

# **FY2015 Annual Report on Energy (Energy White Paper)**

**May 2016**

**Agency for Natural Resources and Energy**

## Part 1 Current Energy Situation and Key Measures

### Chapter 1 Energy Security into the Future against the Backdrop of Low Crude Oil Prices

- Promotion of investment in upstream development
- Responses to oil price fluctuation risks (LNG-related measures)
- Reduction of dependence on crude oil on the demand side

May 26-27: G7 Ise-Shima Summit  
(May 1-2: Energy Ministerial Meeting)

### Chapter 2 Responses to the Great East Japan Earthquake and the Accident at Tokyo Electric Power Company's (TEPCO) Fukushima Daiichi Nuclear Power Station and the Nuclear Energy Policy Based on Such Experience

- Efforts towards the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station Units 1-4
- Support for Nuclear Disaster Victims and the Fukushima New Energy-Oriented Society Scheme
- Efforts to Improve Public Trust in Nuclear Power Policy

March 11: Five years  
after the earthquake

### Chapter 3 Changes in Energy Policy Based on the Paris Agreement

- Influence of the Paris Agreement on Energy Policy
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- New Mechanism in the Electricity Sector - Innovation in the Electricity Sector -

April 1: Full liberalization of the  
power retailing business  
(December 2015: Paris Agreement)

## Chapter 2 Energy Trends

(Basic energy-related data within and outside Japan)

## Chapter 3 Measures Taken in FY2015 concerning Energy Supply and Demand

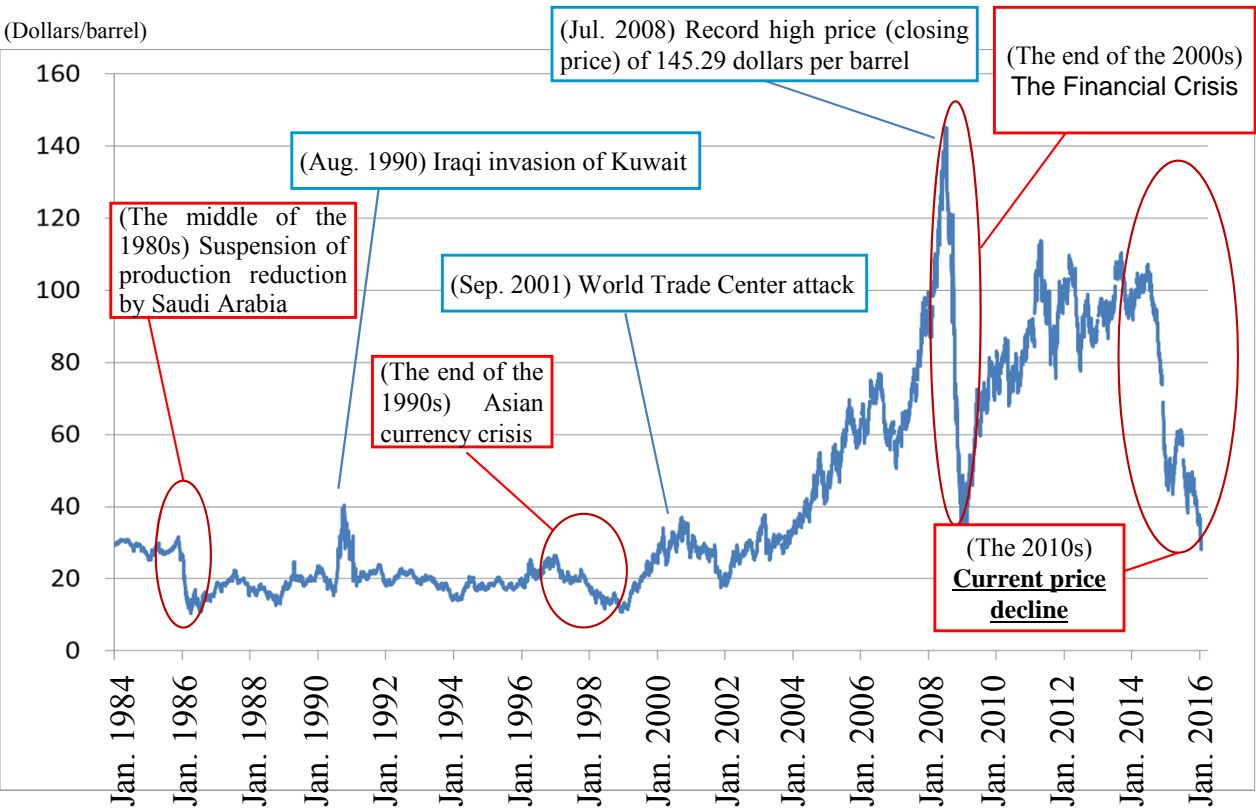
\* The Energy White Paper is a report submitted to the Diet annually based on Article 11 of the Basic Act on Energy Policy outlining energy measures taken during the previous fiscal year.

# **Energy Security into the Future against the Backdrop of Low Crude Oil Prices**

# Crude Oil Price Declines in Historical Perspective

- After experiencing several oil shocks, the world faced significant crude oil price declines in the 1980s, 1990s and 2000s.
  - The middle of the 1980s: **An oversupply occurred** as Saudi Arabia tried to maintain its market share against production increases in non-OPEC oil producers (Mexico, United Kingdom, etc.).
  - The end of the 1990s: **Worries over the possibility of oversupply** prevailed as OPEC decided to increase production while a decrease in oil demand was expected due to an economic slump caused by the Asian Financial Crisis.
  - The end of the 2000s: **Major causes of the decline were financial factors**. Speculative funds, which had been invested in the crude oil market under monetary easing policies and had excessively inflated crude oil prices, were suddenly withdrawn due to the Lehman Shock.
- Currently, crude oil prices are declining mainly due to oversupply (production increase by the United States (shale oil), Saudi Arabia, Iraq, etc.).

[Changes in WTI prices since the 1980s]



[Although crude oil prices have been low, the supply of crude oil continues to increase]

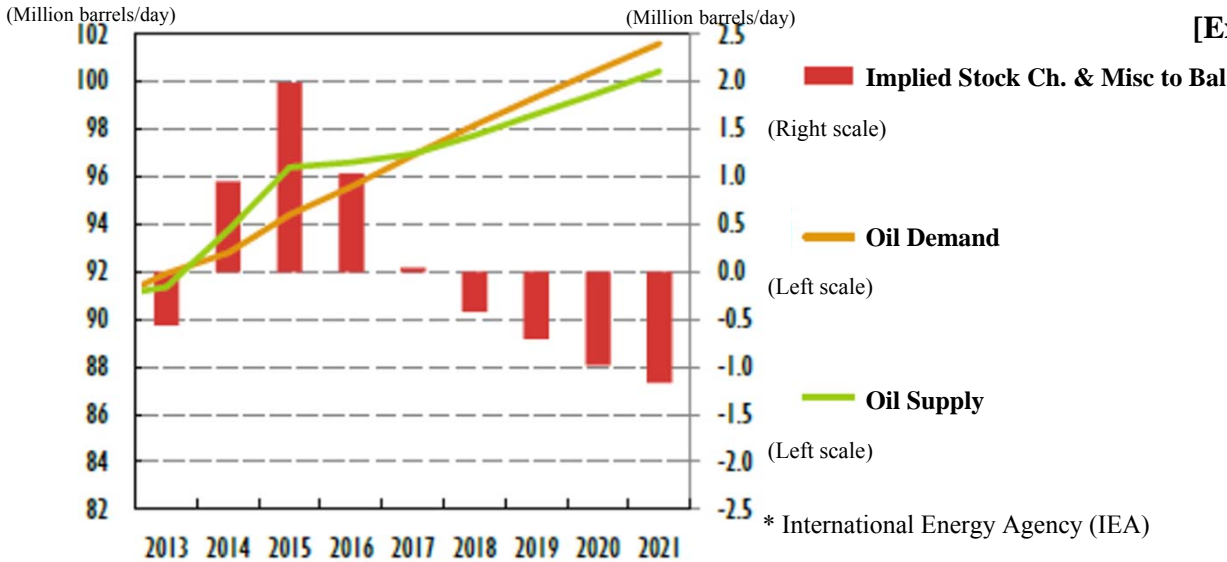
Major countries increasing production	Reasons	Increased amount (Y/Y; Million B/D)	
		2014	2015
U.S.	Production of shale oil is steady thanks to production efficiency improvement and cost reduction.	1.74	0.95
Iraq	Oil development projects using foreign funds have been moving forward.	0.25	0.66
Saudi Arabia	The country postponed production reduction in order to maintain its market share. It is also possible that the intention was to cause other countries to decrease production of shale oil.	0.06	0.45
Russia	A weaker ruble has mitigated the impact of crude oil price declines on the domestic economy. The country maintains high production levels.	0.11	0.15
Canada	Production of oil sand and other unconventional crude oil is steady.	0.28	0.10
World total		2.49	2.66

# Forecast of Crude Oil Prices

- The growth of demand has been slower than supply increases, resulting in a current oversupply of approximately 2 million barrels per day. However, in the medium term, stocks are expected to decrease **due to supply shortages caused by demand increases in emerging countries and the investment slump.**
- According to forecasts by various organizations, it is estimated that **oil demand will increase continuously and oil prices will maintain an upward trend in the longer term.**
- In addition to price fluctuations due to the supply and demand balance, **risks of significant price fluctuations** caused by finance and geopolitics have increased from the 2000s onward.

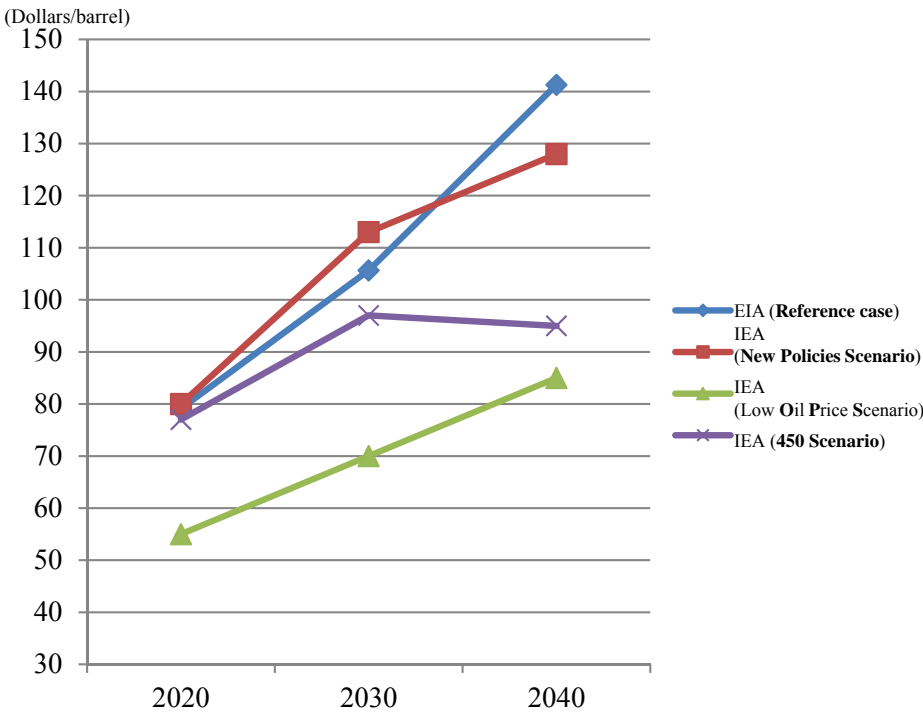
## [Crude oil stocks and expected supply and demand]

