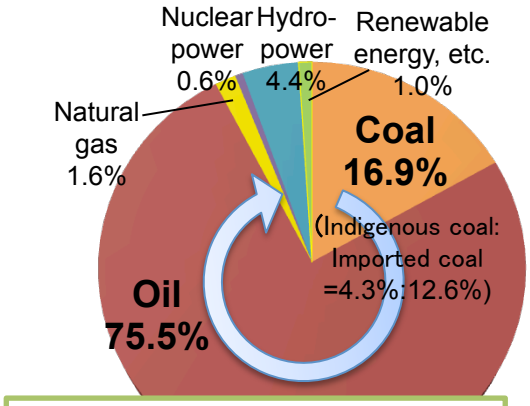
1. Energy Situation in Japan

Changes in the Primary Energy Supply Structure of Japan

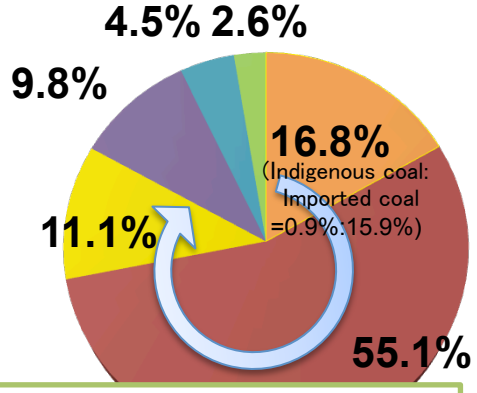
■ Japan's dependency on fossil energy from abroad is over 92% today (FY2012), which is comparable to that during the 1973 oil crisis (about 89.7%).



Dependency on fossil energy from abroad 90%

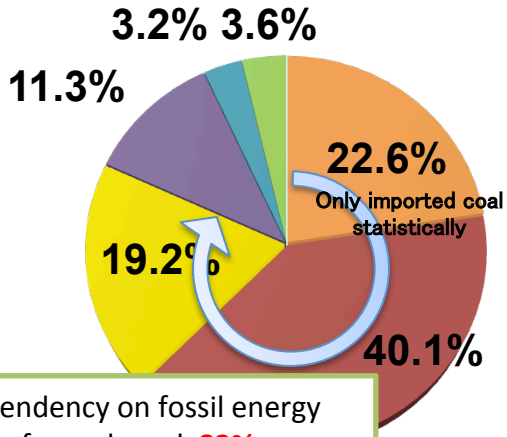
FY1973 (During the 1973 oil crisis)

Coal
Oil
Natural gas
Nuclear power
Hydropower
Renewable energy, etc.



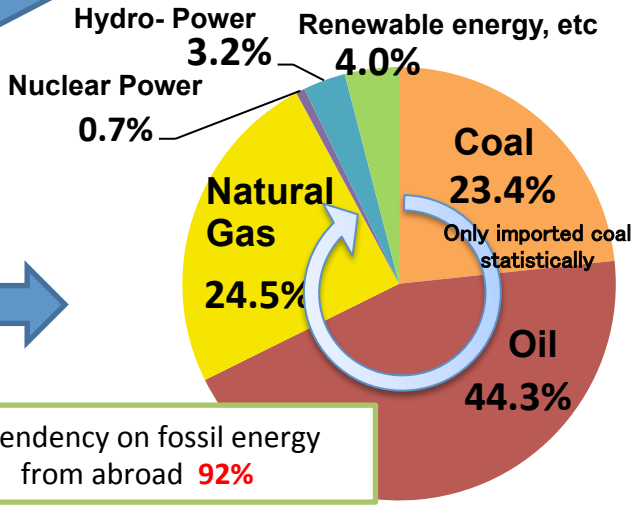
Dependency on fossil energy from abroad 82%

FY1991 (During the Gulf War)



Dependency on fossil energy from abroad 82%

FY2010 (Before the Great East Japan Earthquake)



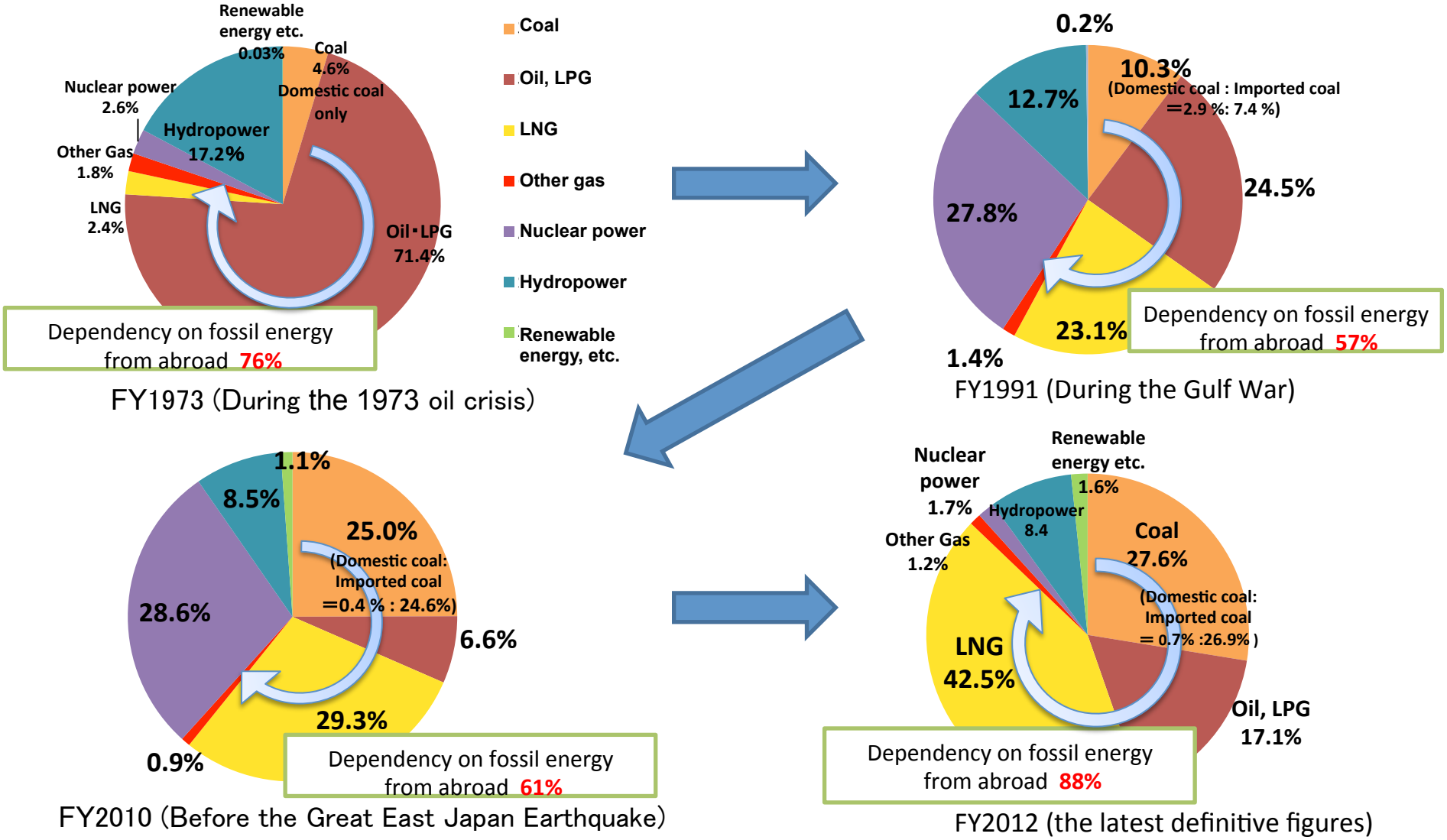
Dependency on fossil energy from abroad 92%

FY2012 (the latest definite figures)

* Drawn based on the table for the balance of supply and demand of energy in "General Energy Statistics." However, the percentages of indigenous coal in FY2010 and FY2012 are around 1% of domestic coal supply according to a survey by the Agency for Natural Resources and Energy.

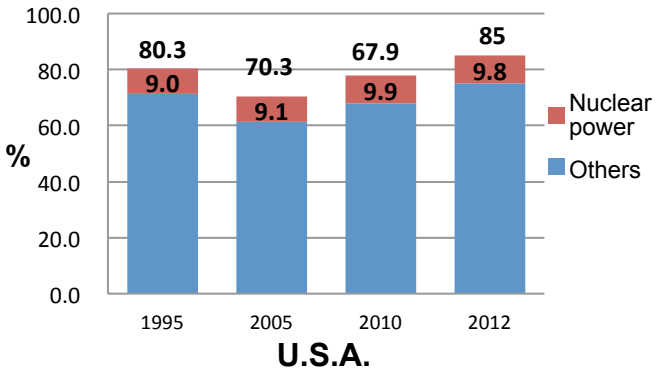
Change in Japan's power source composition

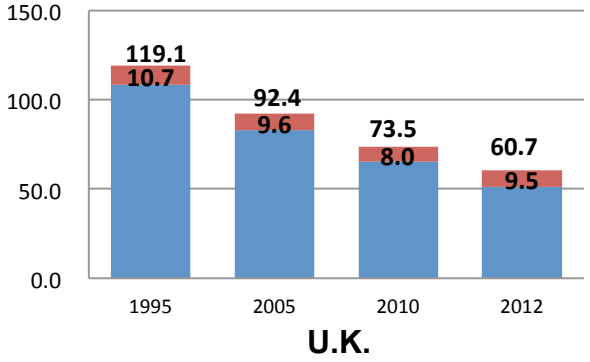
■ Dependency on fossil energy from abroad currently stands at approximately 88% (FY2012), which is higher than during the first oil crisis (approximately 76%).

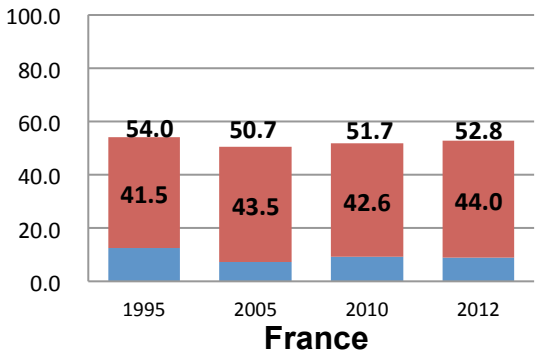


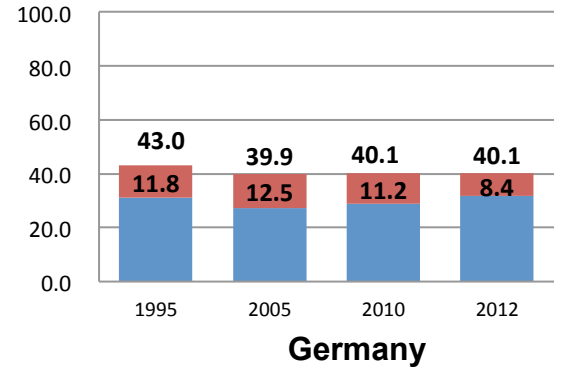
* Prepared on the basis of "Overview of power source development." Calculated % using power generation amount. "Other gas" mainly consists of city gas, natural gas, and coke-oven gas, which are used for mixed-fired use by general electricity utilities. In addition, "other gas" includes "dependency on fossil energy from overseas" (approximately 88%, approximately 76%).

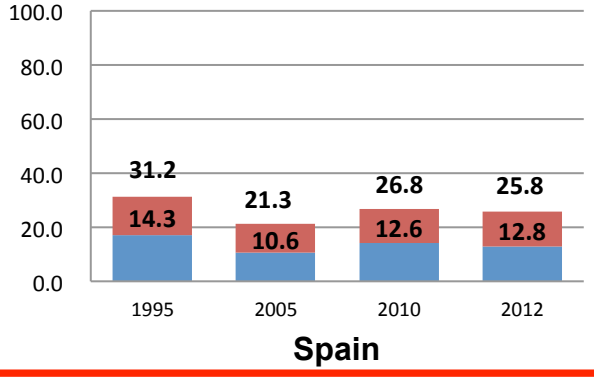
Changes in Primary Energy Self-Sufficiency Rate of Major Countries

