



Energy Supply and Demand in Japan: Current Situation and Challenges

Partnership and Cooperation among Japan, China and South Korea

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The Institute of Energy Economics, Japan

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1. Three Topics Related to Changes in the Surrounding concerning Energy Policies “Arab Spring” + “Shale revolution” + “Fukushima nuclear accident”

2. Energy Supply and Demand in Japan: Current Situation and Challenges

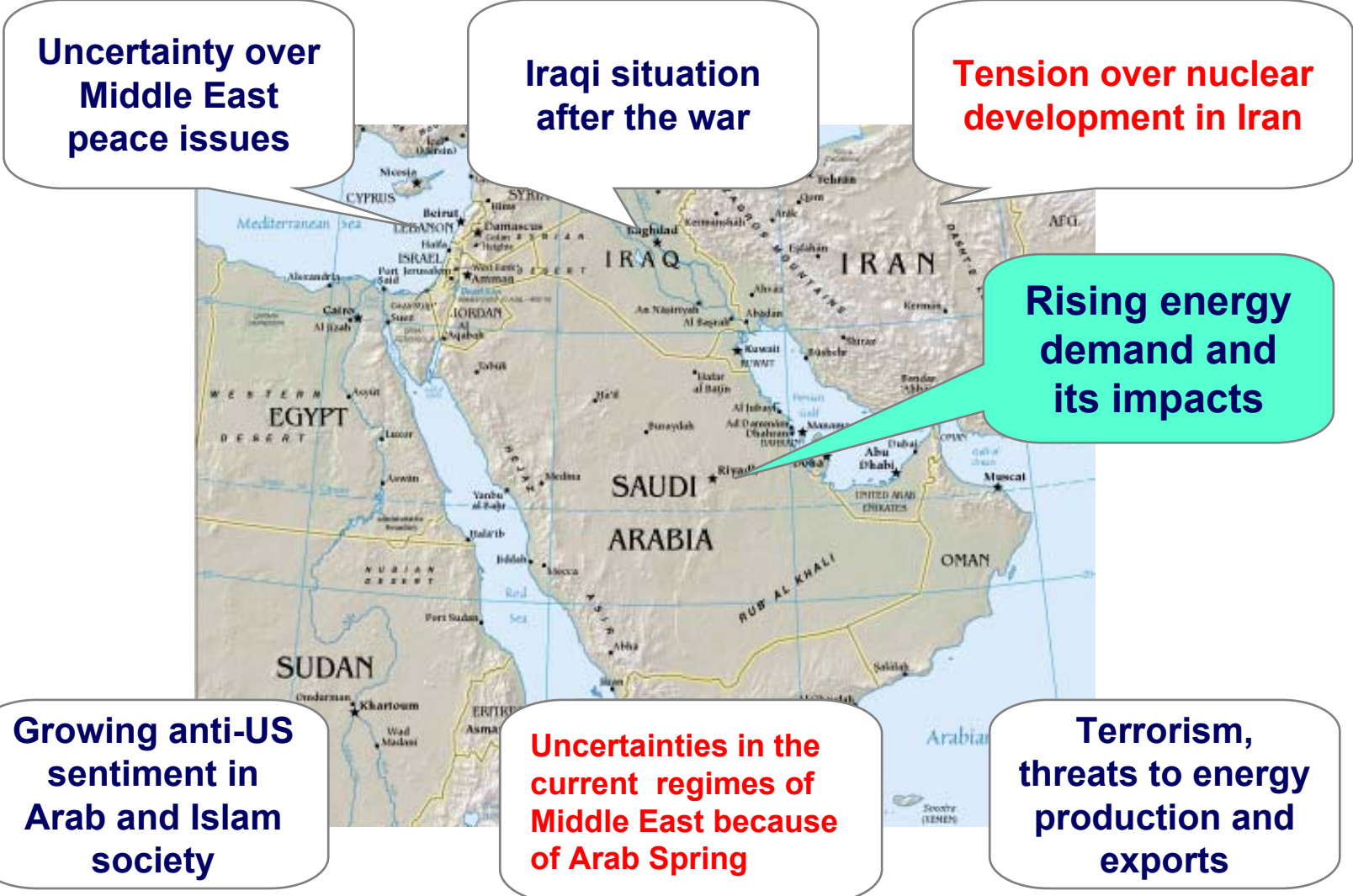
3. Goals of Partnership and Cooperation among Japan, China and South Korea

4. Conclusion: Indispensability of Cooperation among Japan, China and South Korea

1. Three Topics Related to Changes in the Surrounding concerning Energy Policies

(1) Uncertainty in M.E. has increased due to the Arab Spring

a. What is happening in the Middle East?

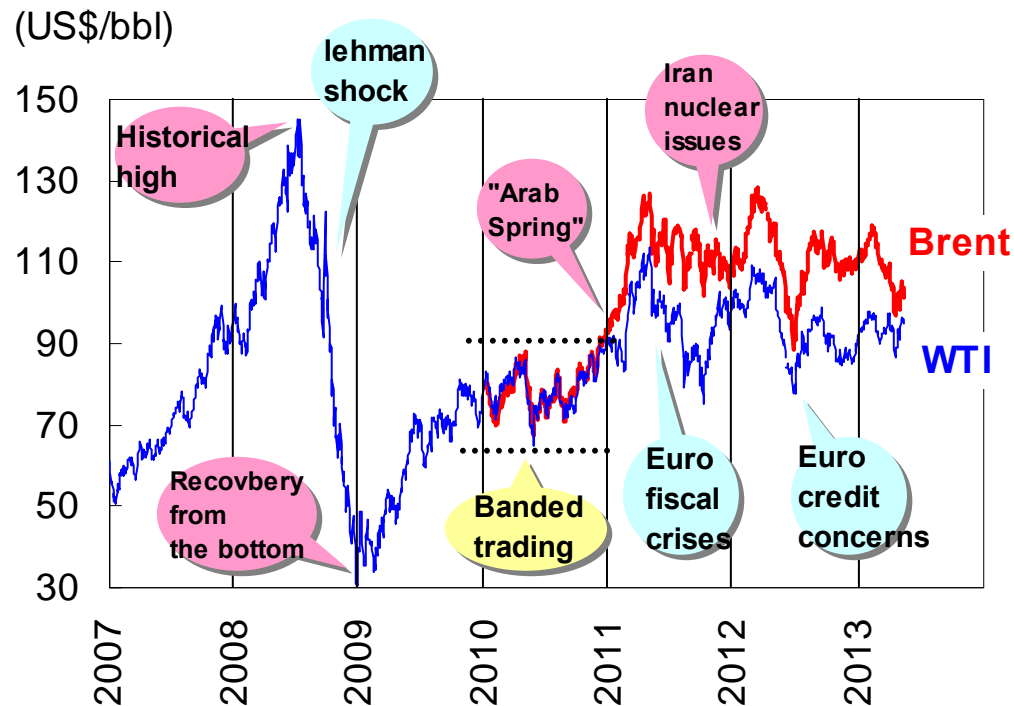


1. Three Topics Related to Changes in the Surrounding concerning Energy Policies

(1) Uncertainty in M.E. has increased due to the Arab Spring

b. Trend of Oil Prices

- Crude oil price have remained at a very high level in 2012.
- Average Brent crude oil price is forecasted at \$105/B (\pm \$10/B) for 2013



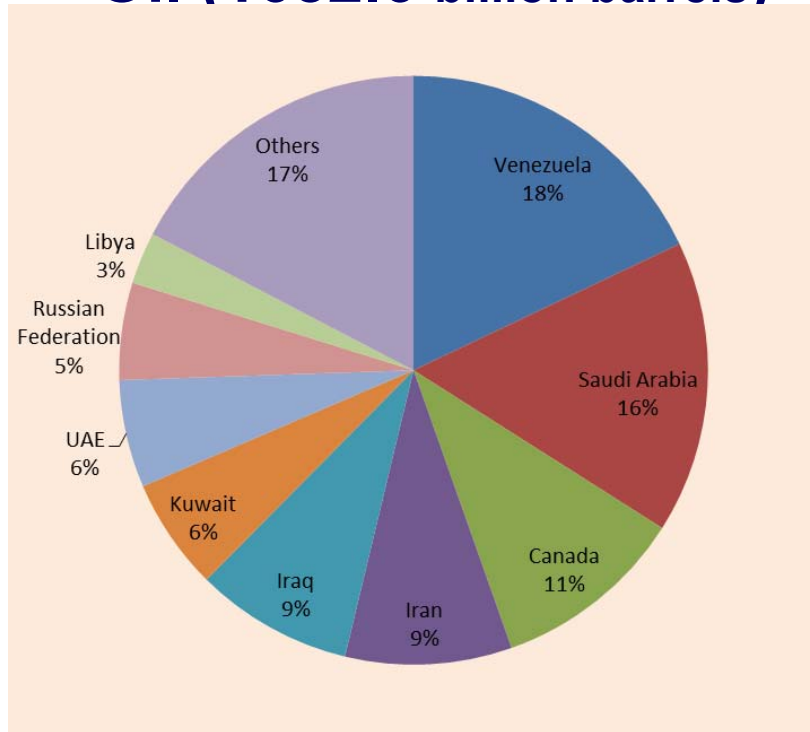
- Average Brent crude oil is \$111.7/B (WTI \$94.2/B)
- The price level remained at a historically very high level since 2011.
- Brent exceeded \$120/B in February to March 2012 due to geopolitical concerns.
- Although Brent fell since May 2012 due to European fiscal crises, it regained another momentum afterward.
- Since the beginning of 2013, Brent has tended to decline while WTI has tended to rise, thus the price gap between them has narrowed.

1. Three Topics Related to Changes in the Surrounding concerning Energy Policies
(2) Shale revolution
a. World oil & gas reserves by region (conventional)

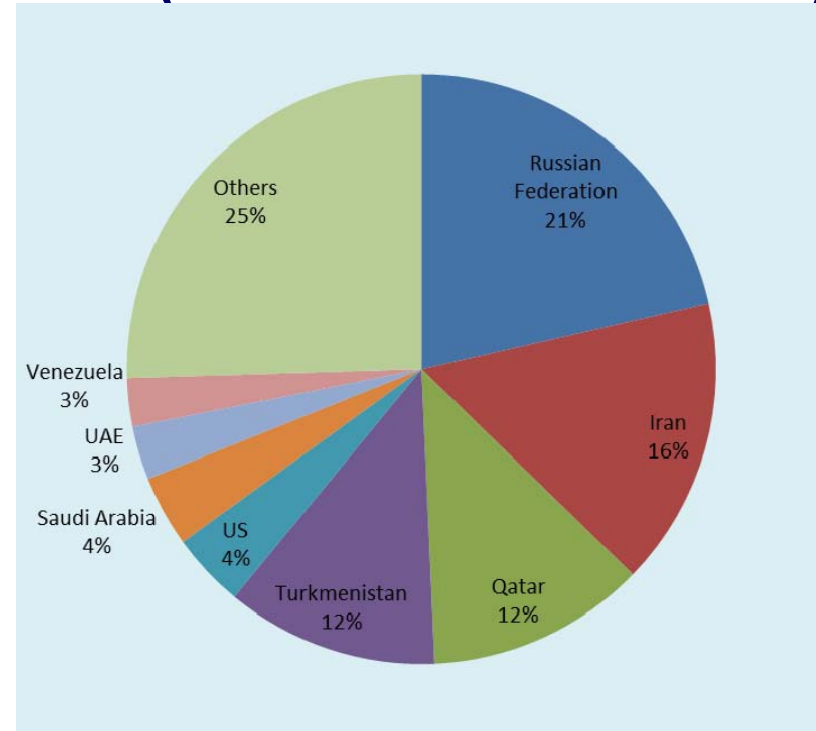


Middle Eastern countries, former Soviet Union (FSU) countries and OPEC hold most of the world's reserves.

