Peaceful uses of atomic energy in Japan

Japan Atomic Energy Commission

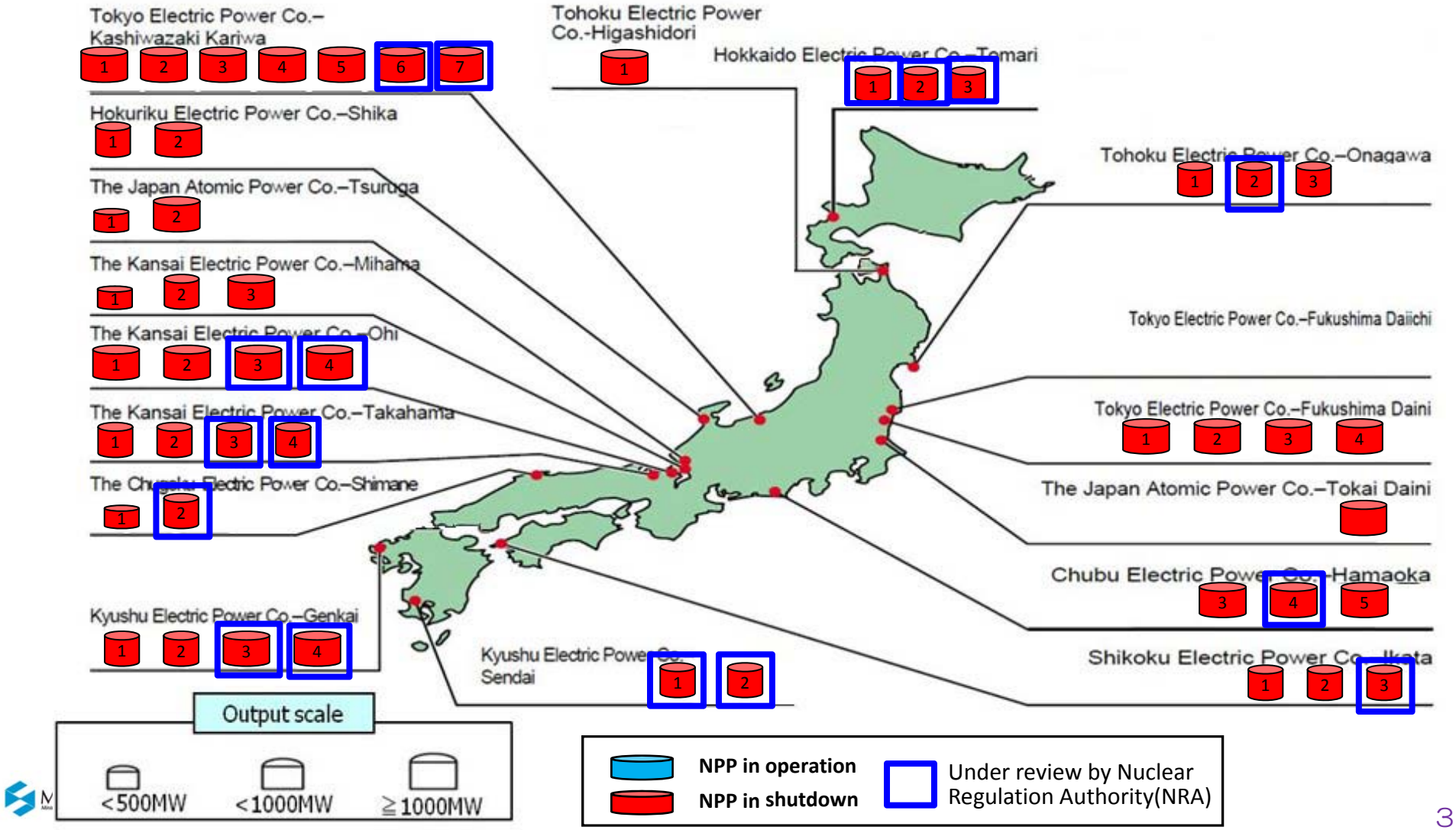
chair

Yoshiaki Oka

contents

Nuclear Power Plants in Japan

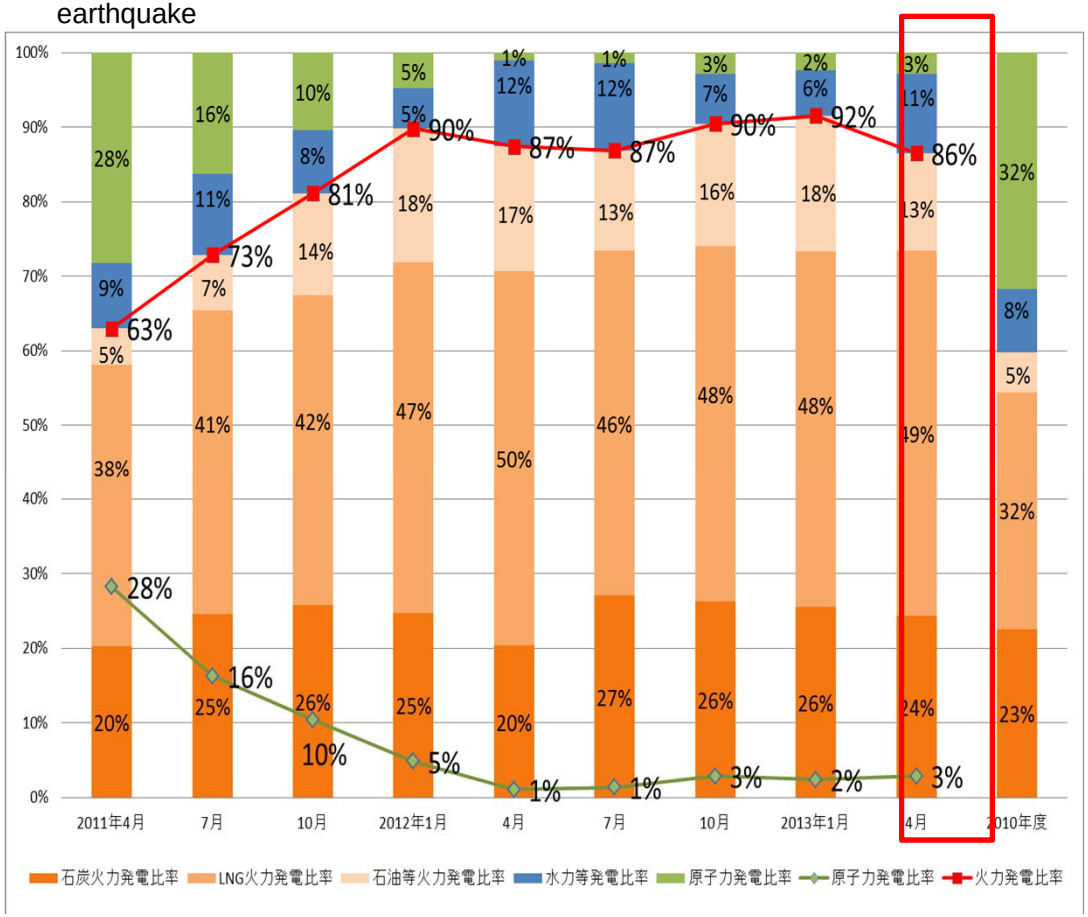
- There are 48 nuclear power plant units in Japan.
- **All units (in red) are in a state of temporary shutdown** as of March 3 2014.
- **17 units (in blue squares)** are under review for restart by the Nuclear Regulation Authority in accordance with its new safety regulations.



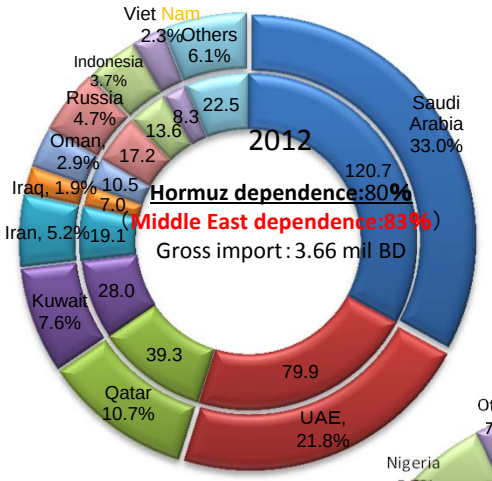
(Ref.) Excessive dependence on thermal power may jeopardize the stable supply of electric power

1. Due to the shutdown of nuclear power plants, Japan's present dependence on thermal power (about 90%) is higher than that at the time of the oil crisis. Because the prices of fossil fuels are on an upward trend, this situation may become a disadvantage in price negotiation.
2. About 80% of petroleum was imported from the Middle East at the time of the oil crisis. Dependence on petroleum decreased after then owing to energy saving efforts and the increase of nuclear power plants, but more than 80% is still imported from the Middle East even now. If concerns grow about a tightening of petroleum supply by a blockade of the Straits of Hormuz, energy prices may rise further or the stable supply of energy and electric power may be jeopardized.