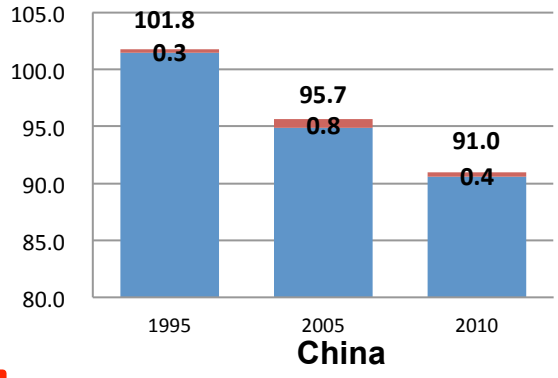


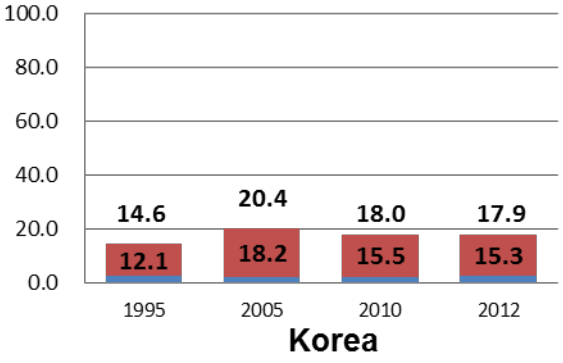


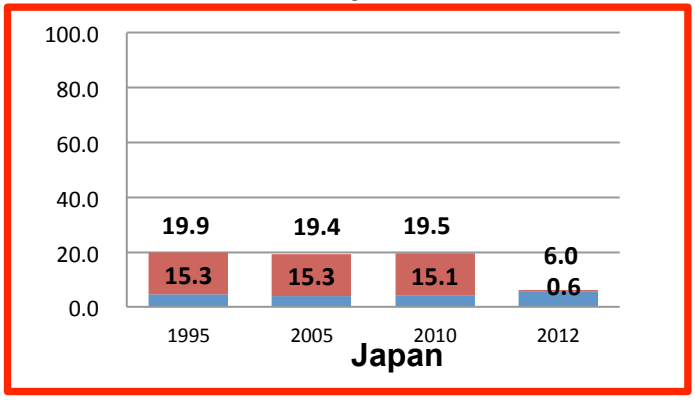


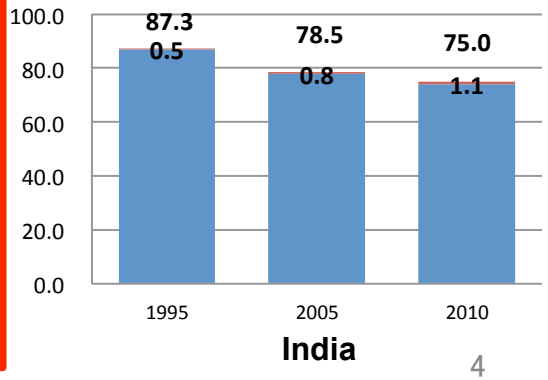






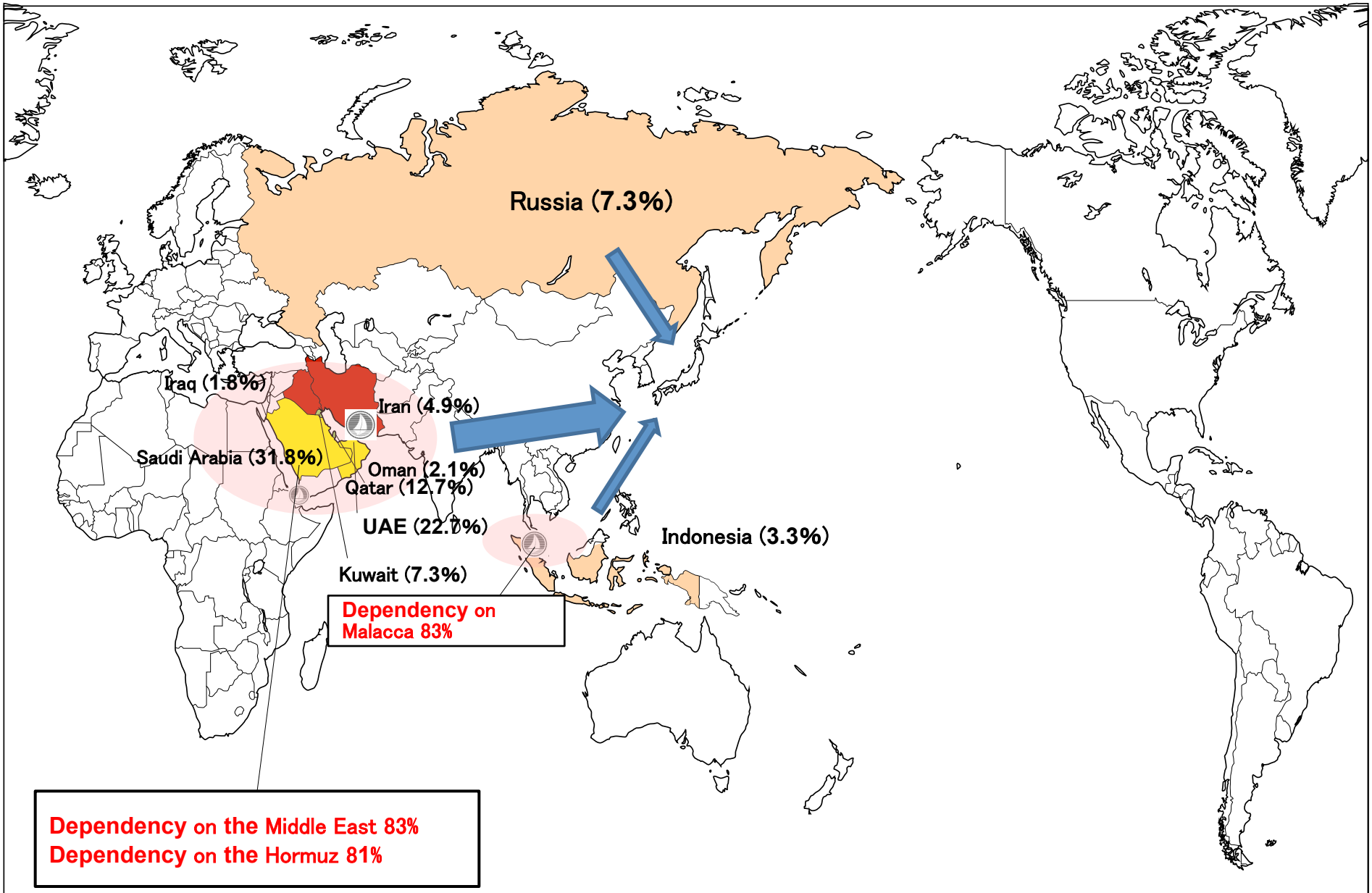






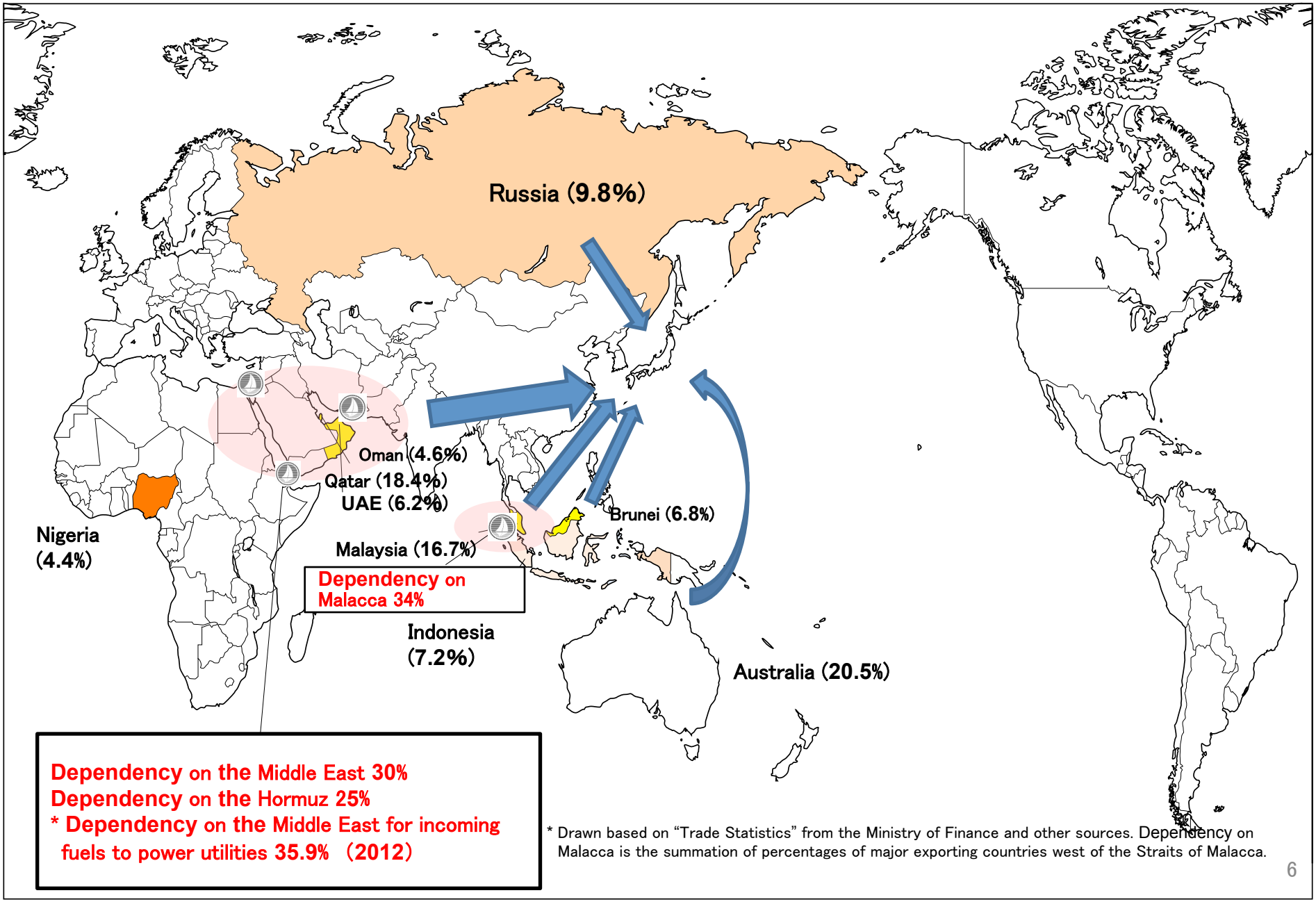
* IEA "Energy Balance of OECD, Non-OECD Countries 2012,2013" (Data is based on the latest estimate of the year 2012 for OECD countries, and the latest estimate of the year 2010 for non-OECD countries).

Japan's Major Procurement of Crude Oil (2013)



* Drawn based on "Trade Statistics" from the Ministry of Finance and other sources. "Dependency on Malacca" is the summation of percentages of major exporting countries west of the Straits of Malacca.

Japan's Major Procurement of Natural Gas (2013)



* Drawn based on "Trade Statistics" from the Ministry of Finance and other sources. Dependency on Malacca is the summation of percentages of major exporting countries west of the Straits of Malacca.

Power Sources Comparison

(1) Fuel amount required to produce the same amount of electric energy as 1 NPP unit can generate (1 million kW) when using an alternative power generation method

(2) Domestic private inventory (days)

(Excludes inventories in transit. The values were calculated based on inventories for power generation at power utilities (such as average inventory day for 2012).

* Drawn based on the Survey of Electric Power Statistics.)

Uranium	About 2 years
LNG	About 13 days
Oil	About 67 days
Coal	About 33 days

* Uranium already processed in other countries such as enriched uranium (values before the Earthquake) Values are actualy larger now.

* The national stockpile can last for about 85 days (IEA standard, end of March 2013) Based on "Sekiyubichiku No Genkyo (Current Situation of Oil Stockpiling) from the Agency for Natural Resouces and Energy

* Source: "Nuclear Power 2010" (Agency for Natural Resources and Energy)

Ratio of the Electricity Generated by Renewable Energy

To increase ratio of renewable energy by 1 percentage ・・・

P V （Residential）

⇒ introduction of 9mn kW(about 2.2mn houses) is needed.

Wind Power

⇒ introduction of about 500mn kW(about 2,690 turbines) is needed

※estimation based on all electricity generated in 2012.

To replace nuclear power with renewable energy・・・

Nuclear power

1 reactor

（1.2mnKW／7.4bnKWH）

＝

PV （residential）

1.75mn houses

※Almost all houses in Tokyo

（about7mnKW／7.4bnKWH）

Introduced about 6.7mn kW at the end of last year

＝

Wind Power

about 2,100 turbines

（about4.2mnKW／7.4bnKWH）

Introduced about 2.7mn kW at the end of last year

※ estimation with the the PV（residential）of 4kw and its utilization rate of 12%
and the window power of 2,000kw and its equipment utilization rate 20%.

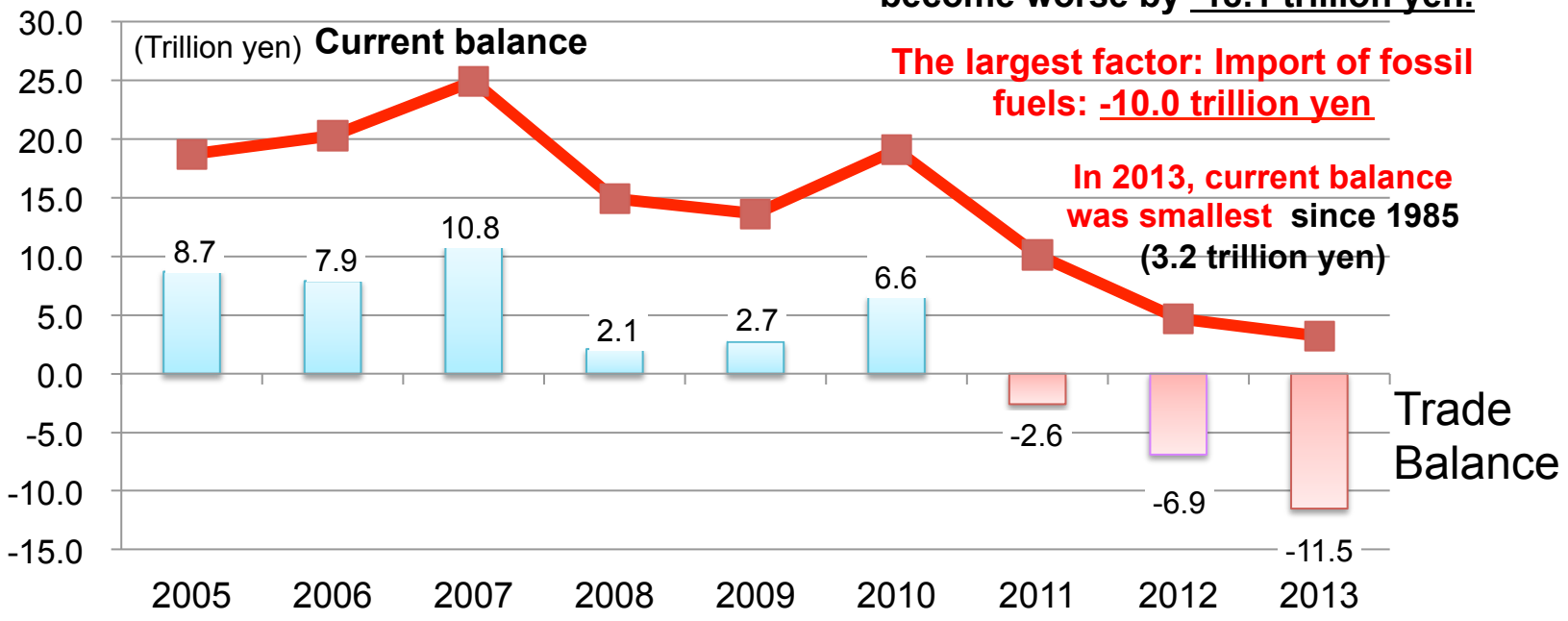
1. Problems of Japan's energy supply and demand structure (from page 6)

Thermal power generation takes place of nuclear power generation that has been suspended and it affects everyday life of every citizen through increase of fossil fuel import

(1) The cost of fuels for power generation without nuclear power increased by approx. 3.6 trillion yen/year after the Great East Japan Earthquake. (Increased by approx. 30,000 yen/person/year and approx. 10 billion yen/day)

Trade balance and current balance have rapidly become worse.

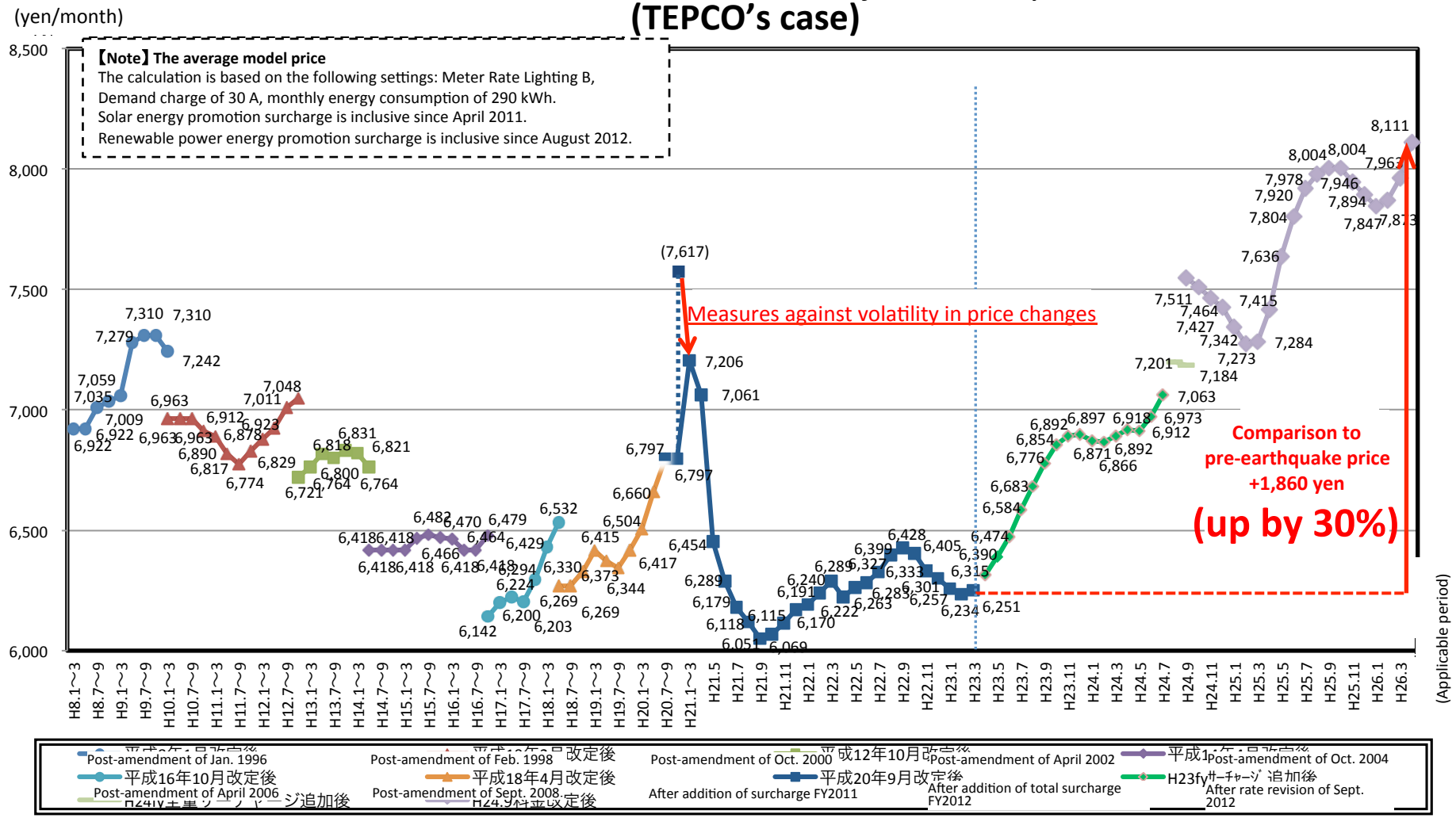
After the earthquake, trade balance has become worse by -18.1 trillion yen.



Electricity cost fluctuation (model rate for a typical household)

■ The electricity rate (model rate for a typical household) is higher by 20% on average compared to the period before the earthquake disaster of 2011, due to the rate revisions owing to the increase of fossil fuel consumption as a result of suspended NPPs, and the rising cost of fuel prices.

