Options for carbon free electricity generation
-Nuclear energy in a global perspective-
Nalen, Stockholm, Sweden

The recent trends and the outlook for nuclear in Japan – the sun will rise again? -

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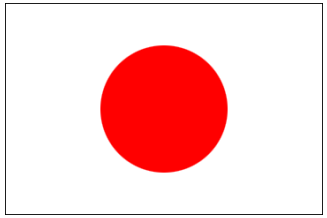
24 November 2015

FAQs and the contents

- FAQs

1. How is Japan going forward? *The sun will rise again?*
2. Why is it taking so much time for the assessment?
3. How about the public opinion?



- Contents

1. The latest demand-and-supply outlook
2. Nuclear power development status and outlook in the world
3. Safety assessment procedure and the restart
4. Public opinion on nuclear and the radioactive waste disposal

1.The latest demand-and-supply outlook

(1) Energy policy targets; 3 "E" + S

- In July 2015, METI has approved the Long-term Energy Supply and Demand Outlook based on the Strategic Energy Plan of 2014.

Energy self-sufficiency

6% (current level)
20% (before Fukushima) → Around 25% (including nuclear)

Electricity costs

30% (industry) and 20% (residential) rise after Fukushima
FIT surcharge: JPY 1.3 trillion (FY 2015)
2.7 trillion (future) → Achieve lower costs than current levels

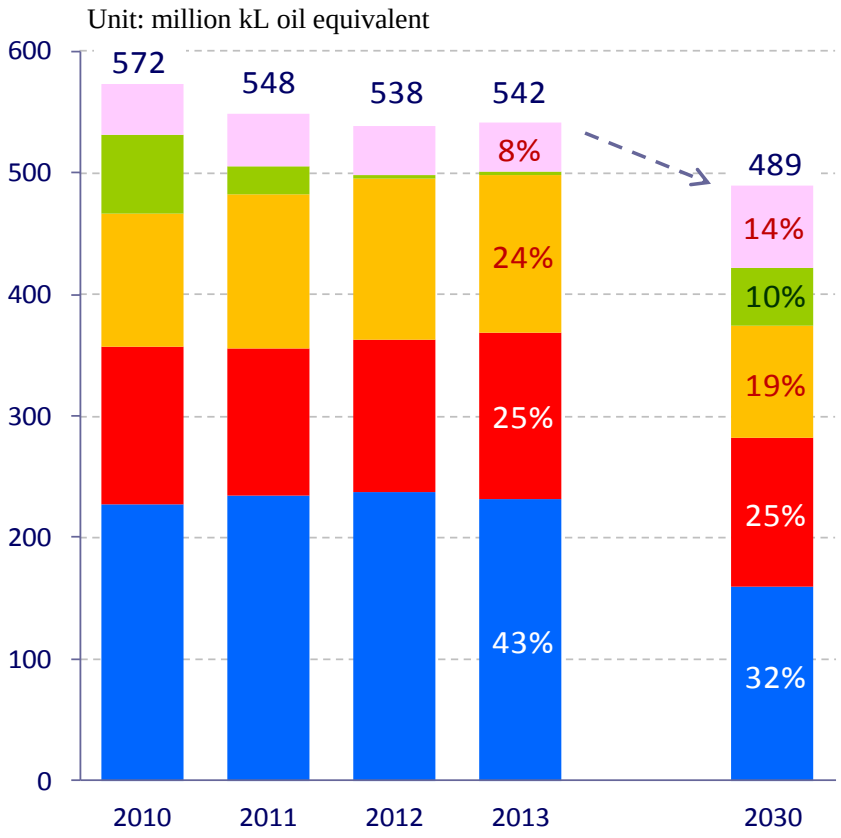
GHG emissions

Historical high in FY 2013 due to the increase in fossil power generation → Achieve mitigation targets as ambitious as other developed countries

Safety as the top priority … should we need to emphasize this?