Oil (1652.6 billion barrels)



Gas (208.4 trillion cubic meters)

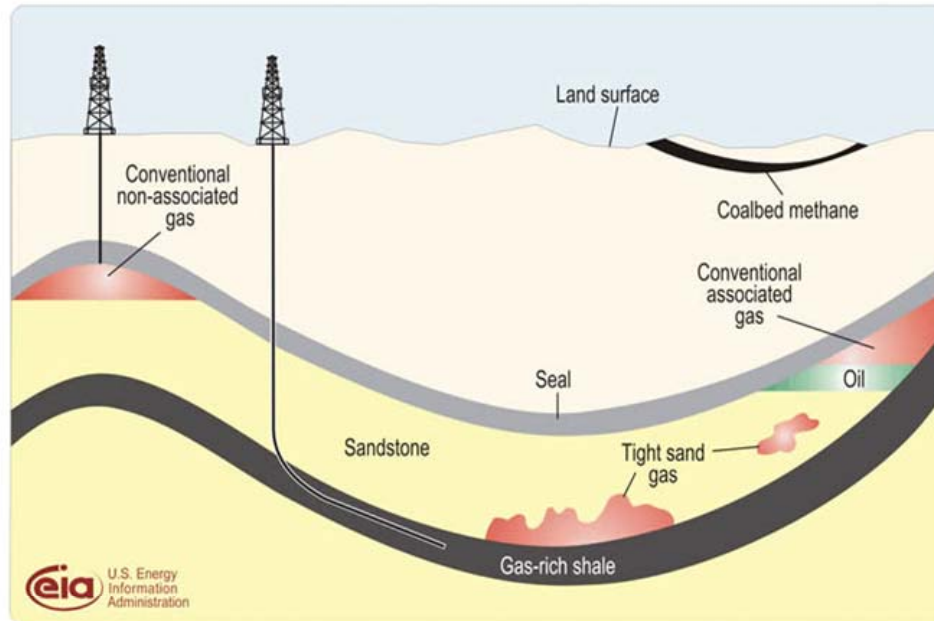


Source: BP Statistical Review of World Energy 2012

1.Three Topics Related to Changes in the Surrounding concerning Energy Policies

(2) Shale revolution

Reference: What is shale gas?



- “Shale gas” refers to natural gas contained in shale, a type of mudstone characterized by hardness and fissility into thin plate-line fragments. Shale gas is one type of natural gas product taken from unconventional sources.
- Shale gas is extracted by drilling a well horizontally into a shale bed and injecting a large amount of water into the well, creating fractures in the shale bed to enable the gas to be extracted.

1. Three Topics Related to Changes in the Surrounding concerning Energy Policies

(2) Shale revolution

b. The surge in unconventional oil & gas has huge implication.



Remaining technically recoverable **oil resources** by type and region

(billion barrels)	Conventional		Unconventional			total
	Crude oil	NGLs	Extra heavy oil and bitumen	Kerogen oil	Light tight oil	
OECD Americas	253	57	809	1000	70	2188
OECD Europe	59	31	3	4	18	116
E.Europe/Eurasia	352	81	552	20	14	1019
Asia	100	37	3	16	63	219
Middle East	982	142	14	30	4	1172
Africa	255	52	2	0	33	341
Latin America	245	32	498	3	37	815
World	2245	433	1880	1073	240	5871

Source: IEA "World Energy Outlook 2012"

Remaining technically recoverable **natural gas resources** by type and region

(tcm = trillion cubic meters)	Conventional	Unconventional			total
		Tight gas	Shale gas	Coalbed methane	
E.Europe/Eurasia	144	11	12	20	187
Middle East	125	9	4		137
Asia-Pacific	43	21	57	16	137
OECD Americas	47	11	47	9	114
Africa	49	10	30	0	88
Latin America	32	15	33		80
OECD Europe	24	4	16	2	46
World	462	81	200	47	790

Source: IEA "World Energy Outlook 2012"

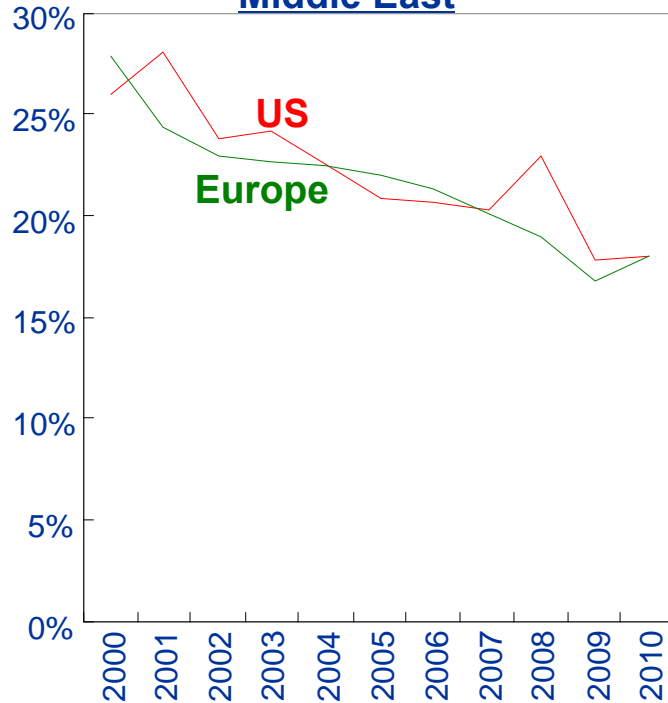
1. Three Topics Related to Changes in the Surrounding concerning Energy Policies

(2) Shale revolution

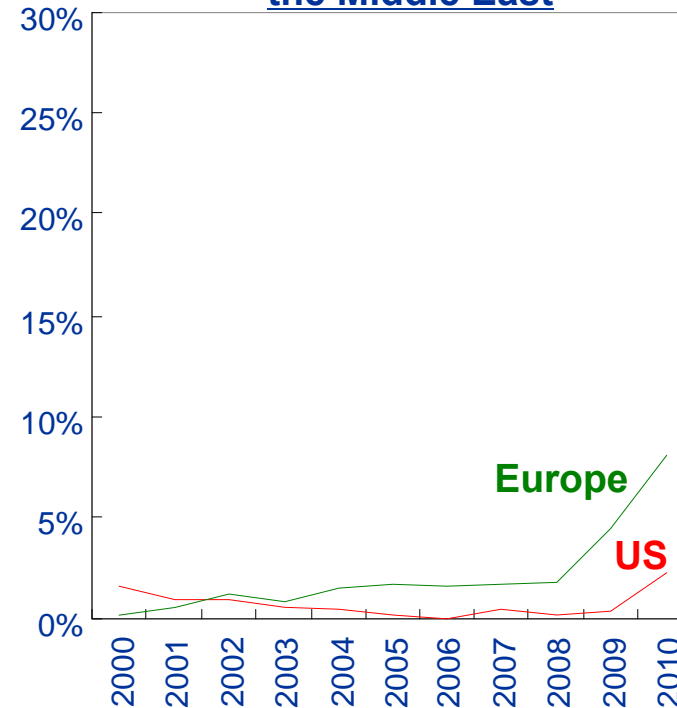


Reference: Implications of decreasing dependence on Middle East in Europe / US

Dependence of oil import on the Middle East



Dependence of natural gas import on the Middle East



- Oil: US dependence on the Middle East continues to decline while the import from Canada and Central and South America increases and dependence of Europe on the Middle East continues to decline while the import from former USSR countries increases.
- Natural gas: Dependence on the Middle East slightly increases due to reinforced LNG export capacity in the Middle East.

1. Three Topics Related to Changes in the Surrounding concerning Energy Policies

(3) Fukushima nuclear accident

a. The trust on nuclear safety was seriously damaged



The trust on nuclear safety was seriously damaged because of Fukushima nuclear accident.

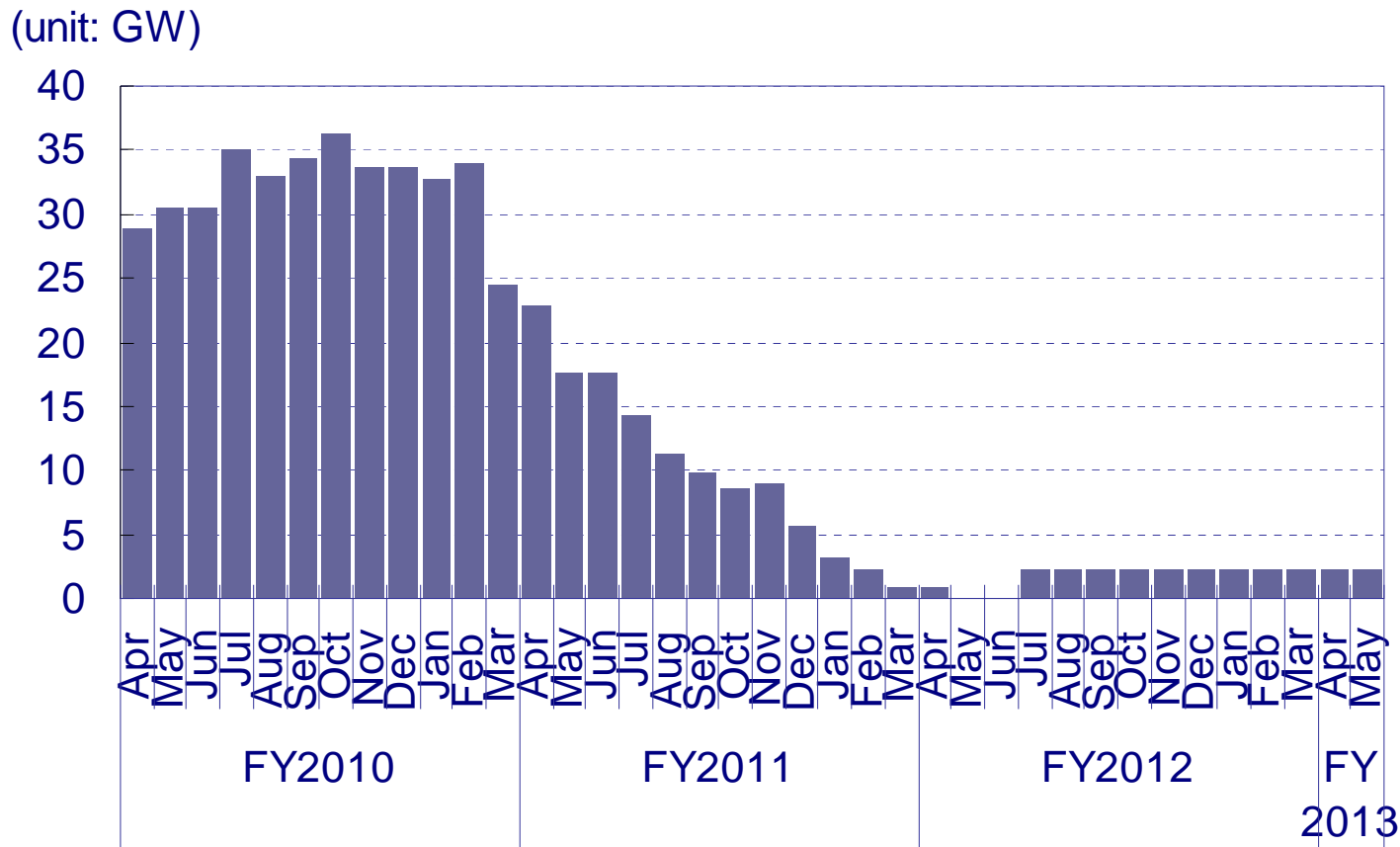
<Global shift in opinion on nuclear energy after Fukushima>

(Unit: %)

	<u>Before (Pro: Con)</u>	=>	<u>After (Pro: Con)</u>
(1) Japan	52:28		39:47
(2) USA	53:37		47:44
(3) France	66:33		58:41
(4) Germany	34:64		26:72
(5) Russia	63:32		52:27
(6) Korea	65:10		64:24
(7) China	83:16		70:30

Source: Gallup International (April 19,2011)

1. Three Topics Related to Changes in the Surrounding concerning Energy Policies
 (3) Fukushima nuclear accident
b. Operating status of nuclear power plants



* The graph shows the total of generation capacity of nuclear power plants operating at the end of each month.

1. Three Topics Related to Changes in the Surrounding around Energy Policies

**2. Energy Supply and Demand in Japan:
Current Situation and Challenges**

- (1) Current status of energy supply and demand in Japan**
- (2) Restarting of nuclear power plants and the Nuclear Regulation Authority**
- (3) Responding to the feed-in tariff system and rapid growth in the use of renewable energy**
- (4) Optimal energy mix**

3. Goals of Partnership and Cooperation among Japan, China and South Korea

4. Conclusion: Indispensability of Cooperation among Japan, China and South Korea

2. Energy Supply and Demand in Japan: Current Situation and Challenges



(1) Current status of energy supply and demand in Japan

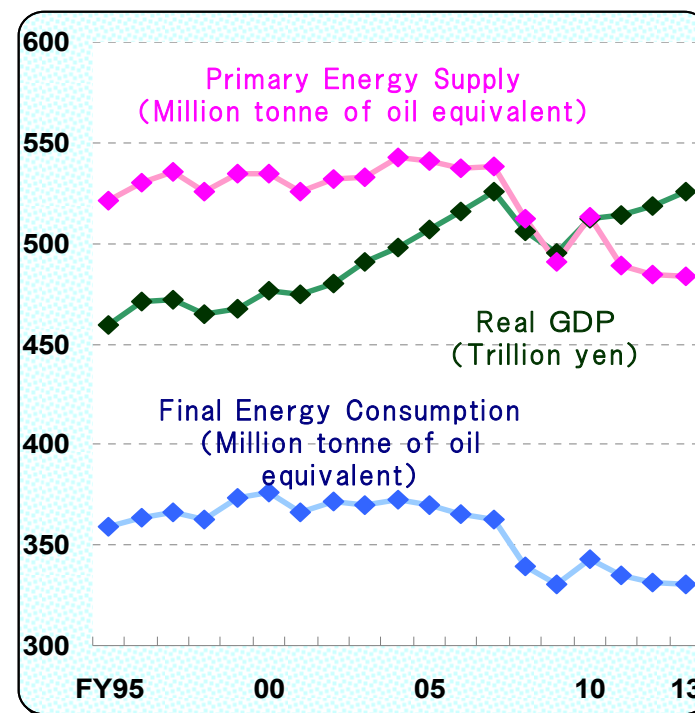
a. Energy supply and demand

- In FY2012, final energy demand is expected to decrease by 1.0% because of energy and electricity savings.
- In FY2013, overseas demand and rush demand in anticipation of the consumption tax hike in April 2014 will push up Japanese economy. However, energy savings will suppress the rise of energy demand.