Trend of the standard household electricity prices after the introduction of the Fuel Cost Adjustment System (TEPCO's case)

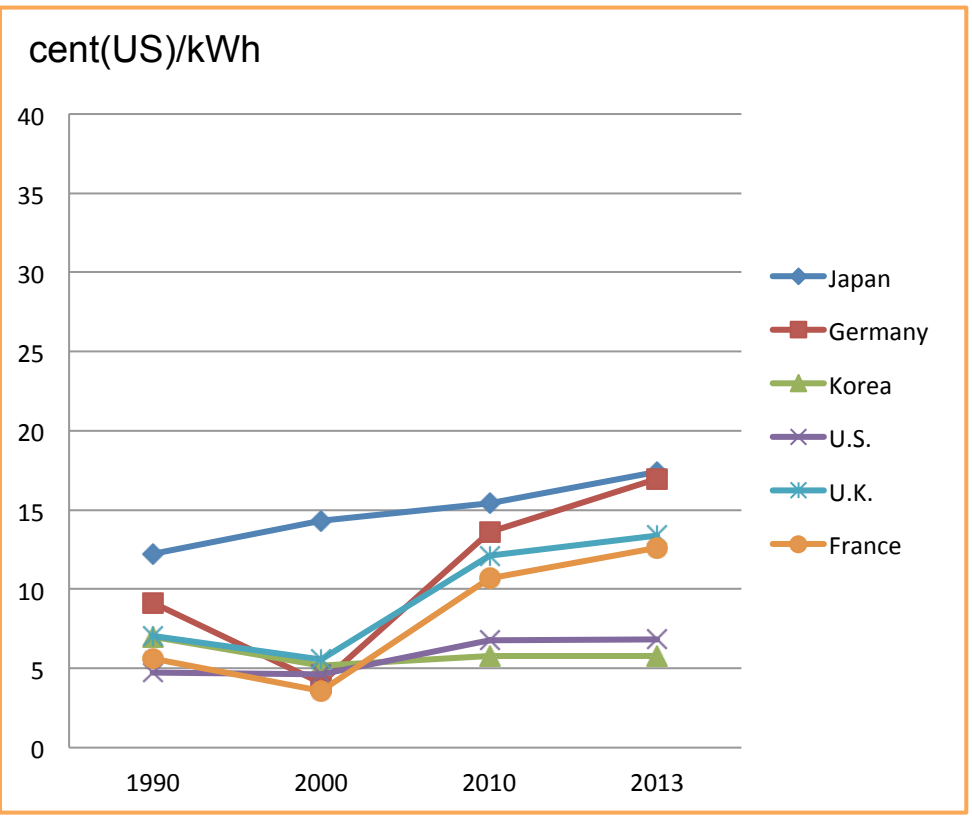


Comparison of Electricity Rate

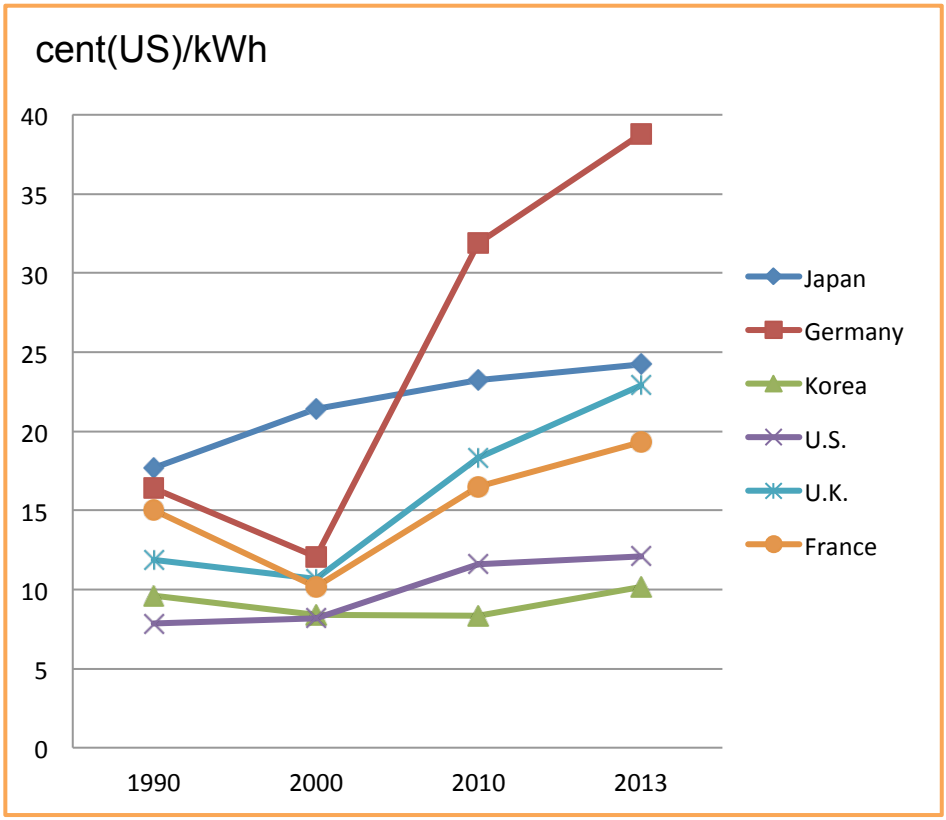
- After the Great East Japan Earthquake, the electricity rate keeps rising due to the rate revisions owing to the increase of fossil fuel costs as a result of suspended NPPs, and the rising renewable power energy promotion surcharge.

（※0.29JPY/kwh（2012） → 0.4JPY/kwh（2013） → 0.75JPY/kwh（2014）

Electricity rate for industry



Electricity rate for household

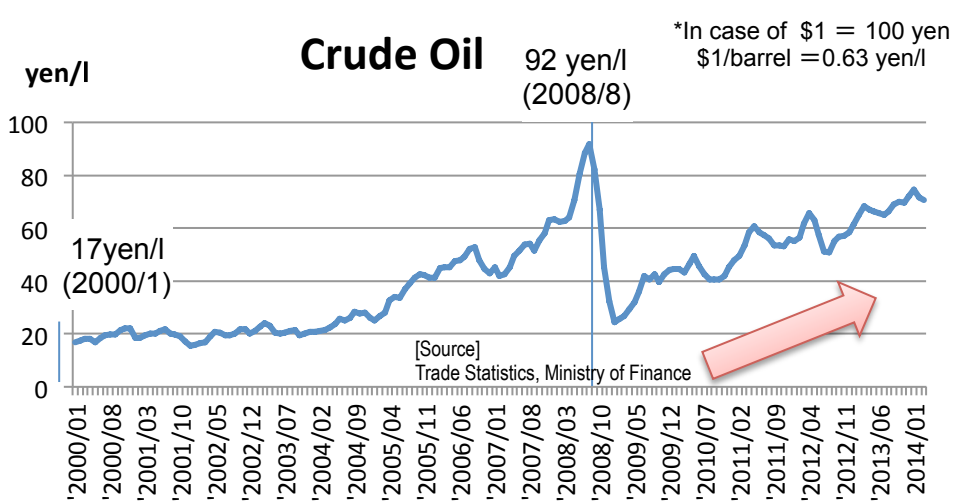


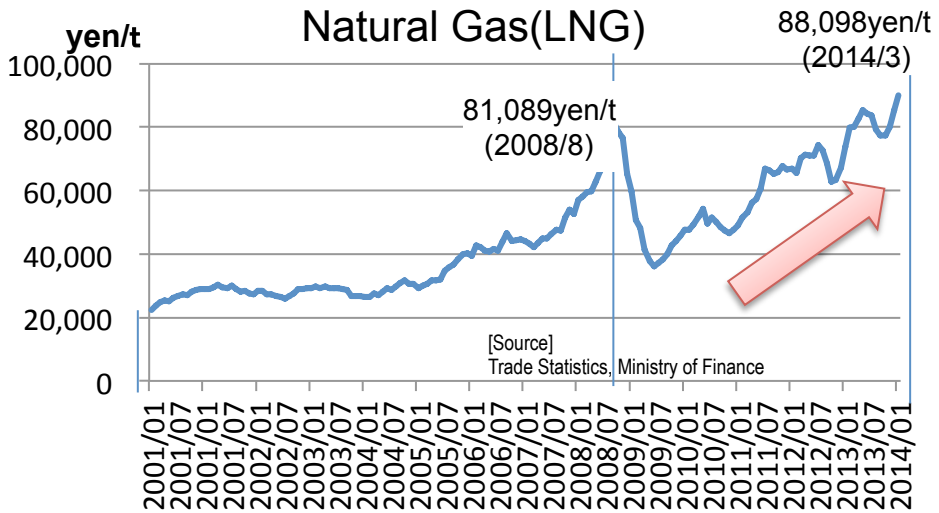
※Electricity rate for industry of Korea use the 2009 data for 2010 and 2013, and Electricity rate for industry of U.K. use the 2012 data for 2013

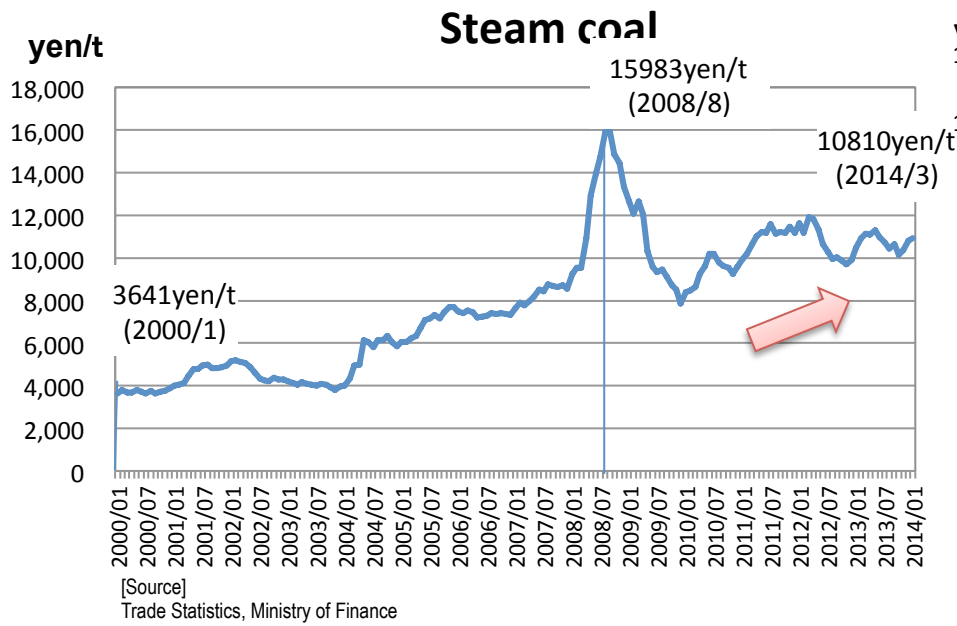
Source：IEA Energy Prices and Taxes（using the exchange rate of OECD）

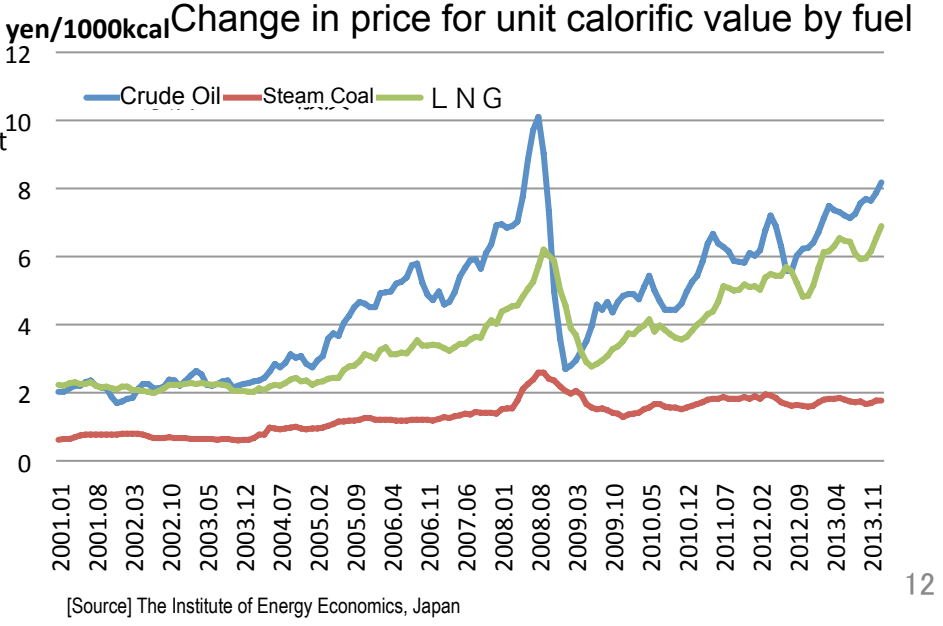
Problems of Japan's energy supply and demand structure

Crude oil and natural gas prices will keep tendency of rise. The prices seem to be kept at today's level or further rise due to robust demands in emerging countries. On the other hand, the coal price will be relatively stable.







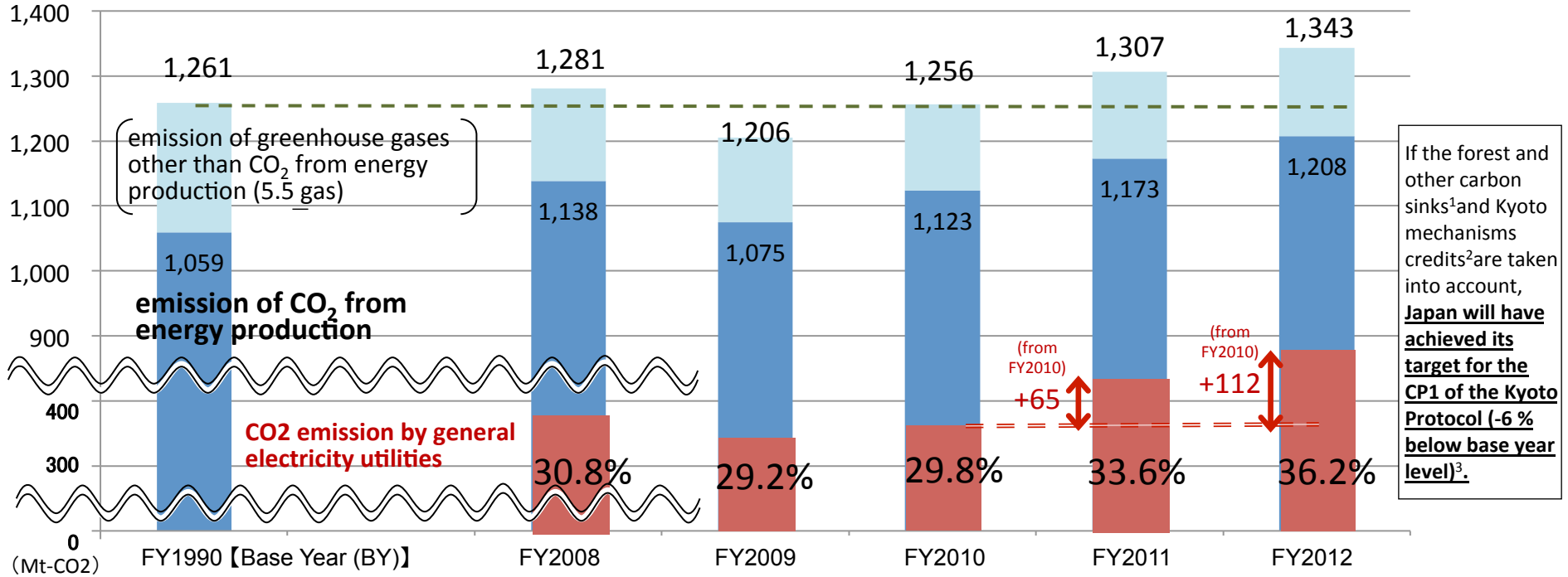


CO2 emission before and after the Great East Japan Earthquake

- CO2 emission for FY2012 increased 84 million tons compared to FY2010.
- Although emission except for electricity (*) are decreasing slightly, the emission from electricity production have increased by 112 million tons compared to FY2010, because of increased use of thermal power generation as this makes up for nuclear power.

(Million t-CO2)	BY (FY1990)	FY2008	FY2009	FY2010	FY2011	FY2012
Greenhouse gas emission volume	1, 261	1, 281 (+1.6% from BY)	1, 206 (▲4.4% from BY)	1, 256 (▲0.4% from BY)	1, 307 (+3.6% from BY)	1, 343 (+6.5% from BY)
CO_2 emission volume from energy production	1, 059	1, 138	1, 075	1, 123	1, 173	1, 208
Of which, for electricity*	—	395	353	374	+65 439	+112 486
Of which, except for electricity	—	743	722	749	▲15 734	▲27 722

*Emission volume "for electricity" means emission volume by general electricity utilities.