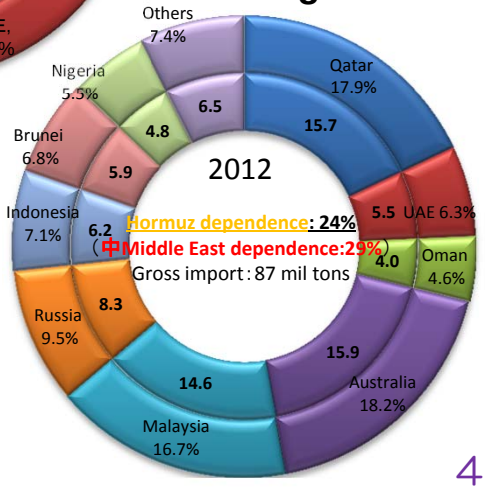
➢ Transition of power source composition in public / wholesale power industries after the earthquake



Crude oil



Natural gas



(Ref.) Impact on the people's life and concern of the hollowing out of industry due to increase in electricity tariffs

1. Six utilities have already raised electricity tariffs due to the increase in imports of fossil fuel (approx. 10% increase for regulation division and 15% increase for liberalization division respectively)
2. The utilities that raised the electricity tariff are to calculate their tariff level assuming the restart of the nuclear power plants. If restarts were postponed than expected, their financial results might deteriorate, which will lead to an additional increase of electricity tariffs.

※ Without any operation of nuclear power plants, additional USD 36 billion equivalent will be needed for the additional fuel cost for other thermal power plants, which will result in approx. additional 25% increase of electricity tariff based on the calculation of total electricity cost in FY2012.

		Increase		Date of application	Date of implementation
		Applied	Approved		
Tokyo Electric Power Company	Regulation division	10.28%	8.46% (▲1.82%)	May 11, 2012	September 1, 2012
	Liberalization division	(16.39%)	(14.90%) (▲1.49%)	-	After April 1, 2012
Kansai Electric Power Company	Regulation division	11.88%	9.75% (▲2.13%)	November 26, 2012	May 1, 2013
	Liberalization division	(19.23%)	(17.26%) (▲1.97%)	-	After April 1, 2013
Kyushu Electric Power Company	Regulation division	8.51%	6.23%(▲2.28%)	November 27, 2012	May 1, 2013
	Liberalization division	(14.22%)	(11.94%) (▲2.28%)	-	After April 1, 2013
Tohoku Electric Power Company	Regulation division	11.41%	8.94% (▲2.47%)	February 14, 2013	September 1, 2013
	Liberalization division	(17.74%)	(15.24%) (▲2.50%)	-	After September 1, 2013
Shikoku Electric Power Company	Regulation division	10.94%	7.80%(▲3.14%)	February 20, 2013	September 1, 2013
	Liberalization division	(17.50%)	(14.73%) (▲2.77%)	-	After July 1, 2013
Hokkaido Electric Power Company	Regulation division	10.20%	7.73% (▲2.47%)	April 24, 2013	September 1, 2013
	Liberalization division	(13.46%)	(11.00%) (▲2.46%)	-	After September 1, 2013

* It indicates an increase rate at the liberalization division for cost calculation corresponding to the increase rate at the regulation division, and the electricity rate at the liberalization shall be determined through negotiations between the parties concerned in principle.

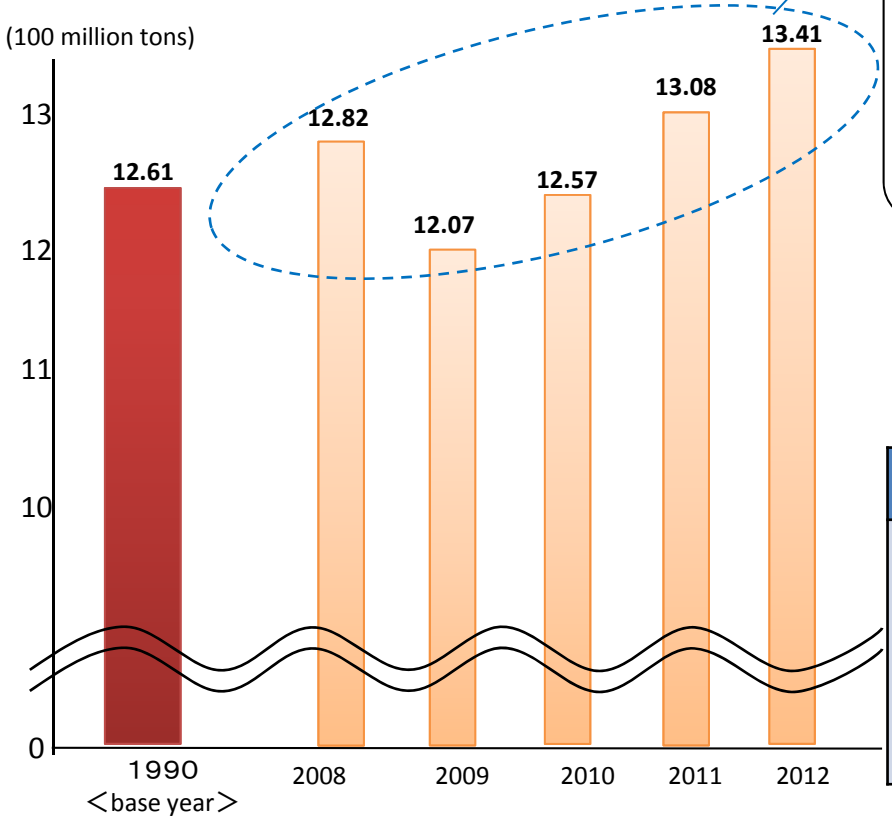
(Ref.) Increase in greenhouse gasses due to the shutdown of nuclear power plants

1. Increase in greenhouse gas emissions after the disaster has been considerably caused by additional utilization of thermal power for replacing nuclear power generation (fiscal 2012: 1.351 billion tons).
2. On the other hand, the reduction target of the Kyoto Protocol, 6% was achieved.
3. The future framework on and after 2020 will be intensively discussed from 2014, and will reach an agreement by 2015.

[Ref 1] CO2 emissions from the power generation increased in fiscal 2012 by 110 million tons over fiscal 2010 (380 -> 490 million tons).

[Ref 2] Increase in CO2 emissions when the power generation by one nuclear reactor (1.2 million kW) is replaced by thermal power (coal) is about 6.1 to 6.5 million tons.

➢ Transition of greenhouse gas emissions



Total emissions during five years (FY 08 to 12) = about 6.4 billion tons

(1) Forest absorption — **about 0.24 billion tons**

(2) Credit write-off by the Japanese government — **about 0.1 billion tons**

(3) Credit write-off by Federation of Electric Power Companies of Japan — **about 0.2 billion tons**

About 5.86 billion tons

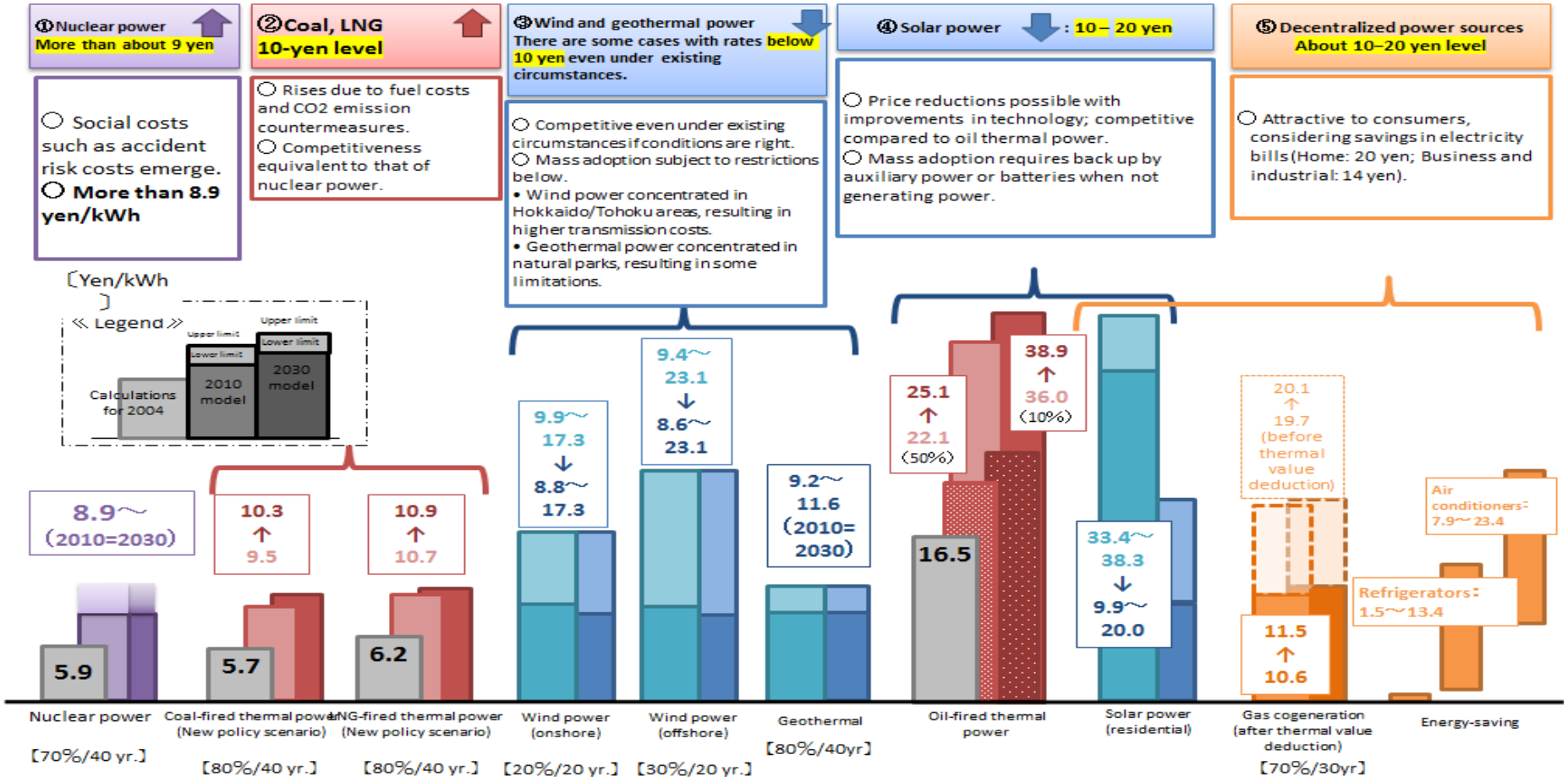
6% reduction target (5.93 billion tons) over the base year 1990 was achieved throughout FY 08-12.