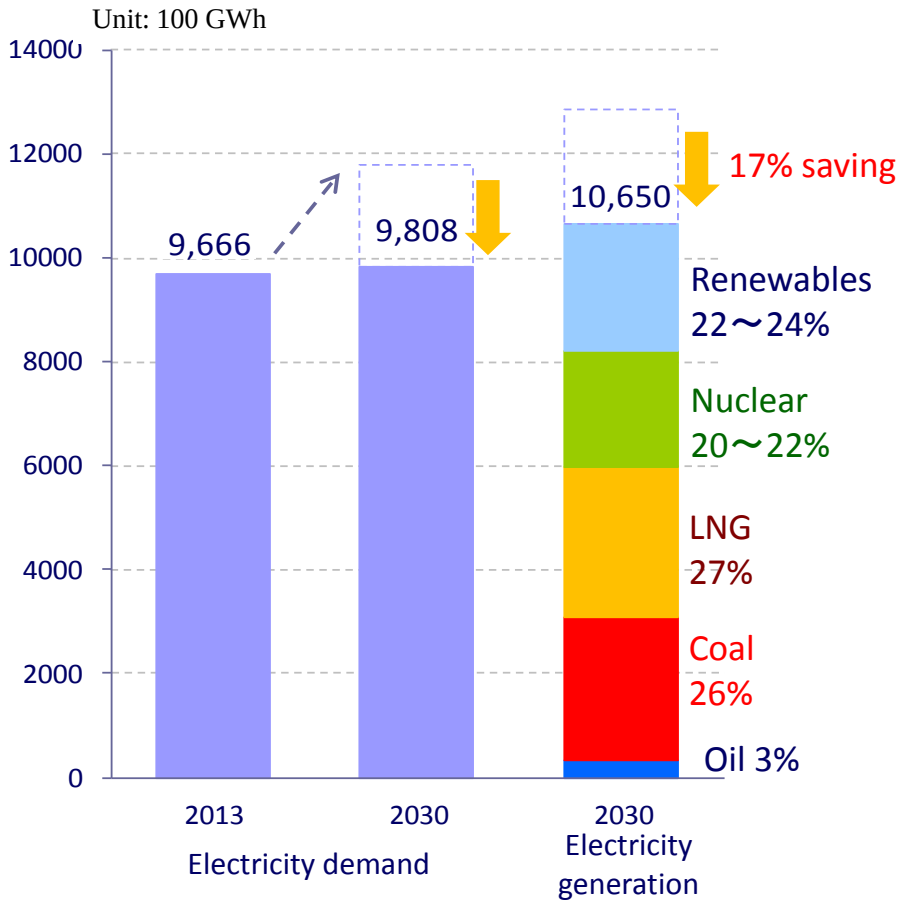
1.The latest demand-and-supply outlook
(2) Power portfolio in 2030

