the Kyoto Protocol, 1990 is the base year for CO_2, CH_4, and N_2O, and 1995, for HFC_3, PFC_3, and SF_6.

[4] These indexes can be defined as follows:

$C = CO_2$ emissions, E = energy consumption, Y = production output (or index)

$C = (C/E) \times (E/Y) \times Y$

C/E: CO_2 emission coefficient—i.e., carbon content of the energy consumed

E/Y: energy intensity—i.e., energy input per production

$C/Y = (C/E) \times (E/Y)$: CO_2 intensity—i.e., CO_2 emissions per production

emissions.[5]

Keidanren attributes such decreases in the CO_2 intensity (CO_2 emissions per unit production) to a steady accumulation of the respective industries' efforts to proactively promote technological innovation, introduce energy-saving or energy-efficient facilities, opt for alternative fuels, recover waste energy, and improve operations of facilities and equipment. Specifically, the energy intensity was down by a significant 30–40% from the 1990 levels in the auto, machinery, and electrical/electronic industries, while it has remained relatively stable in the cement industry, where there is little room for further efficiency improvements, and in the sheet glass industry, where product quality is being upgraded rapidly. The oil refining industry, by contrast, has seen a 28% increase as secondary refining facilities such as heavy oil crackers were expanded. The Keidanren's report is worth noting as it focuses on developments in the energy intensity by industry as well as examples of specific approaches.[6]

The manufacturing sector, as evident from the MOE statistics, is making a fair degree of progress in energy efficiency and conservation (EEC) in the manufacturing industry, whereas the transport, services and household sectors face a pressing need to curb GHG emissions. Accordingly, Keidanren is promoting energy saving measures in these sectors and also pushing forward forest conservation programs to contribute toward achieving the Kyoto Protocol targets. Specific measures include the following:

1. In the follow-up of the Voluntary Action Plan, 14 business associations and enterprises in the services sector (such as finance, communications, etc.) and 13 in the transport sector participated in setting out targets for reduction of CO_2 emissions and improvement of CO_2 intensity and carrying out programs to introduce energy-saving facilities, improve operations and conduct in-house training.

2. In addition to the services sector, EEC solutions for business offices are being implemented also in a broad range of industries such as manufacturing, energy transformation and transportation. In addition, industry groups such as the Petroleum Association of Japan, Japan Iron and Steel Federation, Japan Gas Association, Japan Cement Association, Japan Chemical Industry Association, and Japan Automobile Manufacturers Association are striving to achieve respective industry-specific reduction targets for electricity and energy consumption at offices and factories.

3. The transport sector focuses on improving vehicle fuel efficiency, streamlining distribution networks through integration of hubs and cooperation between shippers and logistic handlers, as well as a shift to low-emission vehicles—all designed to reduce CO_2 emissions.

4. In addition to EEC in manufacturing processes, programs are set out to supply low-carbon products and services from the viewpoint of life cycle assessment to develop and promote products, use of which generates less CO_2 emissions overall. To cite a few, this includes use of wastes as heat energy sources and raw materials, energy-efficient home electric appliances such as TVs and refrigerators, carbon fiber composites to reduce the weight of aircraft and automobiles, lightweight beverage containers, double-glazed glass to improve heat insulation, concrete pavement with low rolling resistance, and use of sewage sludge as a raw material for cement and many others.

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[5] The use of the Kyoto Mechanism credits amounts to 64 million tons in 2008, 52 million tons in 2009, and 57 million tons in 2010, about a quarter of which is taken into account in this follow-up survey.

[6] The Japanese version of the report is available at http://www.keidanren.or.jp/japanese/policy/2011/113/index.html.

Keidanren states that it will continue efforts to achieve its overall goal, placing the Voluntary Action Plan as its pivotal policy and encouraging its members to implement emission reduction measures steadily and without fail. It will push forward proactive global warming prevention measures, throughout and after the Kyoto Protocol commitment period, including a quest for the world's highest energy efficiency, deployment and improvement of EEC measures at home and abroad, and R&D of innovative technologies.

The report says that the impact of the Great East Japan Earthquake of 2011 on the Japanese industry has yet to be determined. However, the prolonged suspension of nuclear power plants is forcing the power generation sector to switch to LNG and oil, causing a spike in CO_2 emissions. As energy-saving efforts with heightened awareness in the services and household sectors could make a dent in energy consumption, it cannot offset the incremental CO_2 emissions brought by suspension of nuclear power plants. Although Keidanren is expected to more or less achieve its goals in the Voluntary Action Plan, Japan's CO_2 emissions are likely to exceed the initial targets for a while.