- IEA forecasts that crude oil demand will exceed the supply in 2018 -



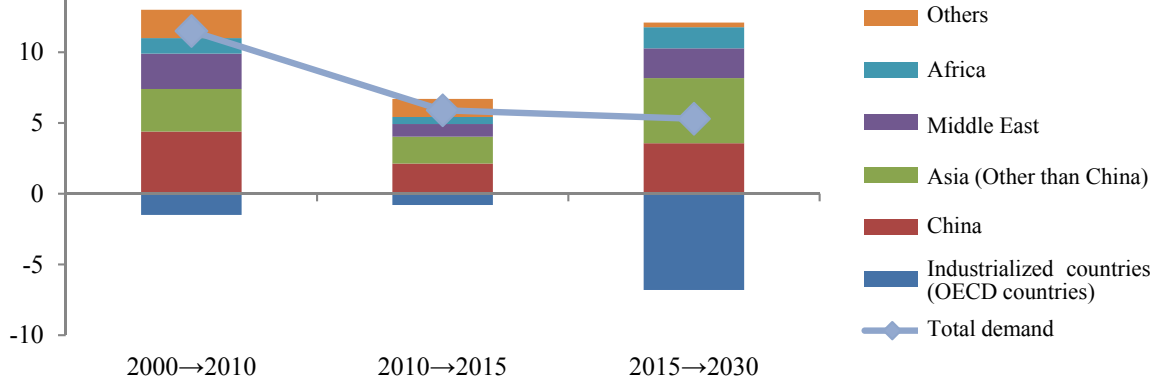
## [Expected crude oil prices (forecasts by major organizations)]

- EIA and IEA forecast crude oil price increases in the long term -



## [Expected changes in demand by region]

- Demand will increase mainly in China and other emerging countries -



## ● Estimated demand (consumption)

Unit: Million barrels/day	2020	2030	2040
EIA (Reference case)	98.4	108.8	121.0
IEA (New Policies Scenario)	98.0	103.0	107.7

\* U.S. Energy Information Administration (EIA)

# < Energy Security against the Backdrop of Low Crude Oil Prices >

Crude oil prices remaining at low levels  
• From over 100 dollars in 2014 to a sharp decrease to the 40-dollar range

## The world

Slump in energy development investment  
to cause tight supply in the future  
• Global investment decreased by 20% in one year  
(down by 15 trillion yen)

## Japan

Japan depends on exports for  
most of its energy resources  
→ Need to secure stable supply

(i)

Promotion of  
investment in  
upstream development

Lead global supply of risk money

Development of resources and  
acquisition of rights by Japanese  
companies/Creation of core  
companies

Ratio of self-  
development  
to be  
achieved:  
40% (2030)

(ii)

Responses to oil price  
fluctuation risks  
(LNG-related measures)

Develop a transparent LNG market with high  
mobility  
Create and enhance international emergency  
response frameworks

Lead  
international  
cooperation  
as the host  
country of  
the G7  
Summit

Promotion of infrastructure  
development such as  
pipelines in Japan

The world's  
largest LNG  
consumer

(iii)

Reduction of  
dependence on crude oil  
on the demand side

Export energy conservation systems to emerging  
countries and oil producers  
Diversify energy sources (high quality  
infrastructure)

Further energy conservation and  
diversification of energy sources to  
strengthen Japan's bargaining power

The most  
advanced  
energy  
conservation  
technology in  
the world

# (i) Promotion of Investment in Upstream Development to Secure Stable Supply in the Future

- Rapidly shrinking investment against the backdrop of low crude oil prices -

- Due to low crude oil prices, global investment in oil/gas development projects decreased by 20% (an annual decrease of 15 trillion yen). This may delay the commencement of new exploration and development projects.
- It is necessary to make the most of such opportunities at the G7 Summit meeting and make efforts to stabilize the world economy and supply of resources through harmonized investment.

Global investment  
in oil/gas  
development

**Down by 20%**

\* The possibility of an investment decrease for two years in a row for the first time since the 1980s

2014  
**Approx.  
80 trillion yen**

Down by  
15 trillion yen

2015  
**Approx.  
65 trillion yen**

Likely to  
decrease

2016  
**Likely to  
further decrease**

\* Source: WEO2015, IEA

\* **Approximately 70 trillion-yen investment** is required annually in order to maintain the current production level.

2014  
**Approx.  
2.1 trillion yen**

Down by  
0.2 trillion yen

2015  
**Approx.  
1.9 trillion yen**

Down by  
0.7 trillion yen

2016 (planned)  
**Approx.  
1.2 trillion yen**

**[Profits of companies engaging in upstream development are decreasing significantly]**

- These companies successively revised down their estimated final earnings for the first half of their business year.
- INPEX Corporation specializing in upstream development revised its estimated final earnings for FY2015 downward by 26 billion yen (approx. 67%).

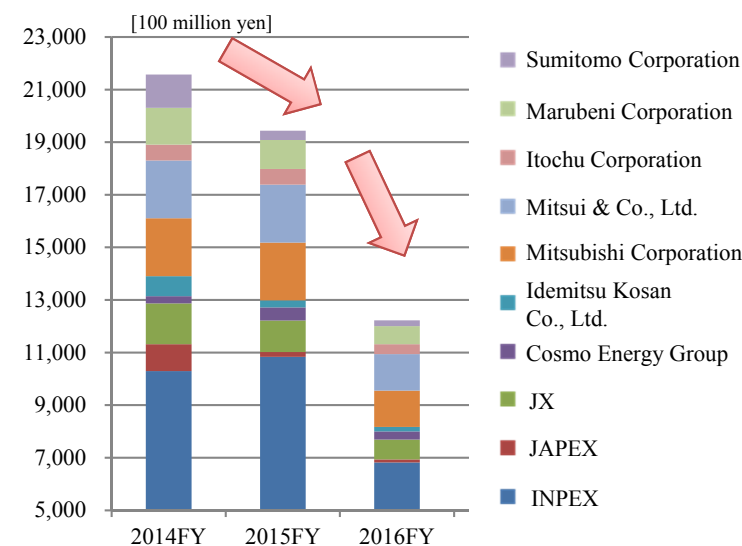
**Estimated closing of accounts for FY2015 of major companies engaging in upstream development**

Estimated closing of accounts for FY2015	Net profit (entirety of group companies) * Figures in the parentheses are changes from the previous year.
JX Nippon Oil & Gas Exploration Corporation	- 196 billion yen (down by 198.4 billion yen)
INPEX Corporation	26 billion yen (down by 51.8 billion yen)
Japan Petroleum Exploration Co., Ltd.	5.2 billion yen (down by 24.3 billion yen)

- Trading companies with energy departments also saw decreases in their earnings. In particular, Mitsubishi Corporation recorded a consolidated deficit of 150 billion yen and Mitsui & Co., Ltd. recorded a deficit of 70 billion yen, the first final deficit since its foundation.

Japan's investment  
in oil/gas  
development

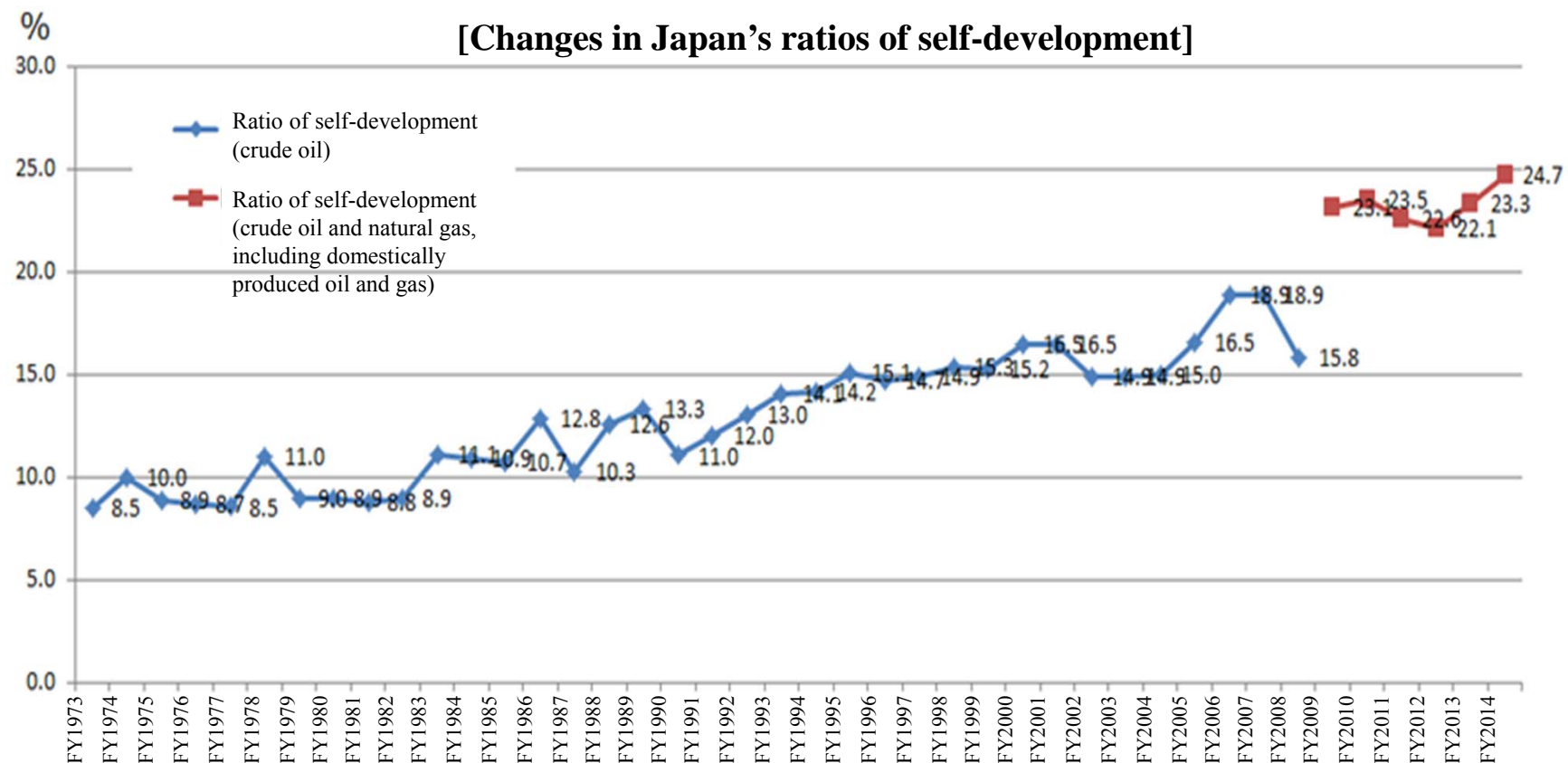
**[Significant decrease in Japanese companies' investment in oil/gas development]**



\* Calculated by METI based on reports by respective companies

# Changes in Ratios of Self-Development

- Japan has set a goal to achieve a ratio of 40% or more for self-development of oil and natural gas by 2030.
- The ratio for FY2014 was approximately 24.7%, the highest level since the measurement was commenced. Major causes for the high ratio in FY2014 include the addition of points thanks to the Garraf project in Iraq and commencement of imports from Papua New Guinea.
- It is necessary to further increase the ratio of self-development by promoting acquisition of rights and purchase of overseas assets and facilitating domestic oil and gas development, thereby strengthening Japan's energy security.



\* From FY1973 to FY2008, ratios of self-development were calculated only for oil. However, the Strategic Energy Plan (Cabinet Decision in March 2007) reviewed the definition of the term, and since FY2009, the ratios have been calculated by totaling data for oil and natural gas.