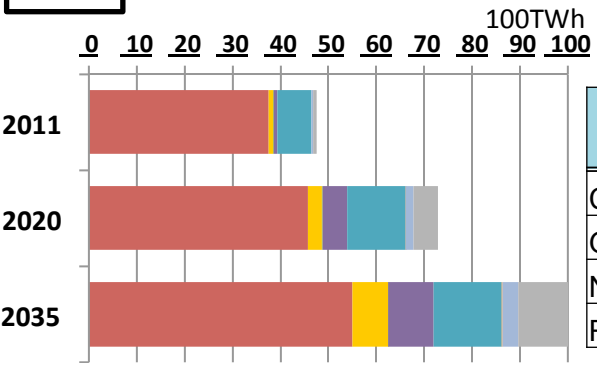


If the forest and other carbon sinks[1] and Kyoto mechanisms credits[2] are taken into account, **Japan will have achieved its target for the CP1 of the Kyoto Protocol (-6 % below base year level)[3].**

1: Removals by forest and other carbon sinks (forest carbon sink measures and urban revegetation etc) that can be used toward achieving the target. The removals by forest carbon sink measures exceeded the upper limit (238.3 Mt-CO_2 for the five years) set for Japan for use toward achieving the target, therefore the value is the upper limit per year.
2: Acquired by the government: Total credits that were acquired as of FY2013 year-end through the Kyoto Mechanisms Credit Acquisition Program (97.493 Mt)
Acquired by the private sector: The amount of credits that were acquired by the Federation of Electric Power Companies of Japan (According to the Environmental Action Plan by the Japanese Electric Utility Industry [FY2013])
3: Total emission and removals for the Kyoto Protocol target will be finalized after the technical review process under the Kyoto Protocol and the Convention to be conducted in FY2014. Also, the Kyoto mechanisms credits will be finalized after the true-up period for the first commitment period (expected to be completed in the second half of 2015 or later).

Outlook of the electricity generation in Asia

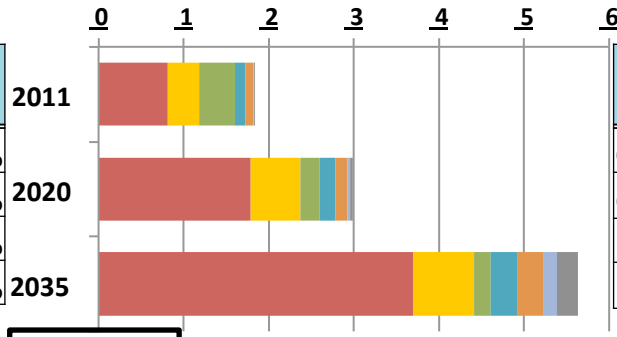
China



Average Annual Growth Rate

China	2011-2020	2020-2035
Coal	2.2%	1.2%
Gas	13.5%	6.2%
Nuclear	22.2%	4.1%
Renewable	9.8%	2.7%

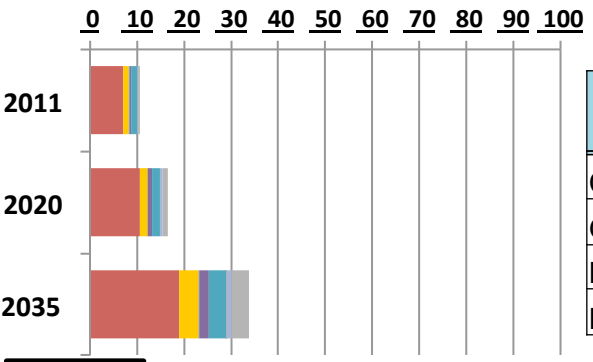
Indonesia



Average Annual Growth Rate

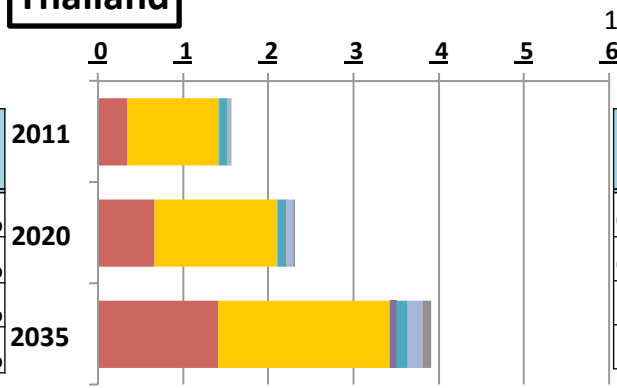
Indonesia	2011-2020	2020-2035
Coal	9.2%	4.9%
Gas	5.1%	1.4%
Nuclear	-	-
Renewable	6.8%	6.5%

India



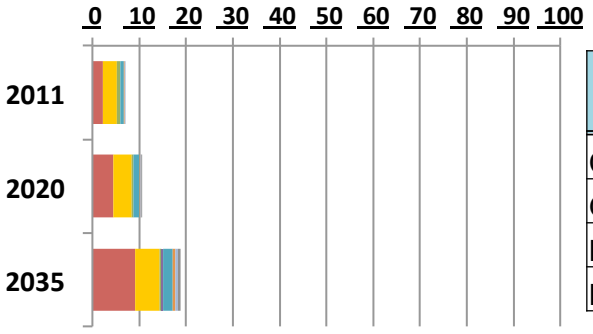
India	2011-2020	2020-2035
Coal	4.5%	3.9%
Gas	4.4%	6.6%
Nuclear	10.5%	6.4%
Renewable	7.4%	6.1%

Thailand



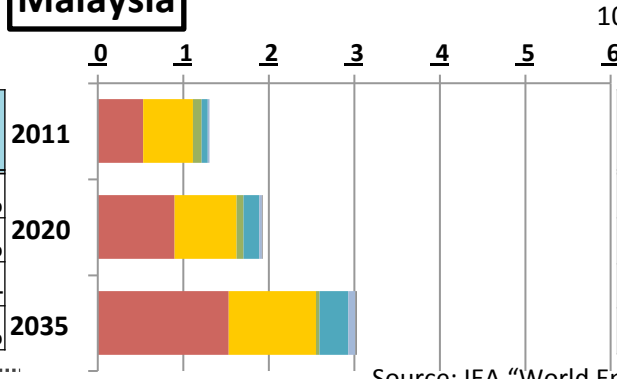
Thailand	2011-2020	2020-2035
Coal	7.4%	5.2%
Gas	3.4%	2.3%
Nuclear	-	-
Renewable	6.1%	4.4%

ASEAN



ASEAN	2011-2020	2020-2035
Coal	8.1%	5.0%
Gas	2.8%	1.9%
Nuclear	-	-
Renewable	7.0%	4.9%

Malaysia



Malaysia	2011-2020	2020-2035
Coal	6.0%	3.6%
Gas	2.4%	2.3%
Nuclear	-	-
Renewable	10.3%	4.9%

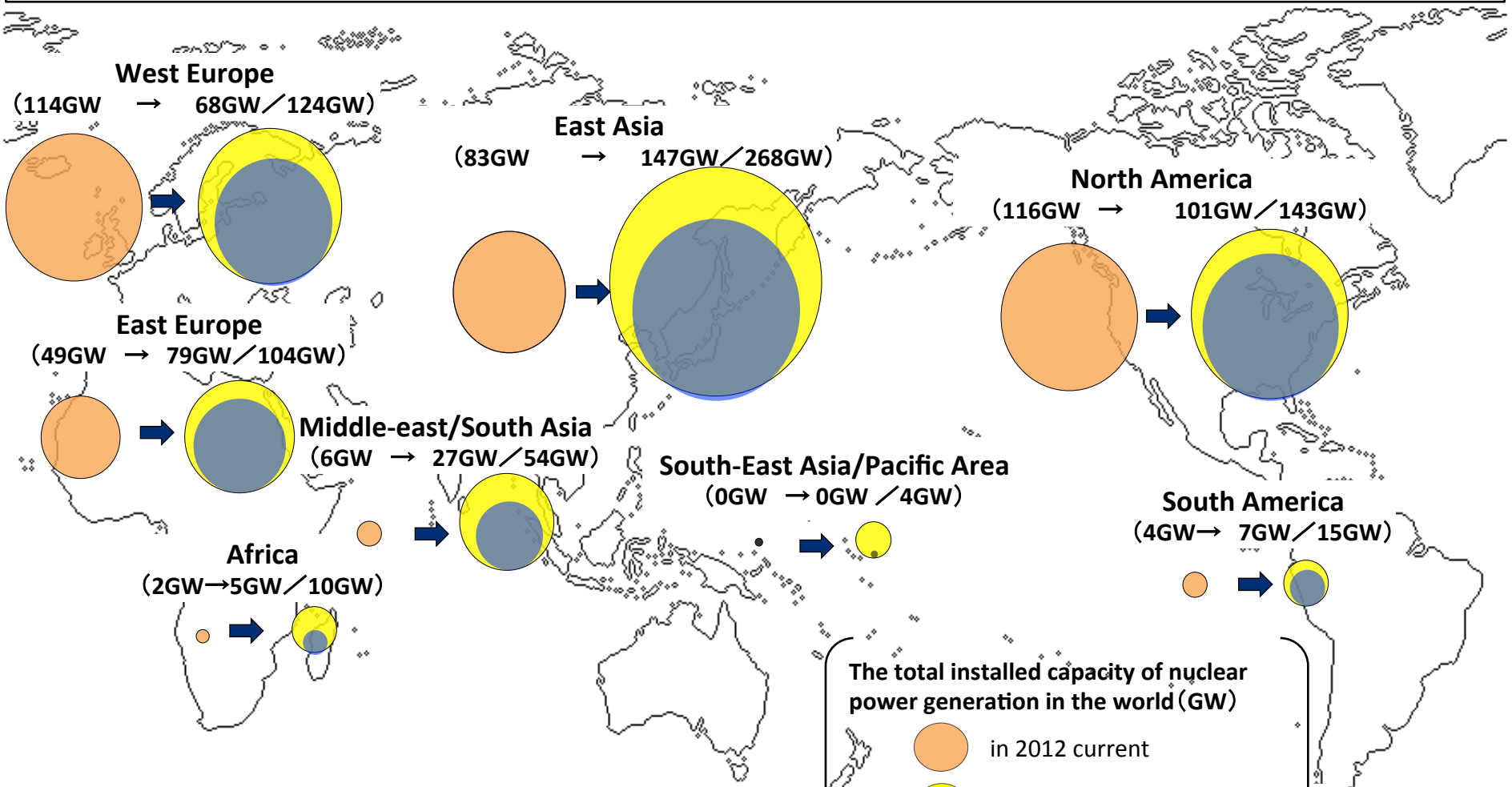
Coal Gas Oil Nuclear Hydro Geothermal Bioenergy Other

Source; IEA "World Energy Outlook 2013"
IEA "South East Asia Energy Outlook"

Outlook of the introduction of nuclear power

○ The total installed capacity of nuclear power generation in the world is expected to grow 1.2 - 1.9 times by 2030 by the IAEA.
(Converted into the number of Plant- Unit, it's estimated to increase around 60 – 350 units (3 – 19 units per year) (expectation of METI))

○ It is expected the large expansion in the area of East Asia, East Europe and the Middle East/South Asia.



*Compiled from data of the total installed capacity of nuclear power generation in the world (GW) published by IAEA in August 2013

2. Summary of the 4th strategic Energy Plan

The Strategic Energy Plan

The Strategic Energy Plan, based on the Basic Act on Energy Policy, is an anchor of energy supply/demand policies in Japan.

The Minister of Economy, Trade and Industry shall formulate a draft of the Basic Energy Plan and Government of Japan shall make it as an cabinet decision.

The first Strategic Energy Plan (October 7th, 2003)
- The Liberal Democratic Party (LDP)
- The Prime Minister : Junichiro Koizumi
- The Minister of Economy, Trade and Industry : Shouichi Nakagawa

The second Strategic Energy Plan (March 9th, 2007)
- The Liberal Democratic Party (LDP)
- The Prime Minister : Shinzo Abe
- The Minister of Economy, Trade and Industry : Akira Amari

The third Strategic Energy Plan (June 18th, 2010)
- The Democratic Party of Japan (DPJ)
- The Prime Minister : Naoto Kan
- The Minister of Economy, Trade and Industry : Masayuki Naoshima

The fourth Strategic Energy Plan (April 11th, 2014)
- The Liberal Democratic Party (LDP)
- The Prime Minister : Shinzo Abe
- The Minister of Economy, Trade and Industry : Toshimitsu Motegi

Introduction

- As for Japan, which depends on most of fossil fuel from abroad, energy security is always a significant issue.

- This plan gives a direction of Japan's energy policies for medium/long-term (about next 20 years) . It declares a period from now to 2018-2020 should be a special stage to reform a variety of energy systems.

- GOJ will share distress of the affected people caused by the accident at TEPCO's Fukushima Daiichi Nuclear Power Plant, and achieve the restoration and reconstruction of Fukushima.
  Japan's energy strategies, which were drafted before the Great East Japan Earthquake, should be reviewed from scratch, and GOJ should make efforts to decrease dependency on nuclear power to the extent possible.
  It is a starting point to reestablish Japan's energy policies.

Ⅰ. Problems on Japan's Energy Supply/Demand Structure

1. Basic Problems

- Japan's energy supply would be easily affected by external factors due to its high dependency on oversea fossil fuel.
- Population decline and innovation in energy conservation technology have caused structural changes in Japan's medium/long-term energy demand.
- Increased energy demand in emerging countries has led rapid increase in natural resources' prices and global greenhouse gas emission.

2. Problems exposed just before and after 3.11

- Concerns regarding safety of nuclear power plants and weak public confidence toward GOJ and utilities.
- Due to an increase of fossil fuel imports, Japan faces further dependency on the Middle-East, a rise in electricity prices, a rapid increase of greenhouse gas emissions, and an outflow of national wealth.
- Exposed structural defects, such as difference in electricity frequency between East and West in Japan, a lack of emergency system to deliver oil products
- New trend for energy saving by household and industries.
- New trend in global energy supply structure such as energy independency of North America due to shale gas, emerging regional differences in energy prices.

Ⅱ. Principles of Energy Policy and Viewpoints for Reform

1. Principles of Energy Policy and Viewpoints for Reformation

(1) Confirmation of basic viewpoint of energy policies (3E + S)

Stable Supply (**E**nergy Security)

Cost Reduction (**E**conomic Efficiency)

Environment

Safety

+

Global Viewpoint

-Developing energy policies with international movement appropriately

-Internationalizing energy industries by facilitating business overseas.

Economic Growth

-Contribution to reinforce Japan's locational competitiveness.

-Activating Japan's energy market through energy system reform.

(2) Building multilayered and diversified flexible energy demand-supply structure

- Establishing resilient, realistic and multi-layered energy supply structure, where each energy source can exert its advantage and complement others' drawbacks.
- Creating a flexible and efficient supply/demand structure where various players can participate and various alternatives are prepared by system reforms.
- Improving self-sufficiency ratio by developing and introducing domestic resources to minimize influence from overseas' situation.

Ⅱ. Principles of Energy Policy and Viewpoints for Reform

2. Evaluation of each energy source

(1) Renewable energy (solar, wind, geothermal, hydroelectricity, biomass)

- Promising, multi-characteristic, important, low carbon and domestic energy sources.
- Accelerating its introduction as far as possible for three years, followed by continuous active promotion.

(2) Nuclear Power

- Important base-load power source as a low carbon and quasi-domestic energy source, contributing to stability of energy supply-demand structure, on the major premise of ensuring of its safety, because of the perspectives; 1) superiority in stability of energy supply and efficiency, 2) low and stable operational cost and 3) free from GHG emissions during operation.
- Dependency on nuclear power generation will be lowered to the extent possible by energy saving and introducing renewable energy as well as improving the efficiency of thermal power generation, etc.
- Under this policy, we will carefully examine a volume of electricity to be secured by nuclear power generation, taking Japan's energy constraints into consideration from the viewpoint of stable energy supply, cost reduction, global warming and maintaining nuclear technologies and human resources.

(3) Coal

- Revaluating as an important base-load power source in terms of stability and cost effectiveness, which will be utilized while reducing environmental load (utilization of efficient thermal power generation technology, etc.) .

(4) Natural Gas

- Important energy source as a main intermediate power source, expanding its roles in a variety of fields.

(5) Oil

- Important energy source as both an energy resource and a raw material, especially for the transportation and civilian sectors, as well as a peaking power source.

(6) LP Gas

- A clean and distributed energy source that can not only be utilized in everyday life but also in emergency situations.