(unit: million t-CO2)

		FY2008	FY2009	FY2010	FY2011	FY2012
GHG emissions	from energy	1,138	1,075	1,123	1,173	1,207
	from power generation	395	353	374	439 (+65)	486 (+112)
	from the other energy sources	743	722	749	734	720

Nuclear Power Generation Cost in Comparison with Other Power Sources

1. The provisional cost estimate undertaken by the “Cost Examination Committee” in Dec. 2011 included not only the generation cost of facilities, fuel, maintenance etc. but the social cost such as the accident risk cost, the CO2 emission countermeasures cost, and other policy related costs.
2. The nuclear power generation cost, in consideration of the above accident risk cost, was estimated a little over JPY 8.9/kWh, which is not inferior to that of other power sources. (In cases of power plants being compliant with the new regulatory standard, the accident probability definitely decreases.)
3. The nuclear power generation has been utilized as an important baseload power source in Japan.



Countermeasures against Accident Risk

1. The Act on Compensation for Nuclear Damage specifies the duties of liable nuclear power operators to prepare the compensation measures (insurance, government guarantee etc.) for the compensation of damage at the time of nuclear accidents.

2. In some foreign countries, there are examples of additional measures to supplement the utilities' compensation such as support by public funds and emergency measures at the time of shortage of utilities' funds.

Country		Japan	Germany	Switzerland	U.S.	South Korea	UK	France
Liability Amount	Limited/Unlimited	Unlimited	Unlimited	Unlimited	Limited	Limited	Limited	Limited
	Limit of Operator's Liability	—	—	—	Equivalent to Compensation Amount	SDR 300 mil	Equivalent to Compensation Amount	Equivalent to Compensation Amount
Immunity		Insurrection & Abnormally Large Disaster	N/A	Victim's Willful Misconduct or Grave Error	War etc.	Armed Conflict etc.	Armed Conflict	War, Armed Conflict, Abnormally Large Disaster
Compensation Measure Amount		JPY 120 B	EUR 2.5 B	CHF 1.1 B	USD 11.9 B	KRW50 B	GBP140 mil	EUR 91.5 mil
Public Fund (with Amount Preset)	Measures	—	1) In case the utility's measures do not function 2) Compensation based on the Brussels Supplementary Treaty in case the compensation exceeds €2.5 billion (including overseas contribution)	Compensation if the utility's measures do not function, or in case of accidents abroad	—	—	Compensation based on the Brussels Supplementary Treaty (including the contribution from overseas) in case the compensation exceeds the set compensation amount.	Same as UK
	Limit Amount	—	1) EUR 2.5 B 2) SDR 125 mil	CHF 1.1 B	—	—	SDR 300 mil	SDR 300 mil
Measures to be Taken if Prepared Fund is Not Enough		Aid if it is regarded necessary , (Article 16)	In case funds are not enough for compensation, necessary legislative measures are taken. (Article 35)	In case the compensation necessity exceeds way over the set compensation amount and the utility's financial capacity, necessary legislative measures are taken. The government's assistance as required. (Article 29)	If the amount of public liability (insurance and mutual aid) is short of the necessity, the Congress will take measures, based on the President's report, for full compensation.	In case the damage exceeds the set compensation amount, the assistance will be provided if it is regarded necessary. (Article 14)	300 mil SDR can be added upon the approval of the Finance Ministry. (Article 18, 1B)	If the compensation exceeds 300 mil SDR, necessary legislative measures are taken. (Article 13)
Status of Treaty Ratification		—	Paris Brussels	Amend Paris (not Effective) Amended Brussels (not Effective)	CSC (not Effective)	—	Paris Brussels	Paris Brussels

※1USD＝JPY100, 1EUR＝JPY130, 1CHF ＝JPY108, 1KRW＝JPY0.09, 1GBP= JPY160, 1SDR＝JPY150

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

Nuclear Power Plant
(Spent fuel pool, etc.)

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

Spent Fuel

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

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

Vitrified Waste

Geological disposal repository

Spent Fuel

Off-site storage facility (Spent Fuel Interim Storage)

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

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

Spent Fuel

Next reprocessing plant

Fast Breeder Reactors(FBR)

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

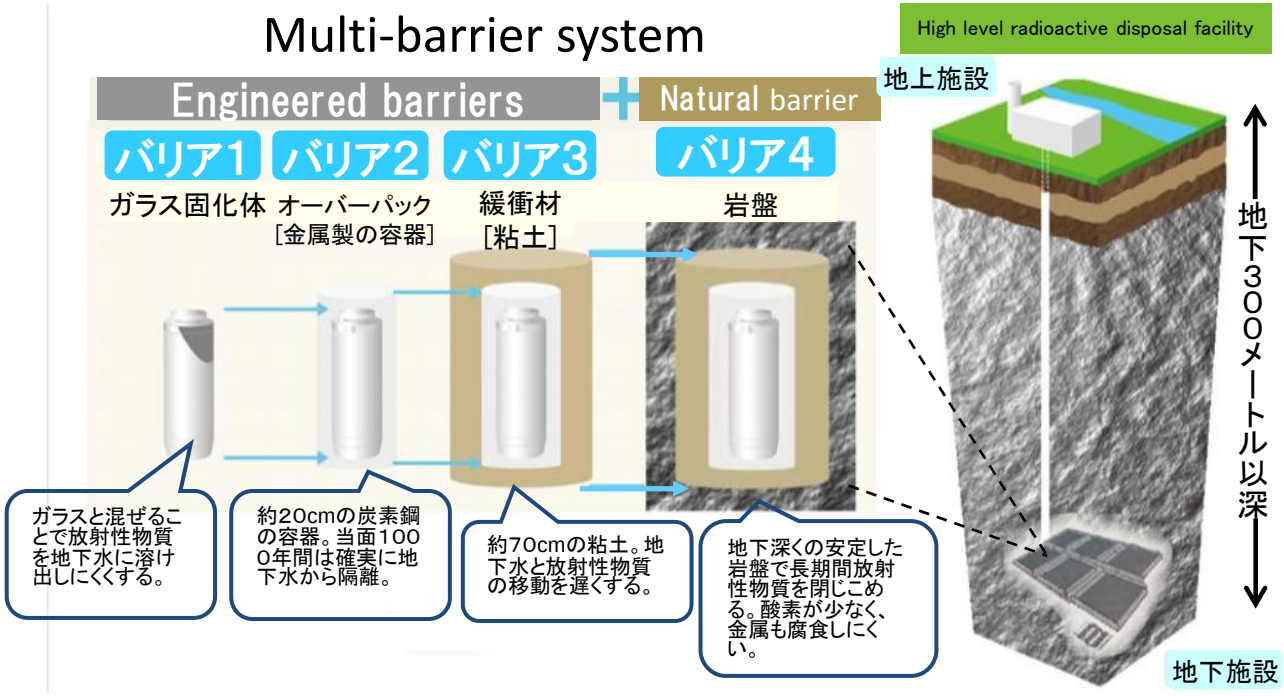
Waste from operation

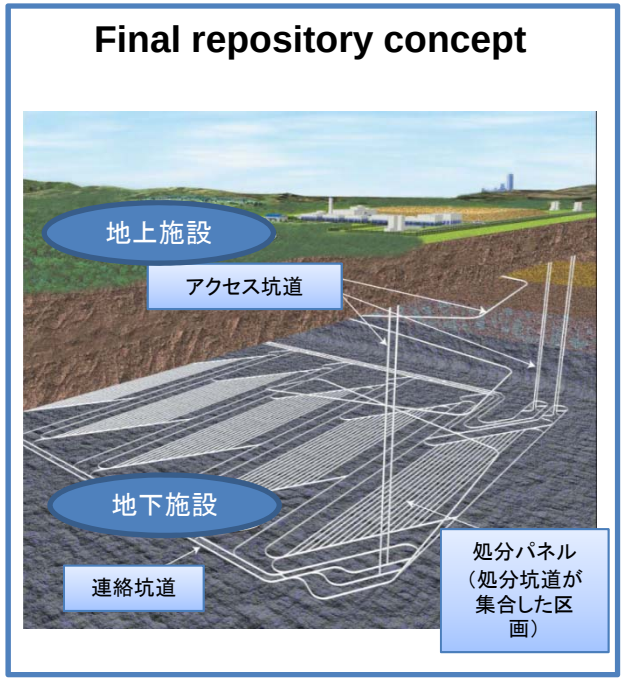
Sub-surface disposal test cavern

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

High level radioactive waste

1. After cooling at Rokkasho storage facility, vitrified waste canisters with over-pack will be buried more than 300m deep in the ground of final repository.
2. Combination of natural and engineered barriers, multiple barriers isolate high level waste from human environment/
3. Final repository will be designed to sore more than 40,000 vitrified waste canisters.