Primary energy demand



Source: Long-term Energy Supply-demand Outlook (METI), July 2015

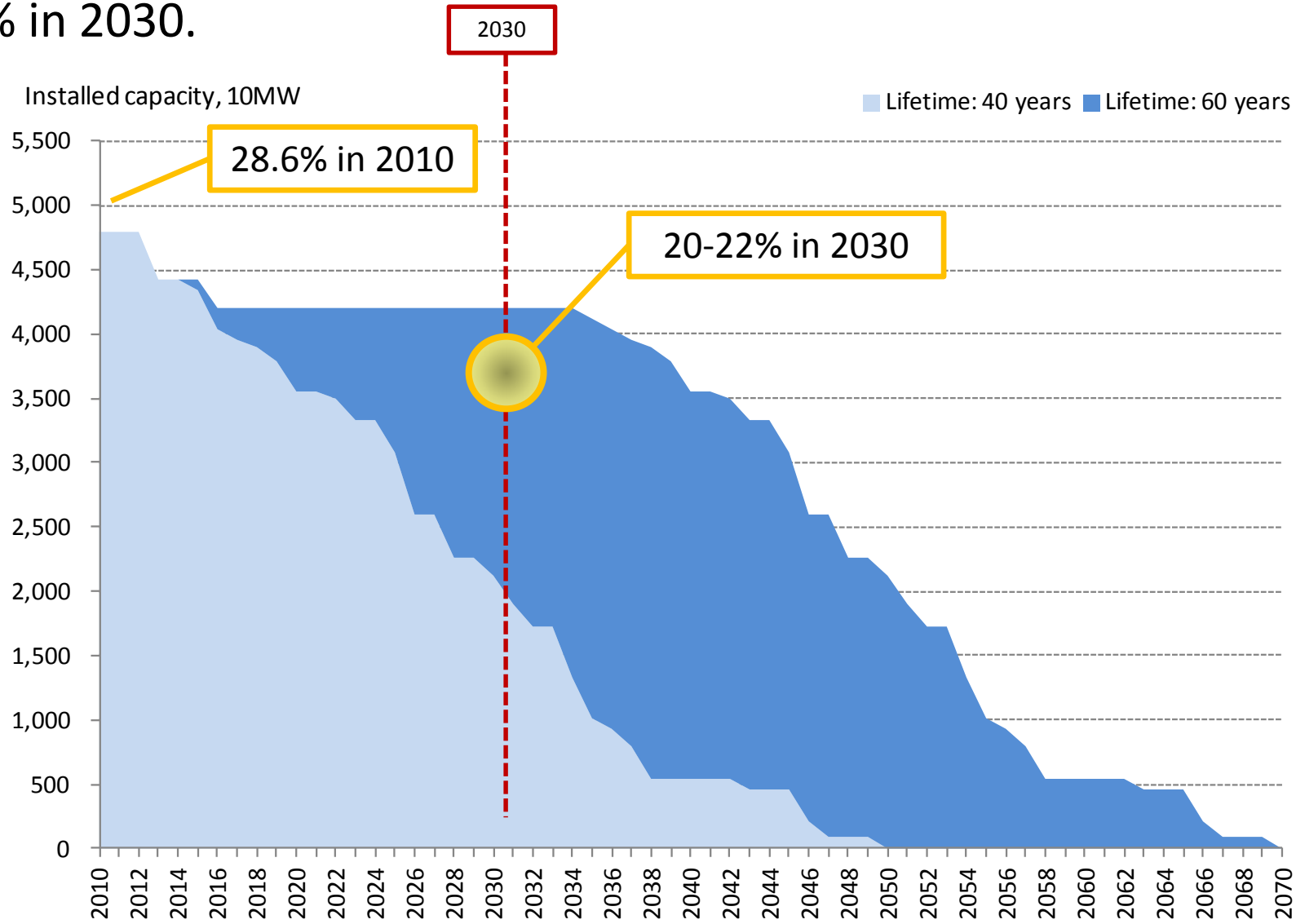
Power generation mix



Challenges in;
Renewables, Nuclear, Energy saving, Securing gas, Emission, …. Everything!

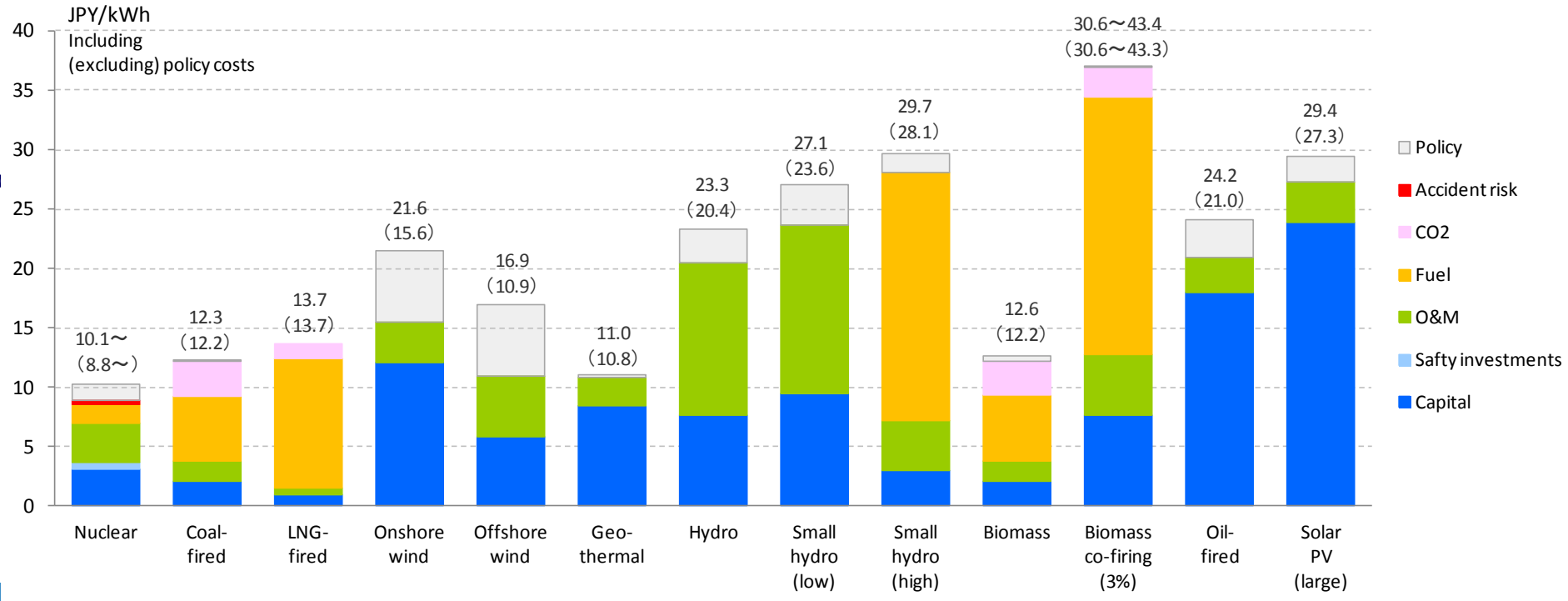
1.The latest demand-and-supply outlook
(3) Challenges in nuclear energy : keeping the share

- Lifetime extension or new construction should be crucial to keep 22% in 2030.