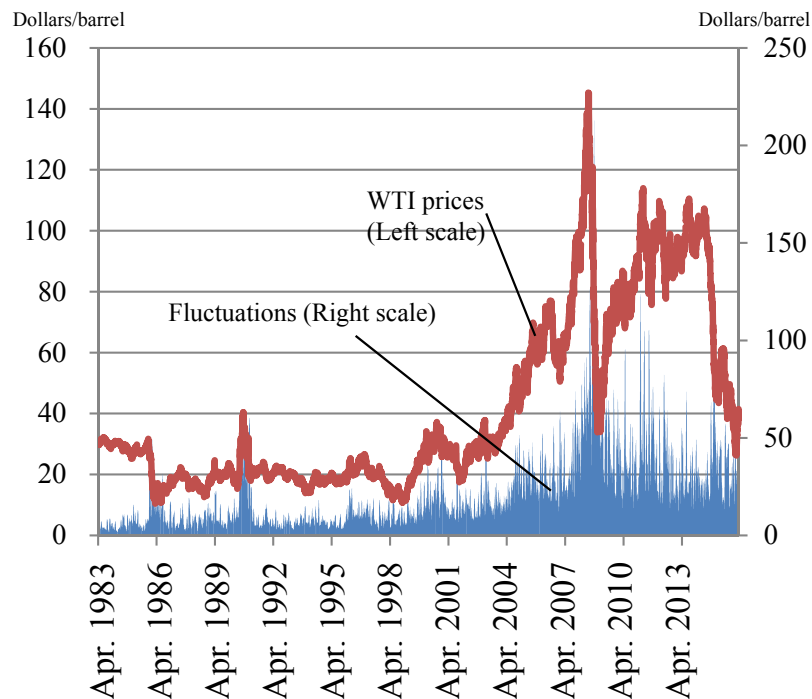


# (i) Promotion of Investment in Upstream Development to Secure Stable Supply in the Future

- Supply of risk money with public funds and creation of core companies -

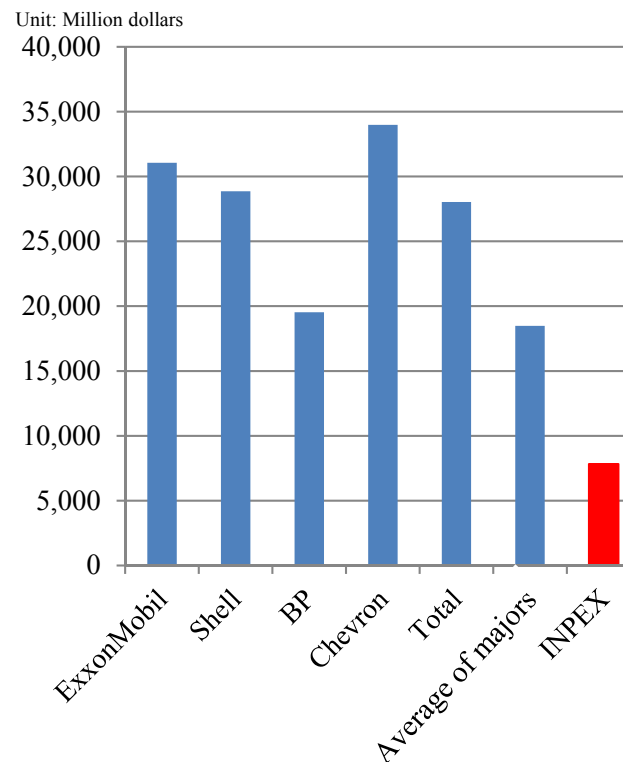
- Currently, Japan's upstream development is carried out under a system wherein three axes ((i) strategic supply of risk money by JOGMEC, (ii) creation of core companies, and (iii) active resource diplomacy) function integrally.
- Japanese companies engaging in upstream development generally have weaker funding bases compared with international resource majors. As fluctuations in crude oil prices have been expanding in recent years, the supply of risk money, which is indispensable for ensuring stable resource exploration and purchase of assets, needs to be strengthened by the use of public funds.
- Additionally, acquisition of overseas resource rights should be facilitated efficiently to secure a stable supply of oil and natural gas in Japan. It is also necessary to create core Japanese companies that have capabilities equal to that of overseas national flag companies in terms of funds, technologies and human resources.

[Fluctuations in crude oil prices have been expanding]

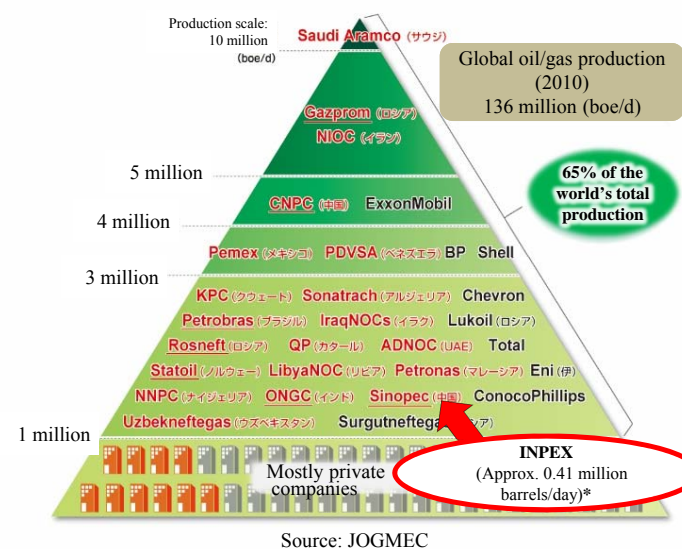


\* Monthly fluctuations in crude oil prices (standard deviations) are annualized.

[Investment by Japanese companies and international resource majors (2015)]



[Production scales of Japanese companies and international resource majors, etc.]

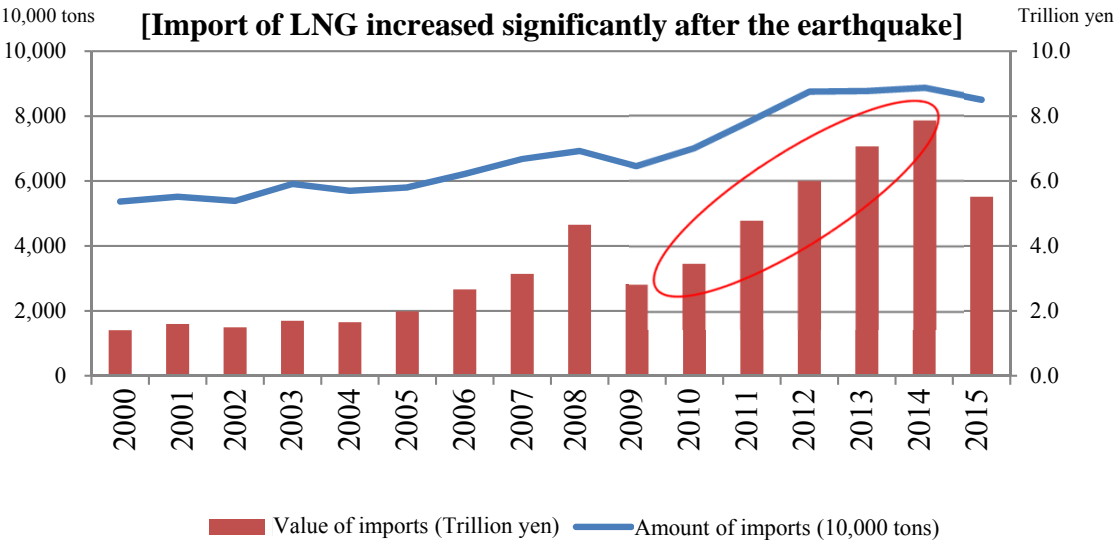


\* The medium-to long-term vision (2012) of INPEX sets the production goal of 1 million barrels/day by the middle of the 2020s.

## (ii) Responses to Crude Oil Price Fluctuation Risks

- Trade balance deteriorated due to a significant increase in imports of LNG after the earthquake -

- Due to the suspension of operation of nuclear power stations after the Great East Japan Earthquake, LNG-fired power stations expanded operation and a large amount of LNG was imported from a spot market to make up for the shortage that could not be covered with the amount of LNG purchased under existing long-term contracts.
- However, at that time, (i) it was a customary practice to trade LNG at prices linked to crude oil prices, and (ii) LNG transactions were mostly based on long-term contracts and a sufficient amount of LNG was not available on a spot market. As a result, **Japan was forced to import natural gas at higher prices than Western countries, which created a trade deficit and significantly deteriorated Japan's current balance.**
- While crude oil prices are expected to increase in the medium to long term, **it is necessary to develop an environment to enable stable procurement of LNG at reasonable prices.** Specifically, Japan needs to collaborate with natural gas producers and other LNG consumers to develop an environment where spot and futures transactions of LNG are carried out based on price indicators, properly reflecting supply and demand of LNG, not on those linked to crude oil prices.



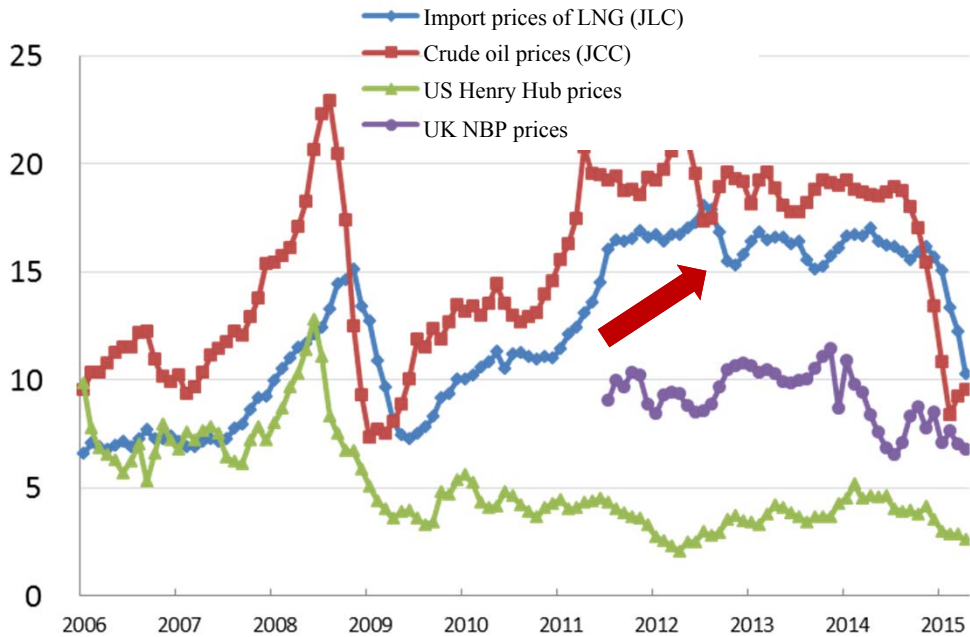
**[Changes in trade balances]**

Calendar year	Trade balance
2010	6.6
2011	-2.6
2012	-6.9
2013	-11.5
2014	-12.8
2015	-2.8

After the earthquake

Source: Trade Statistics, Ministry of Finance

**[Import prices of LNG for Japan surged in tandem with crude oil prices]**



Source: Trade Statistics, Ministry of Finance; EIA; Bloomberg, etc.

(ii) Responses to Crude Oil Price Fluctuation Risks - Problems concerning LNG market -

- Demand for LNG has been increasing, led by Asian and European countries. An increase of approximately 45% (from the 2014 level) is expected by 2020.
- Some new LNG suppliers such as the United States do not impose destination clauses, and market shares of LNG suppliers other than those in the Middle East will continue to increase until 2040.
- Considering these changes in the supply-demand environment in and outside Japan to be a significant opportunity, Japan should address the following challenges to establishing a favorable LNG market, while taking advantage of its status as the world's largest LNG consumer (consuming over 30% of the world's LNG production).

(1) Destination clauses: **Destination clauses\* are included** in many contracts, which makes it difficult to flexibly buy or sell LNG depending on supply-demand relationships.

\* Destination clauses: Clauses included in LNG transaction contracts that limit the landing place (destination) and prohibit resale to a third party

⇒ Relaxation of destination clauses

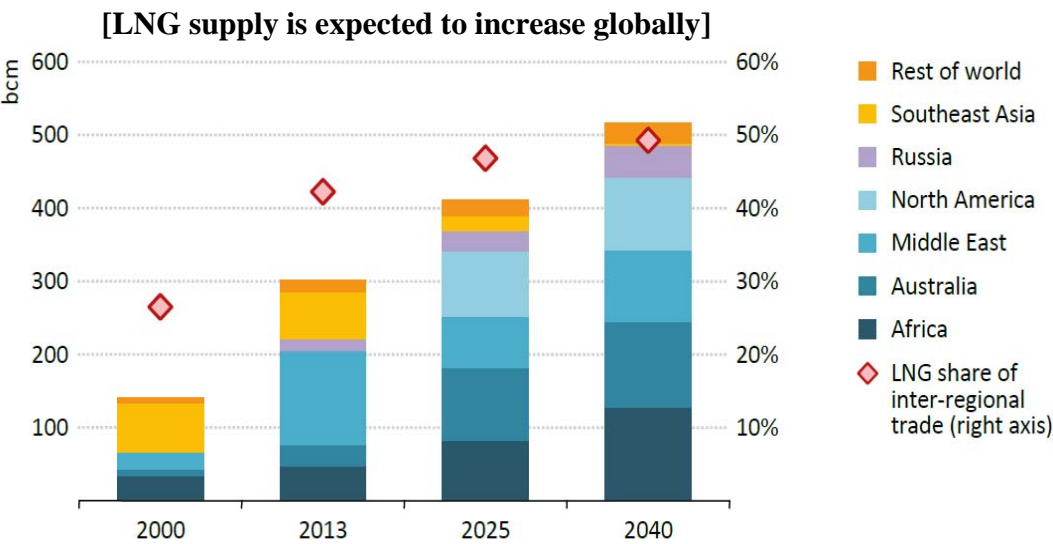
(2) Oil-linked prices: LNG prices are tied to crude oil prices under long-term contracts and **do not reflect the supply- demand relationship of LNG**.