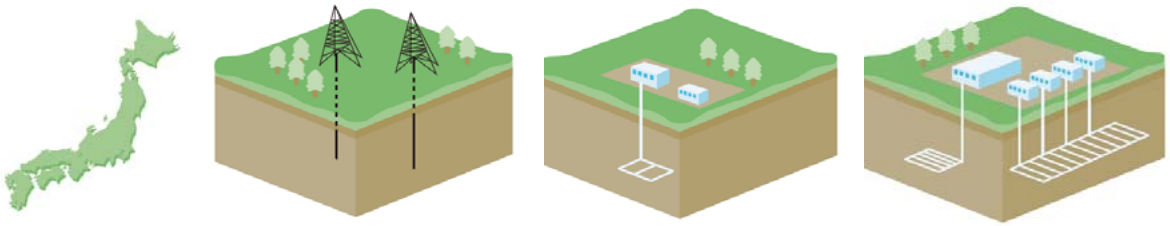




Selection of final repository and schedule

Final repository will be selected in three phases. Public hearing of local community will be held at the end of each phase. Next step will not be taken, if local community disagrees.

Selection process based on the law in 2000.



Selection of sites for rough survey

Selectio of sites for detailed survey

Selection of a repository site

Start operation

Application from potential sites

Gov. 申し入れ

Accept

①Literature survey
Past seismic, volcanic activities etc.
(2 years)

② 1st phase
Boring, 、geological survey
(3 years)

③2nd phase
Both surface and underground examination
(15 years)

Constuction of facility
(10 years)

Operation
(50 years)

Closure of underground facility
(10 years)

Monitoring after closure
(300years)

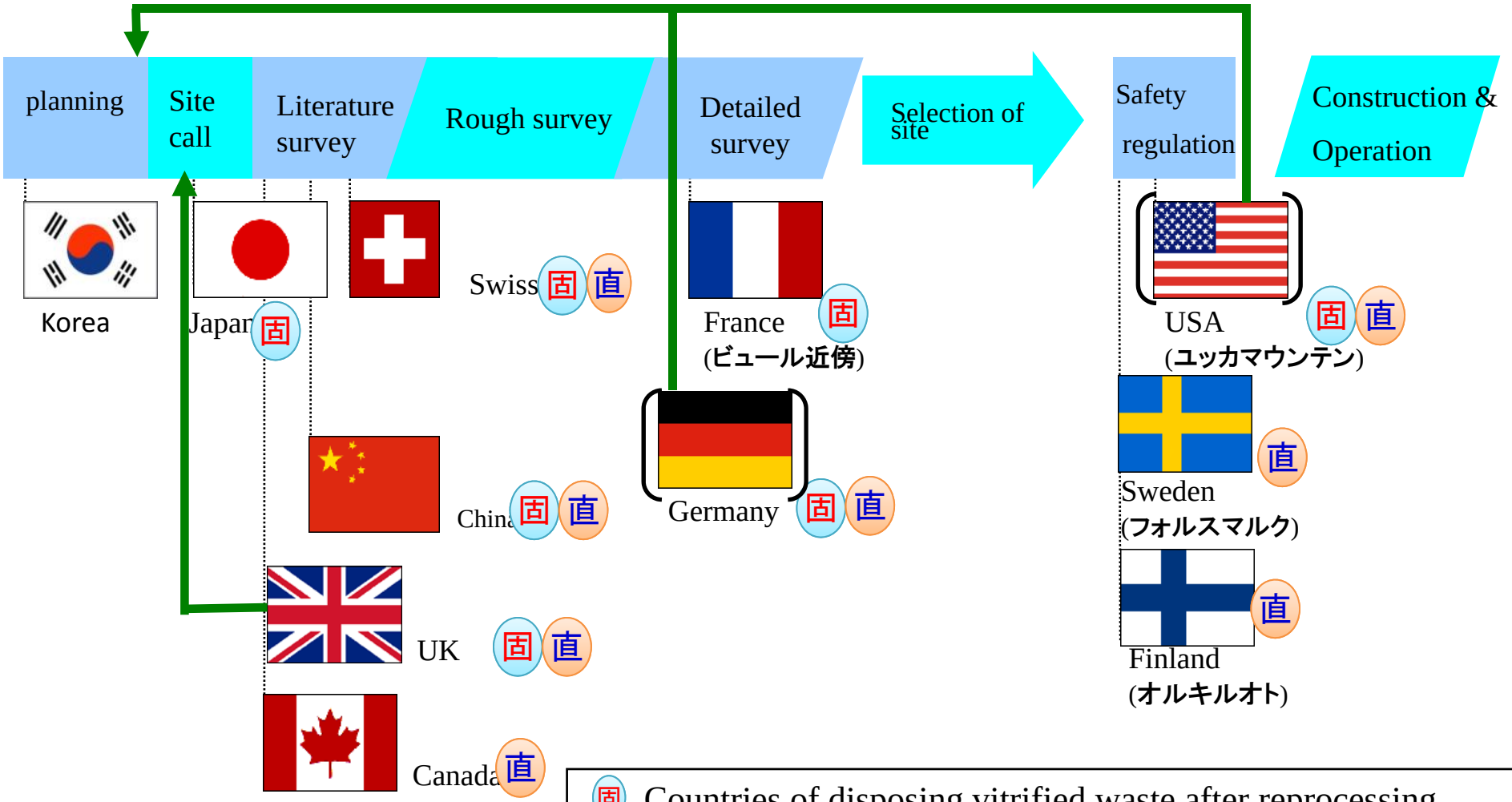
Start closure of underground facility

Next step will not be taken, if local community disagrees.

Maintain retrievability until closure of the repository (report of Advisory committee of energy in 2006)

High level radioactive waste repositories in the world (May 2013)

1. Fundamental principle: Dispose own radioactive waste in the country.
2. International understanding: Deep underground disposal is the most realistic way.



Issues and action plans (draft)

(Issue 1) Insufficient understanding of the safety, although the disposal is the responsibility of the present generation.

⇒ Action 1. **Deep underground repository** is the main option. **Maintain retrievability and reversibility** for selection of future generation. Evaluate the option quantitatively. Study and survey other options.

(Issue 2) Previous action of calling candidate local sites did not work well, because it did not answer the question, why here? Burden of local government was too heavy.

⇒ Action 2. **Central government will propose sites from scientific bases.** Central government will promote understanding and propose multiple candidate sites to local government, prepare for consensus building and supports.

Based on the discussion of Advisory committee of Energy, Central government will prepare concrete plan and revise basic principle of high level waste disposal in Japan.

Draft plan toward final disposal

Previous plan

Call for local government that will accept investigation

Application

Due process

- Literature survey
- Rough survey
- Detailed survey
- Site selection

※Next step will not be taken, if local community disagrees.

New accelerated plan (draft)

Selection of potential sites from scientific base (Mapping)

Understanding activities at selected sites

Application from local government
Proposal from central government to sites.

Due process

- Literature survey
- Rough survey
- Detailed survey
- Site selection

※Next step will not be taken, if local community disagrees.

Retrievability & Reversibility

Periodic review of geological disposal options, Study of alternative options

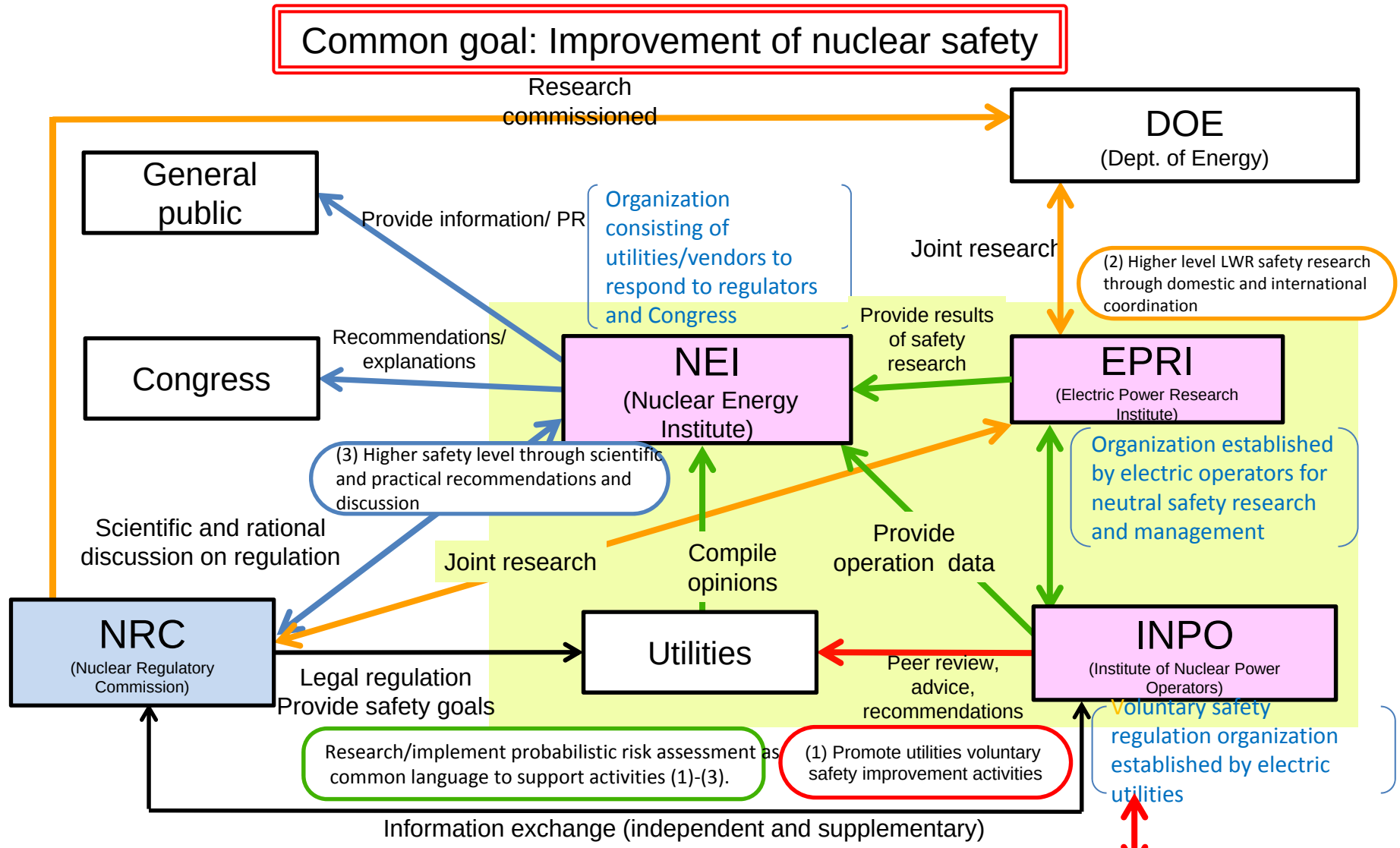
Industry-based initiatives in voluntary efforts toward safety enhancement