1. The latest demand-and-supply outlook
(4) Challenges in the electricity costs; nuclear is the cheapest

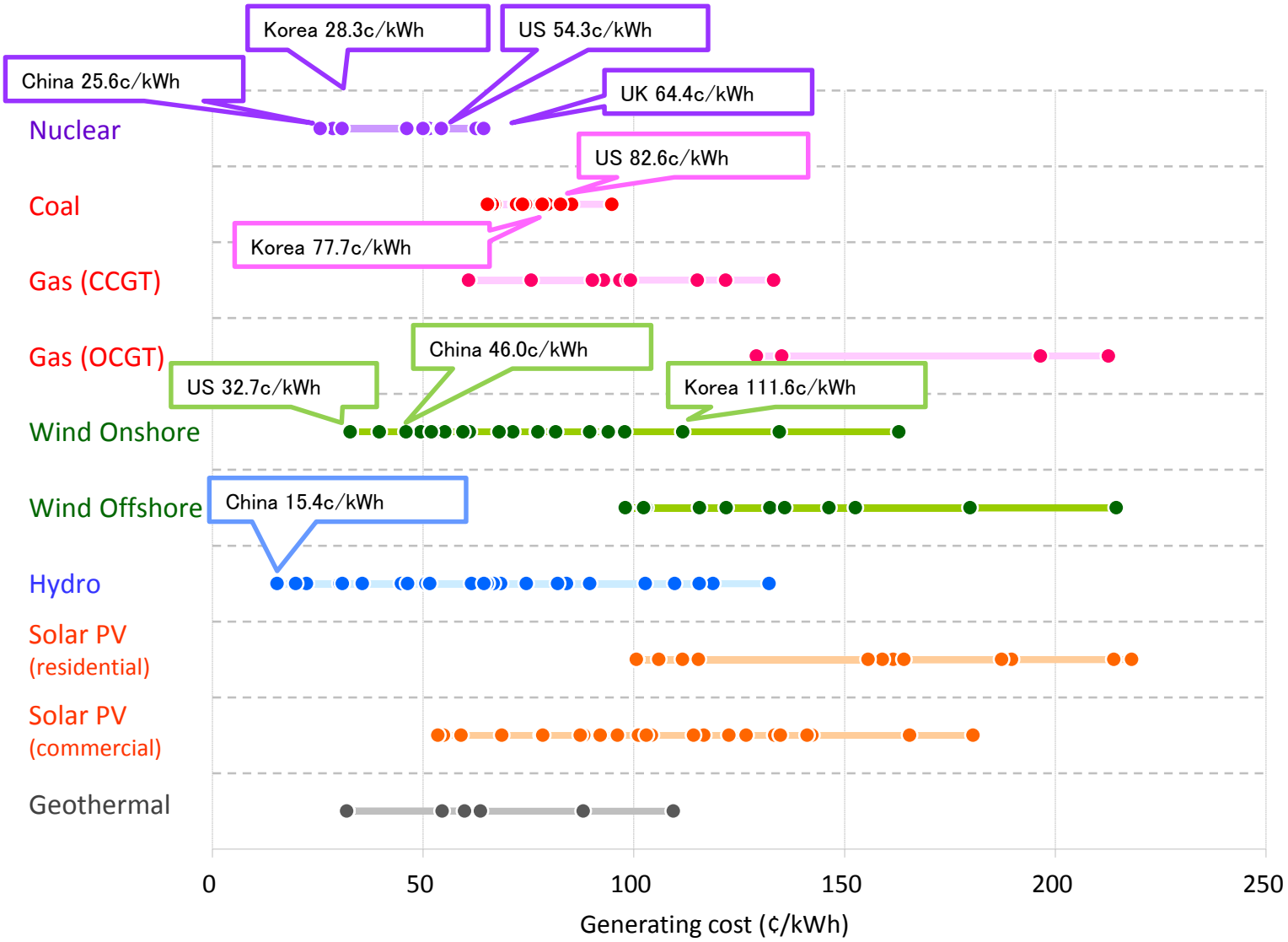
- The governmental working group estimated the costs of various power generation technologies.
- The costs include capital costs, additional safety investment costs, O&M costs, fuel costs, nuclear fuel cycle costs, CO2 costs, accident risk costs and policy costs
  - Plus R&D costs, siting costs for nuclear and FIT costs for renewables).



Source: Power Generation Cost Verification Working Group (2015)

FYI: Comparison of the generating cost by fuel : OECD/NEA, 2015

- Cost-competitive power sources differ by country.



Source: OECD/NEA “Projected Costs of Generating Electricity 2015”

2. Nuclear power development status and outlook in the world

(1) Capacity by country

- Nuclear is an “oligopolized” energy in the world.
- Used in 31 countries, and top 3 countries have more than half of the total capacity.

As of January 2010 → As of January 2015

Country	Operating Capacity(GW)	Unit	Constructing/Planned Capacity(GW)	Unit
1 US	105	104	11	9
2 France	66	59	2	1
3 Japan	49	54	20	15
4 Russia	23	27	16	17
5 Germany	22	17	0	0
6 Korea	18	20	10	8
7 Ukraine	14	15	2	2
8 Canada	13	18	0	0
9 UK	12	19	0	0
10 Sweden	9	10	0	0
11 China	9	11	38	36
Others	15	8	22	0
合計	356	377	120	116

Country	Operating Capacity(GW)	Unit	Constructing/Planned Capacity(GW)	Unit
1 US	▼103	99	12	10
2 France	▼ 66	58	2	1
3 Japan	**▼44**	**48**	**16**	**12**
4 Russia	▲ 25	29	28	26
5 S.Korea	▲ 21	23	12	9
6 China	**▲20**	**22**	**61**	**56**
7 Canada	▲ 14	19	0	0
8 Ukraine	▼ 14	15	2	2
9 Germany	▼ 13	9	0	0
10 UK	▼ 11	16	3	2
11 Sweden	9	10	0	0
12 Spain	7	7	0	0
Others	45	76	65	65
Total	392	431	201	183