【Real GDP and Energy Supply/Demand】

		Actual		Forecast	
		FY2010	FY2011	FY2012	FY2013
Real GDP	Chained to Year 2005, trillion yen	512.3	513.7	518.5	525.9
	(year-to-year rare(%))	(+3.4)	(+0.3)	(+0.9)	(+1.4)
Final Energy Consumption	Million tonne of oil equivalent	343.3	334.7	331.2	330.6
	(year-to-year rare(%))	(+3.8)	(-2.5)	(-1.0)	(-0.2)
Primary Energy Supply	Million tonne of oil equivalent	513.3	489.3	484.2	483.9
	(year-to-year rare(%))	(+4.7)	(-4.7)	(-1.0)	(-0.1)

Sources: Historical data from IEEJ and Cabinet Office's, Forecasts by IEEJ



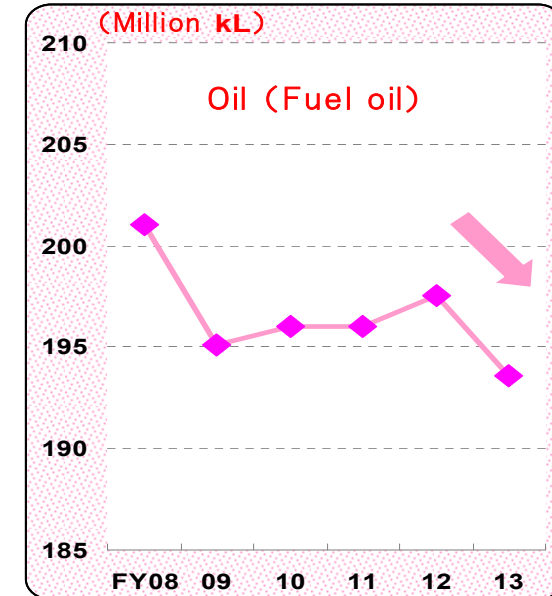
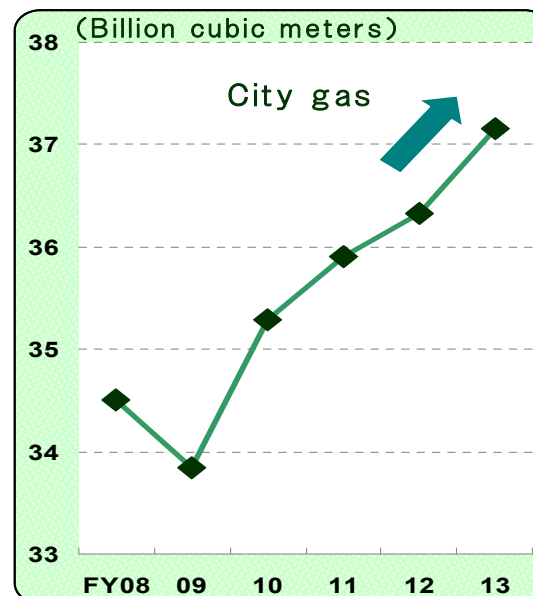
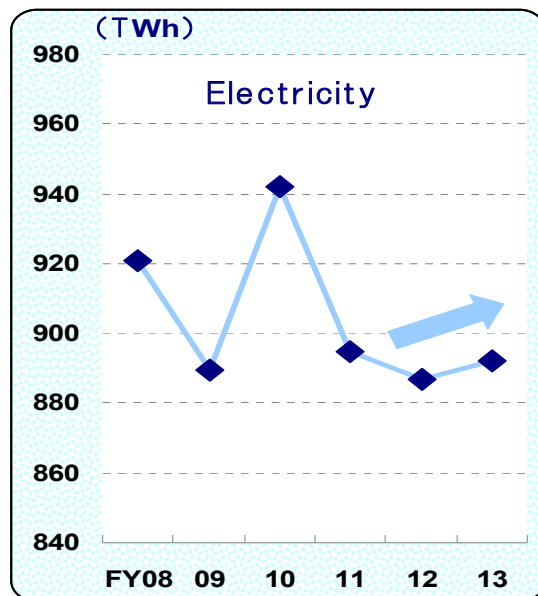
2. Energy Supply and Demand in Japan: Current Situation and Challenges

(1) Current status of energy supply and demand in Japan

b. Comparison of different energy options



- Electricity sales dropped again in FY2012 due to energy conservation and a fall in sales in reaction to the previous year's high power consumption due to the fluctuations in ambient temperature. Electricity sales are expected to slightly increase in FY2013 as the energy conservation campaign stops and the economy recovers.
- City gas sales increased and will increase both in FY2012 and FY2013 because of growing industrial demand, increased in-house power generation and the shift in the use of fuels.
- Fuel oil sales grew slightly in FY2012 due to increased demand for heavy oil C for power generation. However, total sales of fuel oil are expected to decrease in FY2013, assuming progress is made in restarting nuclear power plants.



Sources: Confirmed statistics are from sources such as Monthly report on electric power statistics, Monthly report on gas utility business statistics and Monthly report of mineral resources and petroleum products statistics, published by the Ministry of Economy, Trade and Industry. Forecasts are produced by IEEJ.

2. Energy Supply and Demand in Japan: Current Situation and Challenges

(1) Current status of energy supply and demand in Japan

c. Nuclear power and energy self-sufficiency ratio



- In FY2012, economic activity revived as Japan began to recover from the Great East Japan Earthquake. However, total primary energy supply decreased from the previous fiscal year because of energy conservation including campaigns to save electricity. As to FY2013, despite some effect of the ambient temperature, the overall decrease in the primary energy supply might be minor due to a halt in energy conservation and growing economic activity.
- The supply of coal increased with the restarting of coal-fired power plants that had been shut down due to earthquake damage. The oil supply increased in FY2012 due to growing demand for power generation but is expected to decrease in FY2013. The natural gas supply is expected to continue increasing because of demand for power generation in addition to growing demand for city gas driven by the shift from other fuels and increase in in-house power generation. As to nuclear power, progress in restarting nuclear power plants is expected from the second half of FY2013.

Outlook for the Primary Energy Supply in Japan

(Million tons of oil equivalent)	Actual		Forecast		year-to-year rate (%)			
	FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013
Coal	119.1	112.4	114.3	116.6	10.7	▲5.7	1.7	2.0
Oil	211.9	217.6	224.4	215.3	1.0	2.7	3.1	▲4.1
Natural gas	95.5	112.0	117.8	119.2	5.8	17.2	5.2	1.2
Hydro	18.2	18.4	16.6	17.2	10.8	1.3	▲9.8	3.7
Nuclear	60.7	21.4	3.3	7.5	3.0	▲64.7	▲84.5	125.4
Geothermal, Solar, etc.	7.9	7.6	7.8	8.1	6.2	▲4.3	3.8	3.8
Total Primary Energy Supply	513.3	489.3	484.2	483.9	4.7	▲4.7	▲1.0	▲0.1
Energy self-sufficiency ratio (exc. Nuclear)	5.9%	6.3%	6.1%	6.2%				
(inc. Nuclear)	17.7%	10.7%	6.7%	7.8%				
CO2 emissions of energy source (Million tons) (FY1990=100)	1,123 (106)	1,173 (111)	1,217 (115)	1,199 (113)	4.5	4.4	3.8	▲1.4

Source: CO2 historical data from Ministry of the Environment, forecasts from IEEJ.

2. Energy Supply and Demand in Japan: Current Situation and Challenges

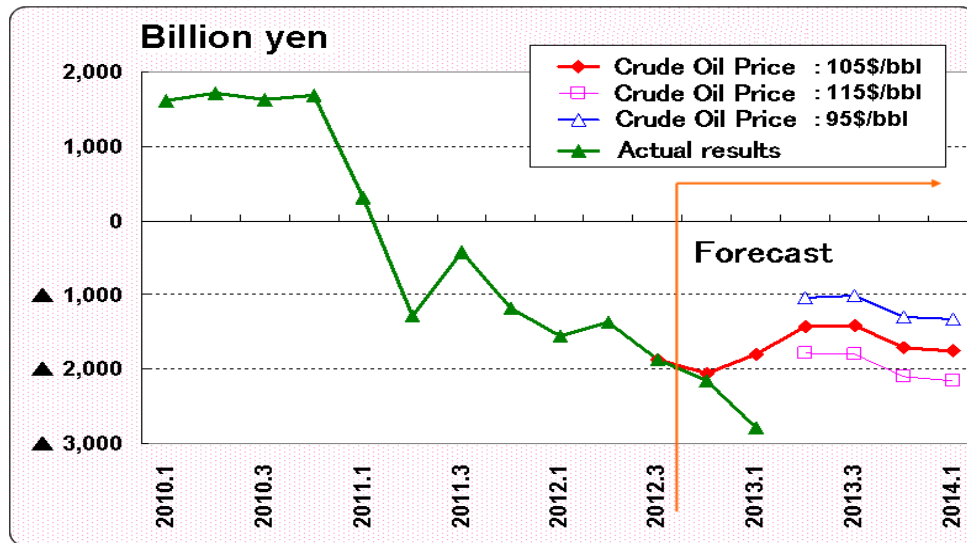
(1) Current status of energy supply and demand in Japan

d. Increasing Import of Fossil Fuel and Worsening of Trade Deficit



- In **FY2012**, economies in other countries decelerated and trade between China and Japan slowed down, before signs of recovery emerged. Thanks to “**Abenomics**”, the rapid depreciation of the yen boosted export values. However, imports of fossil fuels, etc. expanded even faster, causing a large deficit balance of 8.2 trillion yen.
- In **FY2013**, recovery of overseas demand will increase Japanese exports. On the other hand, fossil fuel import value will remain high and the trade deficit will also remain high at 6.3 trillion yen.

■ Balance of trade



Note: When the forecasts are produced (in December 2012), the exchange rate of 82 yen/dollar was assumed.

■ Export and Import

(Trillion yen)	Actual			Forecast
	FY2010	FY2011	FY2012	FY2013
Export	67.8	65.3	63.9	63.6
Import	62.4	69.7	72.1	69.9
Fossil Fuels	18.1	23.1	24.7	23.4
Balance of Trade	5.4	-4.4	-8.2	-6.3

FY2013
Oil price -10 \$
-4.6 trillion yen
Oil price +10 \$
-7.8 trillion yen

trade deficit
(3 years in a row)

Source: Historical data from Ministry of Finance, forecasts from IEEJ.

2. Energy Supply and Demand in Japan: Current Situation and Challenges

(2) Restarting of nuclear power plants and the Nuclear Regulation Authority

a. Sensitivity analysis of nuclear power (energy)



- As nuclear power plants restart, they will impact on gas and oil plants more than on coal plants that are used for middle and peak loads.
- Restart of nuclear power plants will also contribute to reduce CO2 emissions.

	FY2013			(Reference)
	Zero Scenario	Standard Scenario (9 units)	Restart Scenario (26 units)	26 units Full operation
Capacity factor	2.3%	8.8%	34.0%	51.8%
Coal	+0.3 Million ton (+0.2%)	—	-4.69 Million ton (- 2.6%)	-8.27 Million ton (- 4.7%)
Oil	+4.15 Million kL (+1.8%)	—	-12.2 Million kL (- 5.2%)	-17.4 Million kL (- 7.4%)
Natural Gas	+1.26 Million ton (+1.4%)	—	-5.81 Million ton (- 6.4%)	-12.2 Million ton (- 13.3%)
CO2	+15 Million ton (+1.3%)	—	-59 Million ton (- 4.9%)	-98 Million ton (- 8.2%)

2. Energy Supply and Demand in Japan: Current Situation and Challenges

(2) Restarting of nuclear power plants and the Nuclear Regulation Authority

b. Preparation of “appropriate regulatory standards”



- **Principle 2 of the IAEA’s Fundamental Safety Principles calls for the creation of an effective framework for safety including the establishment of an independent regulatory body.**

It must be noted that:

① “Independent” does not mean “isolated.”