□ Energy Mix

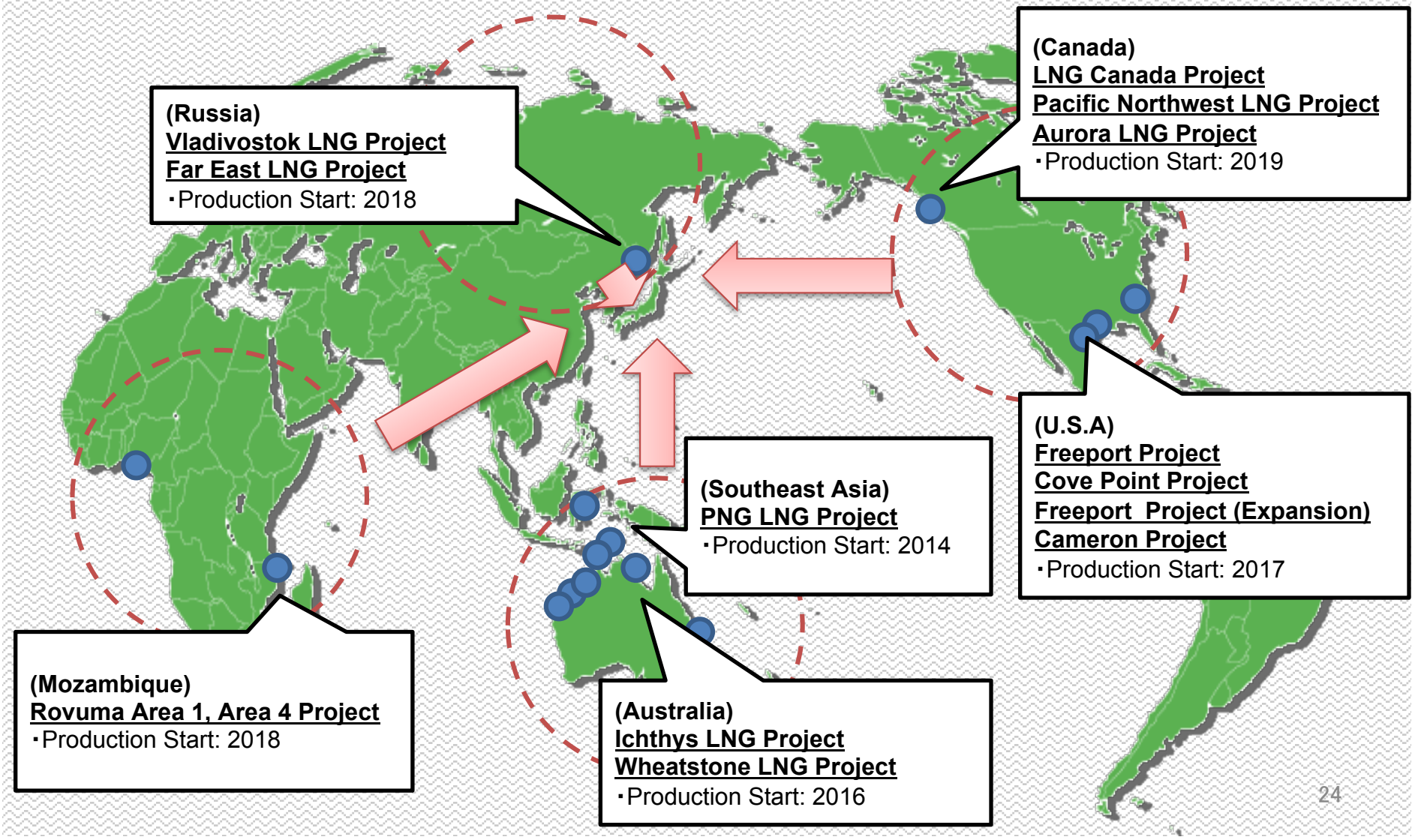
✓ Energy mix will be shown soon after this plan, taking into consideration factors including restart of nuclear power plants and expansion of renewable energy, and so on.

1. Promoting comprehensive policies for securing of resources

- Promoting multilayered “resource diplomacy” with natural resource exporting countries.
- Facilitating diversification of supply sources and upstream development through risk money supply.
- Promoting new styles of joint procurement such as comprehensive business partnership.
- Establishing a stable and flexible LNG supply-demand structure with a long-term strategy that Japan would be a hub of a coming Asia LNG market.
- Developing domestic seabed mineral resources such as methane hydrate and rare metals.
- Promotion of recycling system for rare metals and reinforcement of reserve system.

Emergence of New Supplies

- New suppliers are preparing to enter the LNG market as represented by projects in the U.S. and Canada.
- First LNG exports from Papua New Guinea will ship to Japan in the near future.



Development of Methane Hydrate

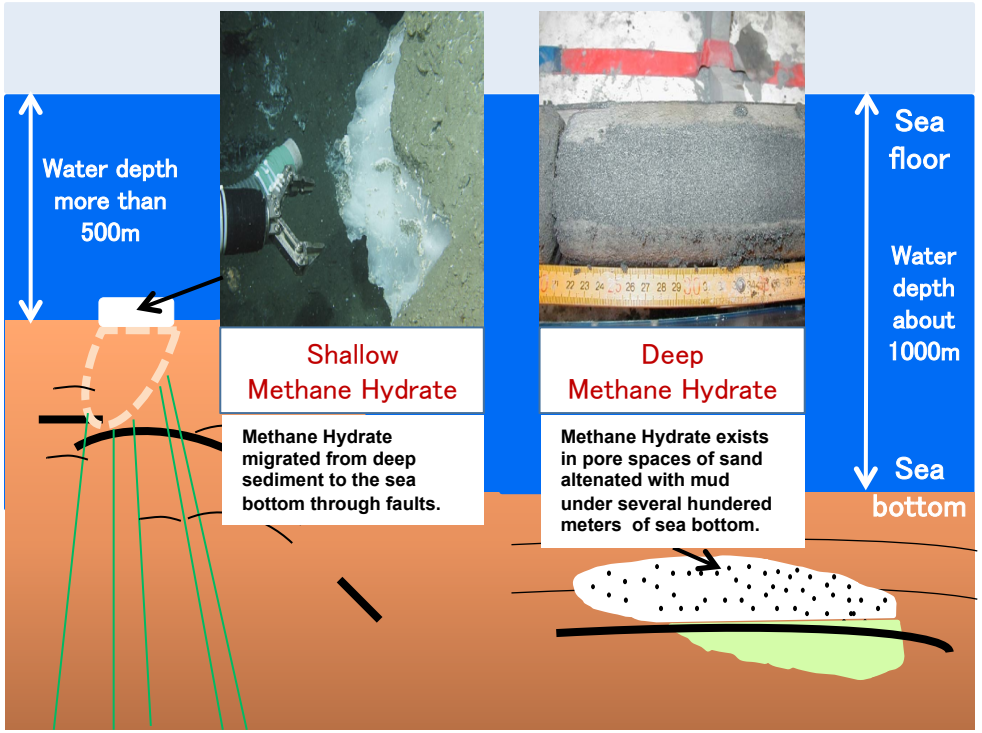
○Methane Hydrate is a promising energy source which exists in the surrounding sea of Japan. Based on the "Basic Plan on Ocean Policy", Japanese government will promote the research for reserves and the preparation of technology for commercialization.

＜Further actions（Based on the "Basic Plan on Ocean Policy" : cabinet approval on FY2013 April 26）＞

【Deep MH】 ①Based on the results of the offshore production test, technology for commercialization will be prepared by FY2018.
②Technological development will be promoted so that a project for commercialization led by private businesses can be started between 2023 and 2027, with an eye to international situation.

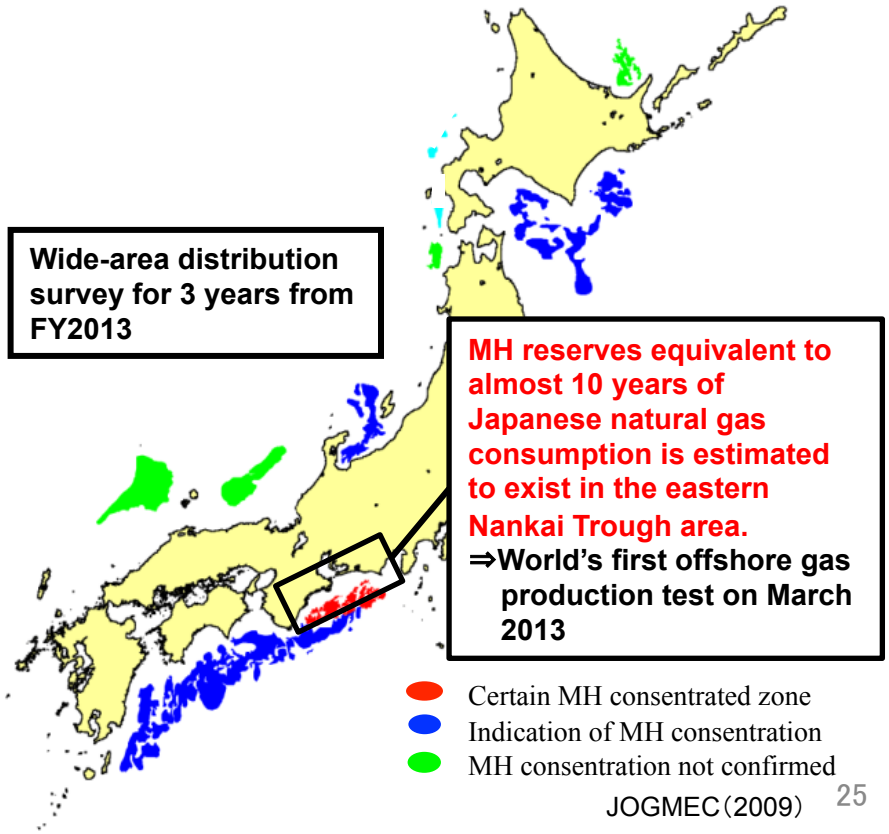
【Shallow MH】 ○A wide-area distribution survey will be conducted for 3 years from FY2013 to assess the reserve amount.

Occurrence of Methane Hydrate



※Methane Hydrate is an ice-like solid substance containing methane gas. It is often called "ice that burns" or "fiery ice".

Distribution of Methane Hydrate (Japan)



JOGMEC（2009）

2. Realization of an advanced energy–saving society

(1) Enhancing energy efficiency in each sector

- Formulating energy efficiency indexes in order to facilitate energy-saving on each sector.

<residential & commercial sector>

- Introduction of complementary energy efficiency standards for buildings/houses.

<transport sector>

- Promoting ITS which enables automatic driving system to improve fuel efficiency.

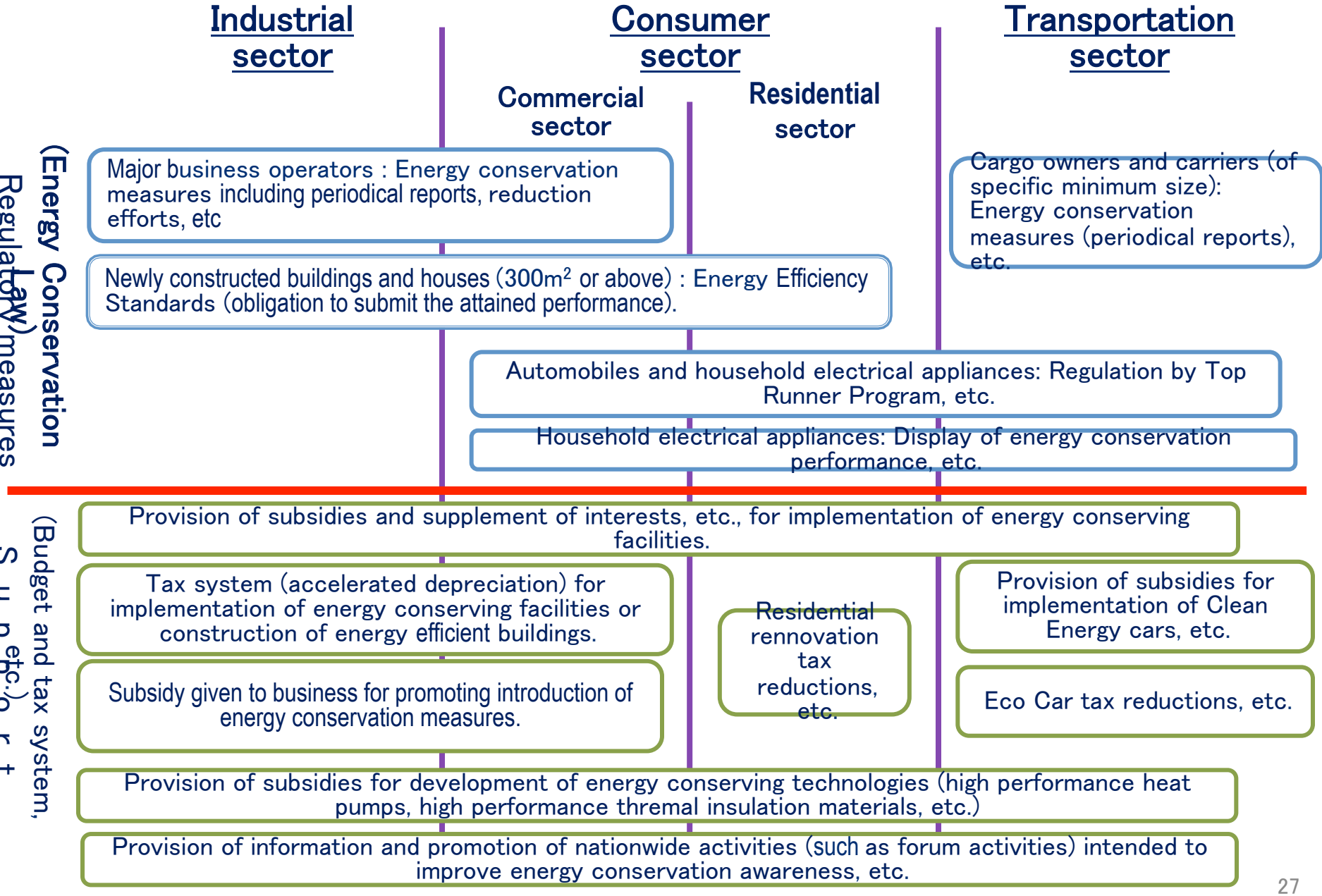
<industry sector>

- Encouraging investment to replace more efficient facilities.

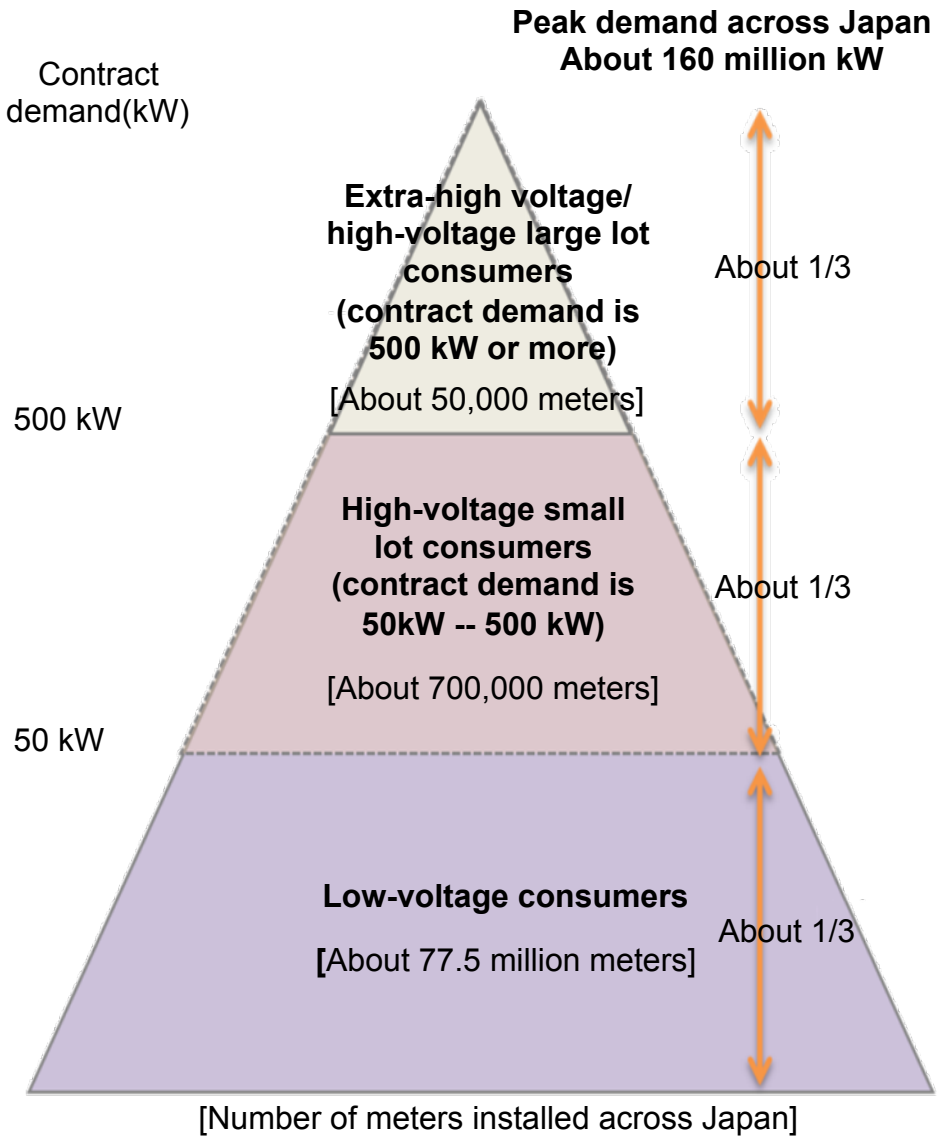
(2) Realization of smart energy consumption through various options to end users

- Establishing a method of “Demand Response” through smart meters in all homes and all businesses.