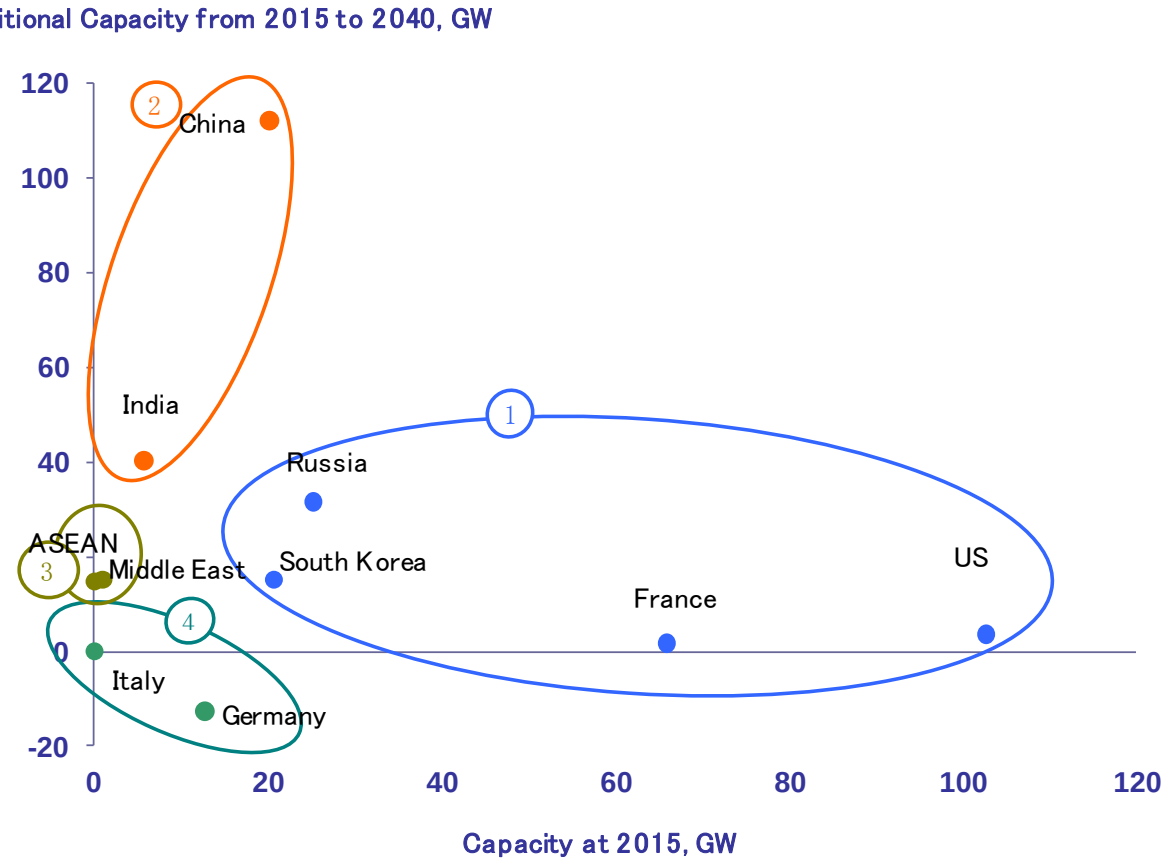
Source: “World nuclear power plants 2015”, JAIF

2. Nuclear power development status and outlook in the world
(2)Trends by category in 2015

1. Countries using and promoting nuclear power
2. Countries required to substantially expand nuclear power
3. Countries planning to introduce nuclear power
4. Countries tending to decrease nuclear power

- Countries in category 1 &2, those position nuclear power as an important part of an energy portfolio maintain giving priority to nuclear power development.

- Countries in category 4, those have traditionally hesitated further nuclear power development feature growing arguments against nuclear.



Source:
Capacity at 2015: “World nuclear power plants 2015”, JAIF
Additional capacity from 2015 to 2040: “Asia/World Energy Outlook 2014”, IEEJ