Energy Committee Highlights

Basic policy for new energy strategy under deliberation

On December 21, the Energy-Environment Council, set up for formulation of the Innovative Energy and Environment Strategy (chaired by Motohisa Furukawa, State Minister for National Policy), held its fifth meeting and announced: a) an appraisal of electricity generation costs by source, b) perspectives for formulating the Strategy , and c) basic concepts for preparing optional pathways for related deliberation. In an interim report issued last July, the Council had set out the basic concepts for the Strategy development made up of: a) lowering dependency on nuclear power, b) shift to a distributed energy system, and c) developing nationwide public debate on nuclear energy. Based on this report, various issues have been discussed to formulate optional pathways for nuclear energy, an optimum energy mix and climate change policies at the Atomic Energy Commission, the Advisory Committee for Natural Resources and Energy and the Central Environment Council.

Electricity generation cost by source

According to the appraisal on electricity generation costs released by the Cost Verification Committee of the Council, the cost of nuclear power generation increased by 50% from the estimates made in 2004 as a result of incorporating social costs such as accident risk response. However, thermal power costs have also increased because of higher fossil fuels prices and introduction of measures to reduce CO_2 emissions. As a result, costs among base power sources have been brought to more or less the same range. Distributed power sources, such as cogeneration systems, and energy efficiency and conservation measures, such as LED lights and high efficiency air conditioners, were also identified to be viable contributors to the energy mix.

The nuclear power generation cost, which was estimated to be ¥5.9/kWh in the previous study, is revised to at least ¥8.9/kWh or an increase of 50%, reflecting inflated construction costs and additional safety costs (¥1.4/kWh), policy-related costs, including subsidies given to host communities of nuclear plants and R&D costs for the Monju fast-breeder reactor (¥1.1/kWh), and damages identified at present for the Fukushima Daiichi accident (5.8 trillion Yen, or ¥0.5/kWh). The accident risk fund, which is currently estimated to be 5.8 trillion Yen per model plant, is exclusive of undefined costs, such as compensation to residents and interim

storage and permanent disposal costs for contaminated materials generated in decontamination activities. If damages amount to 10 trillion Yen, the generation cost is calculated to be ¥9.3/kWh, and if 20 trillion Yen, this will be ¥10.2/kWh

This study also provides estimates of generation costs in 2030 reflecting cost reduction trends for renewable energy sources (photovoltaic and wind power, in particular), increasing fossil fuel prices and costs to reduce CO_2 emissions. Generation costs for large-scale base-load power plants fueled by coal and LNG are also revised upward incorporating CO_2 reduction costs and rising fuel prices[7], but still remain around ¥9.5 to 11/kWh and within competitive ranges. Costs for oil-fired thermal power plants were estimated differently; these are ¥25/kWh as a middle load power source operating at a 50% load factor and considerably higher at ¥39/kWh as a peak load power source operating at 10%. The Petroleum Association of Japan has protested against this calculation stating that oil-fired thermal plants should also be given a certain role in normal times, otherwise they will not be able to adequately respond to emergency situations.

On the other hand, taking account of the benefits of waste heat utilization, gas cogeneration costs are estimated to be in the range of ¥10.6 - 11.5/kWh, which is comparable to large-scale thermal power plants. The generation cost of fuel cells, which have just emerged in the marketplace, is expected to fall significantly to reach ¥11/kWh in 2030. Distributed power sources are considered advantageous in terms of the efficiency of society as a whole, as they do not incur transmission/distribution losses of approximately 5 percent.

Electricity Generation Cost by Source

	2004	2010	2030	Opration	Duration	Note
	¥/kWh	¥/kWh	¥/kWh	%	Years	
Nuclear	5.9	8.9+	8.9+	70	40	
Coal	5.7	9.5	10.3	80	40	With CO2 treatment
LNG	6.2	10.7	10.9	80	40	
Oil	16.6	22.1	25.1	50	40	2004: at 30% operation
		36	38.9	10	40	
Wind (Onshore)		9.9～17.3	8.8～17.3	20	20	
Wind (Offshore)		9.4～23.1	8.6～23.1	30	20	
Geothermal		9.2～11.6	9.2～11.6	80	40	
PV(Residential)		33.4～38.3	9.9～20.0	12	35*	20 yrs for 2010 estimates
Co-generation						
Gas		10.6(19.7)	11.5(20.1)	70	30	1. After (or before) heat
Oil		17.1(22.6)	19.6(26.0)	50	30	value deduction.
Fuel Cell		102.2～102.4	11.5～11.8	na	10 →15	2. Not having
		(109.7～110.0)	(18.7～19.3)			transmission loss of