Structure of Measures for Energy Saving in Japan



Smart meter introduction plan (as of end of 2013)



	High voltage	Low voltage	
	Installation will be completed in	Installation will be started in	Installation will be completed in
Hokkaido	2016	2015	2023
Tohoku	Complete	Second half of 2014	2023
Tokyo	Complete	First half of 2014	2020
Chubu	2016	Jul-15	2022
Hokuriku	Complete	2015	2023
Kansai	2016	Started	2022
Chugoku	2016	2016	2023
Shikoku	2016	Second half of 2014	2023
Kyushu	Complete	2016	2023
Okinawa	2016	2016	2024

* Fiscal year

3. Accelerating Introduction of Renewable Energy: Toward Grid Parity in the Mid/Long Term

- Accelerating introduction as far as possible for three years since 2013, followed by continuous active promotion.
- Establishing "Related Ministers' Cabinet Meeting on Renewable Energy" for policy coordination.
- Pursuing the higher levels of introducing renewable energy than the levels* which were indicated based on the former Strategic Energy Plans, and GOJ takes them into account in a next energy mix.
- Operating FIT stably and appropriately, promoting regulatory reforms, R&D etc.

** "the Foresights of Long-Term Energy Supply and Demand(Recalculated)" (Aug. 2008, METI)*
- The ratio of renewable energy in total watt-hour in 2020: 13.5% (141.4 billion kWh)
"the Shape of Energy Supply and Demand in 2030" (Jun. 2010, the document for Advisory Committee on Energy and Natural Resources)
- The ratio of renewable energy in total watt-hour in 2030: approximately 20% (214 billion kWh)

(1) Strengthening the measures for expansion of wind and geothermal power

<Onshore Wind Power>

- Shortening periods for environmental assessment, establishing regional/inter-regional grid for renewable energy, installing large storage cells, rationalizing regulations, and so on.

<Offshore Wind Power>

- Promoting pilot projects for floating wind turbines technology in Fukushima and Nagasaki prefecture, and making the technology commercialized as early as possible by around 2018.

<Geothermal>

- Reducing investment risk, shortening a period for environmental assessment, and

(2) Promoting distributed energy systems with renewable energy

<Woody Biomass>

- Promoting the power generation and thermal usage of woody biomass, through forest /timber policies and the "Act for Promotion of Power Generation of Renewable Energy Electricity to take Harmony with Sound Development of Agriculture and Forest".

<Medium/Small size Hydro Power>

- Simplification of procedure on water rights by the amendment of the "River Act".

<Solar Power>

- Continuing supports for introduction for self-consumption in regions.

<Thermal Energy from Renewable Energy>

- Promoting introduction of thermal-supply facilities and pilot projects for multi-heat use.

(3) FIT

- Examination of the system from various views; facilitating the maximum use of renewable energy as well as reducing cost burden, referring situations of other countries which have faced challenges of cost burden and strengthening grid systems.

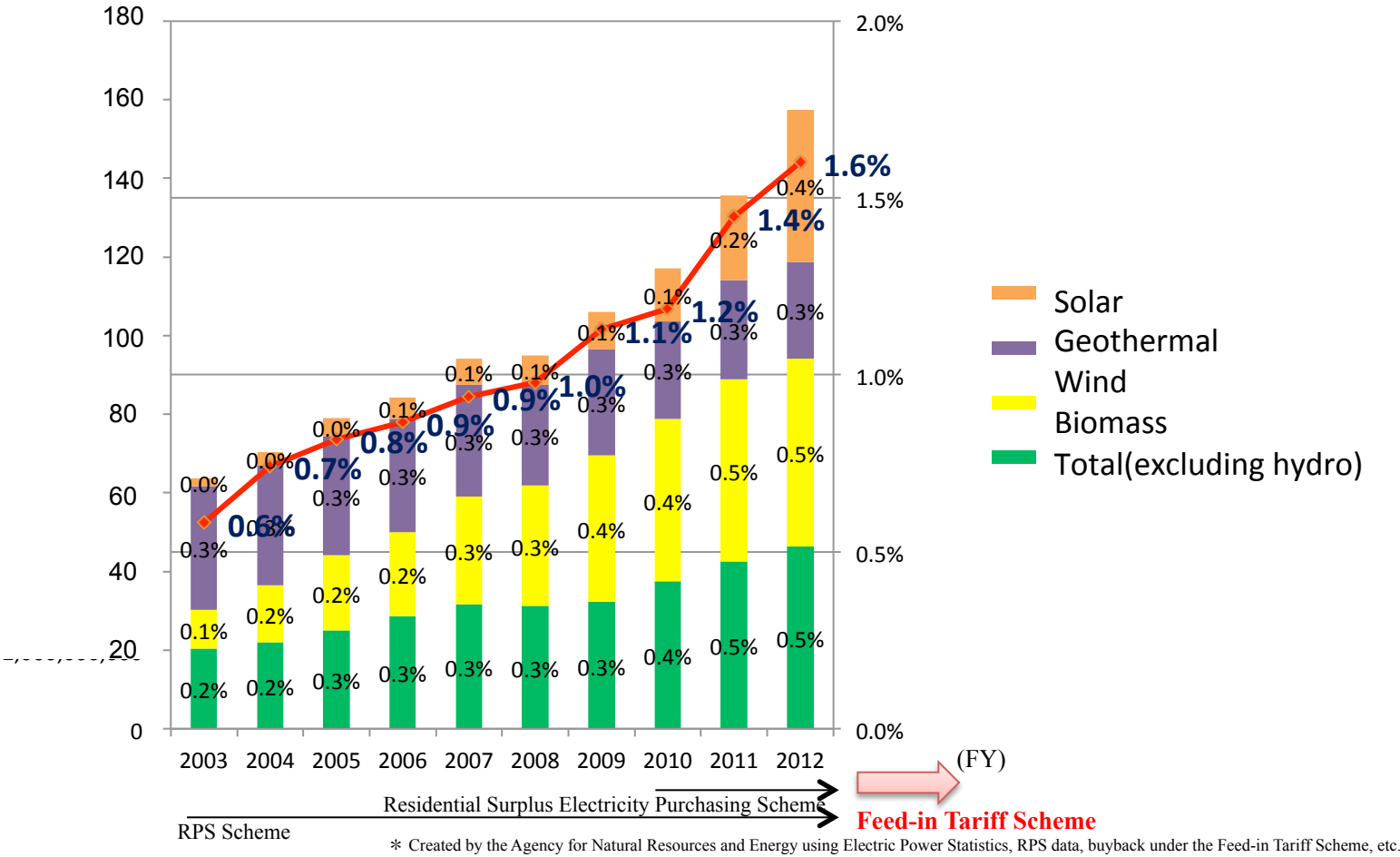
(4) Fukushima as a new hub of renewable energy's industries

- Constructing an AIST's new research center for renewable energy.

Japan's Use of Renewable Energy

- The contribution of renewable energy (excluding hydro power) to the total power generation in Japan covers 1.6% in FY2012.
- Since the launch of the Residential Surplus Electricity Purchasing Scheme for Photovoltaic Power in November 2009 and the Feed-in Tariff Scheme in July 2012, Japan's use of renewable energy, led by solar power, has steadily increased.

Japan's use of renewable energy in percentage

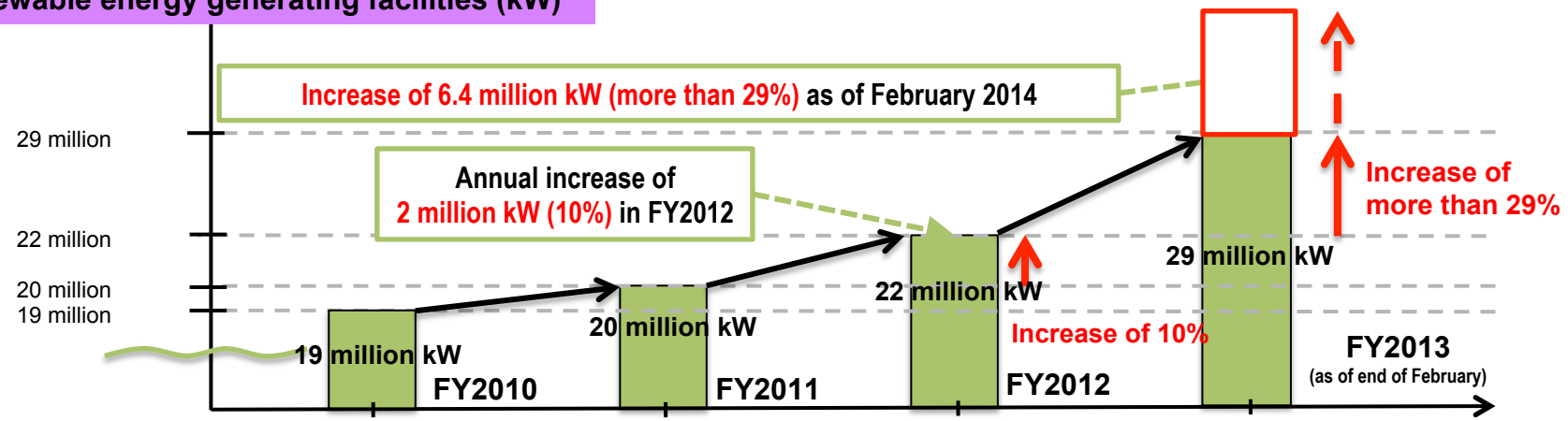


* Created by the Agency for Natural Resources and Energy using Electric Power Statistics, RPS data, buyback under the Feed-in Tariff Scheme, etc.

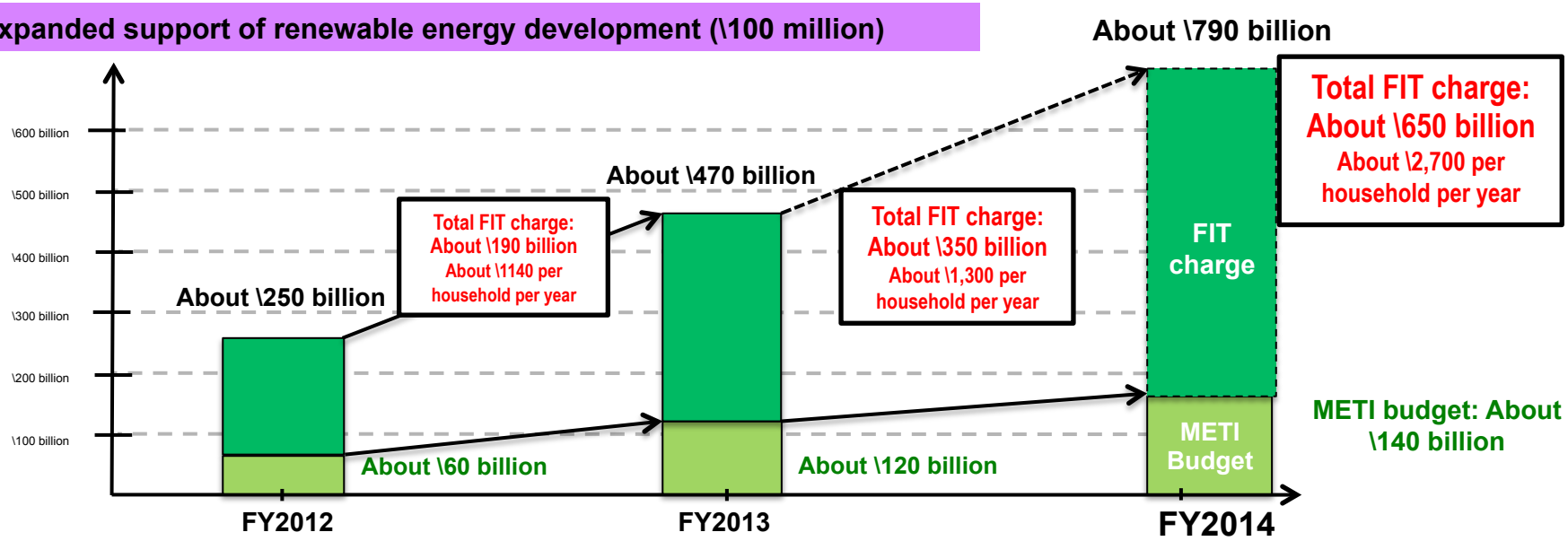
Acceleration of introduction of renewable energy

Generation of power from renewable energy source will be substantially expanded by start of purchase of extra solar-generated power in 2009 and implementation of feed-in tariff system in 2012

Renewable energy generating facilities (kW)



Expanded support of renewable energy development (\100 million)



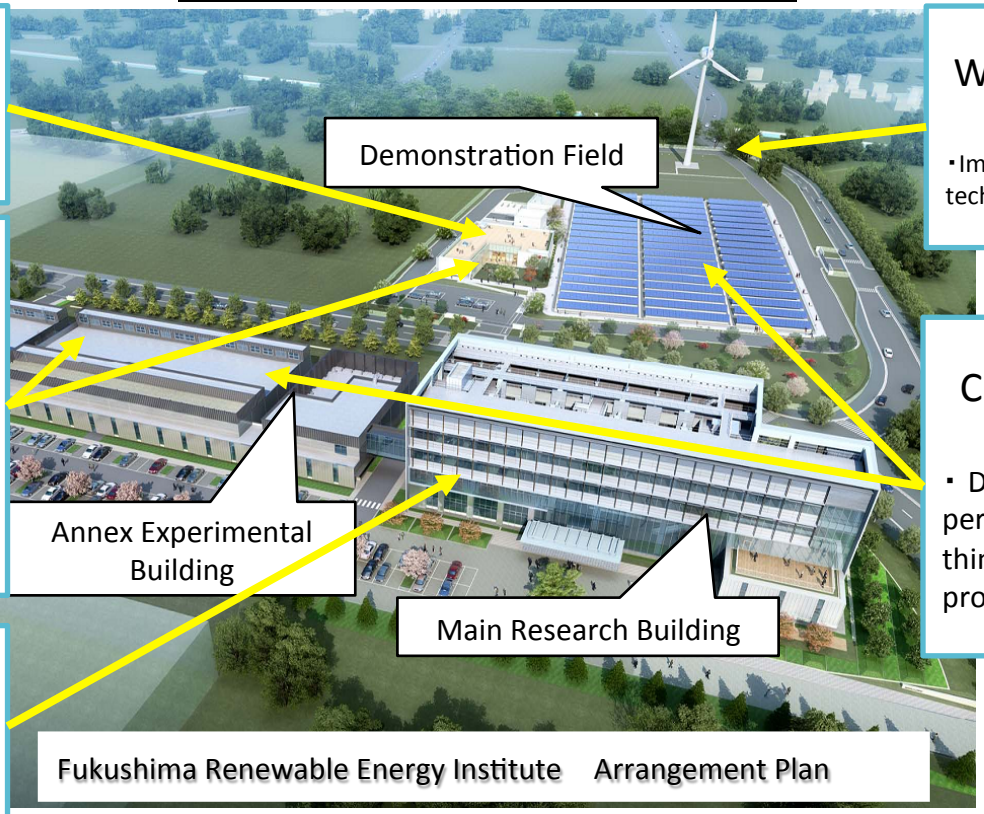
Outline of Fukushima Renewable Energy Institute

Main Research Themes

Renewable Energy Network Technology
・Management of renewable energy by networking with energy storage functions

Hydrogen Carrier Production / Application Technology
・Production of hydrogen through renewable energy and catalytic conversion from hydrogen to hydrogen carrier
・High-efficiency energy regeneration with dehydrogenation catalyst in cogeneration system

Geothermal Energy Application
・Geothermal mapping for application
・Verification of ground-source heat pump system



Wind Power Generation Technology
・Improvement of site assessment technology and generation efficiency

Crystalline Silicon Solar Cells and Modules
・ Development of high performance modules with ultra-thin silicon solar cells in mass production scale

* Number of working peoples：over 100 persons (about 1% of all AIST)
（Research Employees:28, Administrative Employees:8, Contract Employees:36 and Collaborating Visitors:30）
* Budget：7,000M JPY(construction cost), 3,100M JPY(equipment cost), 2,000M JPY(annual)
* Site area: 55,000m^2
* Main equipment: Photovoltaic generation(rated power:500kW), Wind power generation(rated power:300kW), etc.