2. Nuclear power development status and outlook in the world

(3)Trends by category in 2010

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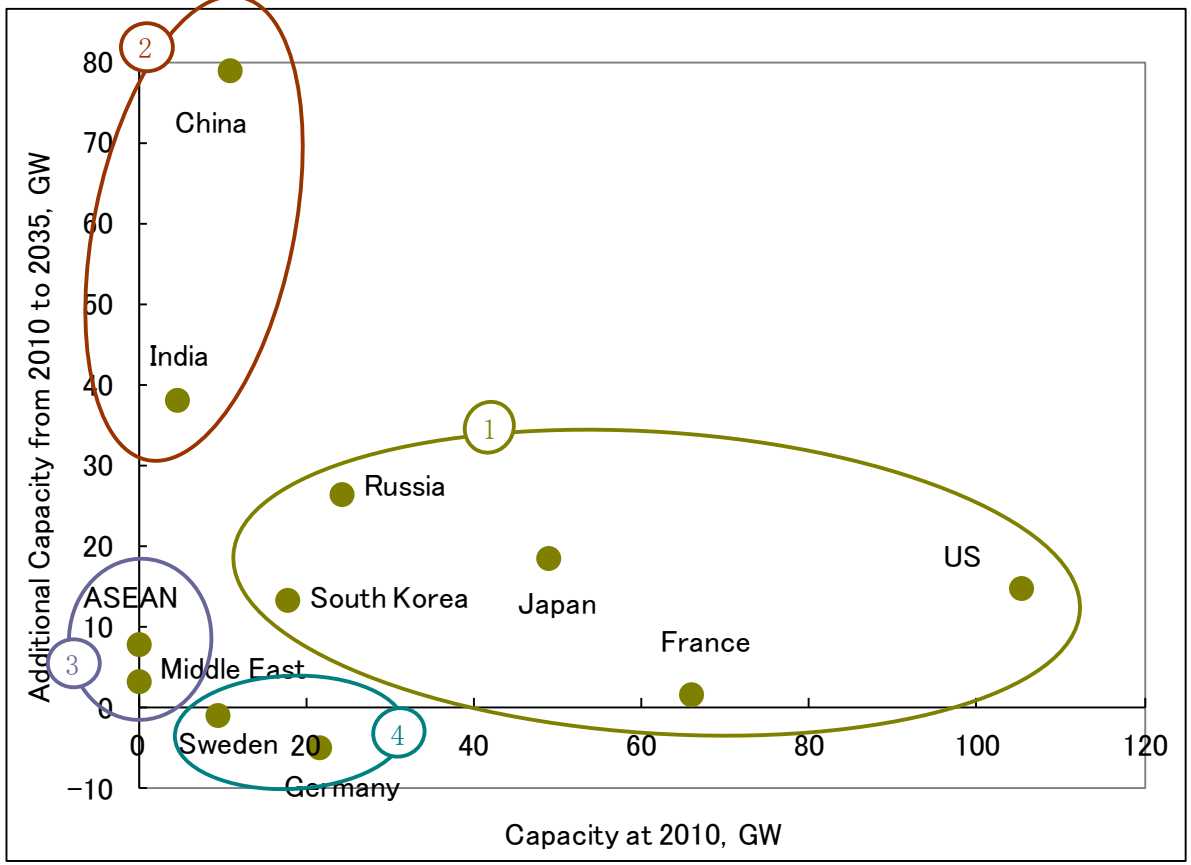
Only Japan has changed !



Source:
Capacity at 2010: “World nuclear power plants 2010”, JAIF
Additional capacity from 2010 to 2035: “Asia/World Energy Outlook 2009”, IEEJ

3. Safety assessment procedure and the restart
(1) 24 Reactors under review

Unit	Utility	Type / 10MWe	No. of hearings*	Date of Submission	Commercial Operation	notes
Tomari 1/2	Hokkaido	PWR/57.9	52(4)	7/8/2013	6/22/1989, 4/12/1991	
Tomari 3	Hokkaido	PWR/91.2	377(4)	7/8/2013	12/22/2009	
Ohi 3/4	Kansai	PWR/118.0	313(9)	7/8/2013	12/18/1991, 2/2/1993	Suspected active faults -> cleared
Takahama 3/4	Kansai	PWR/87.0	513(72)	7/8/2013	1/17/1985, 6/5/1985	Rejected by courtt
Ikata 3	Shikoku	PWR/89.0	449(16)	7/8/2013	12/15/1994	Approved
Sendai 1/2	Kyushu	PWR/89.0	854(50)	7/8/2013	7/4/1984, 11/28/1985	Restarted
Genkai 3/4	Kyushu	PWR/118.0	233(0)	7/12/2013	3/18/1994, 7/25/1997	
KK 6/7	Tokyo	ABWR/135.6	249(77)	9/27/2013	11/7/1996, 7/2/1997	
Shimane 2	Chugoku	BWR/82.0	181(55)	12/25/2013	2/10/1989	
Onagawa 2	Tohoku	BWR/82.5	177(46)	12/27/2013	7/28/1995	
Hamaoka 4	Chubu	BWR/113.7	168(57)	2/14/2014	9/3/1993	
Tokai Daini	JAPC	BWR/110.0	44(5)	5/20/2014	11/28/1978	
Higashidori 1	Tohoku	BWR/110.0	28(0)	6/10/2014	12/8/2005	Suspected active faults
Shika 2	Hokuriku	ABWR/135.8	12(2)	8/12/2014	3/15/2006	Suspected active faults
Oma	J--Power	ABWR/138.3	9(1)	12/16/2014	(Under Construction)	
Takahama 1/2	Kansai	PWR/82.6	27(15)	3/17/2015	11/14/1974, 11/14/1975	
Mihama 3	Kansai	PWR/82.6	15(11)	3/17/2015	12/1/1976	
Hamaoka 3	Chubu	BWR/110.0	5(1)	6/16/2015	8/28/1987	
Tsuruga 2	JAPC	PWR/113.0	-			

