Japan's Nuclear Energy Policy

Ministry of Economy, Trade and Industry

Jun. 2018

METI
Ministry of Economy, Trade and Industry

1. Current Status of Nuclear Energy in Japan

2. Three Key Challenges
    - Challenge to International Market
    - Challenge to Nuclear Innovation
    - Challenge to Decommissioning

Strategic Energy Plan and Energy Mix as of 2030

Strategic Energy Plan

(Cabinet Decision in 2014. According to law, it will be revised in early 2018.)

I. Nuclear power is an important base-load power source as a low carbon and quasi-domestic energy source, contributing to stability of energy supply-demand structure.

II. Dependency on nuclear power generation will be lowered to the extent possible by energy saving and introducing renewable energy as well as by improving the efficiency of thermal power generation, etc.

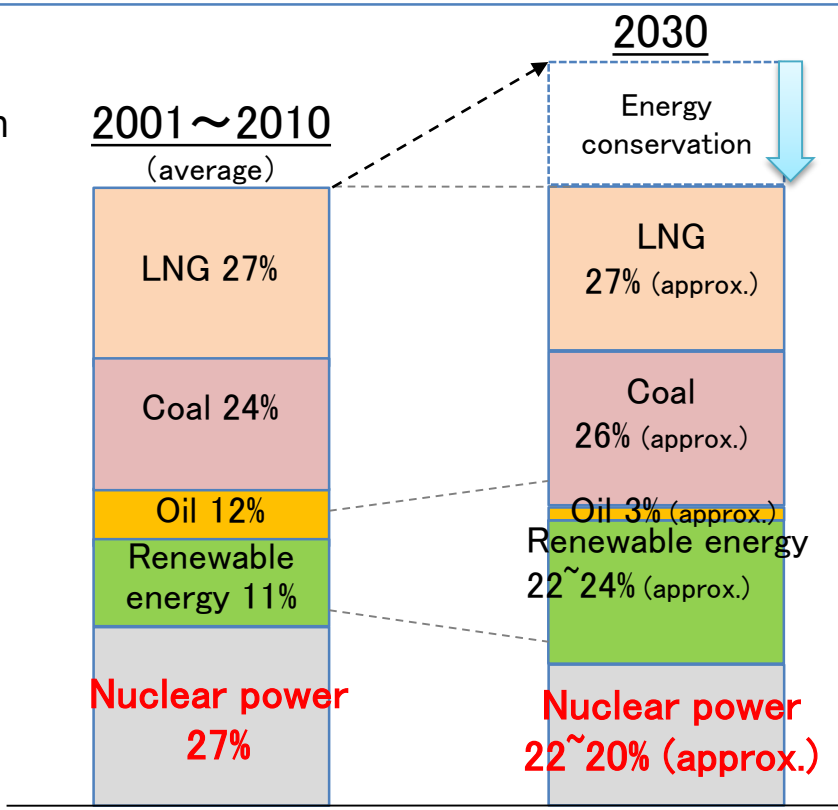
III. The basic policy of Japan is to promote a nuclear fuel cycle that reprocesses spent fuels and effectively utilizes the plutonium retrieved, from the viewpoint of effective utilization of resources and reduction of the volume and harmfulness of high-level radioactive waste.

Target of electricity generation

Based on "Strategic Energy Plan", METI approved "Long-term Energy Supply and Demand Outlook" (so-called Energy Mix).

	2010	2013	2030
Nuclear	**29%**	**1%**	**20~22%**
Renewable*	**10%**	**11%**	**22~24%**
Thermal	**61%**	**88%**	**56%**