Source: Cost Verification Committee of National Policy Unit

Issues upon formulating the Strategy

The report compiled the principles to be examined in formulation of the Strategy as described below based on deliberation in the Advisory Committee for Natural Resources and Energy and the Central Environment Council:

1) Issues on the Basic Energy Plan:

- The energy policy should give top priority to the assurance of public safety and focus on sustainability, demand-side perspectives, consumers and local community, national strength and international contribution, and the utilization of diversified power and energy sources.
- The optimum energy mix should be established focusing on the following elements:
  - Enhancing energy efficiency and conservation (EEC) and power saving taking account of possible evolution in consumer behaviors and social infrastructure;
  - Accelerating development and utilization of renewable energy;
  - Ensuring efficient use of fossil fuels with due consideration to environmental load including a shift to natural gas;

[7] Fuel and carbon prices basically adopt the upward trends projected in the Present Policy Scenario and New Policy Scenario of the IEA World Energy Outlook 2011.

- Lowering dependency on nuclear energy.

Among others, opinions are divided concerning nuclear dependency. Constructive debate is called for instead of dichotomy between parties for and against nuclear energy. Discussions should be based on the acknowledgment that all energy sources have advantages and disadvantages of their own, and should take a quantitative and timeline-oriented comprehensive approach based on objective data.

- Energy policy reform should emphasize the following:
  - EEC measures should be more focused on peak-cut to ease electricity supply and demand balance. Distributed smart communities should be established introducing smart meters and revising the tariff system.
  - A next-generation distributed energy system should be developed to ensure dispersion of risks and improvement in efficiency through provision of multiple options for consumers or utilizing diverse as well as unused energy sources.
- Technological innovation should be accelerated through public-private partnership in order to maintain and reinforce the world's most advanced energy technologies.

2) Issues in relation to counter-climate change measures:

- Efforts for domestic and international emission reductions should be made in order to promote measures to cope with climate change, a challenge common to all mankind. Such efforts will involve promoting green innovation based on technological advancement and the creation of a new market in pursuit of green growth, linking emission reductions with economic growth.
- The 2030 target should be set up as a milestone in the roadmap aimed at the long-term target of limiting global temperature increase to 2 degree C and reducing global emissions by half as well as domestic emissions by 80 percent by 2050. Based on this objective, the domestic emission reduction target for 2020 and optional pathways towards its achievement should be presented.
- Issues to be studied in light of presenting optional pathways:
  - Reduction of the energy-origin CO_2 emissions should be considered in close relation with the energy mix as two sides of the same coin.
  - International cooperation should be promoted in the areas of reducing non-energy origin GHGs, securing carbon sinks through management and conservation of forest and agricultural land as well as urban greening, and developing and disseminating environmental technologies.
  - Adaptation measures should be addressed based on scientific findings that even the most rigorous reduction measures cannot prevent climate change impacts in the next decades.

To give due consideration to the continuity of policy measures, progress and impact of measures previously implemented toward the target under the Kyoto Protocol should be reviewed and utilized effectively.

3. Basic principles for preparing the optional pathways

The Energy-Environment Council is scheduled to present this spring several options of strategic pathways for further deliberation from a fundamental perspective, reexamining

policies with a clean slate. The basic principles of approach is to: a) take all possible measures for nuclear risk management; b) reduce nuclear dependency and shift to non-fossil fuel sources as well as to pursue energy security and climate change simultaneously; and c) establish a new energy system centered on creating, storing and conserving energy under which consumers and local communities are allowed to make their own energy choices.

In particular, the following should be considered as basic principles for preparing optional policies on nuclear power, energy mix and climate change:

- Nuclear safety measures, including social costs and compensation scheme should be fundamentally reviewed. Policy measures, including the nuclear fuel cycle, should be thoroughly verified so that optional pathways can be provided with a clear view on safety, environment, energy security and economic efficiency.
- Nuclear dependency should be reduced through exploring energy frontiers and shifting to distributed energy systems, and thereby enhancing the potential of renewable energy, clean use of fossil fuels, the EEC practices, and distributed energy.
- Climate change measures should be implemented in a form whereby Japan can contribute to reducing global emissions based on future long-term prospects.