4. Re-establishment of the nuclear policy

(1) Efforts towards restoration and reconstruction of Fukushima

- Efforts towards restoration and reconstruction of Fukushima is a starting point to rebuild Japanese energy policies.
- GOJ's playing more proactive roles in the decommissioning of Fukushima Daiichi NPPs and the countermeasures for the contaminated water issue (CWI).
- GOJ's playing more proactive roles in proceeding compensation, decontamination and operations of intermediate storage facilities.
- Conducting necessary studies for the establishment of R&D center for decommissioning and of industrial cluster for the fabrication/maintenance around the Fukushima Daiichi site.

(2) Untiring pursuit of safety and establishment of stable environment for nuclear operations

- Shedding the "safety myth" and pursuing the world's highest level of safety for operations.
- In case that the Nuclear Regulation Authority confirms the conformity of nuclear power plants with the regulatory requirements which are of the most stringent level in the world, GOJ will follow the NRA's judgment and proceed with the restart. In this case, the GOJ will make best efforts with operators to obtain understanding of relevant parties including host municipalities.
- Establishing an appropriate risk management system and implementing objective/quantitative risk assessments by nuclear power operators.
- Examining an appropriate business environment, where nuclear power operators can realize smooth decommissioning, prompt safety measures, stable supply of electricity, etc. under the liberalized electricity markets.
- Discussing a revision of the domestic nuclear damage compensation system comprehensively.
- Accelerating the necessary work towards a conclusion of CSC.
- Supporting municipalities hosting nuclear facility sites to enhance their evacuation plans, and reinforcement of measures for the nuclear emergency response.

Examples of Proposed Safety Requirements

Blue: Strengthening of Design Basis
Red: Severe accident measures

Reinforcement of AC power source
- Connect to two or more substations located in different places through two or more transmission lines
- Continuous operation of emergency diesel generators (7 days)

Emergency response center
- Secure earthquake protection by a seismic isolation function
- Secure safe habitability even if emissions of radioactive materials which is equivalent to 1F accidents occur

Addition of natural disasters to be assumed
- Include volcanic eruptions, tornadoes, and forest fires into design consideration

Measures to cool and depressure containment vessel failure/Measures to cool damaged core
- Mobile water injection system

Water source to prevent severe accidents
- Secure water sources

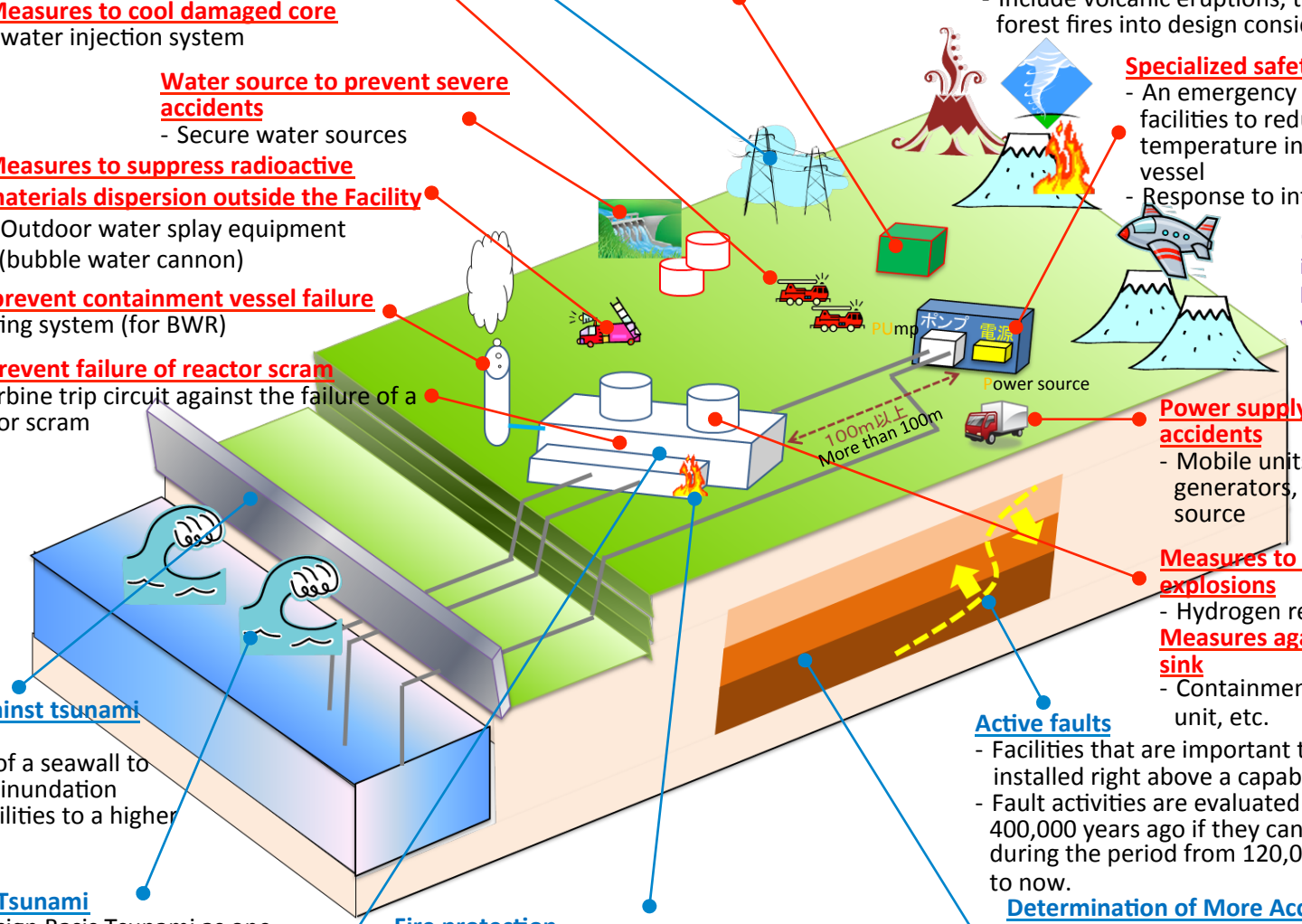
Specialized safety facility※
- An emergency control room back up facilities to reduce the pressure and temperature inside the containment vessel
- Response to intentional aircraft crashes

※Back-up facilities improving reliability will be ready within a five year period

Measures to suppress radioactive materials dispersion outside the Facility
- Outdoor water splay equipment (bubble water cannon)

Measures to prevent containment vessel failure
- Filtered venting system (for BWR)

Measures to prevent failure of reactor scram
- Additional turbine trip circuit against the failure of a nuclear reactor scram



Power supply against severe accidents
- Mobile units, emergency diesel generators, the third DC power source

Measures to prevent hydrogen explosions
- Hydrogen recombiner

Measures against loss of final heat sink
- Containment vessel recirculation unit, etc.

Measures against tsunami inundation
- Installation of a seawall to prevent site inundation
- Relocate facilities to a higher place

Active faults
- Facilities that are important to safety cannot be installed right above a capable fault.
- Fault activities are evaluated as far back as approx. 400,000 years ago if they cannot be clearly denied during the period from 120,000-130,000 years ago up to now.

Design Basis Tsunami
- Define a Design Basis Tsunami as one which exceeds the largest ever recorded

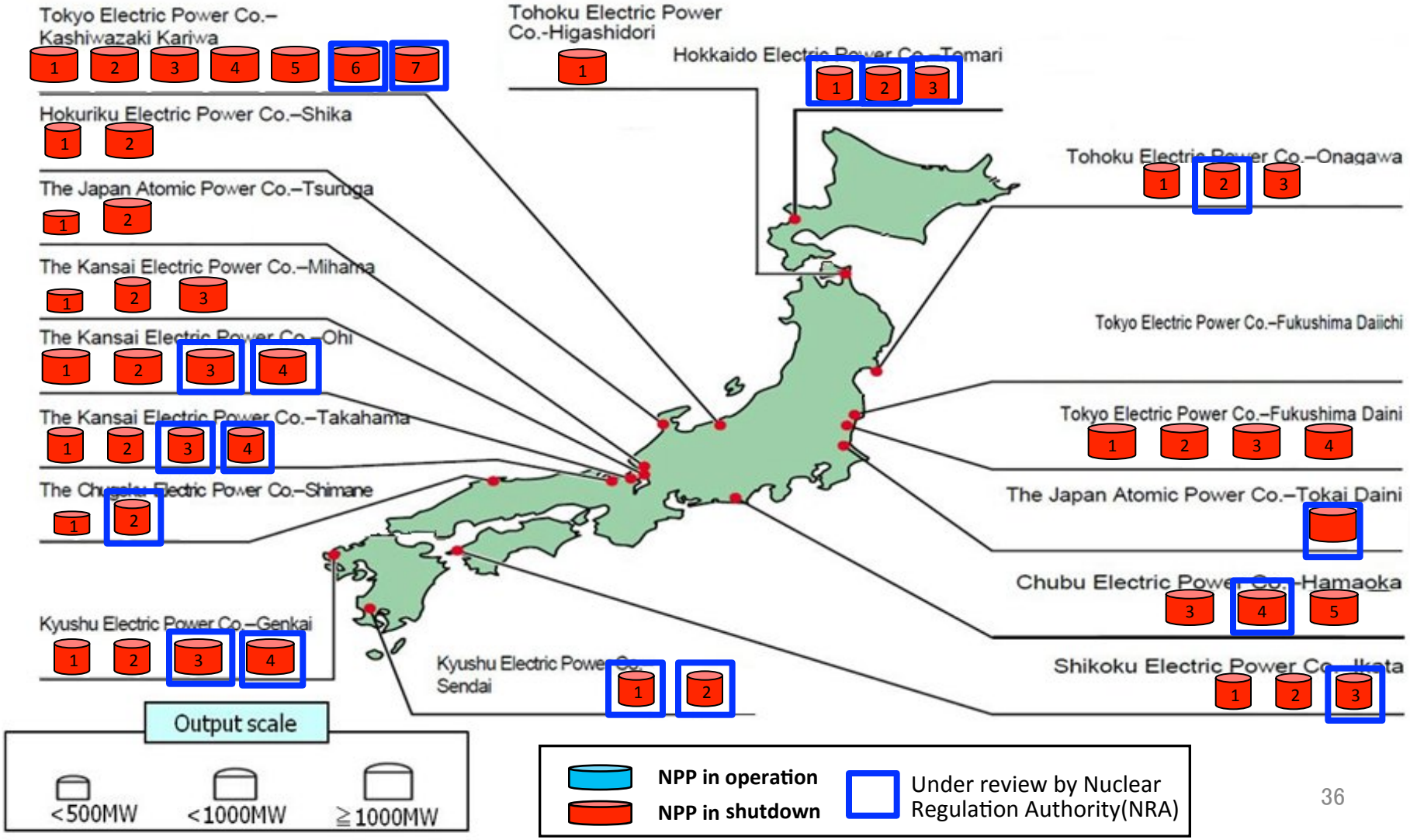
Fire protection
- Measures for fire protection and mitigation of influence in order not to spoil safety functions

Determination of More Accurate Design Basis Seismic Ground Motions
- Three-dimensional evaluations of the subsurface structure
- A concept of ground motion without a specific seismic source

Internal flooding
- Introduce measures against internal flooding

Nuclear Power Plants in Japan

- There are 48 nuclear power plant units in Japan.
- **All units (in red) are in a state of temporary shutdown** as of May 22, 2014.
- **18 units (in blue squares)** are under review for restart by the Nuclear Regulation Authority in accordance with its new safety regulations.



(3) Steady approach to solve issues of nuclear power

(a) Drastic reinforcement of measures for achieving solutions and promotion concerning spent fuel management

-GOJ's playing more active roles in finding proper solutions of geological disposal of high-level radioactive waste (HLW), securing reversibility and retrievability in HLW management for future generation.

-GOJ's promoting study and research on alternative disposal options including direct disposal method.

-GOJ's taking more initiative in explaining selection of candidate disposal sites from a scientific viewpoint and constructs a mechanism to build consensus in regions.

-Facilitating construction and utilization of new intermediate storage facilities and dry storage facilities.

-R&D for reduction and mitigation of volume and harmfulness of radioactive waste.

(b)Promotion of nuclear fuel cycle policy

- Strongly keeping a stable nuclear fuel cycle policy with the understanding and cooperation of located municipalities and international community, and holding flexibility to promote nuclear fuel cycle policy for mid- to long-term.
- Continuing committing to the principle of not possessing reserves of plutonium, of which use is undermined on the premise of peaceful use, and conducting an appropriate management and utilization of plutonium considering an appropriate plutonium balance.
- Promoting R&D of fast reactors, etc., through international cooperation with US and France etc.
- Reforming any aspects of Monju research thoroughly and placing Monju as an international research center for technological development, such as reducing the amount and toxic level of radioactive waste and technologies related to nuclear nonproliferation.

(4) Establishment of confidential relationship with people, municipalities hosting nuclear facility sites and international community

- Carrying out attentive public hearings and public relations based on facts and scientific evidence.
- Promoting measures supporting municipalities hosting NPPs in accordance with each regional situation.
- Providing nuclear technology with enhanced safety based on lessons from the accident, and strengthening support for human resource and institutional development for countries newly introducing NPPs.

Measures for final disposal of high-level radioactive waste

◆Japan currently stores about 17,000 tons of spent fuels.

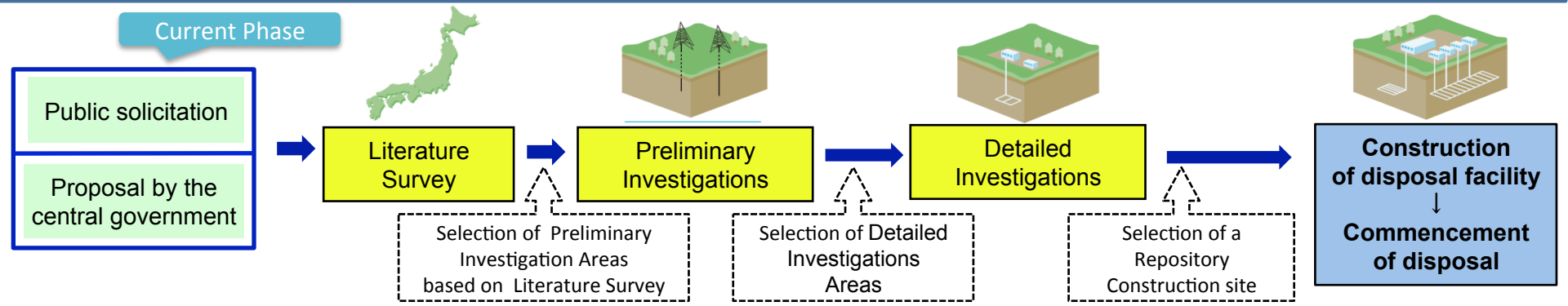
◆It is essential to implement measures to resolve the challenge as the responsibility of the current generation that has generated wastes so that the burden will not be passed on to future generations.

Drastic reinforcement of measures for final disposal of high-level radioactive waste

- the government will take actions for geological disposal of radioactive waste as well as secure reversibility and retrievability so that the future generation will be able to select the best disposal method when a better solution is found in the future.
- The government will seek understanding on the site-selection by suggesting a location that is scientifically considered to be more suitable and by explaining the geological and environmental characteristics of the site from scientific viewpoints.

Promptly revise the "Basic Policy for Final Disposal of Specified Radioactive Waste (decided by the Cabinet in March 2008)"

Outline of Disposal Site Selection Process

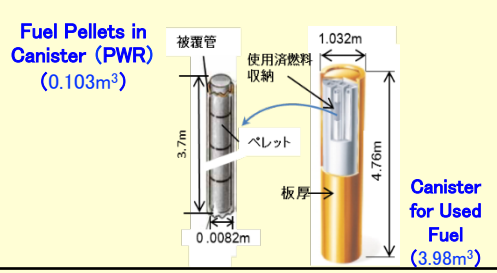
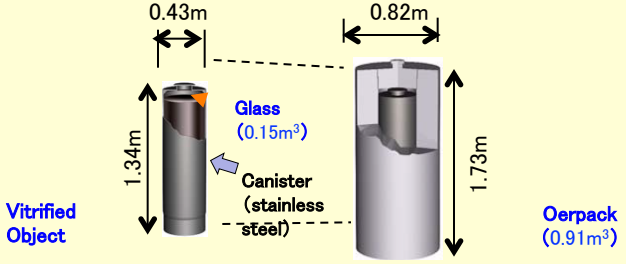


※ If a mayor of a municipality and the governor are opposed, NUMO dose not to go to the next phase.