* Geothermal 1.7~4.6 %
Biomass 3.7~4.6 %
Wind 1.7 %
Solar 7.0 %
Hydro 8.8~9.2 %

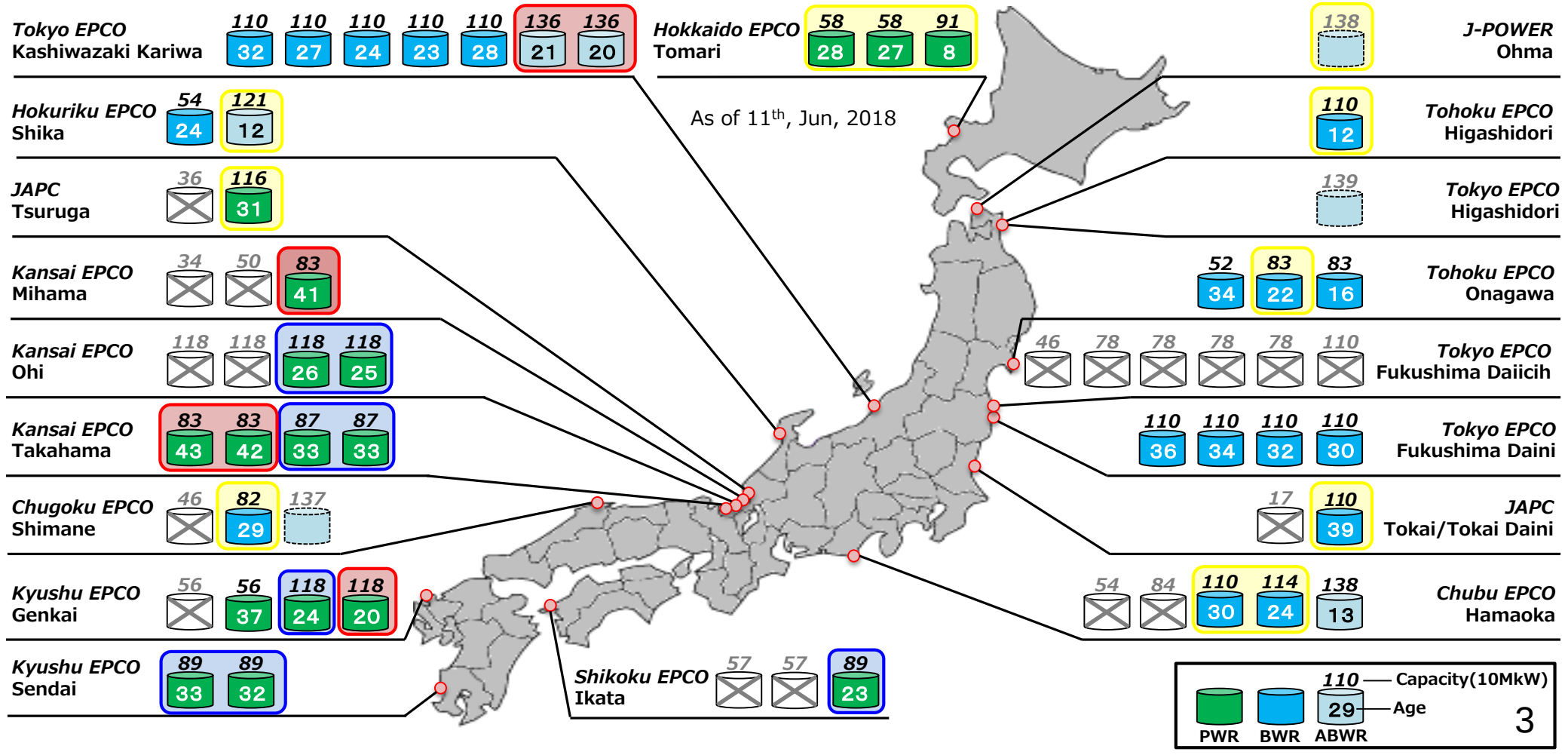


【Source】 extracted (preliminary translation) from documents released in the 11th Long-term Energy Supply and Demand Outlook Subcommittee, Advisory Committee for Natural Resources and Energy, METI

Restart of Nuclear Power Plants in Japan

	In Operation	Passed NRA Review	Under NRA Review	To be Determined	Decided to Decommission
PWR	9	3	4	1	7
BWR	0	2	8	15	11(1 GCR)

*Ikata Unit 3, Sendai Unit 1&2 and Takahama Unit 4 are under the periodic inspection.



Current Status of Nuclear Fuel Cycle

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

Oma Nuclear Power Plant (utilized fully load MOX fuel)

MOX Fuel

MOX fuel from foreign reprocessors

Plutonium quantity possessed by electric power supplier (storage in UK and France)
approx.24.5tPuf

JNFL
Rokkasho Reprocessing Plant
Plan of Operation: FY 2021 (the 1st half)



Plutonium over 4tPuf/y

MOX Fuel Fabrication Plant **JNFL**



Plan of Operation: FY 2022 (the 1st half)

Storing : approx.2,970tU
Storage Capacity : 3,000tU

Nuclear Power Plant
(Spent fuel pool, etc.)