1. Nuclear safety should be determined by the expert and scientific decision of the NRA. At the same time, it is a matter of course that the operator holds the primary responsibility to ensure safety and must always aim to achieve safety levels that exceed regulatory standards.
2. Japan must shed the "safety myth" that nuclear plants pose no risk as long as they meet regulatory standards. It is important that industry aims for new heights in pursuing the world's highest level of safety through continuous and voluntary safety improvement.
3. Therefore, the **Working Group on Voluntary Efforts and Continuous Improvement of Nuclear Safety** has been established as an advisory committee of METI to examine the way to reform the mindset of industry and to clarify the issues that need to be resolved as voluntary measures.

Ten Issues to be discussed at the WG

(1) Shedding the "Safety Myth"
(2) Strengthen Management to Handle Risks Unique to Nuclear Power
(3) Proactive Implementation of New Findings in Japan and Abroad
(4) Fully Enforce Awareness to Aim for Safety Levels that Exceed Regulations
(5) Define Rules-of-thumb to Help Continuous Improvement of Safety
(6) Comprehensive and Continuous Risk Assessment for Plants
(7) Implementing Appropriate Risk Communication
(8) How Operators Engage Nuclear Safety
(9) Necessary Mechanism for Voluntary and Continuous Improvement of Safety
(10) Conducting Effective Safety Research

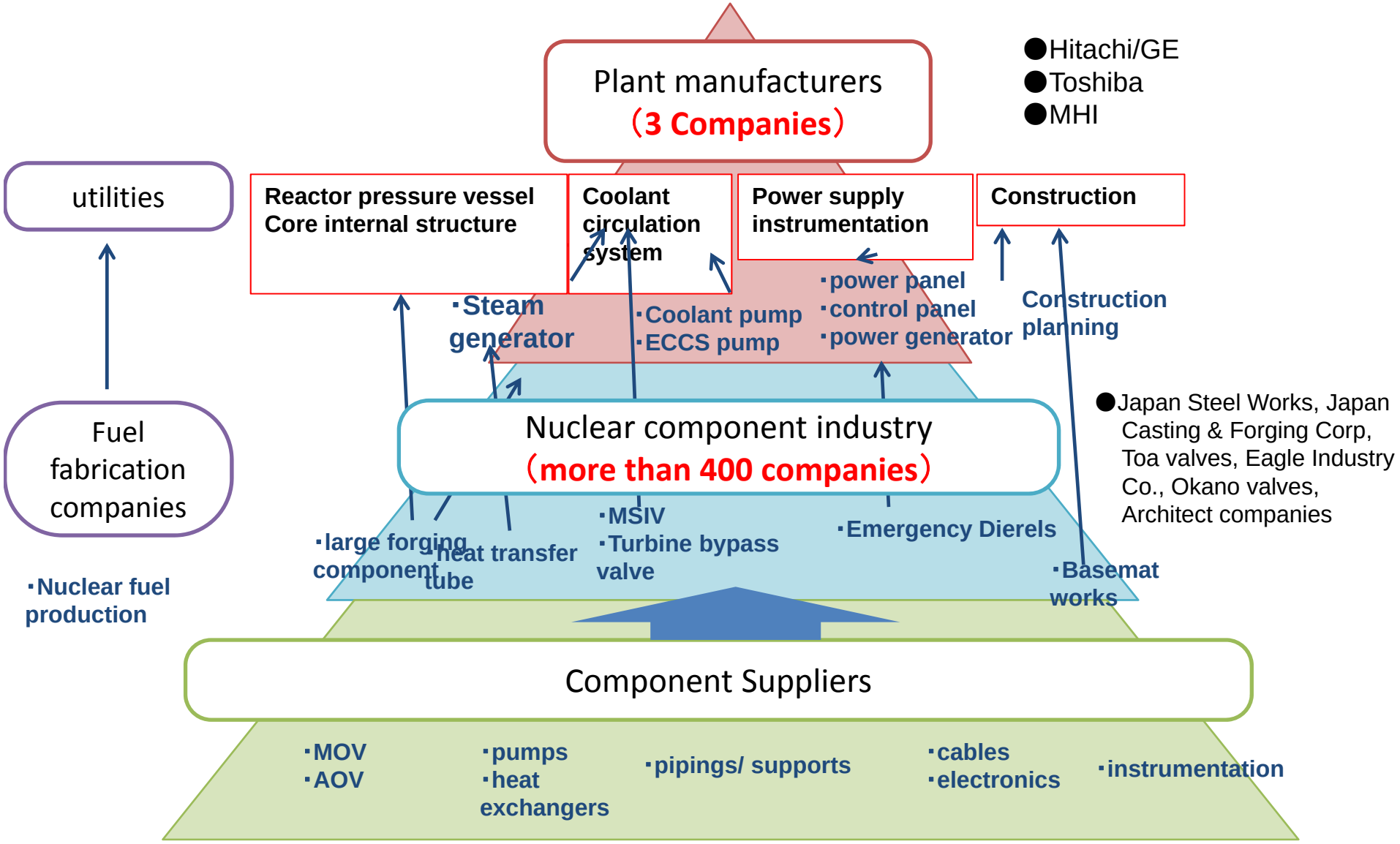
Voluntary and Continuous Safety Improvement Mechanism in US Industry



※INPO : Institute of Nuclear Power Operations
NEI : Nuclear Energy Institute
EPRI : Electric Power Research Institute
NRC : Nuclear Regulatory Commission
PRA : Probabilistic Risk Assessment

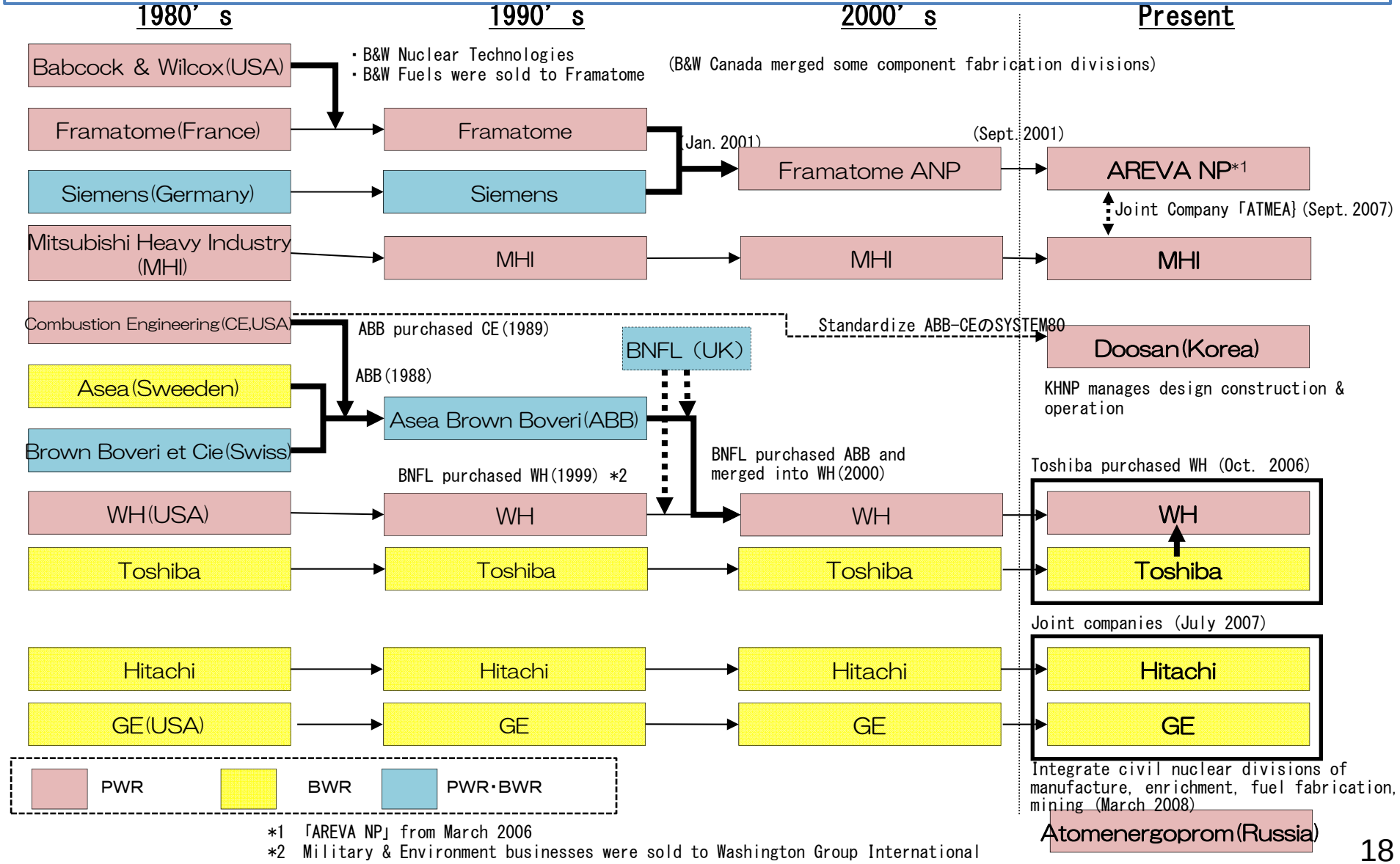
Nuclear industry structure in Japan

Supply chain of Nuclear Power Plant



Nuclear Power Plant Manufacturers in the world

1. Oligopoly proceeds by mergers and purchases
2. Competition increases: USA, France, Japan: Russia&Korea emerges. Chinese industry too.