⇒ Establishment of LNG price indices

(3) Domestic natural gas infrastructure: The amended Gas Business Act, which was enacted last year, introduced a system of third party access to LNG facilities. While ensuring the effectiveness of this system, efforts should be made for the future development of domestic pipelines, etc.

⇒ Development of domestic gas infrastructure

\* Operators of electric utilities and gas suppliers will face severer competition amid progress in the reform of the electricity and gas systems. Therefore, it has become increasingly important to procure LNG flexibly at reasonable prices.

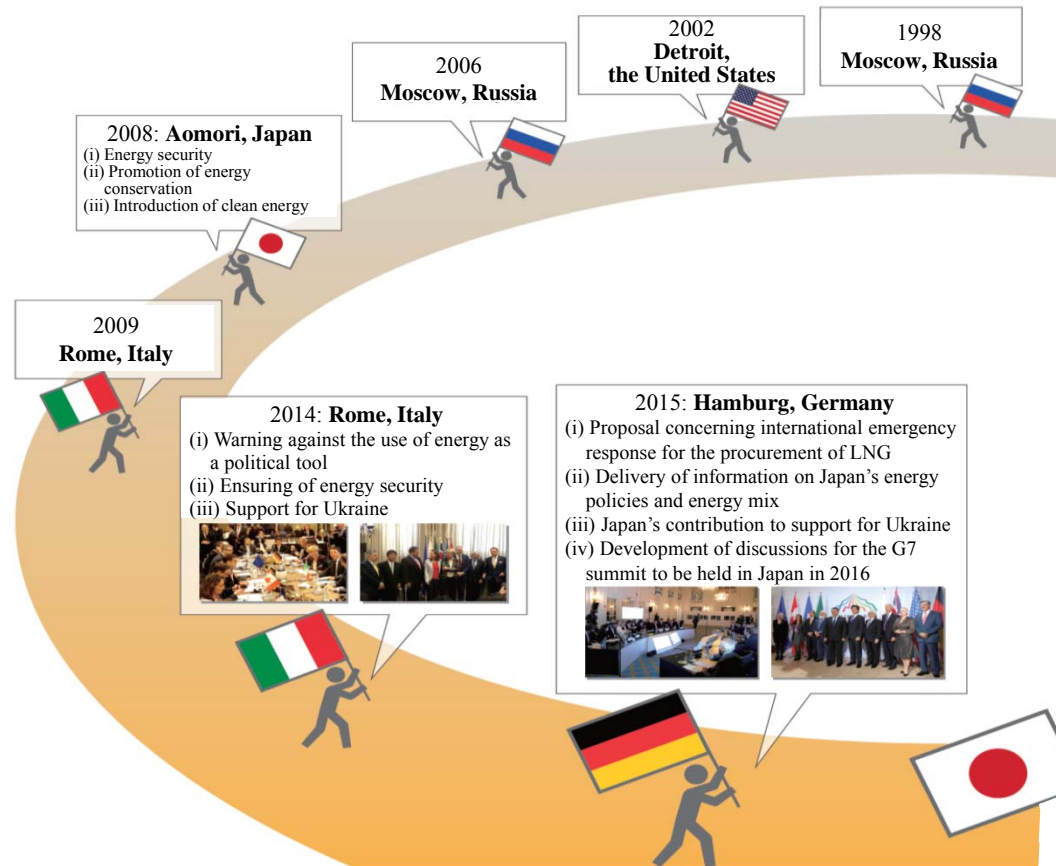


Source: IEA, World Energy Outlook 2015

[LNG market has lower mobility than crude oil market, etc.]		
	Transaction mobility	Price formation
Crude oil	Very high mobility (crude oil, which is liquid at normal temperature, is easy to transport and store)	WTI and other indices have been established.
Natural gas (gas)	High mobility if the area connected with pipelines is vast * Destination clauses have been eliminated in Europe.	Henry Hub and other indices have been established.
Natural gas (LNG)	At present	Low mobility; Third-party access to liquefaction facilities and gasification facilities has not been developed and destination clauses are generally applied. Mostly long-term conditions linked to crude oil prices
	In the future	To enhance mobility through relaxation and elimination of destination clauses, it is necessary to enhance the ease of transactions and develop open and sufficient infrastructure. To establish price indices reflecting the supply-demand relationship of LNG

- On May 1 and 2, 2016, Japan hosted the G7 Energy Ministerial Meeting in Kitakyushu. Previously, it held the Toyako Summit in Aomori in 2008.
- The Energy Ministerial Meeting was held in Italy in 2014 for the first time in five years, in consideration of the circumstances surrounding Russia and the Ukraine at that time. Member countries discussed means to strengthen energy security, focusing on natural gas. At the meeting held in Germany in 2015, member countries discussed sustainable energy, in addition to energy security, ahead of COP21.
- At the meeting this year, under the grand theme of “Energy Security for Global Growth,” a joint statement “Kitakyushu Initiative” was compiled with the aim of contributing to the sustainable growth of the world economy from the perspective of energy, which is the very base of economic activities.

### [Developments of the G7 Energy Ministerial Meeting]



### [Theme of the G7 Energy Ministerial Meeting in 2016]

#### **Grand theme: “Energy Security for Global Growth”**

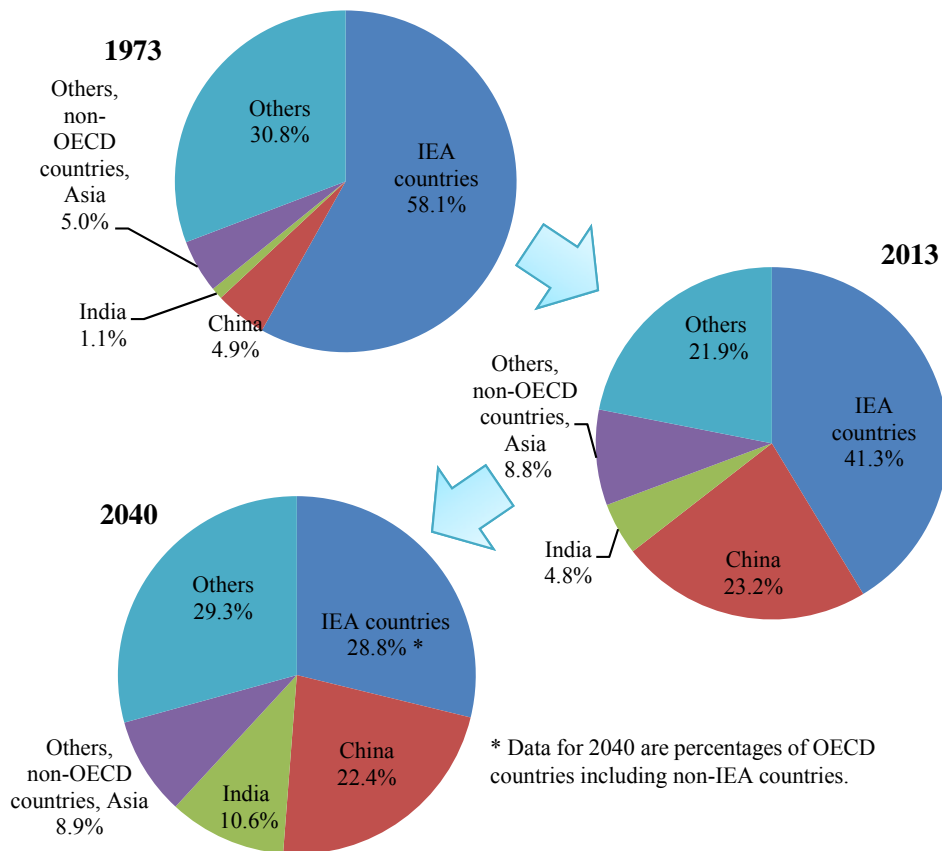
- (i) Promotion of energy investment for global growth
- (ii) Strengthening of energy security in consideration of global energy markets and geopolitical changes
- (iii) Energy technology innovation for balancing the environment and economy in light of the outcomes of COP21



## (ii) Responses to Crude Oil Price Fluctuation Risks - Building and enhancing emergency response frameworks -

- IEA countries share cooperative frameworks for oil stockpiling obligations and for emergency responses.
- Energy consumption by IEA countries as a share of the world total decreased from 60% in 1973 to 40% (and will become less than 30% in 2040). In order to ensure the effectiveness of cooperative actions, IEA countries commenced efforts to collaborate with emerging countries (making China, Indonesia and Thailand association countries).
- Japan will endeavor to ensure energy security domestically and internationally by facilitating deeper cooperation between IEA and association countries and supporting the development of oil stockpiling systems and emergency response frameworks in Asia.
- As the need to strengthen international emergency responses regarding natural gas has been recognized, the issue was discussed at the G7 Energy Ministerial Meeting this year.

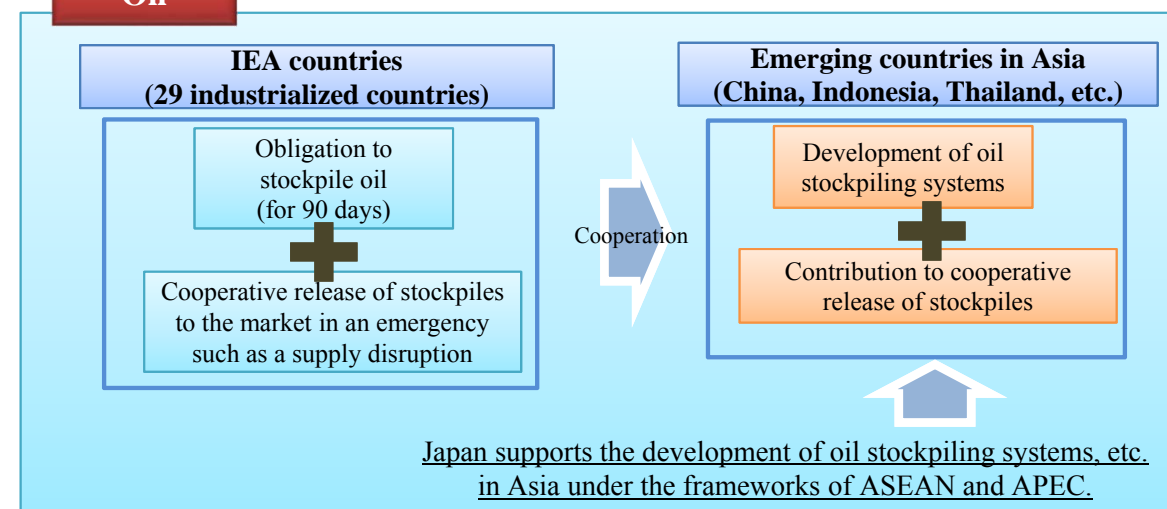
[IEA primary energy consumption as a share of world total is decreasing]



Source: "Energy Balances of OECD Countries 2015," "Energy Balances of Non-OECD Countries 2015," "World Energy Outlook 2015" (IEA)

### Oil

#### [Enhancement of emergency response frameworks]




### Natural gas

At the G7 Energy Ministerial Meeting in May 2015, member countries agreed to discuss means for international emergency responses in the field of natural gas.