The Energy-Environment Council is scheduled to formulate, by this summer, a Green Growth Strategy to serve as the core policy for Japan's revitalization, incorporating outcome of further deliberation on the optional pathways to be presented based on the approaches as above and the ensuing nationwide public debates. The new Strategy is assumed to illustrate a clear picture on how the shift to a low carbon socio-industrial structure will evolve, how the new energy-environment industries will blossom to create jobs, economic growth and new technologies, and how Japan can contribute to Asian growth as well as resolution of global issues by way of a shift to an energy mix with reduced nuclear dependency, transition to a distributed energy system, and the simultaneous battle against climate change.

Energy News in Japan & Asia

World first offshore production test of methane hydrate starts in February

The Research Consortium for Methane Hydrate Resources in Japan (MH21) will start the world first long term production test of methane hydrate in February in the eastern Nankai trough, offshore Japan; the area is thought to hold 1 trillion cubic feet of recoverable natural gas. The MH21 is a consortium of Japanese government organizations, research institutes and academies including the National Institute of Advanced Industrial Technology and Science (AIST) and the Japan Oil, Gas and Metals National Corporation (JOGMEC) led by METI.

The MH21 Consortium has been conducting researches on methane hydrate since 2001. During the phase-1 period of the study up to FY2010, the consortium has located several areas in offshore Japan where methane hydrate is densely accumulated developing innovative geophysical approaches, recovered core samples by intensive drilling, and successfully conducted production tests at a well drilled in the arctic area of Canada. A huge amount of natural gas resources are thought to exist in an icy form of methane hydrate worldwide, however, scientists are yet to establish a stable and safe method to produce them continuously. The Consortium has developed its own theory to establish a continuous production system conducting intensive tests toward the final stage of the phase-1 period.

The Consortium has moved to the phase-2 of the study in 2011 and plans to conduct an intensive production test applying the method developed to date. Starting in February 2012, preliminary drilling of four wells will start in the 1,000m deep water within the Japanese EEZ at one of the locations where most promising accumulation of methane hydrate has been identified during the phase-1 operation. Three monitoring wells will be drilled for about 300m below the sea bottom through the methane hydrate layer for coring and temperature monitoring, and one production well down to just above the layer and suspended there. They will be located within a 50m distance of each other. After intensive examination of samples and downhole conditions, a consecutive production test for one week to one month will be conducted in 2012 deepening and completing the production well. After appraisal of the result, a second production test for a much longer period is scheduled for 2014. The Consortium aims to establish a permanent production method by 2018.

Tokyo Met-gov't constructs distributed energy network

The Tokyo Metropolitan Government plans to construct an independent and distributed type energy system at the new Tokyo waterfront sub-center in 2014. The plan includes 47 MW cogeneration systems and a power and heat distribution system using the multipurpose underground duct existing independent of the electricity network of Tokyo Electric Power Company.

In the phase-1 of the project, a 16MW class cogeneration system (7.8 MW x 2) will be built in 2014, and will supply electricity through its own system to the exhibition hall "Tokyo Big Site" and the Aomi container wharf located nearby. The exhaust heat from the cogeneration will be supplied to the Tokyo Rinkai Heat Supply Corporation, which operates a district heat supply system utilizing steam supplied by the nearby refuse disposal plant at the waterfront sub-center and serving office buildings, shopping malls, an exhibition center, a TV station, hotels and hospitals. The project will be operated as a Power Producer and Supplier (PPS).

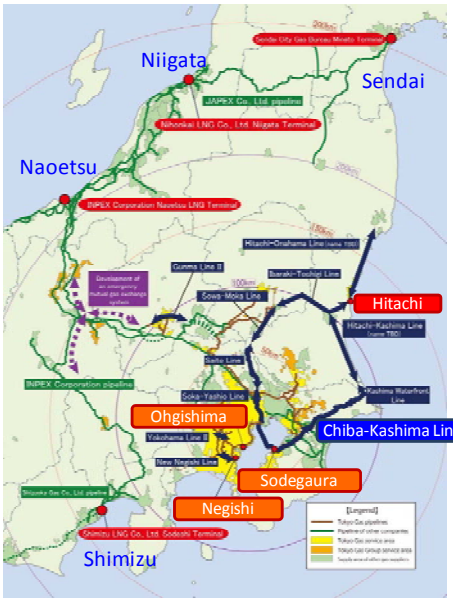
In the phase-2 of the project, a 31MW class cogeneration (7.8MW x 4) will be added in 2015, as new projects will be progressing to construct office buildings in the adjacent sites. The common duct slated for the energy network is currently operated by the Tokyo Metropolitan Government accommodating facilities for electricity, communication, water supply, and waste and sewage treatment. Because of its small size, the biggest concern is how to ensure commercial viability of the project which calls for introducing a streamlined system for fuel procurement and heat supplies. Tokyo Met considers inviting private enterprises through a Private Finance Initiative (PFI). It plans to publicly solicit for feasibility study proposals in early 2012.