*1 「AREVA NP」 from March 2006
*2 Military & Environment businesses were sold to Washington Group International

Importance of nuclear Safety, non- proliferation and Nuclear security

1. Need to prevent from diverting military applications and influencing an accident to other companies
2. Necessary to secure 3S (①Safety ②non-proliferation/ safeguards ③nuclear security)
3. Japan needs to contribute the peaceful uses of nuclear energy in the world as the only country utilizing full sets of nuclear power and fuel cycle technologies and suffering from TEPCO's accidents

International framework for non- proliferation and peaceful use of atomic energy

IAEA started in1957

①Promote peaceful uses of Atomic Energy: Technical support of R&D, Prepare/ disseminate safety guidelines
②Prevent military application:・conduct nuclear safe guides

NPT effecture in 1970

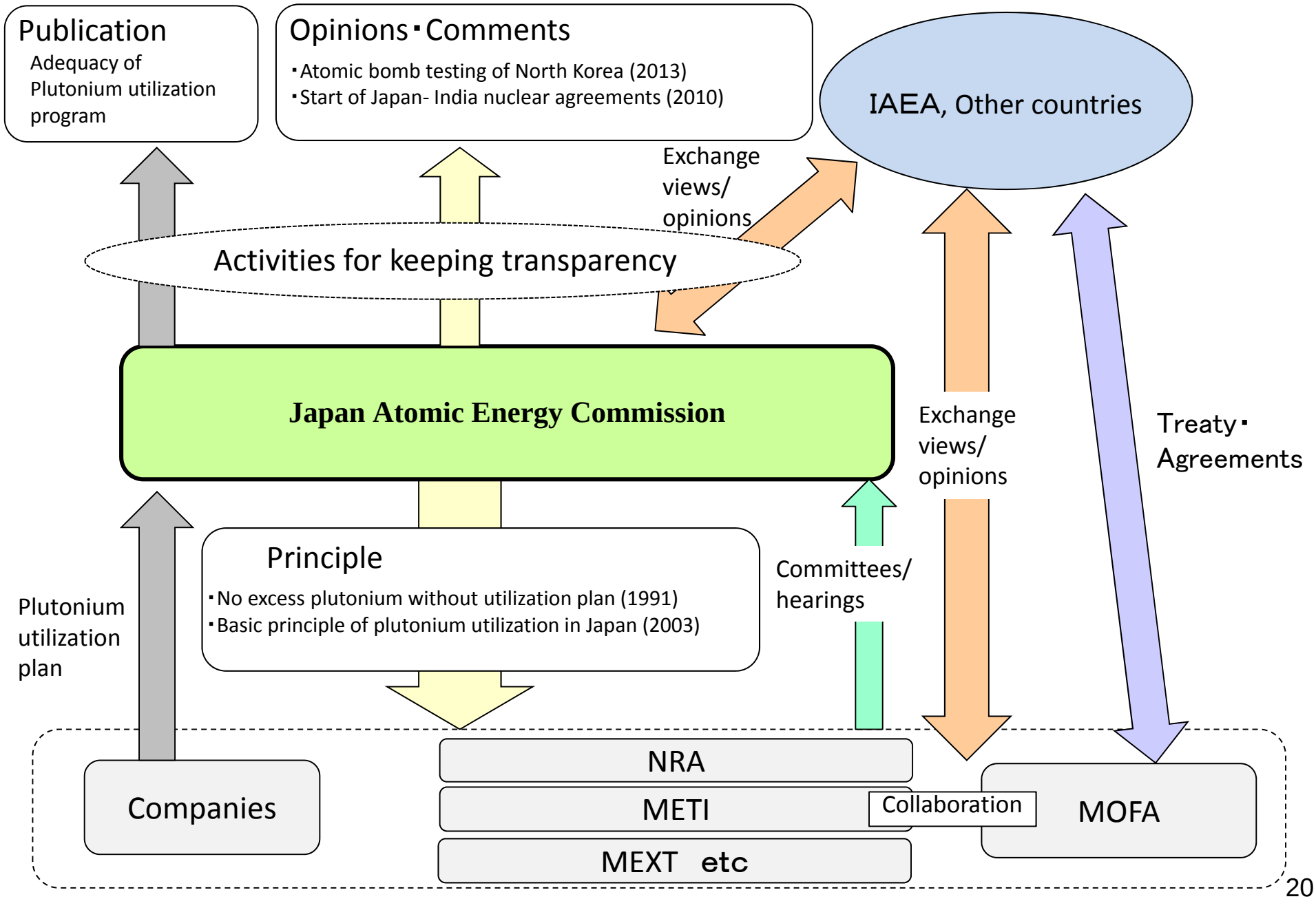
India, Pakistan and Israel are not participated.

①Non- prolifection nuclear disarmament;Prohibit nuclear weapon countries(USA, Russia, UK, France, China) from diversion of nuclear weapons. Prohibit non- weapon countries from receiving/ fabricating of nuclear weapons, and Sincere participation of disarmament
②Peaceful uses is the inalienable right, IAEA safeguards are applied to non- weapon countries

NSG guidelines prepared in 1978

When transferring nuclear components to non- weapon countries, the following items need to be assured:・Accept comprehensive safeguards of IAEA,・Peaceful use of the transferred components, ・Re- assurance is required when transfer them farther.

Peaceful Uses of Atomic Energy in Japan (policy)



Peaceful uses of Atomic Energy, Actions of Japan Atomic Energy Commission

Enhance transparency of plutonium utilization from early 90's

◆「Recycle of Nuclear fuel in Japan」(1991)
⇒Principle of not- having plutonium without utilization purposes

◆Publish plutonium management in Japan(1994～)

◆Report of amount of plutonium to IAEA based on the international guidelines (prepared by 9 countries) effective in December 1997

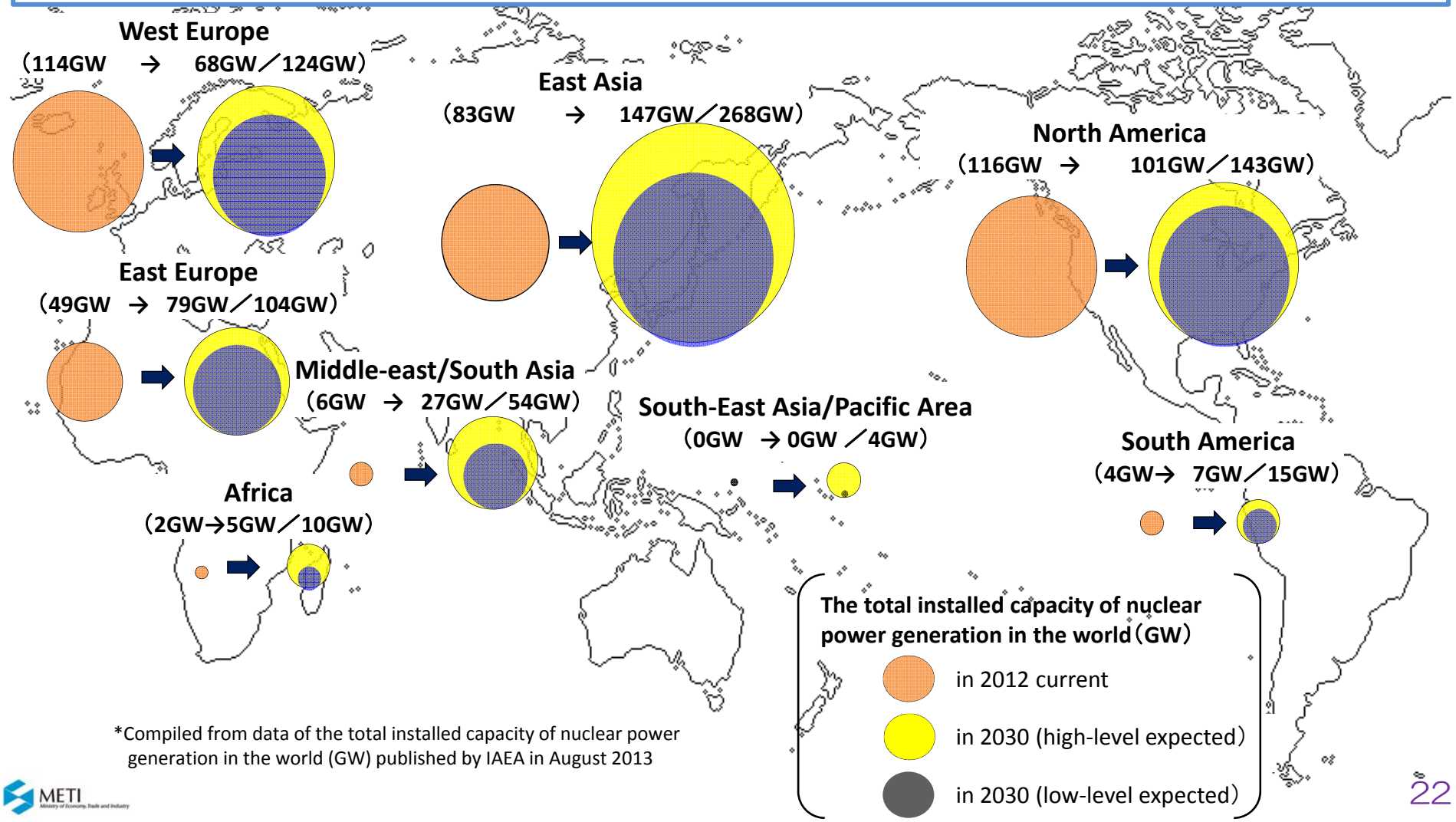
◆Fundamental principles of plutonium utilization in Japan(2003)
⇒Utilities report plutonium utilization plan every year. JAEC will wakes sure of the utilization purposes