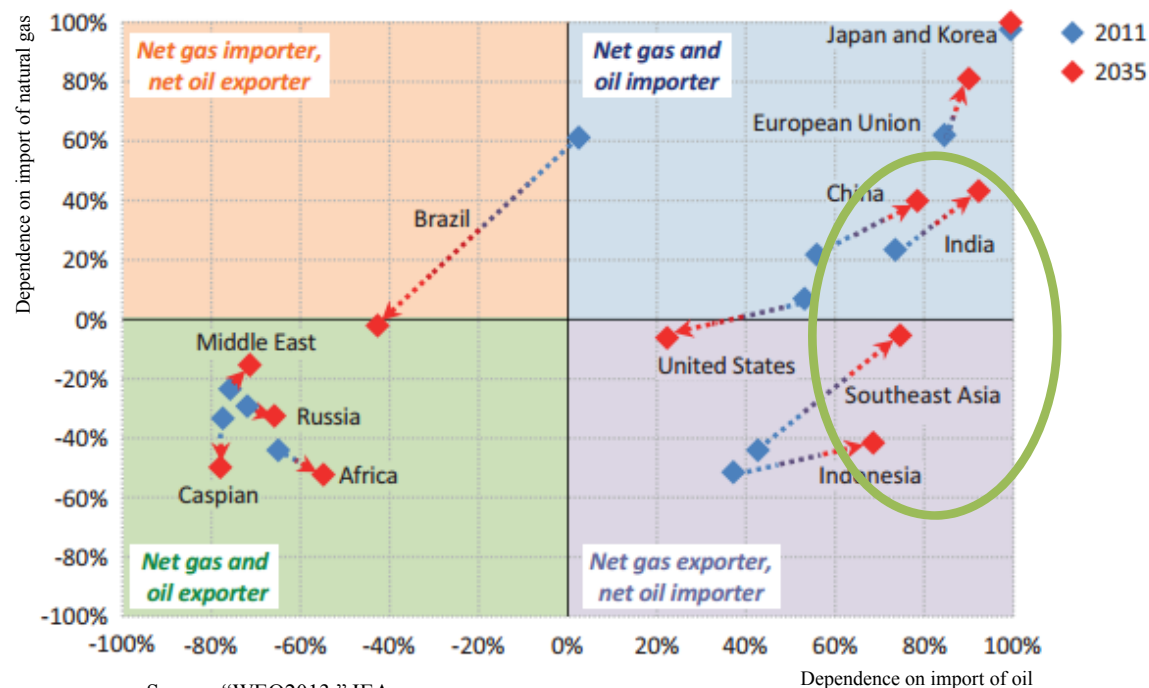
At the G7 Kitakyushu Energy Ministerial Meeting in May 2016, member countries agreed to take concrete actions, such as conducting resiliency assessments.

### (iii) Enhancement of Energy Efficiency and Diversification of Energy Sources

- Make a contribution with Japan's high quality infrastructure -

- Emerging countries in Southeast Asia and elsewhere will become increasingly dependent on the import of energy and will thus need to plan accordingly. In these countries, it is necessary to expand investment in high quality energy infrastructure in such fields as electricity, and to diversify energy sources.
- METI newly commenced the Enevolution initiative last year, aiming to achieve diversification of energy sources and a stable energy supply in Asia by utilizing Japan's experience in energy policy planning and advanced technological capabilities. 
- For example, Japan promotes cooperation with the Indonesian government on energy systems development towards achieving its 35GW Power Development Plan goal. Similarly in India, which plans to introduce renewable energy on a large scale, Japan will offer cooperation on stabilizing the system, critical for the introduction of alternative energies.

[Emerging countries are becoming increasingly dependent on import of energy due to demand increases]



[Example of a highly efficient coal-fired thermal power station]

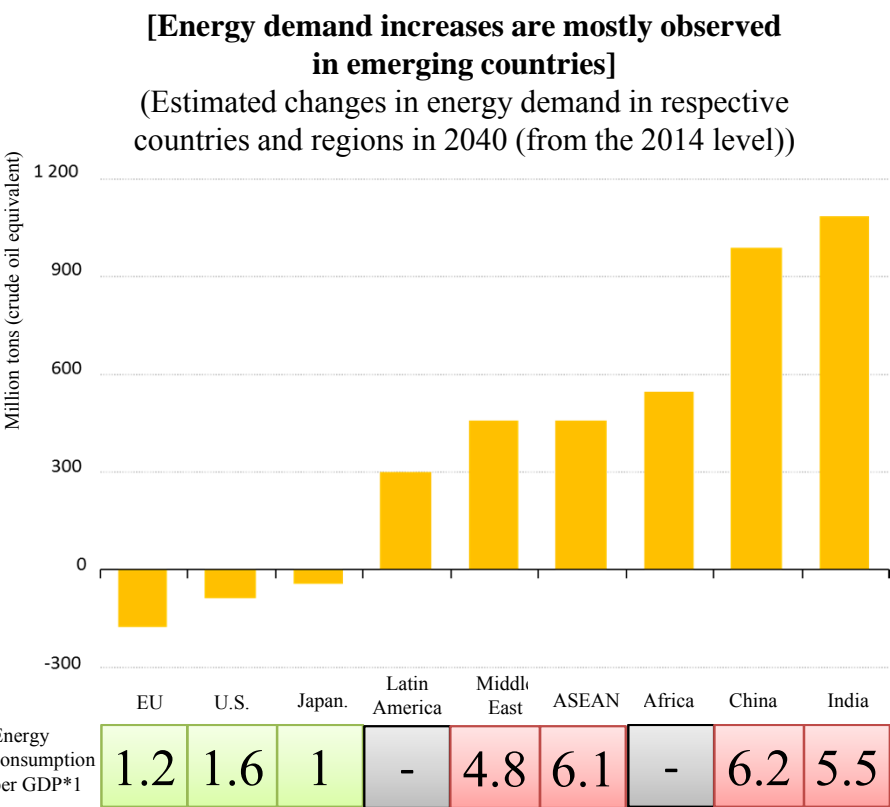
(Isogo Thermal Power Station)



### (iii) Enhancement of Energy Efficiency and Diversification of Energy Sources

- Export of energy conservation systems to emerging countries and oil producers -

- **Energy demand is expected to increase significantly in ASEAN countries and oil producers in the Middle East**, not only in China and India.
- China, India and ASEAN countries are now endeavoring to build an energy conservation system, while oil producers in the Middle East are falling behind in their efforts for energy conservation as a result of subsidies working to reduce energy prices.
- Japan will **export its energy conservation systems**, which have achieved the world's top energy efficiency, in accordance with the maturity of the systems and characteristics of energy supply and demand in respective countries and regions. Through these activities, Japan will contribute to the improvement of the energy intensity (energy consumption per unit) in these countries in order to mitigate the tightness in global **energy demand and supply**.



\*1 Primary energy supply (tons (oil equivalent)) / Real GDP

\*2 Figures for respective countries and regions while assuming Japan's consumption to be 1 (2013)

\*3 The figure for ASEAN is that for Thailand only.

Source: World Energy Outlook 2015

[Comparison and problems of energy conservation-related systems of respective countries]

		Strengthening of systems in the Commercial/Building sector			Strengthening of systems in the industrial sector				Strengthening of structures	
		Japan	China	India	Thailand and Malaysia	Viet Nam	Indonesia	Cambodia, Laos and Myanmar	Saudi Arabia	Iran
Energy conservation laws or orders * Figures in the parentheses show years of enactment.		○ (1979)	○ (1997)	○ (2001)	○ (1992/2008)	○ (2010)	○ (2009)	-	-	○ (2011)
Industrial sector	Energy management standards for business entities	○	○	○	-	-	-	-	-	-
	Qualified energy manager system (for plants, etc.)	○	△ (conducting a trial)	○	○	○	○	-	△ (conducting a trial)	○
Commercial/Building sector	Energy management standards for business entities (for buildings, etc.)	○	-	○	○	-	-	-	-	-
	Qualified energy manager system (for buildings, etc.)	○	-	-	○	○	-	-	-	-
	Energy conservation standards and labeling system (for air conditioners, etc.) * Figures in the parentheses show the number of items.	○ (31)	○ (33)	○ (20)	○ (19/11)	-	-	-	○ (6)	○ (4)
Transport sector		○	○	-	○	-	-	-	○	-
Energy subsidy system		-	○	○	○	○	○	* No such system in Cambodia	○	○

### (iii) Enhancement of Energy Efficiency and Diversification of Energy Sources

- Development of energy conservation technologies together with export of systems -

- In order to enhance energy efficiency, it is important to disseminate excellent energy conservation technologies broadly in society, in addition to establishing proper legislation for exporting energy conservation systems.
- Japan will implement projects to mitigate tightness in the global energy demand and supply balance through expanding energy efficiency policy and related technologies for both the supply side and demand side.

#### [Establish energy conservation systems]

Primarily with government officials of partner countries, provide training in Japan, along with the dispatch of experts, to improve knowledge and know-how concerning the establishment and operation of an energy conservation system.

##### [China and India]

Training on measures for the Commercial/Building sector, etc. in China



##### [ASEAN countries]

Training on measures for the industrial sector in Indonesia



##### [Oil producers in the Middle East]

Seminar on measures for the Commercial/Building sector in Saudi Arabia



Create an  
energy  
conservation  
market

Enhance  
energy  
conservation  
systems

#### [Expand energy conservation technologies]

Conduct demonstration projects overseas and dispatch public-private missions to build recognition of the excellence of Japan's energy conservation technologies while achieving goals of partner countries



[Commercial/  
Building sector]  
Building Energy  
Management System  
(BEMS)



[Industrial sector]  
Exhaust heat  
recovery boiler in  
the manufacturing  
process of cement



[Commercial/  
Building sector]  
Highly efficient  
freezer



**Responses to the Great East Japan Earthquake and the Accident  
at Tokyo Electric Power Company's (TEPCO):  
Fukushima Daiichi Nuclear Power Station and Nuclear Energy Policy**

# Responses to the Accident at Tokyo Electric Power Company's (TEPCO) Fukushima Daiichi Nuclear Power Station

- The “Mid-and-Long-Term Roadmap towards the Decommissioning of TEPCO’s Fukushima Daiichi Nuclear Power Station” was revised in June 2015.
- The national government continues to take the initiative in promoting measures concerning decommissioning and contaminated water while placing top priority on safety, and providing related information accurately inside and outside Japan.
- The Landside Impermeable Wall (Ice Wall) to prevent the inflow of groundwater into reactor buildings was constructed and freezing began on March 31, 2016, leading to a significant progress of measures against contaminated water.

## [Milestones in the Mid-and-Long-Term Roadmap (major targets)]

Clarify the most immediate targets (**in green**) with higher priority while maintaining the general framework of targets (**in blue**)

Overall measures	Completion of decommissioning measures	In 30 to 40 years
<b>Measures against contaminated water</b>	Completion of disposal of the stagnant water in reactor buildings	Within 2020
Remove	Reduce additional effective doses at the border of the premises to less than 1mSv/year Commence preparation for deciding matters concerning long-term treatment of sewage from the Advanced Liquid Processing System (ALPS)	FY2015 First half of FY2016
Isolate	Reduce the inflow of groundwater into reactor buildings to less than 100m <sup>3</sup> /day	FY2016
Prevent leakage	Store in welded tanks all water used for the treatment of high concentration contaminated water	Early date in FY2016
Treatment of the stagnant water	Halve the amount of radioactive materials in the water stagnant in reactor buildings	FY2018
<b>Fuel removal</b>	Decide treatment and storage methods of spent fuel	Around FY2020
	Start fuel removal for Unit 1	FY2020
	Start fuel removal for Unit 2	FY2020
	Start fuel removal for Unit 3	FY2017
<b>Fuel debris removal</b>	Decide policies for fuel debris removal for each unit Finally decide methods of fuel debris removal for the first unit Start fuel debris removal for the first unit	Around the summer of 2017 First half of FY2018 Within 2021
<b>Measures against waste</b>	Compile basic ideas concerning treatment and disposal	FY2017

## [Land-side impermeable walls utilizing the frozen-soil method]



South side of Unit 4 building: Construction completed

- ◆ Construction of the Ice Wall completed
  - Mountain side: September 15, 2015
  - Sea side: February 9, 2016
- ◆ Freezing started: March 31, 2016

# Efforts for Accelerating Fukushima's Reconstruction from the Nuclear Disaster

○As of the end of March 2016, the number of evacuees in Fukushima as a whole was approximately 100,000, of which approximately 70,000 were from the areas where evacuation orders were issued. The national government will accelerate enhancement of an environment conducive to the lifting of such evacuation orders as early as possible and promote the Innovation Coast Scheme to create new industry in Hamodori, centered on cutting-edge technologies for decommissioning and robotics, to facilitate efforts for revitalization of local communities.