Storing:
approx.15,000tU
Storage capacity :
approx.21,000tU

Spent Fuel

Vitrified Waste

Geological disposal repository

Off-site storage facility
(Spent Fuel Interim Storage)

Mutsu：5000tU



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

Plan of Operation: FY 2018 (the latter half)

Spent Fuel

Next reprocessing plant

Fast Breeder Reactors(FBR)

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

Waste from operation and decommissioning

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

1. Current Status of Nuclear Energy in Japan

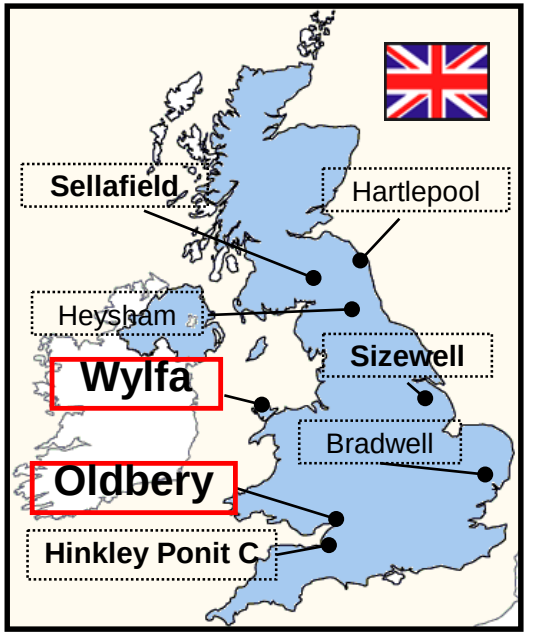
2. Three Key Challenges
   - Challenge to International Market
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Contribution to Peaceful Use of Nuclear Power in the World

- make proactive contributions to improvement of nuclear safety, peaceful use of nuclear power, nuclear non-proliferation and nuclear security in the world, by sharing the experiences and lessons learnt from the TEPCO's Fukushima nuclear accident.

UK: HORIZON Project

- In 2012, from its parent companies (E.ON and RWE), HITACHI purchased all stocks of HORIZON, which has a plan to construct new nuclear power plants in the UK such as Wylfa (1,350MW, 2 reactors) and Oldbury (1,350MW, 2 reactors).
- HITACHI plans to construct ABWRs through HORIZON.
- In Dec 2013, HORIZON agreed with HM Treasury on cooperation regarding external financing of the building for new NPPs.





Turkey: Sinop Project

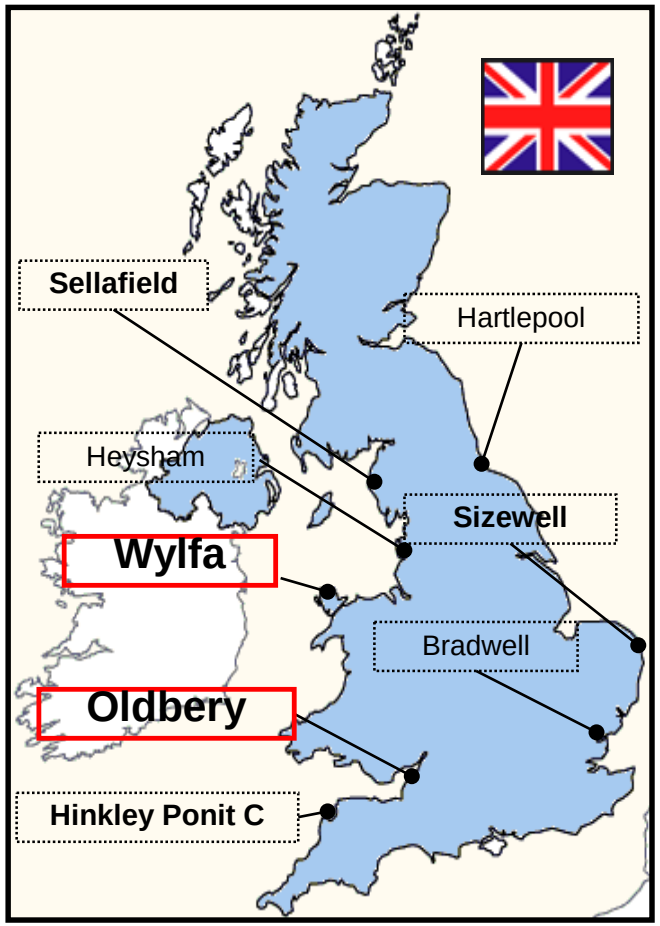
- In 2013, Japan obtained the exclusive negotiating right for Sinop NPP (4 ATMEA1 reactors are planned).
- In 2015, Inter Governmental Agreement (IGA) entered into force.
- Feasibility Study for detailed construction plan has been undertaken by MHI.