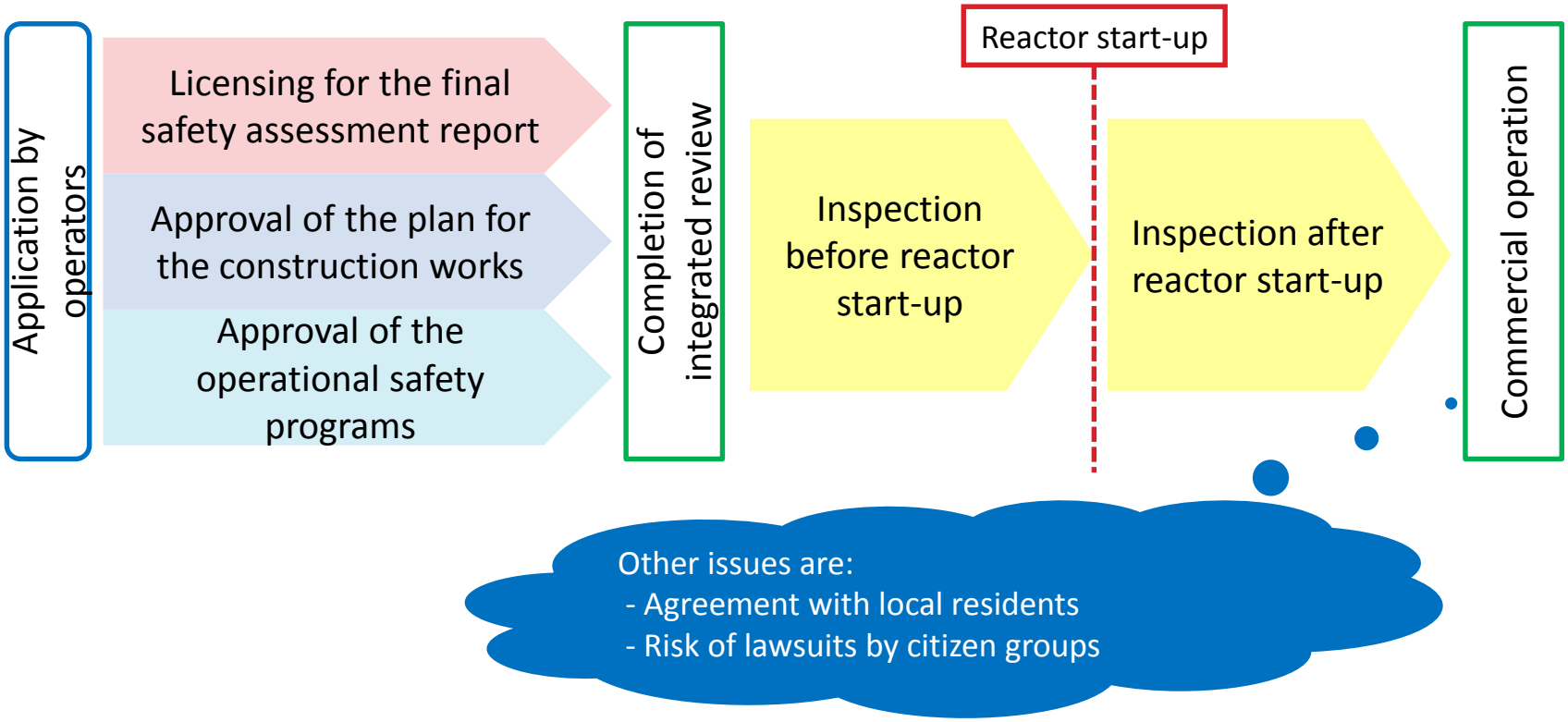
•As of October 15. In ( ) are numbers of hearings in FY2015

Source: Nuclear Regulation Authority, http://www.nsr.go.jp/activity/regulation/tekigousei/index.html (Japanese only)

3. Safety assessment procedure and the restart

(2) Why does the safety assessment take so much time ?