Tokyo Gas expands gas supply by 50% by 2020

Tokyo Gas disclosed its long term vision named "Challenge 2020" on November 15, 2011, in which it plans to expand gas supply in the greater Tokyo area by 50% by 2020. The new core facility to develop the required supply network is the Hitachi LNG receiving terminal scheduled for completion in 2015, at a location on the Pacific coast north of Tokyo.

The company plans to construct a high pressure trunk line network linking the new terminal with the existing loop in the Tokyo metropolitan area connecting three LNG receiving terminals, which will cover considerably expanded service areas. It also plans to develop gas interchange

systems via a pipeline linkage with other gas distributors to enhance emergency response capability. The new system will assure more stable supply via a greater loop with strategically located terminals. As a preceding investment, the Chiba-Kashima line under construction will be completed in 2012 linking the existing system to the Kashima waterfront industrial zone. Other trunk lines will be completed by 2020 fully covering the greater Tokyo area. Northern markets north of the network will also be served via LNG tank trucks.



With investments amounting to 2.06 trillion yen including other domestic and overseas projects, Tokyo Gas plans to increase city gas supply to 22 billion cubic meters per year in 2020, up 47% from the 2011 sales amount. Major outlets will be developed through fuel shifts from oil as well as increasing popularity of cogeneration and distributed gas power generation. Detail report is available at http://www.tokyo-gas.co.jp/IR/english/event/vision_e.html.

APERC Letter

CEEDS Workshop on Energy Efficient Urban Passenger Transportation

The 2nd and final workshop of the Cooperative Energy Efficiency Design for Sustainability (CEEDS) Phase 3 project on "Energy-Efficient Urban Passenger Transportation in the APEC Region" was held in Singapore on 17-19 January. The workshop was organized by APERC and hosted by Singapore's Energy Market Authority.

The key urban transport energy challenge, which was the focus of the workshop, is the projected rapid growth in urban transport energy demand in the developing economies of the APEC region between 2010 and 2050. By 2050, assuming business-as-usual, APERC projects the demand for urban transport energy in the participating economies of China, Indonesia, Philippines, Thailand, and Vietnam will grow by 250%. Fast-growing and increasingly affluent urban populations will be more and more able to buy their own vehicles. The consequences are likely to include increasing oil security risks and exposure of the economy to oil price rises, along with traffic congestion, air pollution and greenhouse gas emissions.

The CEEDS workshop featured presentations by a number of distinguished experts on policies to promote more energy-efficient urban transportation. The speakers focused on three themes 'Avoid'-'Shift'-'Improve,' specifically:

- Avoiding or reducing trips through measures such as promoting development of more compact cities and low-carbon towns, as well as better integrating transport and land development;
- Shifting to public transport and non-motorized transport; and
- Improving vehicle technology to reduce energy use and greenhouse gas emissions from each kilometer travelled.

Delegates from participating economies made presentations on their proposals to promote

more energy-efficient urban transport. The participants exchanged views and opinions, and provided suggestions for how the proposals could be improved.

The host economy of Singapore is itself a benchmark for energy-efficient urban transportation policy. Singapore pioneered the use of Electronic Road Pricing (ERP), which uses time-varying tolls to restrict traffic when and where it is likely to cause congestion. Singapore also restricts the number of new vehicle sales each year through the use of a Certificate of Entitlement (COE) scheme. This scheme is used to control the number of vehicles in Singapore; each year a limited number of COEs for the purchase of vehicles are offered through an open online auction.

These policies would be impossible without the major investments in public transit and emphasis on compact city design by the Singapore government. The final afternoon of the workshop was devoted to a site visit to one of Singapore's transit hubs, which accommodates stations for trains and buses, a shopping mall and residences in one integrated development. The comprehensive transportation policies of Singapore have created a clean, safe, environmentally sustainable, and largely congestion-free city for its inhabitants.

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