Significance of Nuclear Fuel Cycle – Volume Reduction and Mitigation of Degree of Harmfulness

(1) Reprocessing spent fuel in LWRs enables a 75% volume reduction of high-level radioactive waste, and shortens the period required to reduce the radioactive harmfulness level down to that of natural uranium to below 1/10th.
(2) Implementation of the FR/FBR fuel cycle might be able to further reduce the long-term residual radiation dosage in high level radioactive waste, and substantially mitigate the environmental load per energy generated.

* In case of direct disposal, fission products such as uranium and plutonium remain in the waste. On the other hand, in case of vitrified radioactive materials after reprocessing, uranium and plutonium are removed and they subsequently lower the degree of radiotoxicity.
* In case of FR/FBR, since radioactive nuclides with extremely long half-lives can be used, further mitigation of the degree of radiotoxicity could be expected.

Comparison Items \ Technical Option		Direct Disposal	Reprocessing	
			LWR	FR
Waste Image of Disposal				
Volume Ratio of Waste Generated※1		1	Reduction to about 1/4 → app.0.22	Reduction to about 1/7 → app. 0.15
Potential Radiotoxicity	Reduction Period down to Natural Uranium Level※2	app 100,000 yrs	Mitigation to about 1/12 → **app. 8,000 yrs**	Mitigation to about 1/330 → **app. 300 yrs**
	Radiotoxicity after 1,000 yrs※2	1	**app** 0.12 yrs	app. 0.004 years
cost※3	Nuclear Fuel Cycle – Total (Total of Front End & Back End)	JPY 1.00 ~ 1.02 / kWh	JPY 1.39 ~ 1.98 / kWh	N/A ※The 2nd Reprocessing Plant for FR is required
	Cost of Disposal	JPY 0.10 ~ 0.11 / kWh	JPY 0.04 ~ 0.08 / kWh	

* 1. Based on the estimate by Japan Atomic Energy Agency. The figure shows the relative value compared to the canister for the direct disposal set as 1.
* 2. Source: Nuclear Energy Policy Guideline The upper column shows the period required to make equivalent to the potential harmfulness level of the volume of natural uranium necessary for the power generation of 1 GWy. The lower column shows the relative value compared to the harmfulness of the direct disposal set as 1.
* 3. Provisional Estimate by Nuclear Regulation Authority (Nov. 2011) (Case of Discount Rate 3 %) The figures of LWR disposal were calculated with two models, one with the current reprocessing & storage of used fuel, and the other with continuous reprocessing.

Nuclear Fuel Cycle in Japan

（5.5~6.5tHM/y Plutonium usage by 16 to 18 MOX fuel load nuclear reactors
*Including 1.1tHM/y plutonium usage by Oma Nuclear Power Plant）

Oma Nuclear Power Plant (utilized fully load MOX fuel)

MOX Fuel

JNFL
Rokkasho Reprocessing Plant

Plutonium over 4tHM/y

MOX Fuel Fabrication Plant

JNFL

MOX fuel from foreign reprocessors

Plutonium quantity possessed by electric power supplier (storage in UK and France)
23.3tHM

Spent Fuel

Storing : approx.2,900tU
Storage Capacity : 3,000tU

(start of construction : 2010
plan of operation : 2016)

Vitrified Waste

Geological disposal repository

Nuclear Power Plant
(Spent fuel pool, etc.)

Storing:
approx.14,000tU
Storage capacity :
approx.20,000tU

Spent Fuel

Off-site storage facility (Spent Fuel Interim Storage)

Electric power supplier
(Tokyo Electric Power co./
Japan Atomic Power co.)

Spent Fuel

Next reprocessing plant

Fast Breeder Reactors(FBR)

Mutsu：**5000tU**
(start of construction : 2010
Plan of operation : 2015)

Waste from operation and decommissioning

Study on implementation of sub-surface disposal for waste from decommissioning (2002FY~)

Waste (from Spent Fuel Reprocessing) returned from UK and France

Vitrified Waste Storage Center

Low-Level Radioactive Waste Disposal Center

Waste from operation

Sub-surface disposal test cavern

JNFL: Japan Nuclear Fuel Limited
MOX：Uranium-plutonium mixed oxide

Dry Storage of Spent Fuels

（1）Expanding storage capacity of spent fuels broaden the range of choices for managing the spent fuels produced by nuclear power generation while ensuring safety. These measures will enhance the flexibility of response, and contribute to mid- to long-term energy security .

（2）Studying a wide range of locations as possible sites, regardless of whether they are inside or outside the sites of a power plant, the government will strengthen its effort for facilitating construction and utilization of new intermediate storage facilities and dry storage facilities .

（3）For example, in the United States, Germany, etc., dry storage have been carried out inside and/or outside the sites of power plants, and the construction of new facilities are planned.

Tokai No.2 Power Station at The Japan Atomic Power Company
（A case of construction of new storage facility in power plant site）

reference：The Federation of Electric Power Companies of Japan

Safety Function	Safety Measures
Heat Removal	Natural Convection on the Cask and the Storage Building (Heat Removal by Helium Gas in the Cavity of the Cask and the Heat Transfer Fins in the Cask Body)
Confinement	Confinement System for the Prevention of the Release of Radioactive Material (An Open Area of the Cask is closed by a Double Lid.) (The Confinement system is secured under the water.)
Shielding	Radiation Shielding by the Cask and the Storage building (Multiple Barriers of the stainless steel, lead and Resin)
Criticality Prevention	Isolation of the Spent Fuel Assemblies by the Basket in the Cask (Neutron Shielding Material made of Aluminum Alloy Plate including Boron.)

reference：Drawn based on Technical Subcommittee on Nuclear Power, Nuclear Fuel Cycle (8th)

5. Environmental arrangement for the efficient/stable use of fuel fossils

(1) Promoting the effective use of high efficiency coal/gas thermal power generation

- Shortening a period for environmental assessment.
- Developing next-generation high efficiency coal thermal power generation technologies (e.g., IGCC) and carbon capture and storage (CCS) technology.
- Promoting exports of Japan's advanced coal/gas thermal power generation.

(2) Restructuring of the Market and Business Foundations for Petroleum and LP Gas Industries

- Supporting business restructuring for a oil refining industry, SS and LP gas operators.

6. Promotion of reforms in supply structure to remove market barriers

(1) Electricity System Reform

- Expanding cross-regional coordination of transmission operators, introduce full retail competition and legally unbundle transmission and distribution sectors.
- Introducing a mechanism for Transmission System Operators to purchase load following power, an obligation to retailors for securing power supply and so on, to secure stable supply to end users under full competition.

(2) Promoting Reforms in Gas Systems and Heat Supply Systems

- Introducing a full competition in gas supply market, and reviewing a system to use gas supply infrastructure for new comers.
- Overhauling a heat supply business to further promote effective use of heat.

Coal Thermal Power generation (Promotion of Low-Carbon Technologies)

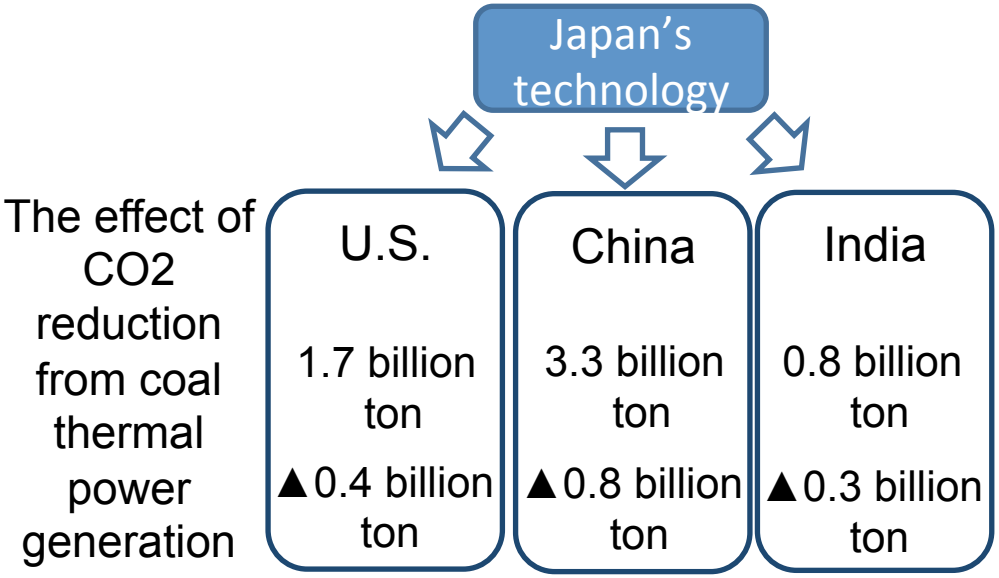
○Coal thermal power generation in Japan achieved the highest level of efficiency in the world.

○If the most advanced technology in operation in Japan is applied to coal thermal power generation in the U.S. , China and India, it is estimated that CO2 emission could be reduced by about 1.5 billion tons.

The most advanced high efficiency coal thermal power generation

J-Power (Isogo Thermal Power Plant)

The estimation of CO2 reduction in case Japan's technology is applied



Total ▲1.5 billion ton
(The total emission in Japan: 1.3 billion ton)

Roadmap for Electricity Market Reform in Japan

Bills

1st Reform: passed in Extraordinary Diet in 2013

1) **Establishment of the Organization for Cross-regional Coordination of Transmission Operators (OCCTO)**
2) Action programs for 2nd and 3rd reforms etc.

2nd Reform: Ordinary Diet in 2014

1) Full retail competition
2) Revision of applicable and regulations associated with the abolishment of General Electricity Utility system

3rd Reform: Ordinary Diet in 2015 (Plan)

1) Legal unbundling of transmission/distribution sectors
2) Code of Conduct

Reforms

Apr. 2, 2013 Cabinet Decision

Nov. 13, 2013

【1st Stage】 Around 2015

【2nd Stage】 Around 2016

【3rd Stage】 Around 2018 through 2020

1st reform

Cabinet Decision on the Policy on Electricity System Reform

The 1st Bill was passed.

Establishment of the Organization for Cross-regional Coordination of Transmission Operators (OCCTO)

2nd reform

Full retail competition

Period of transitional arrangement for retail tariff

Abolishment of retail tariff

3rd reform

Legal unbundling of transmission / distribution sector

（※At around 2015:Transition to new regulatory organizations）

7. Enhancing resilience of the domestic energy supply networks

- Reinforcing oil and LP gas storage systems and promoting cooperation with oil-producing countries and neighboring countries.
- Enhancing disaster response capability of refineries, service stations, as well as ensuring stable supply of petroleum products in everyday life.
- Establishing an emergency response system to coordinate among public agencies.
- Encouraging critical consumers(hospitals, etc.) to store petroleum products for emergency.
- Enhancing resilience of the electricity/gas supply system.

8. Future of the secondary energy supply structure

(1) Promoting co-generation and introduction of storage batteries

- Examination of a new dealing to introduce electricity from co-generation to the market.

(2) Facilitating new technologies, which can use new energy sources, to introduce competition among energy sources in such new energy vehicles

- Aiming that a sale of new next-generation automobiles will reach at 50% through 70% in total new vehicles sale by 2030.

(3) Realization of the “Hydrogen Society”

- Promoting residential fuel cells “Ene-farm” to 5.3 million in 2030.
- Building 100 hydrogen refueling stations in 2015.
- Commercialization of advanced technologies such as Hydrogen Power Generation.
- Continuing R&D efforts for the technologies such as hydrogen production ,transport and storage.
- Making a roadmap to realize the “Hydrogen Society” in Spring 2014.

Basic policies for measures to secure energy supplies

Significance and status of the use of hydrogen energy → A promising secondary energy source from the perspective of energy security and environment, etc.

[Significance of the use of hydrogen energy]

○ Significance as an energy policy

Energy security

- Hydrogen, which is produced from a variety of primary energy sources, can be stored and transported in various ways.

Low environmental burden

- Hydrogen is energy efficient and its consumption produces less greenhouse gases.

Resilience

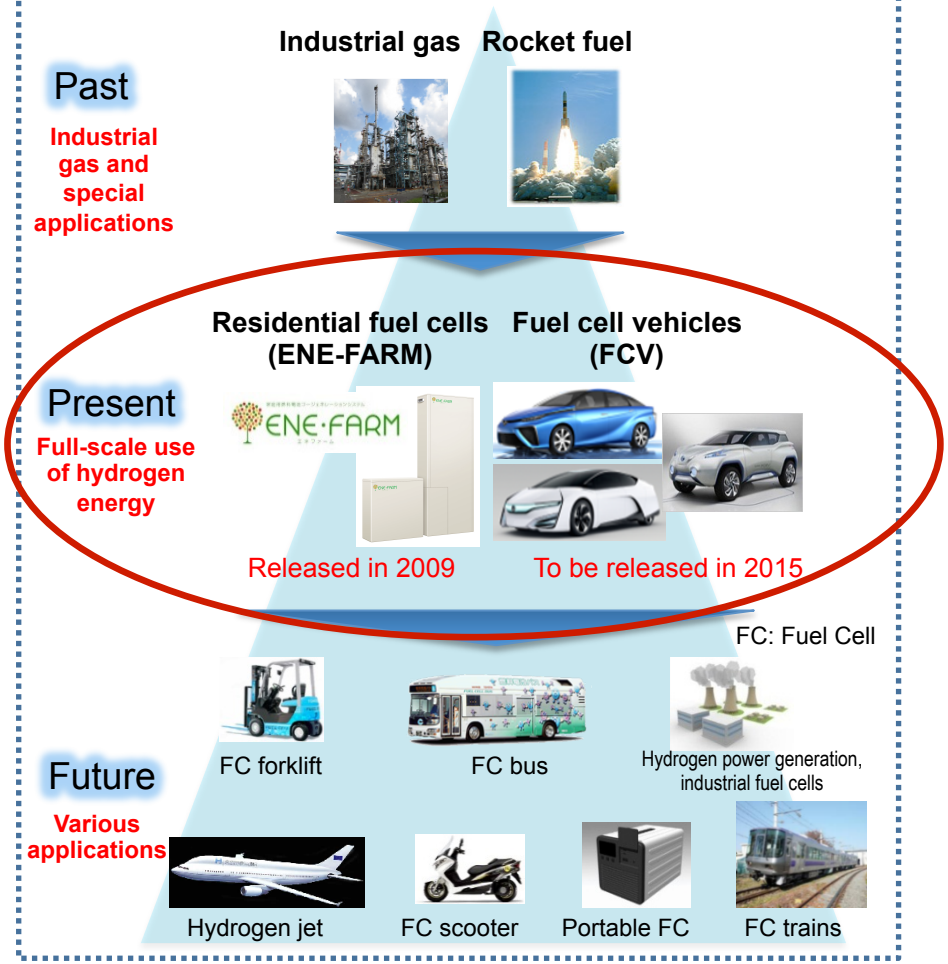
- Stationary fuel cells function as distributed energy sources.
- Fuel cell vehicles provide electricity in times of emergency.

○ Significance as an industrial policy

Japan's technological advantage

- As for hydrogen-based fuel cells, patents applied in Japan outnumber those applied in the West, accounting for about 60% of those applied in major countries, which is the source of Japan's competitiveness.

[Current use of hydrogen energy]



9. Energy leading Growth Strategy : creation of new energy enterprises etc,

(1) Big turnaround of industrial structure in energy sector

- Facilitating new entries by new servicers to energy markets through electricity/gas system reforms.

(2) Fostering new energy enterprises

- Mitigating regulations for creation of comprehensive energy enterprises.
- Promoting smart communities which would give a new energy supply service with other regional public services.

(3) Creation of new energy markets and development of international energy markets

- Facilitating of Japan's advanced technologies such as storage batteries and fuel cells.
- Promoting exports of energy related infrastructures such as efficient thermal power plants, nuclear power plants and technologies for renewable energy and energy conservation.

10. Strengthening comprehensive international energy cooperation

- Contributing to multilateral energy cooperation frameworks such as the IEA and IAEA.
- Utilizing EAS as a framework to secure energy security with ERIA.
- Enhancing bilateral energy cooperation, especially Japan-US energy cooperation should be more comprehensive.

Ⅳ. Promoting strategic R&D

- Formulating a roadmap for technological development by next summer.
- Accelerating innovative technological development such as
  - -lower-cost storage batteries and fuel cells
  - -higher efficiency coal/gas thermal power generation
  - -technologies to reduce nuclear fuel waste and so

Ⅴ. Communication with all levels of society on energy issues

- Sharing energy issues with all levels of Japan's society more.
- Expansion of inter-active communication with various people.

Thank you for your attention.

You can take the strategy under the following address.

http://www.enecho.meti.go.jp/en/category/others/basic_plan/pdf/4th_strategic_energy_plan.pdf