⇒ The regulatory body should communicate with all stakeholders (electric power companies, manufacturers, the government, NGOs, etc.) and collect all kinds of information, and then make an independent judgment.

② Independence needs to be supported by staff who have excellent technological knowledge.

⇒ While the NRC has more than 4,000 staff, the NRA has just over 500. (Note: In Great Britain, attempts are being made to improve the independency of ONR.)

③ Appropriate regulatory standards do not mean requiring all measures to be taken.

⇒ Principle 10 of the IAEA’s Fundamental Safety Principles calls for the justification and optimization of protective actions. The methodology of PRA should be used.

④ From the regulation of actions to the regulation of performance

⇒ The measures that can be implemented to satisfy the safety objectives may differ from plant to plant.

Note: The NRC’s back-fit rules are applied conditionally.

“Substantial improvement of safety” + “Justification of cost”

A period of less than two months until the establishment of the regulatory standards is important for ensuring that the defined safety is aligned with international standards.

2. Energy Supply and Demand in Japan: Current Situation and Challenges

(3) Responding to the feed-in tariff system and rapid growth in the use of renewable energy

a. Current situation concerning the introduction of renewable energy



- Renewable-based power generation facilities commissioned in the period from April 2012 to the end of February 2013

Generated electricity: 1.662 GW (licensed installed capacity: 13.059 GW)

Contribution of photovoltaic to the above: 1.559 GW (licensed installed capacity: 12.258 GW)

	Cumulative power delivered by the end of FY2011	Installed capacity commissioned in the period from Apr. 2012 to the end of Feb. 2013	Reference: Installed capacity licensed by the end of Feb. 2013
Photovoltaic (residential)	Approx. 4.40 GW	1.137 GW	1.246 GW (+0.288 GW from the previous month)
Photovoltaic (non-residential)	Approx. 0.90 GW	0.422 GW	11.012 GW (+5.263 GW from the previous month)
Wind power	Approx. 2.50 GW	0.063 GW	0.622 GW (+0.052 GW from the previous month)
Mini/mid-class hydro (1 MW or above)	Approx. 9.40 GW	0.001 GW	0.023 GW (+0.022 GW from the previous month)
Mini/mid-class (less than 1 MW)	Approx. 0.20 GW	0.002 GW	0.005 GW (+0.001 GW from the previous month)
Biomass	Approx. 2.10 GW	0.036 GW	0.147 GW (+0.063 GW from the previous month)
Geothermal	Approx. 0.50 GW	0.001 GW	0.004 GW (+0.002 GW from the previous month)
Total	Approx. 20.00 GW	1.662 GW	13.059 GW

Source: An article published on April 16, 2013 on the website of the Agency of Natural Resources and Energy (<http://www.enecho.meti.go.jp/saiene/kaitori/dl/setsubi/201302setsubi.pdf>)

2. Energy Supply and Demand in Japan: Current Situation and Challenges

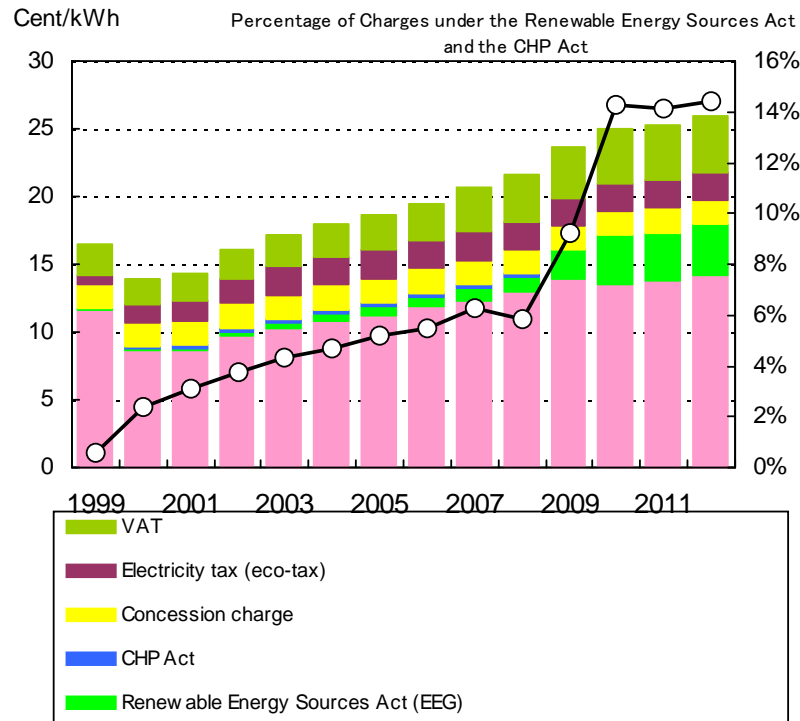
(3) Responding to the feed-in tariff system and rapid growth in the use of renewable energy

b. The burden of the feed-in tariff (FIT) (in Germany)



Germany is considering revising the system in which the amount of surcharge added to electric power prices is increasing along with the changing government policy measures for promoting renewable energy, etc.

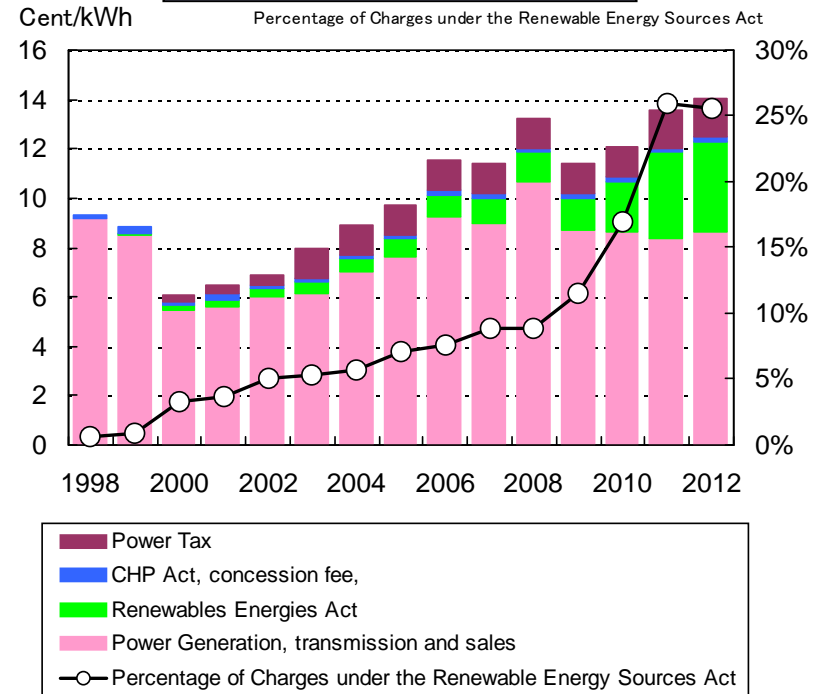
Household electricity rate



Note: Electricity billing rates are given in €/month (3,500 kWh/a). The rates in the period from 2009 to 2011 include the CHP surcharge.
Sources: "Electricity from Renewable Energy Sources: What does it cost?" from the BMU, etc.

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Industrial electricity rate



Note: Supply at medium voltage level. Demand of 100 kW/1,600 h to 4,000 kW/5,000 h.
(The application of relief measures under the Renewable Energy Sources Act is not considered.)

Source: Annual editions of "Strategy & Key Figures" from E.ON

2. Energy Supply and Demand in Japan: Current Situation and Challenge



(4) Optimal energy mix

a. From 3E to 3E + S + M

a. Energy Security

* Geopolitical situation in Middle East continues to be uncertain.

b. Environment

* The importance of Global warming remains unchanged.

c. Economic Efficiency

* Nuclear energy seems to be less costly for Japan.

..... In addition

d. Safety

* The challenge is whether nuclear safety is comfortably assured.

e. Macro Economic Impact

* Appropriate energy mix should be found to minimize the adverse effect on economic development

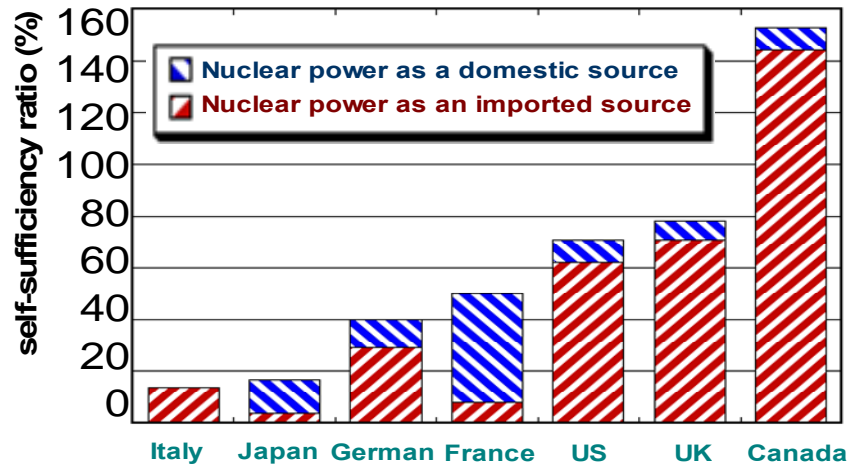
2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

Reference: 3E as key elements

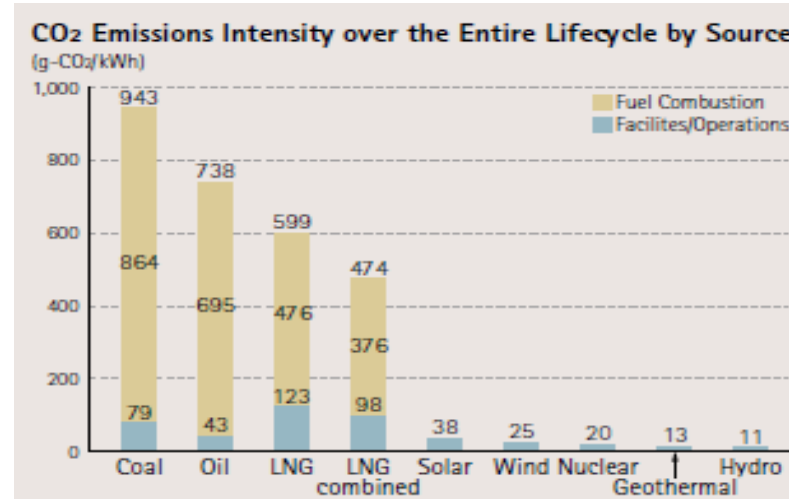


Energy Security



Source: White Paper on Energy, METI

Environment (Climate Change)



Source: Report of the Central Research Institute of Electric Power Industry, etc.

Efficiency (Cost)

Power Source	Generation Cost (yen/kWh)	Capacity Factor (%)
Hydro	8.2~13.3	45
Oil	10.0~17.3	30~80
LNG	5.8~7.1	60~80
Coal	5.0~6.5	70~80
Nuclear	4.8~6.2	70~85
Solar	46	12
Wind	10~14	20