Nuclear Projects in UK

(1) France-China Coalition (EDF, CGN) and Japan have own projects.

(2) Hitachi (HORIZON) plans to build two ABWRs in Wylfa, Wales.

(3) UK strongly expects the success of Hitachi PJ. The PJ is important for Japan in terms of maintenance of global competitiveness of JP nuclear tech & HRs.



	Company	Site	Reactor type	Unit	Status
France-China	NNB GenCo	Hinkley Point C	EPR (1,600MW)	2	<Total cost> £18.2bn <PPA> £92.50MW/h <Investment> EDF66.5%, CGN33.5% Under construction (start operation in 2025)
		Sizewell	EPR	tbd	EDF80%, CGN20%
		Bradwell	Hualong1 (Chinese)	tbd	EDF33.5%, CGN66.5%
Toshiba	NuGen	Moorside	tbd	3	-Toshiba will sell the PJ -First refusal right to KEPCO
Hitachi	Horizon Nuclear Power	Wylfa	ABWR (1,350MW)	2	Planned (start operation in middle 2020s)
		Oldbery	ABWR	tbd	Planned

HORIZON Project

1. HORIZON chronology

2012 HITACHI purchased all stocks of HORIZON

HITACHI plan to construct ABWRs at Wylfa and Oldbury
- ✓1350MW × 2-3 reactors for each site
- ✓Same design as Tokyo EPCO
  "Kashiwazaki Kariwa unit 6"

2013 Apply for GDA (Generic Design Assessment) of ABWRs in UK

⇨ 2017 approved By ONR and EA

2018 Parliament Statement on Horizon Project

⇨ UK government and Hitachi have decided to enter into negotiations

2. Wylfa Project Schedule in the future

2017 Apply for Granted SL (Nuclear Site License)

⇨ 2018 approved by ONR (tentative)

2020 Start construction (tentative)

mid 2020s : Commercial Operation (tentative)

<Wylfa site image>







Greg Clark
SoS for BEIS

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Search

Departments Worldwide How governm
Policies Publications Consultations S

Home

Oral statement to Parliament

Statement to Parliament on Horizon project at Wylfa Newydd

Business and Energy Secretary Greg Clark updates Parliament on Horizon nuclear project at Wylfa Newydd.

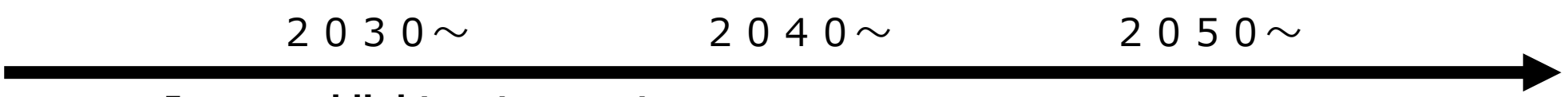
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Prospects of Nuclear Development in the World



Improved light water reactors
(G3+ reactors incl. ABWR; commercial phase)

For large-scale demand regions

- Concretizing business (incl. construction and operation) thru involving utilities & financial institutions.
- Increasing capacity utilization, reducing costs, extending operation period.
- Replacing

Near-future reactors
(eg. light water SMRs; early development ~ pre-commercial phase)

For small-scale demand regions

- Supporting tech devel with competitive research funds
- Tech selection by their future users incl. utilities
- Commercializing them with supports for site selection and licensing

Next-generation reactors
(eg. SFR, MSR; basic research phase)