- Current Procedure for the restart



- "Principles of Good Regulation" by US Nuclear Regulatory Commission

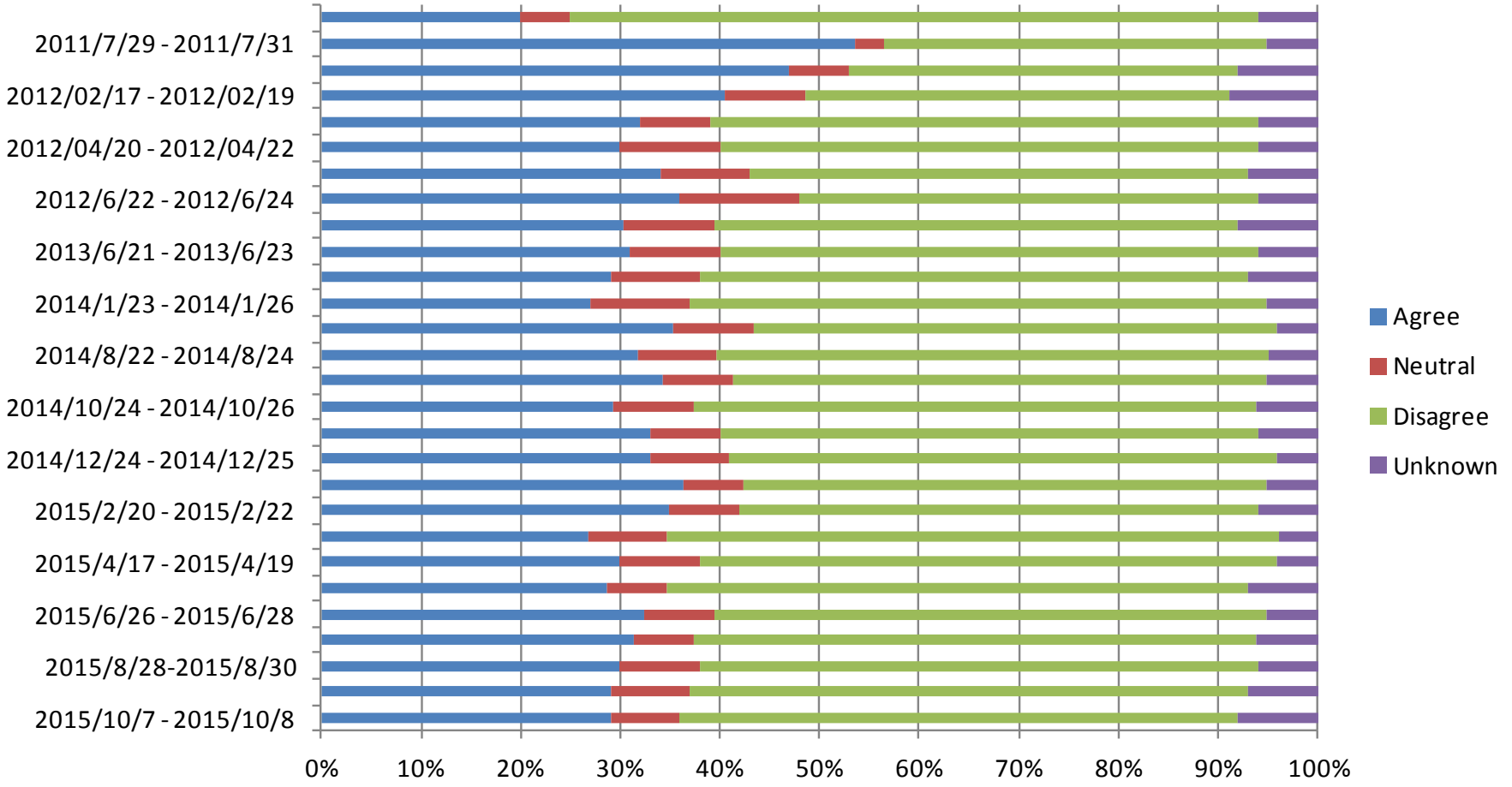
Independence | Openness | Efficiency | Clarity | Reliability

How about NRA? -> Efficiency? Transparency?

4.Public opinion on nuclear and the radioactive waste disposal

(1) More than 50% are still against nuclear

- The share of “anti-nuclear” has been increasing year by year.
- We have survived four summers since 2011 without blackouts.
  -> We don’t need nuclear energy anymore?



Public opinion to the question: “we should proceed with restarting nuclear power plants”
Source: Telephone opinion poll by Nikkei

4.Public opinion on nuclear and the radioactive waste disposal
(2)Policy change of the final disposal assessment

- On May 22, 2015, "Basic Policy on the Final Disposal of Designated Radioactive Wastes"(*) was approved by the Cabinet.

(*)a document on the selection of a final repository site for high-level radioactive waste

waiting for municipalities to apply for hosting

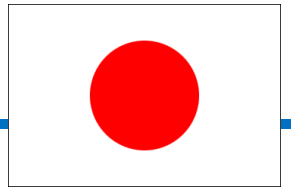
→ the government will indicate scientifically-promising regions

→ request the municipalities concerned to cooperate with the survey, and help to build regional consensus and sustainable development

A similar approach has been adopted in Finland and Sweden over 20 years. Considering that it took these countries 20 years after starting this approach to actually select a final repository site, it is naturally expected to take at least as long in Japan.

START OF A TRUE DIALOG WITH THE PUBLIC?

Why have we used nuclear? The sun will rise again?



Economic Efficiency

Environment

Strategic Marketing

Only rich countries can afford discussion of phasing nuclear out.
By Nikola Azalov, Ukrainian Prime Minister, March 2011

ENGIE and Mitsubishi Heavy Industries signed a MOU to develop their collaboration in energy sector and technology.
By ENGIE/MHI press, October 2015

Energy Security

Chinese reactors are safer than German ones?
By a reporter from overseas, June 2011

Competence

SAFETY?

Photo: Chartres, France on 25 October 2015