Source: White Paper on Energy, METI

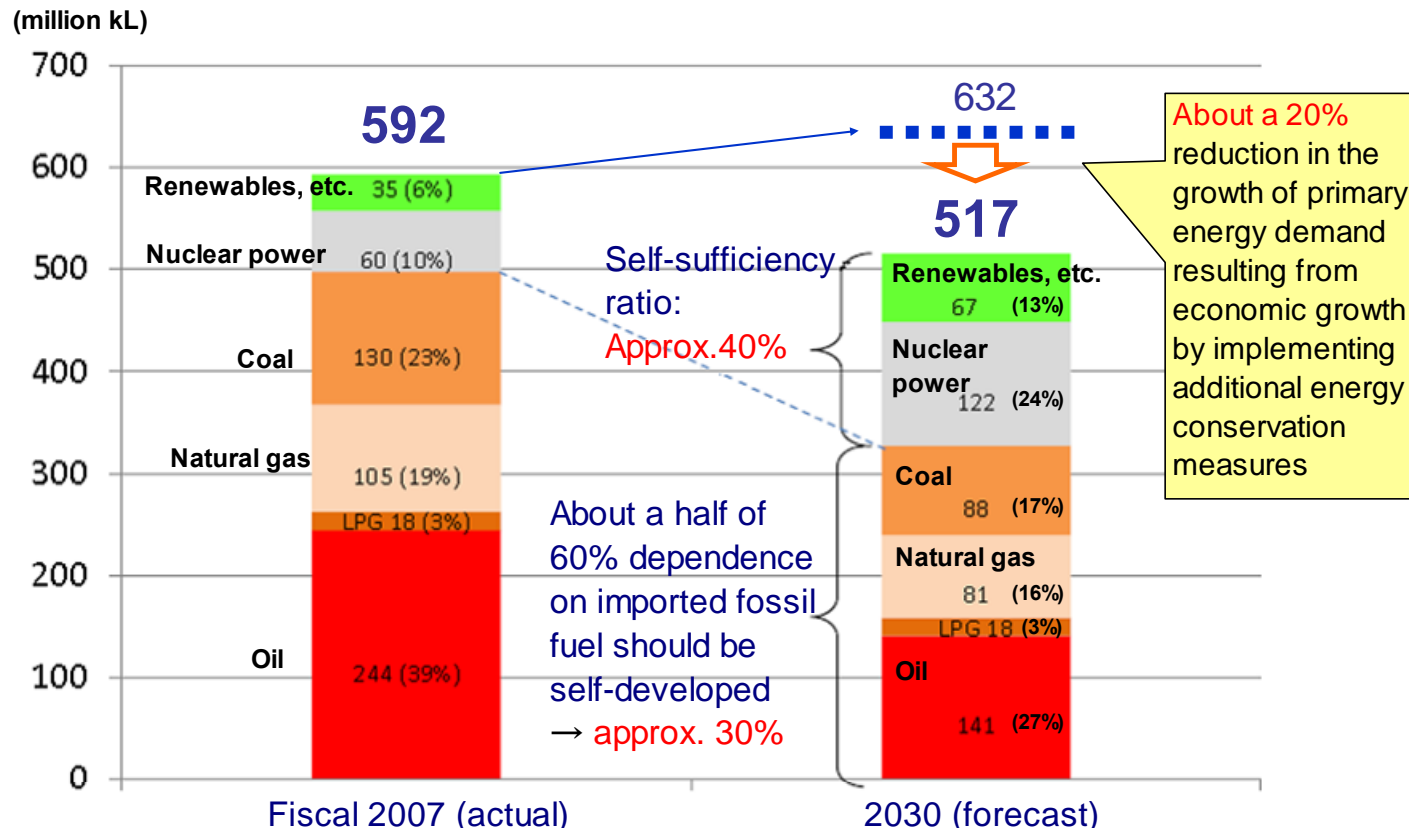
2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

Reference: A basic energy plan to address 3E was determined in 2010 (1) : Primary Energy



- Increasing the self-managed energy ratio
(self-sufficiency ratio + self-development ratio) from 38% to ~70%
- Reducing CO2 emissions by 30% from the 1990 level



2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

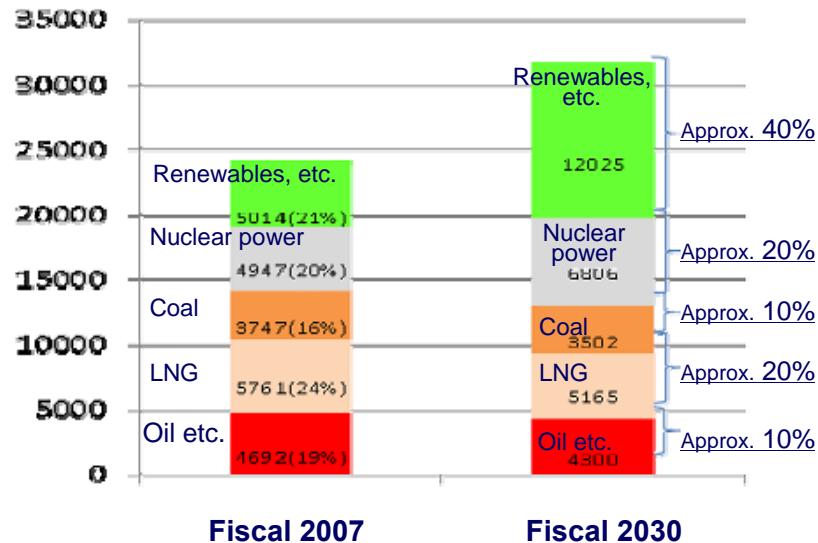
Reference: A basic energy plan to address 3E was determined in 2010 (2) : Generation Mix



- Building 14 reactors at new and existing sites and improving the operating ratio from 60% to 90%
- Increasing the introduction of renewable energy by 2.4 times (by 15 times, excluding hydropower)
- Increasing the proportion of zero-emission power sources from 34% to ~70%

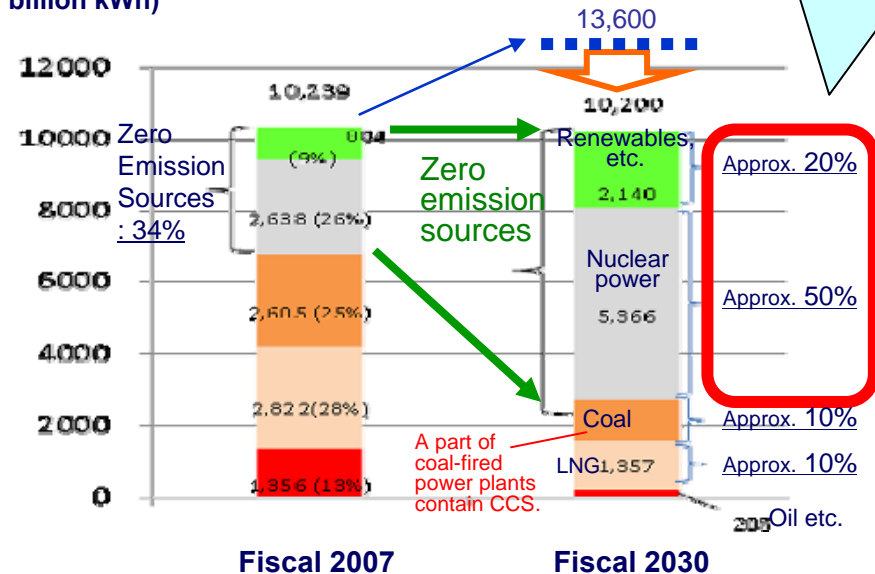
Installed capacity

(Unit: 10,000 kW)



Power generation

(Unit: 0.1 billion kWh)



2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

b. The importance of the Three E's remains unchanged since Fukushima.



1. Energy Security

① More than two years after the Arab Spring . . .

- Growing uncertainty about the future of popular movements and political upheavals in countries of the Middle East and north Africa
- Remarks made by the King of Jordan: Is the age of Arab imperial rule about to end?

② Scenario for events after sanctions on Iran:

- a. Iran compromises and abandons its nuclear development (uranium enrichment) program.
- b. Iran closes the Strait of Hormuz and enters into military conflict with the United States.
- c. The international community approves Iran's uranium enrichment program but takes measures to ensure peaceful use.
- d. Irrespective of the moves of the United States and Iran, Israel may . . .

2. Environmental Compatibility

① Agreement at COP18 in Qatar

- An agreement was made concerning the process toward creating a framework to which "all countries" including the United States, China and India should be committed.

② Role Japan should play

- It is important for Japan to take the initiative in creating a new framework for the future.

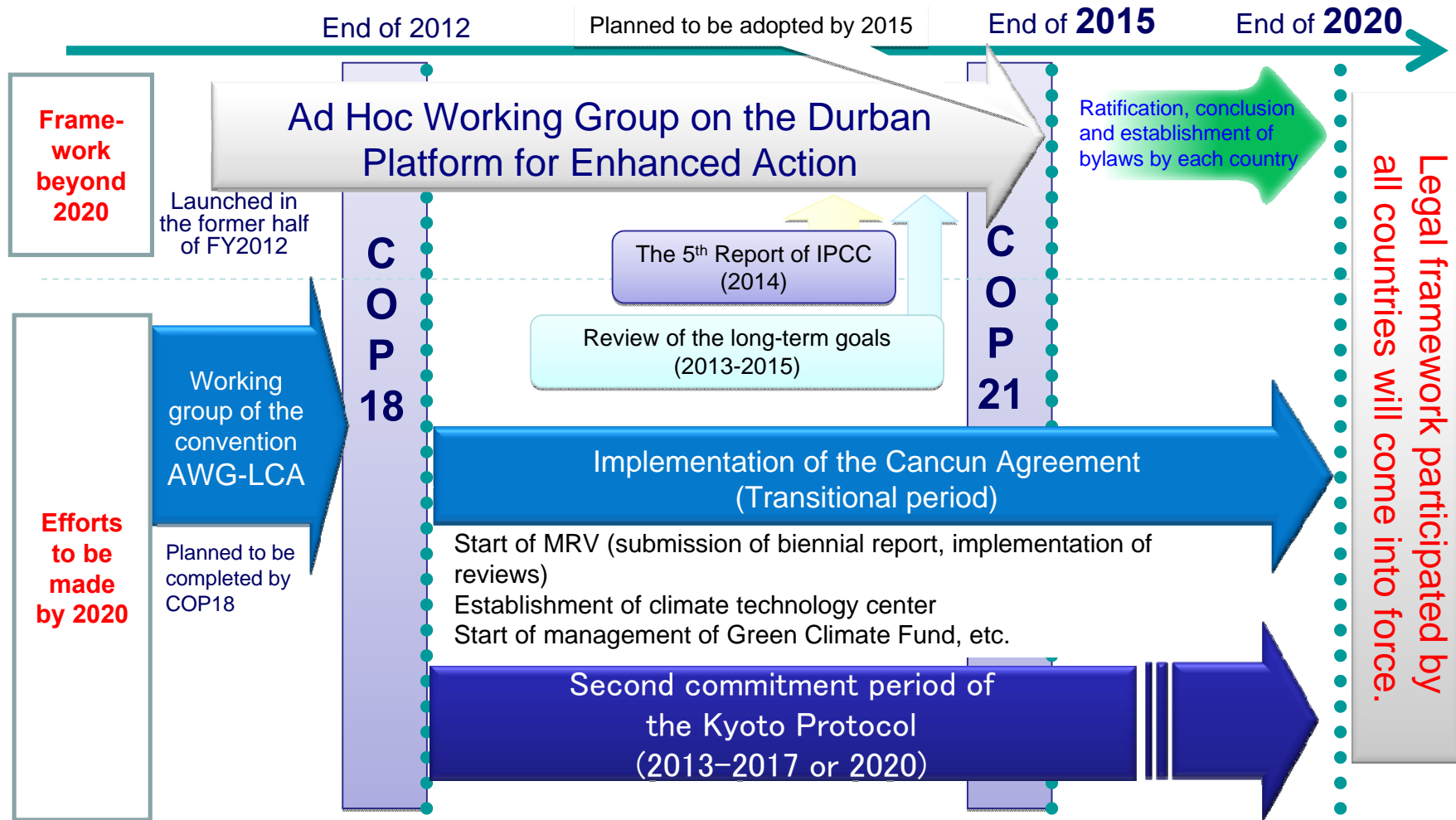
3. Economic Efficiency

- Even after the Fukushima accident, nuclear power remains a relatively low-cost energy option.

2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

Reference: Future Schedule for New Framework (Climate Change)



2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

Reference: Negotiation on global warming: commitment of different countries



- The targets for major countries are based on the targets acknowledged according to the Copenhagen Accord.
- Advanced countries have promised commitment to a gross reduction in GHG emissions while developing countries have promised commitment to a reduction on the basis of Business-as-Usual (BAU) ratio or emission intensity.

	Ref. year	Medium-term goal		Reduction (%) from 1990 level	Reduction (%) from 2005 level	IEA (from 1990 level)	Marginal cost of reduction (\$)
Japan	1990	-25%	(*1)	-25%	-30%	-10%	476
EU	1990	-20% to -30%	(*1)	-20% to -30%	-13% to -24%	-23%	48 to 135
U.S.	2005	-17%	(*2)	-4% (percentage insisted by the U.S.)	-17%	-3%	60
Canada	2005	-17%	(*2)	+3%	-17%	-	92
Australia	2000	-5% to -25%	(*1)	+13% to -11%	-10% to -29%	-	46 to 92
New Zealand	1990	-10% to -20%	(*1)	-10% to -20%	-28% to -36%	-	n.a.
Russia	1990	-15% to -25%	(*1)	-15% to -25%	+18% to +33%	-27%	0
Brazil	-	-36.1% to -38.9% (from BAU emission level in 2020)		-	-23%	-	n.a.
S. Korea	-	-30% (from BAU emission level in 2020)		-	-4%	-	21
China	2005	-40% to -45% (emission intensity per GDP)		8% GDP growth up to 2020: emission increases to 1.9 times the 2005 level ----- 6% GDP growth from 2015: emission increases to 1.7 times the 2005 level		-47% (from 2005)	0
India	2005	-20% to -25% (emission intensity per GDP)		7% GDP growth up to 2015 and 6% from 2015: emission increases to 2.1 times the 2005 level		-40% (from 2005)	Less than 0

Source : RITE, etc.