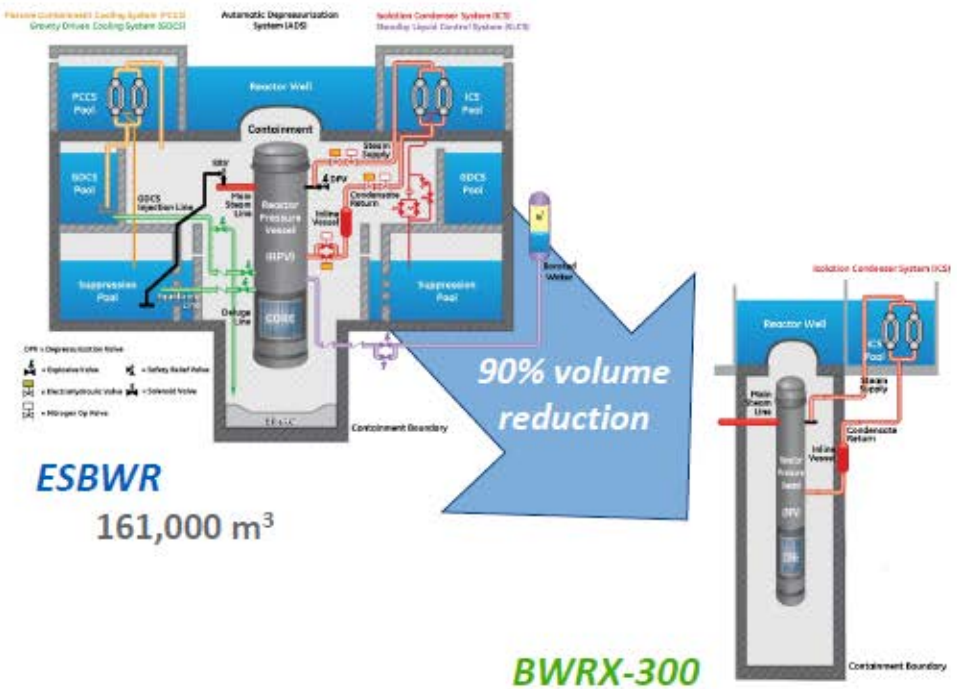
For specific purpose
For specific area

- Fundamental R&D for various reactor types with competitive research funds
- Supporting tech devel with competitive research funds
- Tech selection by its future users incl. utilities
- Commercializing them with supports for site selection and licensing

Small Modular Reactor Technology

GE Hitachi BWRX-300

A dramatic reduction in scale and complexity vs ESBWR



ESBWR
161,000 m³

BWRX-300
15,500 m³

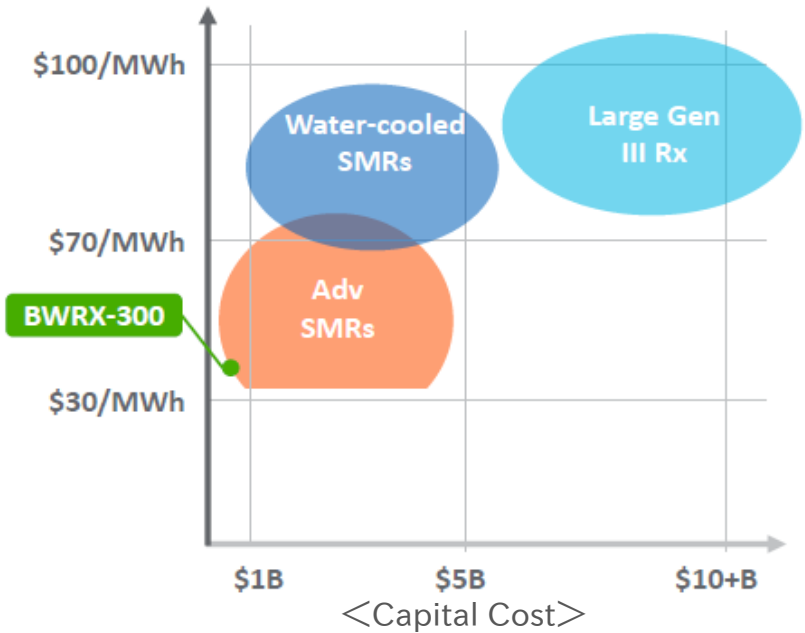
HITACHI

Compared to ESBWR:
>50% building volume reduction/MW
>50% less concrete/MW

BWRX-300 design principles

- 300 MW Small Modular BWR
- Designed to eliminate LOCA
- 'Design-to-cost' … think like a startup
- ESBWR design/licensing basis
- Underground/concrete security
- Natural circulation
- Isolation Condenser System cooling
- Small, dry containment
- Rethink control systems … passive controls
- Design for 'off-the-shelf' TI/BOP
- Goal of 75 onsite staff