◆making sure of adequacy of plutonium utilization purposes(2006～)

Outlook for Major National and Regional Markets

○ 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

Expectations for Japan's Nuclear Technology after Fukushima (2)（U.S.）

1. Amid global expansion of nuclear power generation, **the Unites States has a strong interest in securing non-proliferation as well as nuclear safety and security in the world**.
2. The United States strongly expects Japan to be its reliable partner for non-proliferation and nuclear safety and security.

●The 3rd Armitage-Nye Report issued by CSIS on August 15, 2012 (Excerpt)

(i) A permanent shutdown will also stymie responsible international nuclear development, **as developing countries will continue to build nuclear reactors.** --- **China could eventually emerge as a significant international vendor. As China plans to join Russia, South Korea, and France in the major leagues of global development in civilian nuclear power, Japan cannot afford to fall behind** if the world is to benefit from efficient, reliable, and safe reactors and nuclear services.

(ii) **Japan and the United States have common political and commercial interests in promoting safe and reliable civilian nuclear power domestically and internationally.**

(iii) **Safe, clean, responsibly developed and utilized nuclear power constitutes an essential element in Japan's comprehensive security.** In this regard, U.S.-Japan cooperation on nuclear research and development is essential.

●John J. Hamre, President and CEO of the CSIS (Former Deputy Secretary of Defense)

"**Japan is one of the strongest countries in the world in the field of commercial nuclear energy use.** However, if Japan abandons domestic use of nuclear power, the country must lose its position."

"Should that ever happen, nuclear power plants would be constructed mainly in China, India, Persian Gulf states and Russia, in future. However, none of these countries is the one to take the lead in promoting non-proliferation regime. **When the present three-polar system should collapse, countries that do not necessarily share the goal of non-proliferation would come to have a larger influence. Then, the world would be exposed to a larger proliferation threat."**

"The United States needs to have partners to support non-proliferation. **Japan has been ever the strongest partner of the United States**."

（Interview by *Asahi Shinbun* on October 24, 2012）

Expectations for Japan's Nuclear Technology after Fukushima (1)

Country	Summary of comments
Viet Nam (Prime Minister)	The Prime Minister of Viet Nam mentioned about new NPP construction in Viet Nam in which Japan will be involved: "I have confidence in Japan's high-level technology and nuclear safety. I also believe that Japan will further develop its nuclear technology through lessons and experience learnt from the Fukushima accident." (April 21, 2012)
Turkey (Minister of Foreign Affairs)	The Minister of Foreign Affairs of Turley mentioned about the negotiation on NPP import from Japan: "I have confidence in Japanese nuclear safety and technology. I would like to promote cooperation with Japan for nuclear power plant construction in Turkey." (January 8, 2013)
Brazil (Mines and Energy Minister)	The Mines and Energy Minister of Brazil responded to Minister Motegi, METI of Japan: "We would like to utilize high level nuclear technology of Japan", when Motegi expressed his willingness to support Brazil's plan of NPP construction. (May 2, 2013)
Lithuania (Prime Minister)	The Prime Minister of Lithuania expressed his expectation for high level nuclear technology of Japan to Lithuania's new NPP construction plan at the Japan-Lithuania summit. (February 20, 2012)
United Kingdom (Minister of State for Universities and Science) (First Minister of Wales)	The Minister of State for Universities and Science of UK expressed in the bilateral meeting with Minister Furukawa that he hoped to build a cooperative relationship with Japan based both on the accumulation of the knowledge and technology related to nuclear power in the UK and on lessons and experience learnt from the Fukushima Daiichi accident. (April 10, 2012) First Minister of Wales of UK mentioned: "I was very impressed with the nuclear power plants of Japan" when the Minister visited Oma NPP site. He also expressed his expectation that new Japanese-designed NPPs with enhanced safety based on the lessons and experience of the Fukushima Daiichi NPS accident, will be constructed in the UK. (April 10, 2013)
Poland (Prime Minister)	The Prime Minister of Poland expressed his expectation that Poland will promote cooperation with Japan in the field of nuclear power, renewable energy, smart grids, etc. at the Japan-Poland summit. (June 16, 2013)

Towards the decommissioning of TEPCO's Fukushima Daiichi NPS

1. On 21 December 2011, the Government and the TEPCO Council adopted "the Mid-and-Long-Term Roadmap towards the decommissioning of TEPCO's Fukushima Daiichi NPS"
2. In February 2013, the Nuclear Emergency Response Headquarters established "The Council for the Decommissioning of TEPCO's Fukushima Daiichi NPS." The Council adopted the revised Mid-and-Long-Term Roadmap ver. 2.0. on 27 June, 2013 (to accelerate the schedule for fuel debris removal, etc.)
3. In August 2013, the government established an organization to manage R&D activities in an integrated manner.
   → International Research Institute for Nuclear Decommissioning (IRID)

Council for the Decommissioning of TEPCO's Fukushima Daiichi NPS

(Established by the Nuclear Emergency Response Headquarters in February 2013)

→ Enhance the further collaboration between on-site work and R&D through involvement of relevant R&D bodies into Government of Japan and TEPCO.

Chair:	Toshimitsu Motegi, Minister of METI
Vice Chair:	Kazuyoshi Akaba, State Minister of METI
	Teru Fukui, State Minister of MEXT
Members:	Shojiro Matsuura, JAEA Chair of the board directors
	Naomi Hirose, TEPCO President and CEO
	Norio Sasaki, Toshiba President and CEO
	Hiroaki Nakanishi, Hitachi CEO
	Shunichi Tanaka, NRA Commissioner
	Hironori Nakanishi, DG of METI
Observer:	Masao Uchibori, Fukushima vice-governor

International Research Institute for Nuclear Decommissioning (IRID)

Gathering international expertise for the R&D management organization
→Appoint international advisors
→Establish an international collaboration department
→Establish an international decommissioning expert group

Mid -to-Long Term Road Map

Phase 1: Period up to the commencement of the removal of the fuel from the spent fuel pool (within 2 years)

-Commence the removal of fuels from the spent fuel pools
-Maintain reactor cooling and accumulated water processing and improve their reliability.
-Start R&D and decontamination towards removal of fuel debris, etc.

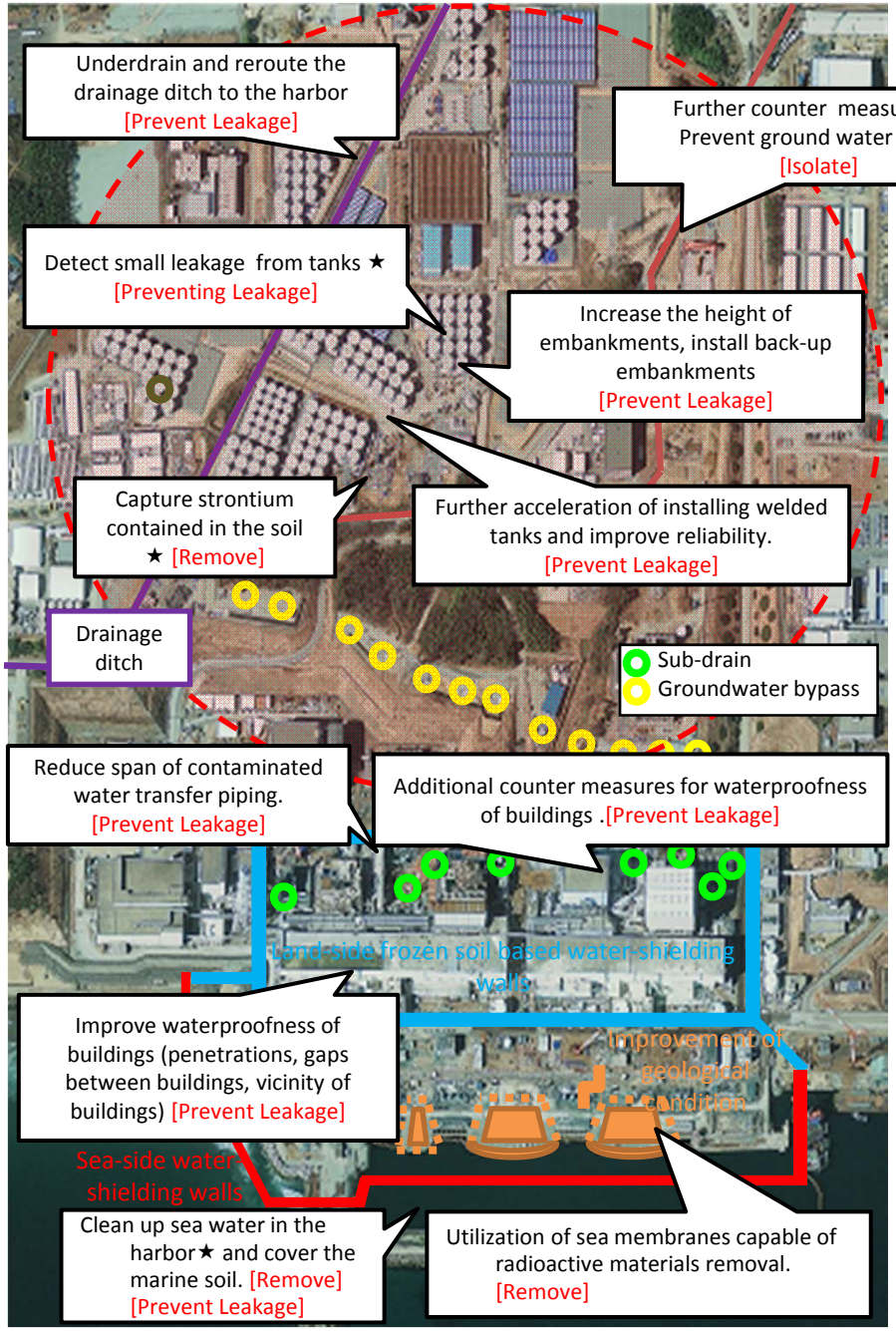
Phase 2: Period up to the commencement of the removal of the fuel debris (within 10 years)