Note 1: National targets marked *1 are conditional and dependent on the moves of each country, etc.

National targets marked *2 are conditional and dependent on the passing of bills, etc.

Note 2: The marginal cost of reduction is estimated by RITE.

Note 3: Reduction from BAU means reduction from the "Business as Usual" emission level without special measures.

2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

c. Nuclear power seems less costly in 2030



Points to estimate costs

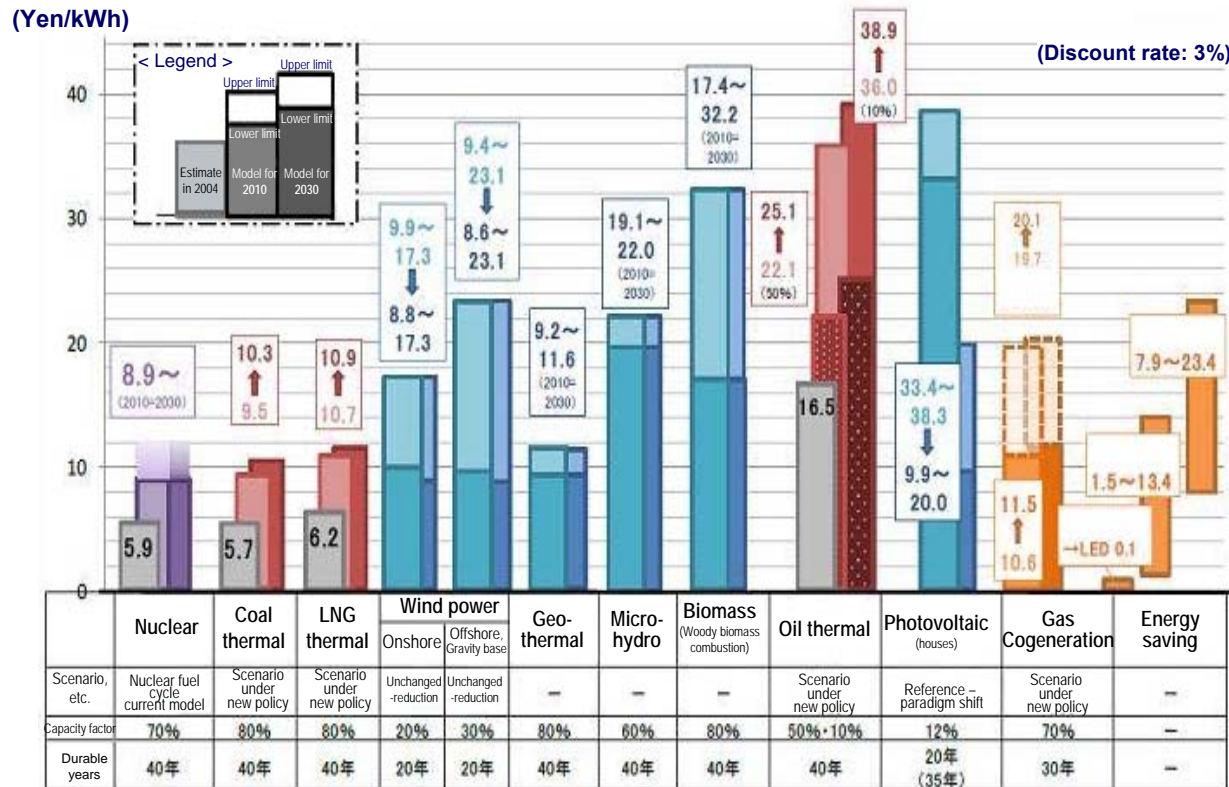
- Model plant form (Based on plants which started to operate these 7 years, subsidies paid these 3 years, etc)
- Including social costs such as cost for countermeasures against nuclear accident risks and political policy costs
- As for models for 2020 and 2030, estimated the cost expecting increase of fuel cost and CO2 reduction cost, and decrease of the price caused by technology innovation

■ The Cost Investigation Committee was established to reexamine the generation cost after the Fukushima accident.

■ Due to reasons such as the cost of accident prevention measures, the increase of construction cost and the rising crude oil price, the costs of thermal power and nuclear power generation have risen from the previously estimated levels. Even according to the lowest estimations, the generation cost was given as follows:

8.9 yen/kWh by nuclear power, 9.5 yen/kWh by coal-fired generation and 10.7 yen/kWh by LNG-fired generation.

■ As the presently confirmed loss caused by the Fukushima accident, 5.8 trillion yen was added to the cost of nuclear power generation. The additional cost of each trillion yen will raise the generation cost by 0.09 yen/kWh.



2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

Reference: The three steps for the restart of offline nuclear reactors



Dismissing the Safety Myth and Ensuring Defense-in-Depth

Following the three steps described below, the risk of recurrence of accidents should be reduced and the radioactive hazard in the event of an accident should be prevented through the coordinated efforts of the government and the private sector:

- a) Enhancement and evolution of severe accident management measures and preparedness against station blackout and **the restarting of plants under the presently accepted arrangements**
 - Emergency safety measures + stress tests
 - Additional safety measures for 30 items
 - Constant evolution of the safety regulation framework
 - Improving emergency preparedness based on the awareness that there is no absolute guarantee of safety

- b) **In the future, plants should be restarted under new arrangements**, while maintaining the independence of the nuclear regulatory institutions.
 - Enhancement of safety in terms of both hardware and software, capable of coping with strict regulation and inspection
 - **The Nuclear Regulation Authority (NRA) was established on September 19, 2013. Mr. Shunichi Tanaka, NRA chairman, announced the intention to review the ongoing arrangements described in a) above.**

- c) **Furthermore, steps should be taken to enable mutual verification of safety through international cooperation, and alignment with international standards should be ensured.**
 - Japan's contribution to the enhancement of IAEA safety standards and voluntary commitment to the implementation of peer reviews
 - Mutual monitoring of activities and sharing of best practices with countries like the United States and France
 - **Emphasis on technology, safety scheme, and safety culture**

2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

Reference: The cause of the Fukushima accident



A. The Japanese Government's Nuclear Incident Investigation and Verification Committee

- (1) Safety measures/emergency response measures
: Introducing new techniques and findings covering complex disaster.
- (2) Safety measures taken in the nuclear power generation system
: Severe accident measures
- (3) Preparation for nuclear disasters
: Risk management system in time of a nuclear disaster
- (4) Measures to prevent/mitigate damages
: Activities to disseminate risk information, monitoring, evacuation of residents, etc.
- (5) International consistency
: Consistency with the international criteria including IAEA standards, etc.
- (6) How the related organizations should be
: **Independence of nuclear safety organizations**
- (7) Continuous investigation
: Continuation of investigation activities, etc.

B. The National Diet of Japan, Fukushima Nuclear Accident Independent Investigation Commission

- (1) Supervision of a regulatory authority by the national diet
: Establishment of a permanent committee
- (2) Review of the government's risk management regime
: Operators shall have the primary responsibility on the site.
- (3) The response of the government to the disaster victims
: Information disclosure, prevention of escalation of contamination
- (4) Supervision of the electric utilities
: Preventing the operators to put undue pressure to the regulatory authority.
- (5) Requirements of the new regulatory organization
: **Independence**, high transparency, and expertise etc.
- (6) Review of nuclear regulation laws
: Review and backfit based on the world latest technologies.
- (7) Utilization of independent investigation committee
: Establishment of a third party committee in the diet.

2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

Reference: Significance of International Standards



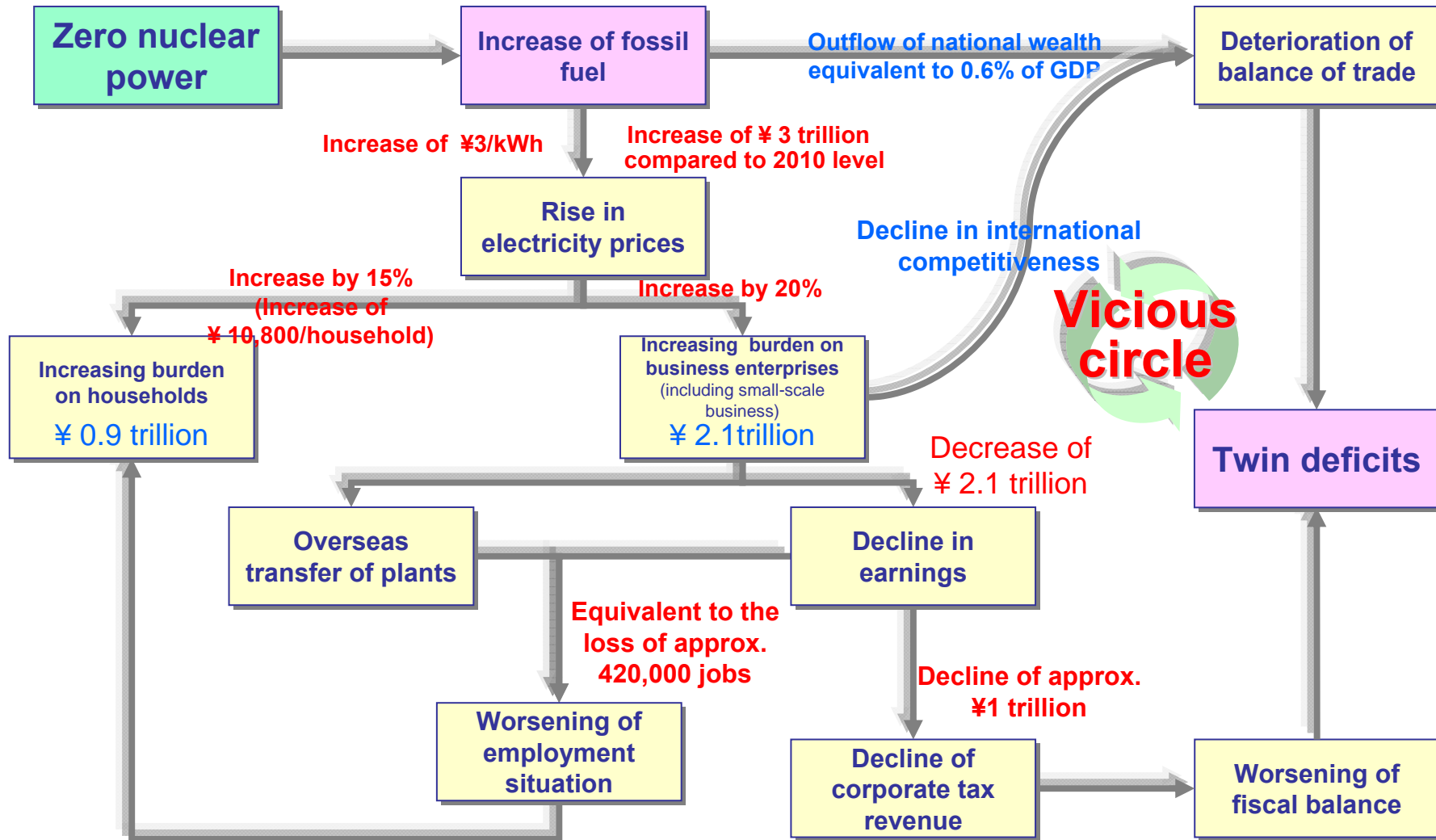
<10 fundamental safety principles set out by IAEA>

- Principle 1:** The prime **responsibility** for safety **rests with the licensees**.
- Principle 2:** An effective framework for safety, **including an independent regulatory body**, must be established and sustained by the governments.
- Principle 3:** Leadership in safety matters has to be demonstrated at the highest levels in an organization.
- Principle 4:** Only those facilities and activities whose benefits exceed radiation risks should be justified.
- Principle 5:** Protection shall be optimized to provide the highest level of safety and it shall be reviewed regularly.
- Principle 6:** Individual risk shall be controlled within the prescribed limits.
- Principle 7:** **People and environment**, present and future, must be protected against **radiation risks**.
- Principle 8:** Primary means of the **prevention and mitigation** of the accident consequence are the “**defense in depth**”. Good design and engineering features providing safety margins, and diversity and redundancy must be introduced.
- Principle 9:** **Emergency preparedness** and response should be established.
- Principle 10:** Protective actions to reduce radiation risk must be **justified and optimized**.

2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

d. Macro Economic Impact (The case for 2012)



2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

e. Major points of the strategies announced in Mid Sept. under the previous Adm.



(Three pillars)

1) Earliest possible realization of a nuclear independent society

- * Devote all types of political resources to realize zero nuclear power in the 2030's
- * NPSs of which safety is confirmed in the above process will be used as important power source

2) Implementation of green energy revolution

- * Emergence of a newly growing economic sector

3) Stable energy supply

- * Ensuring fossil fuel supplies, thermal use, research and development of next generation energy technology

As a result,

○GHG emissions in 2020 are expected to be cut by 5-9% (compared to 1990 level).