## [Enhancement of environment to achieve the lifting of evacuation orders]

### (1) Support for prompt returns

- Accelerating the enhancement of the environment so that evacuation orders may be lifted within six years of the accident (March 2017) in areas ready for such measures to be adopted
- Regardless of the time period of the lifting of evacuation orders, payment of compensation for mental suffering will be equivalent to those paid in cases where evacuation orders are lifted six years after the accident

### (2) Support for new lives

- Flexible utilization of and one-stop support for measures for rapid enhancement of reconstruction bases
- Taking concrete measures for the Fukushima Innovation Coast Scheme
- Full opening of the JR Joban Line as soon as possible

### (3) Support for self-reliance efforts

- Through intensive support measures for the two years of FY2015 and FY2016, strive to substantially reduce the damage caused by the nuclear disaster.
- Establishment of new supporting entities that carry out measures to support self-reliance efforts
  - Enhancement of efforts for rebuilding businesses and occupations of disaster victims, supporting their self-reliance efforts and helping them rebuild their lives and livelihoods
  - Measures concerning compensation for business damage and harm caused by rumors

**Legend**

- Areas where it is expected that residents will have difficulties in returning for a long time
- Areas in which residents are not permitted to live
- Areas for which evacuation orders are ready to be lifted

**[Innovation Coast Scheme]**

**Abukuma-Hamadori Area Wind Power Generation Scheme**

- Take concrete measures for the prefectural wind power generation scheme targeting the Abukuma Mountains and Hamadori area

**Radioactive Material Analysis and Research Facility (Okuma Town)**

- Develop technologies for the treatment and disposal of fuel debris and radioactive waste, etc.; The facility in Okuma Town is scheduled to commence operation in FY2017.

**Collaborative Laboratories Building, Collaborative Laboratories for Advanced Decommissioning Science (CLADS) (Tomioka Town)**

- Gather Japanese and foreign universities, research institutes, companies, etc. in diverse fields and strengthen research on decommissioning; The facilities are scheduled to be developed in Tomioka Town within FY2016.

**Floating Offshore Wind Farm Demonstration Project**

- Commence operation of a 5MW floating offshore wind farm in FY2016 and conduct a full-fledged demonstration project using multiple units for the first time in the world

**Naraha Remote Technology Development Center (Naraha Town)**

- Develop remote-controlled machines and devices and conduct demonstration experiments; An opening ceremony was held in October 2015 and the Center commenced full-fledged operation in April 2016.

**Other major projects**

- [Agriculture, forestry and fisheries industry]** Various projects are to be carried out and Fukushima Prefecture considers concrete measures therefor.
- [Smart Eco Park]** A project aiming to accumulate recycling-related industries is to be carried out and a panel to study relevant issues is being held in Fukushima Prefecture.
- Project to promote commercialization of innovative technologies contributing to the revitalization of local economies (FY2016 initial budget: 6.97 billion yen)
- Support companies' efforts for commercialization in collaboration with local companies in relation to robotics or other priority fields in the Innovation Coast Scheme

**Robot Development and Demonstration Base**

- Develop an international government-industry-academia joint use facility as a testing field for the development and demonstration of robots

# Making Fukushima a Pioneering Model for a New Renewable Energy-Oriented Society

- Fukushima Prefecture has been endeavoring to be a pioneer in introducing renewable energy as the core initiative for achieving reconstruction.
- The Fukushima New Energy-Oriented Society Scheme is to be established by around the summer of 2016, with the aim of expanding the introduction of renewable energy to the extent possible and creating a new social model in Fukushima for realizing a cycle of generating hydrogen from renewable energy and storing, transporting and using it.
- For that purpose, the first meeting of the Council for Realizing the Fukushima New Energy-Oriented Society Scheme was held in Fukushima City in March 2016.

## Creation of a model for a future new energy-oriented society

\* In addition to the examples below, concrete items will be added based on proposals and discussions by the Council.

### Expand the introduction of renewable energy

- Utmost support for the people of Fukushima -

- < Fukushima Renewable Energy Institute, AIST (FREIA) >
  - Japan's only research institute specialized in new energy
- < Fukushima Floating Offshore Wind Farm >
  - The world's largest offshore wind power facility (7000KW) off the coast of Fukushima
- < Support only for Fukushima >
  - Development of electric transmitting facilities and improvement of substations
- < Support for improving major power lines >
  - Construction of power lines from the Abukuma and Futaba areas, which are suited for wind power generation, to TEPCO is supported under a new framework with the participation of electric power companies.

Matters to be considered on an ongoing basis

### Create a model for realizing a hydrogen energy-oriented society

- Lead the world in developing a system to generate hydrogen from renewable energy and store and use it -

- < Generate hydrogen >
  - Large-scale generation of hydrogen with wind power, etc.  
(Demonstration at the world's largest scale of 10,000KW)
- < Store and transport hydrogen >
  - Field demonstration of next-generation technologies for transportation and storage of hydrogen
  - Evaluate the feasibility of converting renewable energy to hydrogen and using it inside and outside Japan  
(Conduct a feasibility study, etc.)
- < Use hydrogen >
  - Hydrogeneration  
(Through the use of IGCC, etc.)
  - Development of hydrogen stations using renewable energy

### Build smart communities

- Support reconstruction of local communities through the use of renewable energy and hydrogen -

- Demonstrations in Naraha Town, Shinchi Town, Soma City and Namie Town
- Creation of a model hydrogen energy-oriented town free of CO<sub>2</sub>
- Prefecture-wide expansion of the initiative  
(Conduct a feasibility study)

To be a pioneer in introducing renewable energy

Accumulate new energy-related industries

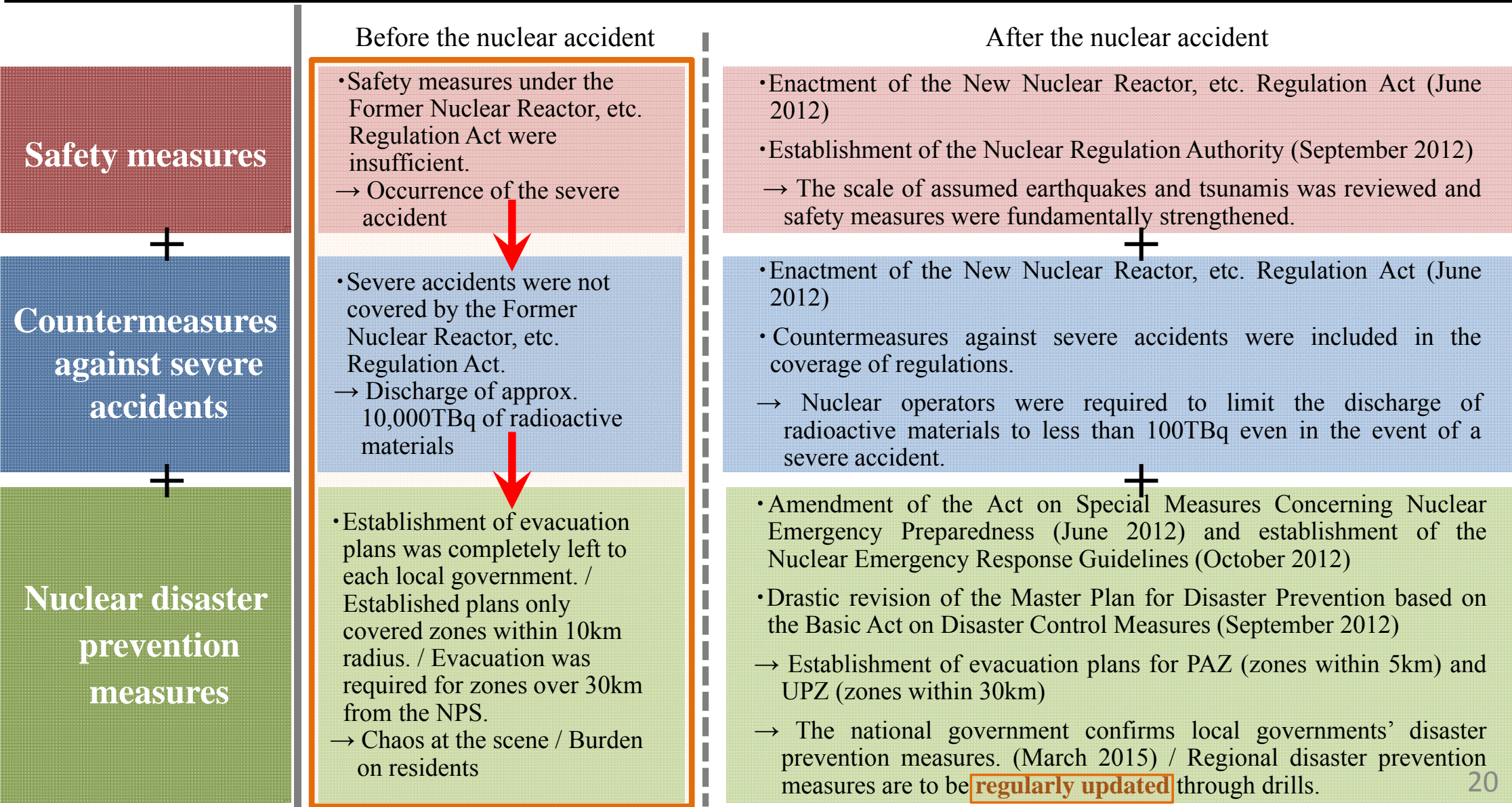
\* Build a scheme to intensively support R&D by companies in Fukushima

Communicate a model of a future new energy-oriented society to the world



# Efforts to Improve Public Trust in Nuclear Power Policy

○Based on lessons learned from the nuclear disaster in Fukushima, comprehensive policy measures for improving public trust in nuclear power policy will be taken by actively utilizing nuclear-related ministerial meetings or other opportunities in order to sufficiently cope with issues concerning (i) the reduction of dependence on nuclear power, (ii) safety measures and countermeasures against disasters, (iii) spent fuel, and (iv) reconstruction of Fukushima.

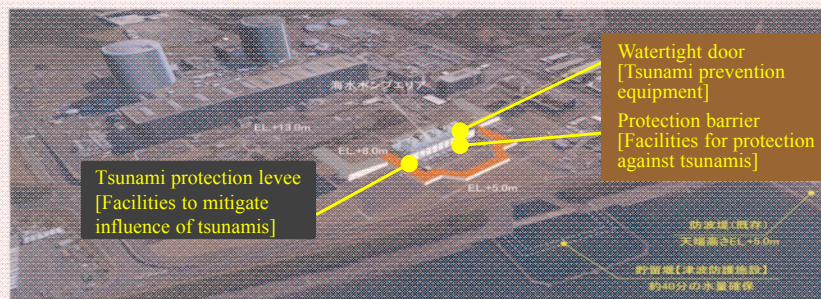




# Efforts to Improve Public Trust in Nuclear Power Policy

- Based on lessons from the accident at the Fukushima Daiichi NPS, the national government set up the Nuclear Regulation Authority and established new regulatory standards. Additionally, nuclear operators are expected to make voluntary efforts.
- In preparation for any accident, the national government has supported local governments in establishing evacuation plans and has confirmed the details thereof. Through disaster drills, etc., efforts should be made to enhance the effectiveness of such plans.

## Safety measures



### Strengthening of protective measures under new regulatory standards

(e.g.) At the Sendai NPS, countermeasures against tsunamis were strengthened, including construction of the tsunami protection levee to prevent sea water from flowing into the premises.

### **Further efforts**



### Voluntary efforts by nuclear operators

(Example 1) Nuclear operators improved a jointly organized nuclear rescue team in order to enhance their capabilities for restoration following an accident.

(Example 2) The electric utility industry as a whole promotes efforts, centered on the Nuclear Risk Research Center established in 2014, for the development of a means to quantify the effectiveness of safety measures at each power station.

## Efforts for further enhancing safety



Nuclear Emergency Preparedness Commission

September 12, 2014: Sendai area

October 6, 2015: Ikata area

December 18, 2015: Takahama area

### Support for the establishment of evacuation plans and confirmation of the details

The national government supports local governments in establishing evaluation plans, and the Nuclear Emergency Preparedness Commission chaired by the Prime Minister grants approval for plans thus established.

### **Further efforts**



Comprehensive Nuclear Emergency Drills

October 11, 2013: Sendai NPS

November 2, 2014: Shika NPS

November 8, 2015: Ikata NPS

\* Additionally, local governments independently carry out drills.

### Implementation of disaster drills

Evacuation plans are verified through the implementation of drills, etc. and are improved and enhanced on an ongoing basis.