-Complete the fuel removal from the spent fuel pools at all Units
-Continue stable reactor cooling
-Complete the processing of accumulated water
-R&D on radioactive waste processing and disposal and on reactor facilities decommission, etc.

Phase 3: Period up to the completion of decommissioning measures (30 to 40 years in the future)

-Complete the fuel debris removal (in 20-25 years)
-Complete decommissioning (in 30-40 years)
-Implement radioactive waste processing and disposal

Overview of Preventive and Multi-layered Measures



Three principles

1. Remove contamination sources
2. Isolate contamination from groundwater
3. Prevent leakage of contaminated water

Immediate measures

1. Remove highly-contaminated water in the trenches【Remove】
2. Soil improvement with sodium silicate (liquid glass) , rainproof pavement, and pumping out【Isolate】【Prevent leakage】
3. Pump up groundwater for by-passing【Isolate】

Fundamental measures

1. Pump up groundwater from sub-drains near buildings【Isolate】
2. Install sea-side impermeable walls【Prevent leakage】
3. Install land-side frozen soil impermeable walls【Isolate】
4. Install more efficient water treatment equipment【Remove】

etc.

Preventive and Multi-layered Measures

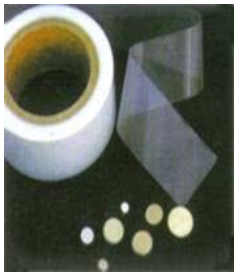
(★:measure to be studied on its feasibility)

1. Further counter measures for Prevent ground water inflow【Isolate】
2. Increase height of embankments, install back-up embankments【Prevent leakage】
3. Further acceleration of installing welded tanks and improve reliability【Prevent leakage】
4. Underdrain and reroute the drainage ditch to the plant port【Prevent leakage】
5. Detect small leakage from tanks.★【Prevent leakage】
6. Capture strontium in contained water in soil.★[Remove]
7. Reduce span of contaminated water transfer piping. [Prevent Leakage]
8. Improve waterproofness of buildings(penetrations, gaps between buildings, vicinity of buildings), etc. [Prevent Leakage]
9. Counter measures for great tsunami (consideration on additional counter measures for waterproofness of buildings, wave breakers, etc.)[Prevent Leakage]
10. Clean up sea water in the harbor★ and cover the marine soil. [Remove] [Prevent Leakage]
11. Utilization of sea membranes capable of radioactive materials removal. [Remove]

Main measures taken or to be taken after decision of basic policy on Sep. 3

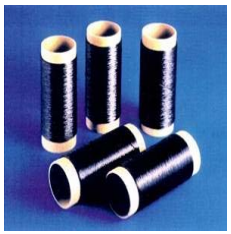
Radiation utilization

- Comparable economic scale as nuclear power
- Contributes advances of science, improvements of health and living conditions, and promoting industrial activities







Raising human resources

1. Nuclear education at nuclear departments of universities
2. Nuclear education of mechanical/ electrical/ chemical engineers
3. Education of radiation
4. Continuing education
5. Raising human resources for nuclear safety, security and safe guards
6. Learning of radiation risk
7. Securing human resources for operation of NPP in Japan
8. Raising human resources for international deployments
9. Education of energy and environment

Management improvement

Function①responsibility, ②competition and③feedbacks

①responsibility：management of employee and budget

②purpose of competition：Pursue no.1 in the field: companies; world share of products/ services

R&D organization: projects.

Research of universities: number of citation of published papers

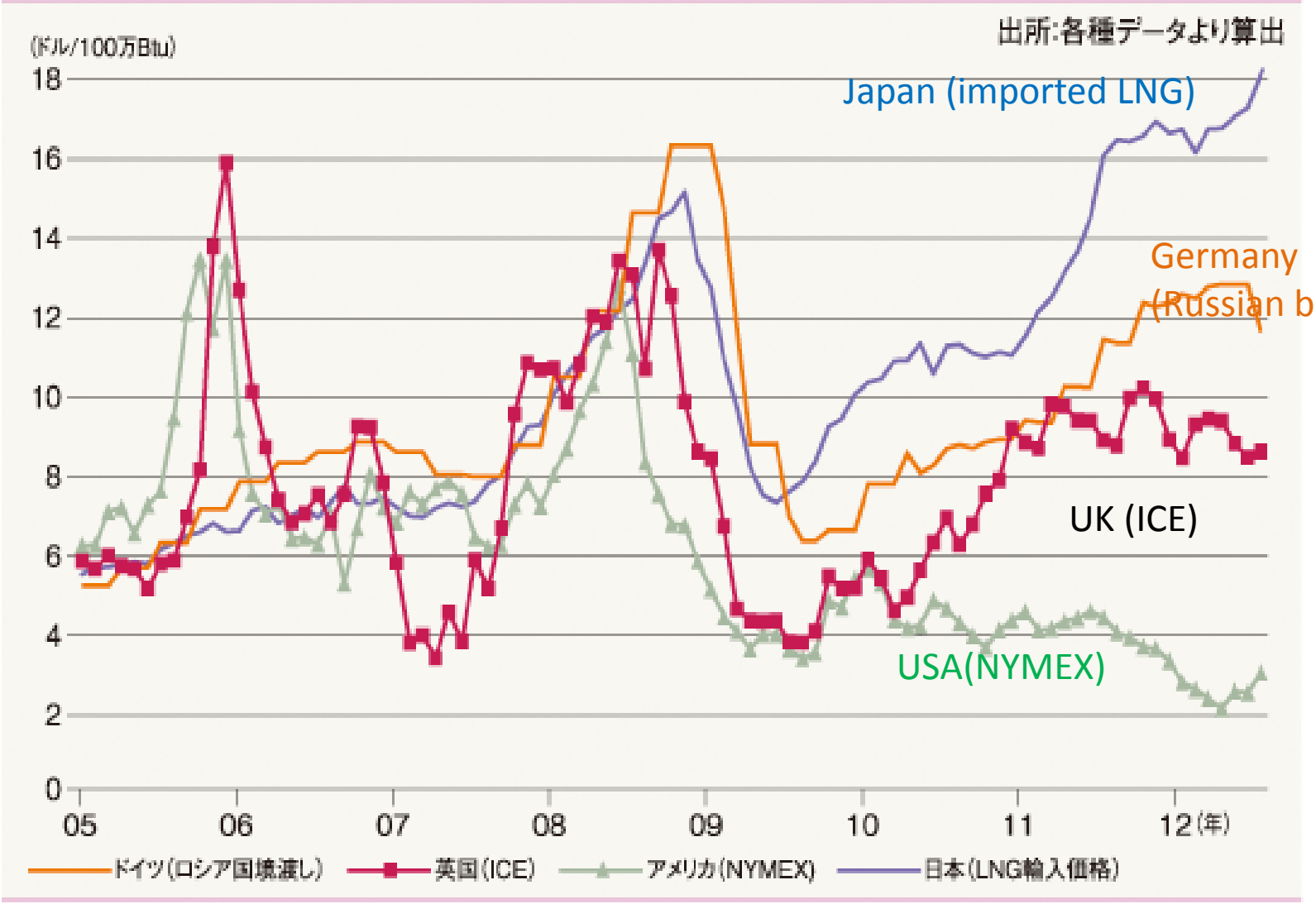
Government agency: administrative services

②Competition mechanisms (Universities): Promotion/ increase in salary by competition, endeavor for competitive research budgets

③Feedback mechanisms：example：Utilize peer reviews for improvements

Natural gas prices (2005-2012)

not stable



Source : JOGMEC, http://www.jogmec.go.jp/library/contents8_05.html

Nuclear future in Japan

- Learn lessons of the accidents, overcome the difficulties
- Pursue highest safety by utility/industry initiatives.
- Expect highest regulatory service to the public by the government.
- “International” is more important key word than ever. “Enhance competitiveness” is the goal of revitalization of Japan, not only nuclear.

Let’s do our best for “Nuclear”

Thank you for your attention