In 2030, emissions are expected to be cut by almost 20% (compared to 1990 level).

(Note) According to the current plan, the emissions in 2020 and 2030 are expected to be cut by 25% and 30%, respectively.

However, this strategy itself was not approved by Cabinet meeting

2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

Reference: 3 options



Four options under discussion (Advisory Committee for Natural Resources and Energy, as of June 7):

	Nuclear power	Renewable energy	Fossil-fired generation	Cogeneration	Energy conservation (power conservation)	CO₂ emissions (change from the 1990 level)
Option (1)	0%	35%	50%	15%	-20% (-10%)	-16%
Option (2)	15%	30%	40%	15%	-20% (-10%)	-20%
Option (3)	20-25%	25-30%	35%	15%	-20% (-10%)	-23%
(Addition)	35%	25%	25%	15%	-20% (-10%)	-28%

Option (4) Achieving the most desirable generation mix for society by the choice of power consumers in the market after setting up a framework for sharing the social cost (of generation) by utilities (and power consumers)

2. Energy Supply and Demand in Japan: Current Situation and Challenge

(4) Optimal energy mix

Reference: Economic Impact Analysis



(Interim outputs from the Advisory Committee for Natural Resources and Energy as of June 7)

	Real GDP	Impact on household budget (substantial)	Electricity charge (nominal) (In FY2010: about 9,900 yen/month, or 118,800 yen per year)
Option (1)	-5.0 to -2.0% [-31 to -12 trillion yen]	-6.0% to -5.6% [-19 to -18 trillion yen]	99% to 102% [19,700 to 20,000 yen/month] (236,400 to 240,000 yen/year)]
Option (2)	-4.1 to -1.5% [-25 to -9 trillion yen]	-4.6% to -4.4% [-15 to -14 trillion yen]	71% [16,900 yen/month] (202,800 yen/year)]
Option (3)	-3.6 to -1.2% [-22 to -7 trillion yen]	-4.2% to -3.8% [-14 to -12 trillion yen]	54% to 64% [15,200 to 16,200 yen/month] (182,400 to 194,400 yen/year)]
(Additional scenario)	-2.5 to -0.9% [-15 to -6 trillion yen]	-3.4% to -2.9% [-11 to -9 trillion yen]	38% to 39% [13,700 to 13,800 yen/month] (164,400 to 165,600 yen/year)]

These are the results of estimations made at research institutions (the Research Institute of Innovative Technology for the Earth and Associate Professor Nomura of Keio University) using generation cost data provided by the Cost Investigation Committee.

2. Energy Supply and Demand in Japan: Current Situation and Challenge
(4) Optimal energy mix
f. The messages from the new administration



< The policy of LDP (The Liberal Democratic Party of Japan.) >

a. Short term

***Existing nuclear reactors should be restarted as the Nuclear Regulatory Commission, which was established in mid-September in 2012, confirms their safety within three years.**

b. Long term

***The best energy mix should be determined within ten years, by evaluating the performance of renewable energy, which is being increasingly introduced after “ Feed in tariff system ” set in last July.**

< The policy of LDP/New Komeito coalition government >

***The reactors could be restarted after the NRA's safety judgment through the new regulation in line with international standards.**

1. Three Topics Related to Changes in the Surrounding around Energy Policies

2. Energy Supply and Demand in Japan: Current Situation and Challenges

3. Goals of Partnership and Cooperation among Japan, China and South Korea

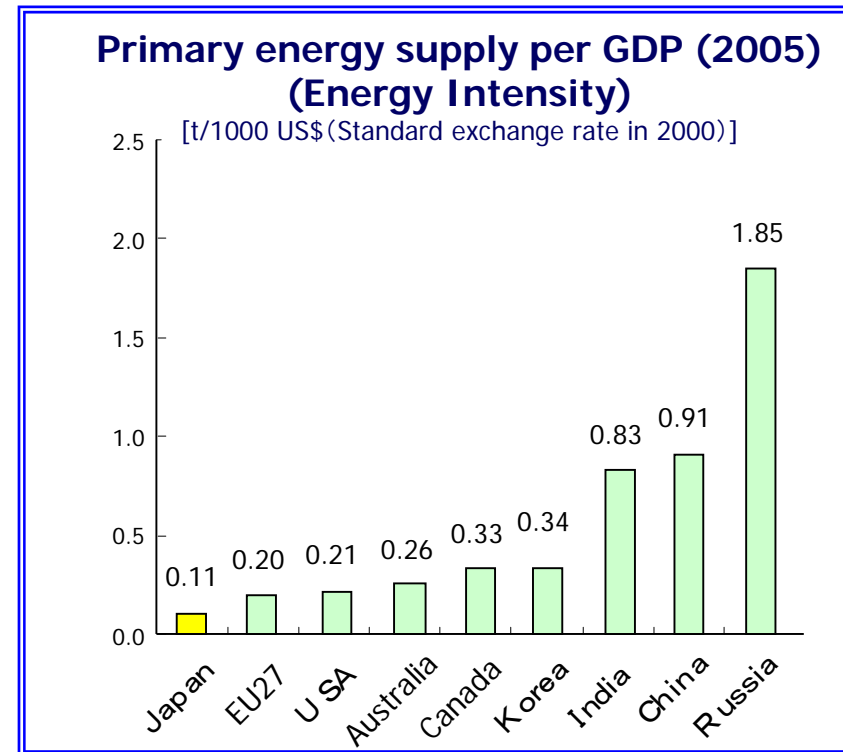
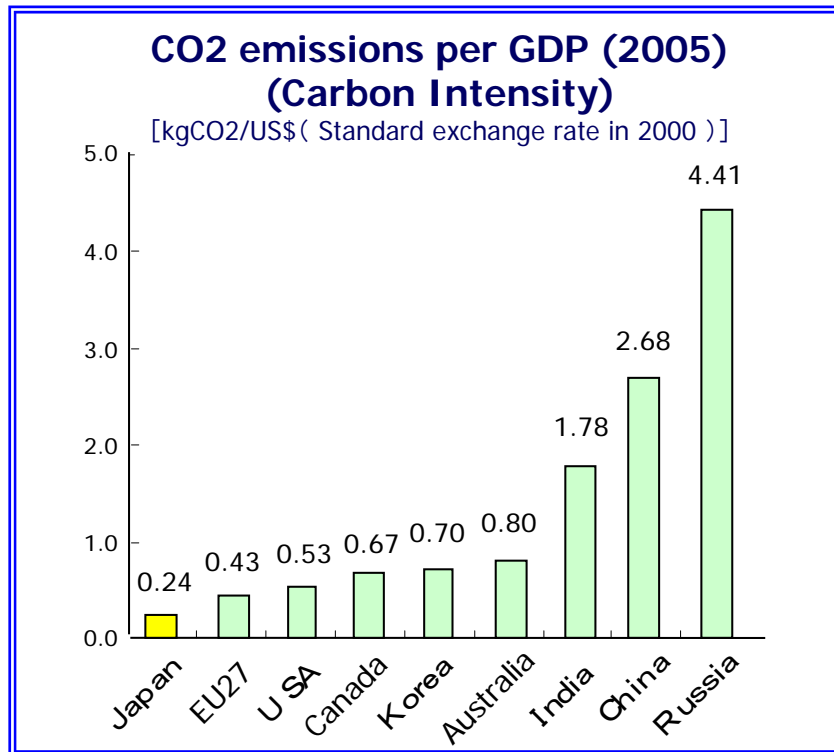
- (1) Promoting energy conservation
- (2) Solving the problem of the Asia premium in LNG trading
- (3) Establishing nuclear safety in Asia
- (4) Joint initiatives to cope with global warming

4. Conclusion: Indispensability of Cooperation among Japan, China and South Korea

3. Goals of Partnership and Cooperation among Japan, China and South Korea (1) Energy conservation is beneficial for all importing countries.



Energy conservation would increase energy independence and contribute to combat Climate Change

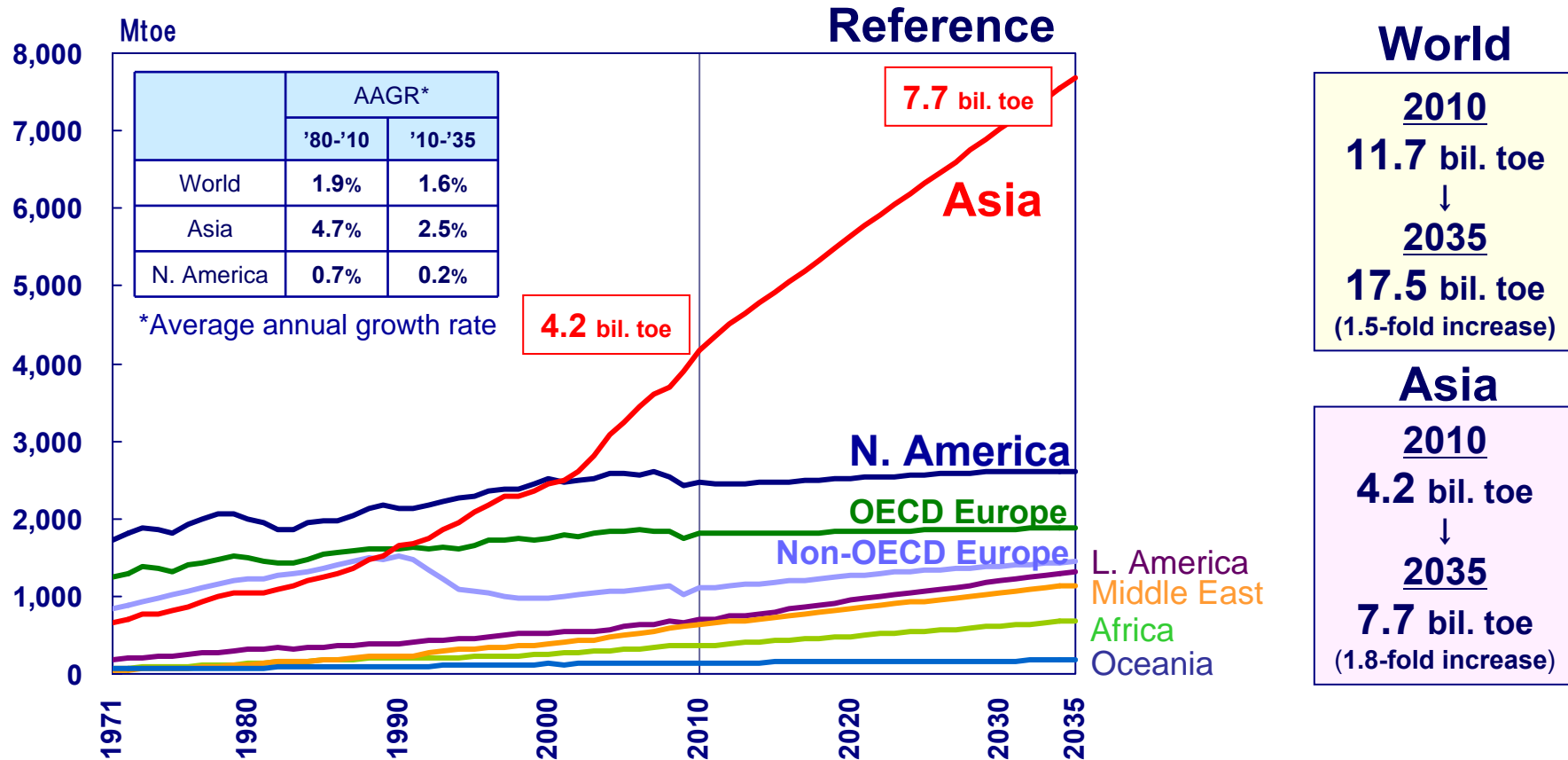


Source: IEA (2007), "CO2 emissions from fuel combustion 1971-2005"

3. Goals of Partnership and Cooperation among Japan, China and South Korea

(1) Energy conservation is beneficial for all importing countries.

Reference: Energy conservation is beneficial for all importing countries.



- Reflecting high economic growth for Asian countries, primary energy demand in Asia will increase 1.8 times by 2035 from current levels; 4.2 billion toe(2010) → 7.7 billion toe(2035).
- Non-OECD countries will represent 93% of incremental growth of global energy demand.

3. Goals of Partnership and Cooperation among Japan, China and South Korea

(1) Energy conservation is beneficial for all importing countries.