**Increasing Sense of Crisis  
Regarding Climate Change Issues  
and the Need to Change Energy Policy**



# Achieving the World's Lowest Level "Emissions per GDP" through Realization of the New Energy Mix

- The Paris Agreement was adopted with the participation of all major countries. Countries have submitted their targets.
- Japan set a target of a 26% reduction in greenhouse gas emissions, which is ambitious compared with targets set by US, EU. Japan aims to achieve the world's lowest level of "emissions per GDP" (0.16kg/US\$).

All countries including major emitters submit their targets

< Difference between the Paris Agreement and the Kyoto Protocol >

	Paris Agreement	Kyoto Protocol
Coverage	All countries including major emitters set their targets.	Only some industrialized countries (around 20%) set their targets.
Approach	Each country submits their own target.	Targets were decided through international negotiations.

[Kyoto Protocol]

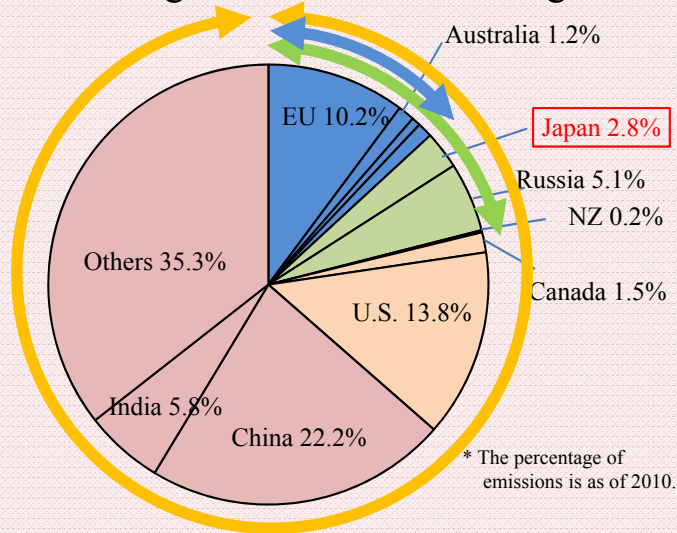
22.0%  
(Participants in the First  
Commitment Period)

13.4%  
(Participants in the Second  
Commitment Period)

[Paris Agreement]

Agreement with the participation  
of all major countries (framework  
from 2020 onward)

< Coverage rates of reduction targets >



[Source] Prepared by METI based on IEA 2014

Japan's ambitious challenge

< International comparison of reduction targets >

Country	From the 1990 level	From the 2005 level	From the 2013 level
Japan	-18.0% (2030)	-25.4% (2030)	<u>-26.0%</u> (2030)
U.S.	-14 to 16% (2025)	<u>-26 to 28%</u> (2025)	-18 to 21% (2025)
EU	<u>-40%</u> (2030)	-35% (2030)	-24% (2030)

< Emissions per dollar of GDP >

Country	2013	2030 / 2025
Japan	0.29kg-CO2	0.16kg-CO2 (2030)
U.S.	0.47kg-CO2	0.28-0.29kg-CO2 (2025)
EU	0.29kg-CO2	0.17kg-CO2 (2030)

[Source] Prepared by METI based on IEA 2015, statistics of respective countries, INDC, etc.

\* Countries and regions that submitted their targets as of March 10: 160 countries and one region  
(Cover 189 countries and regions whose greenhouse gas emissions account for **approx. 99%** of the world total)

Approximately 90% of greenhouse gas emissions originate from CO<sub>2</sub>. The key is to realize the prerequisite for the 26% reduction target.



# Innovative Energy Strategy to Overcome Environmental Restrictions and Achieve Economic Growth

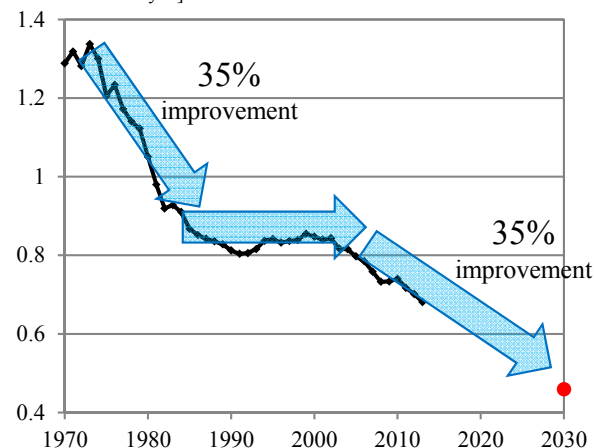
- Sustainable efforts are required to find real solutions to climate change issues; it is essential that a balance be achieved with economic growth.
- The key to ensuring a good balance is to (i) achieve thorough energy efficiency, (ii) expand the use of renewable energy, and (iii) expand energy investment for improving efficiency and building a new energy system. In order to achieve these goals, the Innovative Energy Strategy was established and is being carried out.

## Energy efficiency

Improve energy efficiency by the same percentage as after the oil crises in the 1970's (35%)

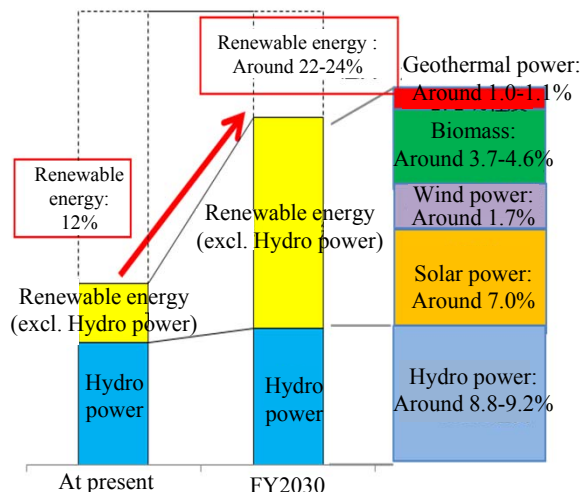
Changes in final energy consumption per GDP

[Million kl/trillion yen]



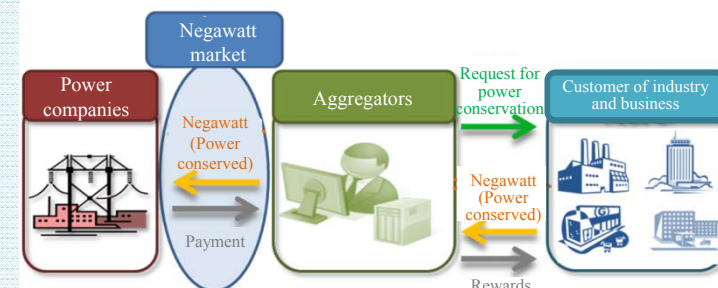
## Renewable energy

Double the current level (from 12% to 22-24%)



## New energy system

- Creation of a negawatt market



- Target for disseminating fuel cell vehicles  
(Around 800,000 cars in 2030)
- Target for building hydrogen stations  
(A four-fold increase from the current level to 320 stations in FY2025)



The national government established the Innovative Energy Strategy, which integrally develops relevant systems in the fields of energy conservation and renewable energy, etc.

## Thorough energy efficiency

(Industry) Benchmark System	(Transport) Next- generation vehicles	(Household) Housing and home appliances
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## Expansion of the use of renewable energy

Review of the Feed-in Tariff System

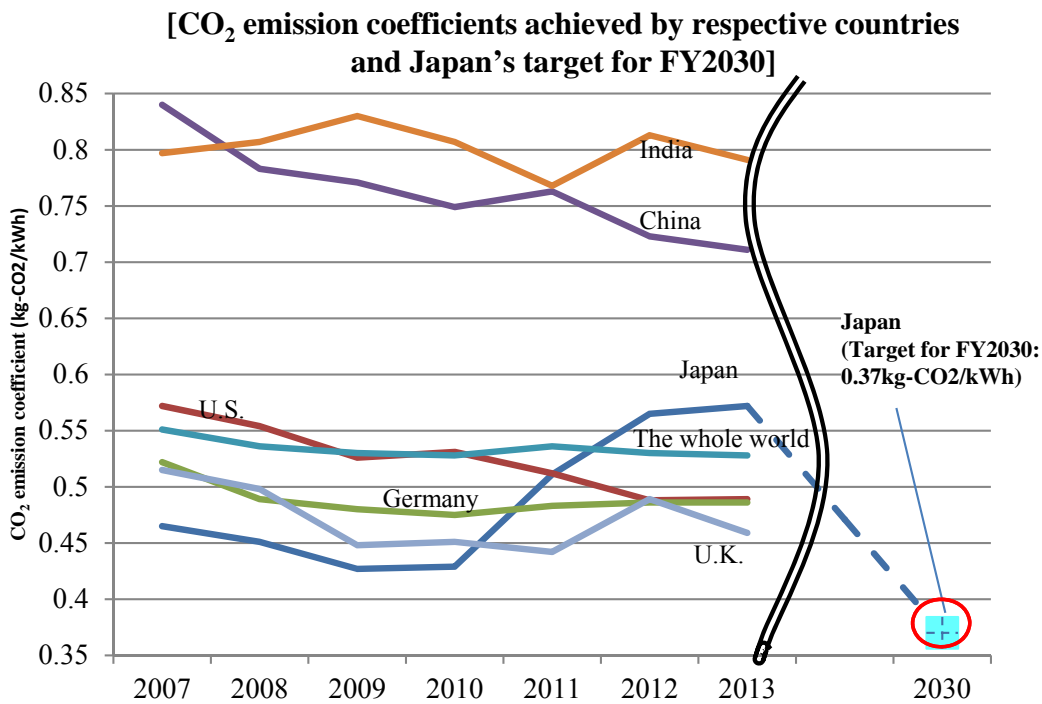
## Building of a new energy system

Integration of renewable energy and energy conservation initiatives through the use of IoT

Establishment of a strategy concerning a hydrogen energy-oriented society from 2030 onward

# New Mechanism in the Electric Utility Industry for Reducing CO<sub>2</sub> Emissions

- In order to encourage newcomers and further investment amid electricity deregulation and achieve the CO<sub>2</sub> emission reduction target at the same time, the national government has developed systems to support the framework of voluntary efforts by the electric utility industry (the Act on the Rational Use of Energy, the Act on the Promotion of Use of Non-fossil Energy Sources and Effective Use of Fossil Energy Materials by Energy Suppliers, etc.).
- Additionally, the national government will promote further improvement of the efficiency of thermal power generation (development of further advanced technologies), and will endeavor to develop an environment under which the value of the types of renewable energy sources that emit less CO<sub>2</sub> is properly appreciated and traded in the market.
- Through these comprehensive efforts, Japan aims to achieve a GDP of 600 trillion yen and CO<sub>2</sub> emission reduction at the same time.



\* Source: Prepared based on "CO<sub>2</sub> EMISSIONS: FROM FUEL COMBUSTION 2015"

Compared with other countries, the efficiency of Japan's thermal power generation is at the technological frontier. However, further efficiency improvement and reduction of carbon emissions are required to achieve the new energy mix.

## [Mechanism to support the framework of voluntary efforts by the electric utility industry]

### (i) [Framework of voluntary efforts by the electric utility industry]

Set a target consistent with a new energy mix to be achieved  
(0.37kg-CO<sub>2</sub>/kWh in FY2030)

### (ii) [Supporting mechanism (at power generation stage)]

- Set efficiency standards for each facility newly constructed (Coal: Level equivalent to USC coal-fired power stations; LNG: Level equivalent to combined cycle power stations)
- Set efficiency standards for each operator, including existing ones (Power generation efficiency consistent with a new energy mix to be achieved (44.3%))

### (iii) [Supporting mechanism (at retailing stage)]

- Targeted ratio of non-fossil power sources in FY2030: 44%  
(Equivalent to 0.37kg-CO<sub>2</sub>/kWh in line with the Act on the Rational Use of Energy)
- In addition to the ratio of non-fossil power sources, CO<sub>2</sub> emissions must be reported.

Based on performance, the Minister of Economy, Trade and Industry issues guidance, advice, recommendations or orders.  
[Ensure effectiveness and transparency]

### [Supporting mechanism] (market design)

Design an energy market consistent with deregulation:  
Creation of a low-carbon power-source market

**Achieve a GDP of 600 trillion yen and CO<sub>2</sub> emission reduction at the same time**

# Promote Expansion of Well-balanced Introduction of Renewable Energy

- The FIT System increased the introduction of renewable energy but in an unbalanced manner, centered on solar power. The required cost for this system amounted to 2.3 trillion yen throughout FY2016 with the monthly burden on an average household reaching 675 yen.
- Regarding solar power that has been broadly introduced, it is important to make efforts to reduce costs and secure solar power as a sustainable independent power source through guaranteeing its appropriateness by reviewing safety regulations.
- Regarding other types of renewable energy such as wind power and geothermal power, predictability of purchase prices should be enhanced and their introduction needs to be expanded together with relevant research and development. Development of community-based distributed power sources will also be supported.