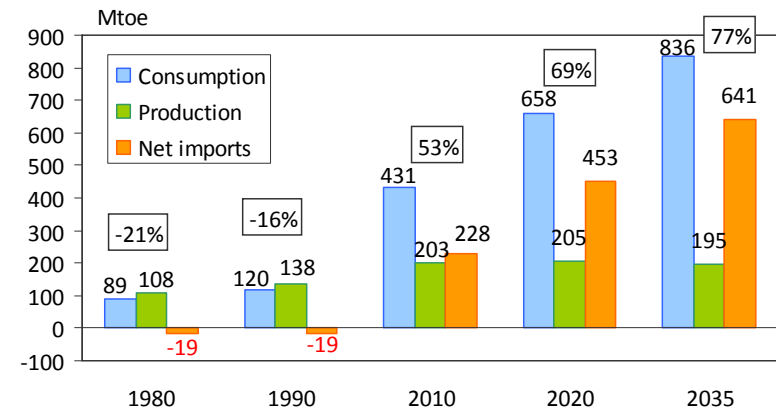
Reference: Growing dependency of Asian countries on imported energy



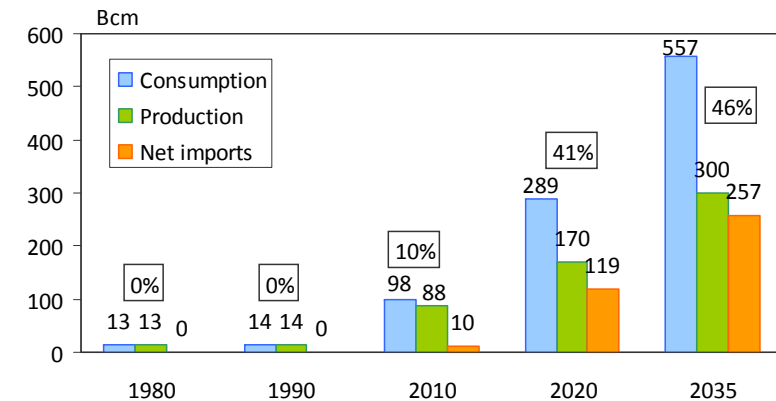
- Increasing recognition of the **growing dependency on imported energy** as a vulnerability (particularly by countries like China)
- **As countermeasures**, countries seek to **intensify strategies** such as developing indigenous energy resources, diversifying supply sources, investing in autonomous overseas development, and strengthening private companies as market players.
- However, when these activities become overly exclusive, **they may lead to the guarding of resources or competition over the ownership of resources**, causing unrest in global markets.

Energy Demand and Supply in China

Oil

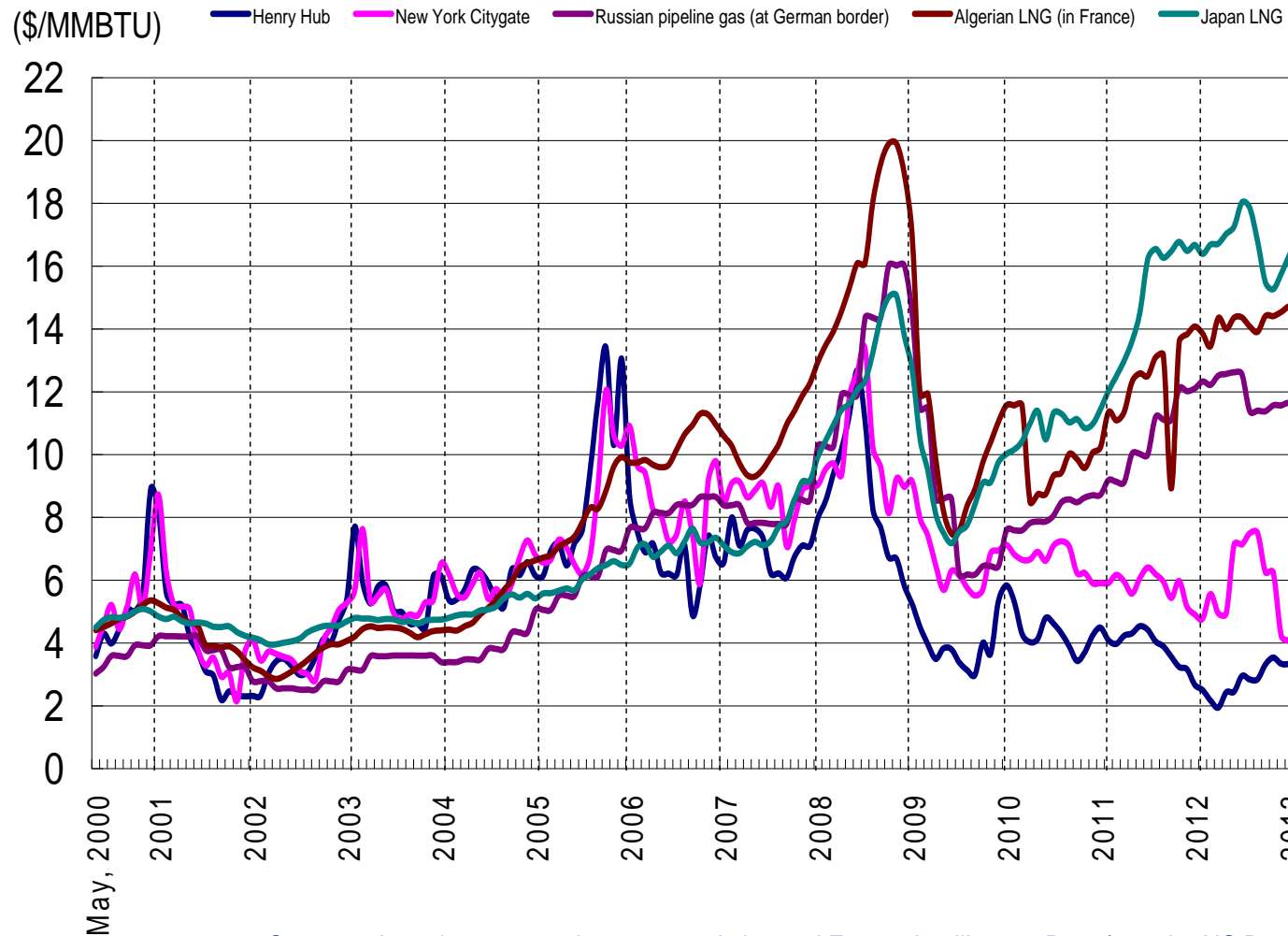


Natural Gas



Source: IEEJ, "Asia/World Energy Outlook 2012"

3. Goals of Partnership and Cooperation among Japan, China and South Korea (2) Asian Premium of LNG price should be eliminated



Japan LNG

France LNG
from **Algeria**

German border:
Pipeline gas from
Russia

NY City Gate
(U.S.: Pipeline gas)

Henry hub
(U.S.: Pipeline gas)

Sources: Japan's customs clearance statistics and Energy Intelligence Data from the US Department of Energy

3. Goals of Partnership and Cooperation among Japan, China and South Korea

(2) Asian Premium of LNG price should be eliminated

<Example of cooperation>: Possible cooperation to eliminate Asian premium



(1) Goals

1. Easing of supply and demand situation for LNG trade
2. Securing of LNG at an affordable price and reviewing price formula
3. Formulating of Asian spot market and establishing Asian hubs.

(2) Possible cooperation

2-1) Cooperation by private sectors

- a. Joint development and purchase of LNG while opening access to facilities
- b. Importing shale gas and reviewing price formula (Oil-indexation)
- c. Establishing Asian wide spot market

(Note) Formation of pipeline market in Asia, accommodating of LNG whenever necessary

2-2) Cooperation by Governments

- d. Providing finances, if necessary, for pipeline network either domestic or international
- e. Prohibiting destination clause
- f. Ensuring free flow of goods, personals and money through EPA
- g. Deciding energy mix, which will improve price negotiation

3. Goals of Partnership and Cooperation among Japan, China and South Korea (3) Nuclear Power could expand safely based on lessons from Fukushima



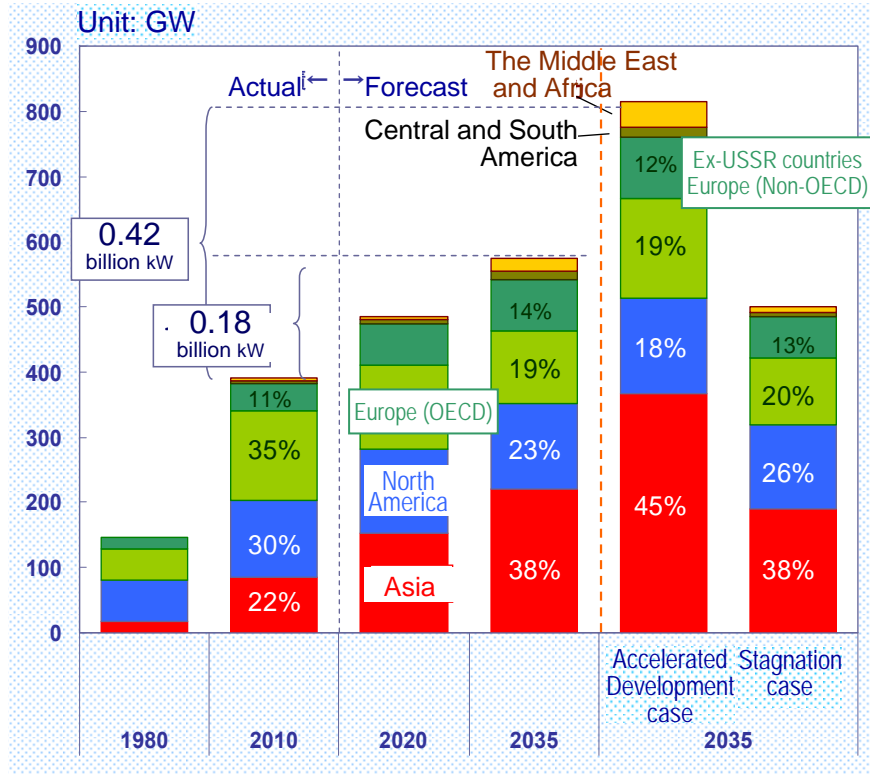
- The rapid expansion of nuclear power generation in Asia is based on its advantages of **energy security** and **global warming prevention**, and the vital need for nuclear power as **an economically efficient generation option**, for economic growth.
- The total installed capacity of nuclear power generation in Asia is expected to increase by at least a factor of two to four from the present level by 2035.

Outlook for Installed Capacities in Asia for Nuclear Power Generation

(Unit: GW)

	2010	2020			2035		
		Reference case	Accelerated development case	Stagnation case	Reference case	Accelerated development case	Stagnation case
China	9	60	70	60	104	158	104
Taiwan	5	8	8	5	6	8	4
S·Korea	18	24	32	24	34	48	34
ASEAN	0	0	0	0	9	26	3
India	4	18	26	18	35	72	35
All Asia	85	153	179	139	220	366	190

Outlook for Installed Capacities in the World for Nuclear Power Generation



3. Goals of Partnership and Cooperation among Japan, China and South Korea

(4) Joint initiatives to cope with global warming



■ **What is the ideal framework to be created for 2020 onward?**

→ **A framework that aims to effectively reduce GHG emissions in the mid to long term by the commitment of major countries including the United States and China**

- (1) Sectoral/bottom-up approach focusing on the reduction of specific energy consumption**
- (2) Flexible use of peer reviews without being overly concerned about legal binding force**
- (3) Bilateral crediting to promote the transfer of technologies to developing countries**
- (4) Acceptance of the 450ppm overshoot method and the promotion of “adaptation” measures**
- (5) Promoting the development of innovative technologies for the absorption and containment of GHG gases:**
CCS + CCU

Based on cooperation among Japan, China and South Korea, the above suggestions should be presented to the United Nations after acquiring reasonable consensus within the framework of APEC, etc.



1. Three Topics Related to Changes in the Surrounding around Energy Policies

2. Energy Supply and Demand in Japan: Current Situation and Challenges

3. Goals of Partnership and Cooperation among Japan, China and South Korea

4. Conclusion:

**Indispensability of Cooperation among Japan,
China and South Korea**

4. Conclusion

1. The energy situation for Japan **is filled with uncertainties** such as:
(1) unrest in the Middle East, (2) shale gas revolution, and (3) Fukushima nuclear accident.
2. After the Fukushima accident, Japan is facing various problems concerning energy supply and demand due to reduced operation of nuclear power plants, including **a worsening trade balance and rising electricity rates**.
It is vitally important that **nuclear power plants are restarted** after verifying safety and finalizing **a policy concerning the energy mix** as soon as possible.
3. From the viewpoint of 3E+S+M, **no single energy option can be a perfect choice for Japan**.
When “M” (macro economy) is taken into account, the optimal mix would probably be close to (3) [on page 35] (20 to 25 percent contribution of nuclear power).
4. Given the above, **it is necessary to promote cooperation among Japan, China and South Korea, all of which are facing similar challenges**:
 - 1) Promoting energy conservation
 - 2) Solving the problem of the Asia premium in LNG trading
 - 3) Establishing nuclear safety in Asia
 - 4) Joint initiatives toward curbing global warming

Thank you for your attention !!