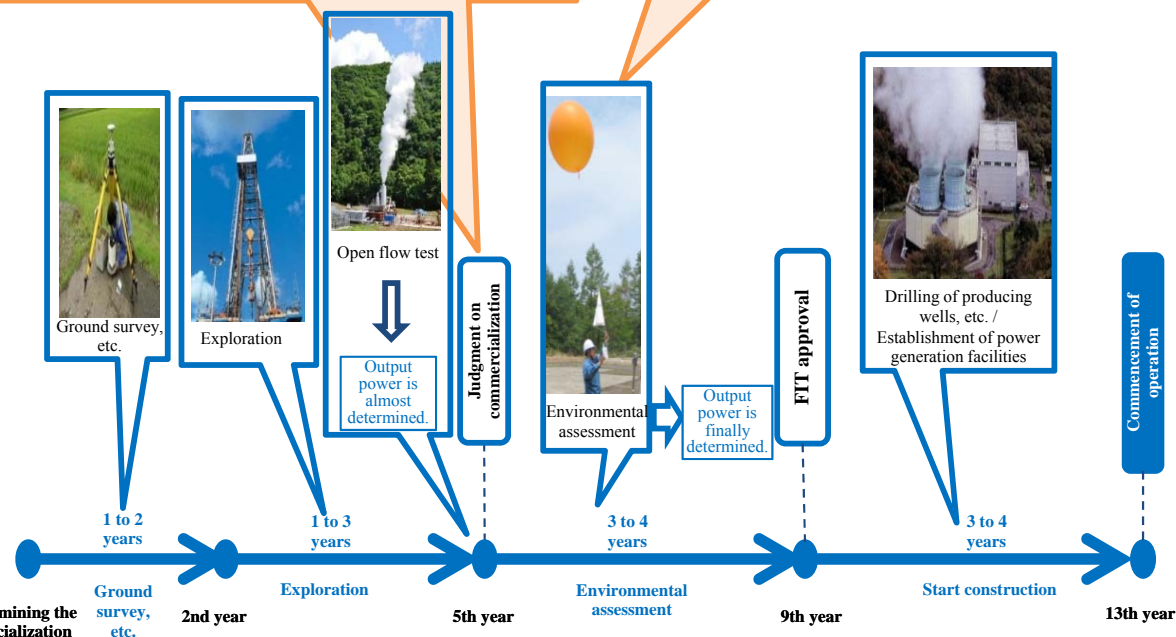
## [Promotion of introduction of power sources requiring a long lead time (geothermal power, wind power, etc.)]

### (i) Decide purchase prices in approved projects several years later

- Purchase prices in an approved project after environmental assessment are decided in advance upon making a judgment on the commercialization, and this will increase the predictability of relevant business (a bill to amend the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities was submitted to the Diet).

### (ii) Speed up procedures for environmental assessment

- Aim to halve the period required for the procedures for environmental assessment



## [Promotion of offshore wind generation]

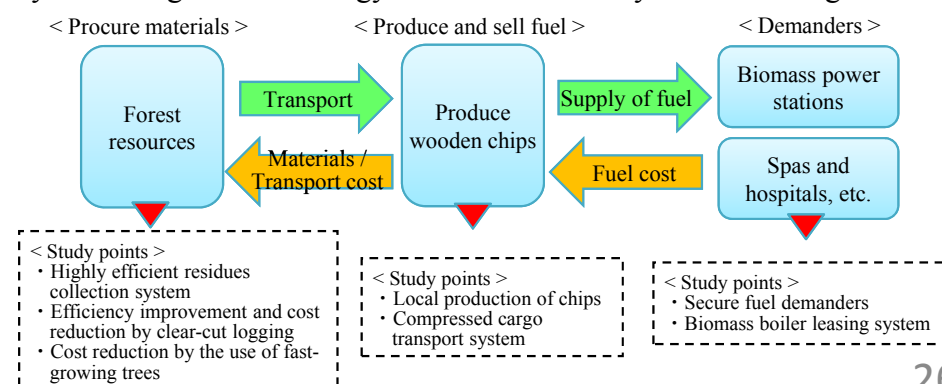
Demonstration projects on bottom-mounted offshore wind farms are carried out off the coast of Choshi and the coast of Kitakyushu, etc. with the aim of developing the wind power generation facilities most suited to Japan's natural environment.

The national government has submitted a bill to amend the Port and Harbor Act to develop proprietary use rules within ports and harbors with the aim of facilitating long-term maintenance of wind power facilities.



## [Creation of a local self-sustaining system using biomass energy]

A demonstration project is carried out with the aim of creating a local system using biomass energy that is economically self-sustaining.

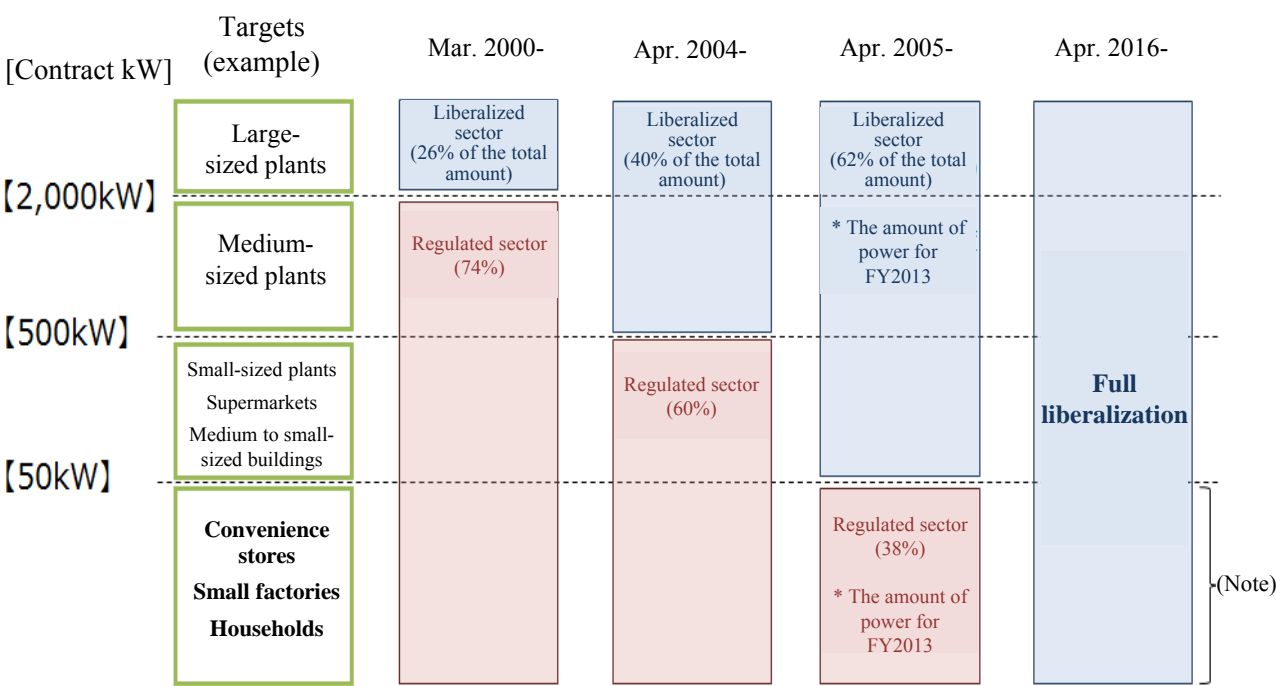




# (Column) Full Liberalization of Power Retailing Business

- On April 1, 2016, the power retailing business was fully liberalized, and all consumers including ordinary households and stores are now able to freely select power suppliers and electric rate systems.
- The size of the newly liberalized electricity market is worth approximately 8 trillion yen annually. Competition caused by new entries from other business sectors is bringing about benefits to consumers such as a restraining effect on price increases and provision of new services.
- As of April 1, 2016, 280 retailers were registered and approximately 530,000 applications for switching power suppliers were filed. As of March, approximately 80% of consumers were considering changes of power suppliers. Consumers' selections are expected to vitalize the market.
- Innovation based on diverse consumer needs will create dynamic power-related markets and general energy companies targeting overseas markets may emerge in the future.

## [Liberalization of power retailing business was carried out in a phased manner]



(Note) As transitional measures to protect demanders, regulations on charges remain applicable at least until 2020 (demanders can select regulated charges).

## [Competing power retailers]

- Retailers offering new charge plans (existing power companies)
- Retailers offering discounted rates to large-scale users (companies in the energy industry)
- Retailers offering discounts for a set of contracts with other types of services (companies in the life infrastructure industry such as telecommunications carriers)
- Retailers procuring power from FIT power sources or other renewable energy sources (companies in the renewable energy industry)
- Retailers selling locally-generated power based on the locally-grown and locally-consumed principle (companies based on the locally-grown and locally-consumed principle)
- Retailers aiming to reduce power consumption through energy management (companies in the energy control or energy conservation industry), etc.

- Based on opinions of persons in the disaster-affected areas, the utmost efforts are being made to support recovery and assist victims. The national government actively ascertained the energy needs of hospitals, welfare facilities and other vital facilities to provide them with necessary electricity and fuel.
- Response measures are being taken while utilizing various mechanisms that were developed after the Great East Japan Earthquake, such as developed core SSs, increased storage capacity of gas supplying vehicles, and an enhanced power accommodation system.

## Electricity



(Recovery of power using power source cars and resumption of power supply)



- Efforts were made to ensure prompt resumption of power supply and Kyushu Electric Company and other electric companies nationwide dispatched a total of 110 power source cars to secure power mainly at vital facilities, such as government offices, shelters, hospitals and welfare facilities.
- Preferential supply of fuel was requested to the Petroleum Association of Japan and the All Japan Petroleum Association.

## Gas

- Saibu Gas, which sustained damage due to the earthquake, accepted a support team consisting of approximately 2,600 personnel from other gas suppliers (mainly from Tokyo Gas, Toho Gas, and Osaka Gas) and carried out emergency measures such as shutting off gas valves, checking damage and repairing gas pipes under a structure consisting of approximately 4,600 personnel.

- Temporary service was conducted using gas supplying vehicles directly to hospitals and welfare facilities, etc. Approximately 130 gas supplying vehicles were secured including those dispatched from nationwide.



(Gas supplying vehicle)

## Fuel



(Fuel supply by core SSs)



(Fuel supply to power source cars)

- The Emergency Oil Supply Collaboration Plan was initiated and a cooperation system among oil distributors was formed. Under said cooperation system, stable oil supply to SSs was continued by increasing tanker trucks.
- Core SSs (34 stations in Kumamoto Prefecture) supplied fuel preferentially to emergency vehicles.
- Fuel was delivered to hospitals, welfare facilities and other important facilities, as well as to shelters and power source cars from small-sized delivery points.
- Information concerning operating SSs was provided.

## Efforts having been made after the Great East Japan Earthquake

- **Fuel:** The Oil Stockpiling Act was amended and the Emergency Oil Supply Collaboration Plan, under which oil companies collaboratively supply fuel in the event of a disaster, was established. Furthermore, core SSs have been developed to ensure preferential fuel supply to emergency vehicles of local governments and Self Defense Forces, etc. in an emergency.
- **Electricity:** Each power company has developed disaster response systems, such as securing power source cars and other equipments, building emergency cooperation systems with construction contractors and carrying out joint drills. Based on a request from the Organization for Cross-regional Coordination of Transmission Operators, Japan, power companies have developed a mechanism of accommodating equipment and personnel for recovery and offering support among themselves, and have been conducting drills, etc. to ensure a smooth support system.
- **Gas:** All major gas pipes (high-pressure pipes and medium-pressure pipes) have been reinforced against earthquakes. Reinforcement is scheduled to be conducted for 90% of branch pipes (low-pressure pipes) by the end of FY2025. Relevant Ministerial Ordinances, etc. were amended to increase the storage capacity of gas supplying vehicles with the aim of enabling continuation of temporary supply to hospitals and other facilities that consume large amounts of gas.