Fast Reactor Development

- Currently, “Strategy Roadmap” is being made in “Strategic Working Group on Fast Reactor development” for specifying the development work in next 10 years.
- One of key points is utilizing the best combination of domestic and international resources/facilities.

Experimental Fast Reactor ”JOYO”



- Application to NRA in March 2017 for alteration of reactor installation to verify the conformity to the new regulatory requirement.

- Use for fuel/material irradiation test, human resource development, etc.

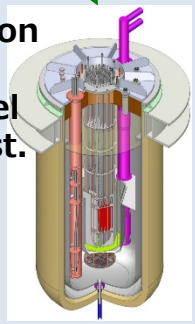
Large-scale Test Facility “AtheNa”



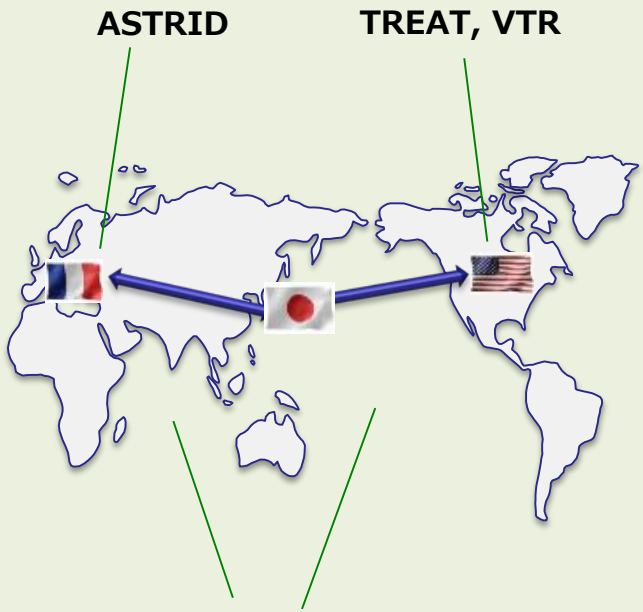
- Dimension of facility: 130m x 62m x 55m-height

- Sodium inventory: 240 ton

- Reactor vessel test model for thermal-hydraulic test. (tentative plan)



SFR R&D through International Collaboration



Multi-lateral collaboration in GIF (Generation IV International Forum)

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Decommissioning of Nuclear Power Plants in Japan

Decommissioning caused by Accident	**Decommissioning already decided**	**Other reactors**
6 reactors	3＋9 reactors	40 years Operation
(Fukushima-Daiichi #1 - #6)	(Before The Earthquake + After the Earthquake)	(If life extension is approved, 60 years maximum)

<Three Challenges for Decommissioning>

Negative impact on **balance sheet** of the operators	Negative impact on **local economy** (employment, tax revenue etc.)	**Waste disposal** (rule-making etc.)

- International Workshop on Decommissioning (30, June, 2017)

learning more about the various efforts from the experienced countries (U.S., UK, France, etc.)

Ref. Overview of International Workshop on Decommissioning

1. Purpose

- For the decommissioning of NPP, the big issues are to carry out dismantling work efficiently with the existing technologies, and optimizing process management and so on.
- Therefore the Workshop was held for the purpose of learning more about the various efforts from the experienced countries (USA, UK, France, Russia), and sharing the knowledge and discuss solutions.

2. Outline

Date and Time : June 30th , 2017 , 10 : 30～17 : 30
Venue : 49th floor of the Mori Tower, 6-10-1 Roppongi Minato-ku, Tokyo
Language : English and Japanese. (simultaneous interpretation)
Participants : about 400 people


(Roppongi Hills)


(Tower hall)


(Reception hall)

3. Program

10:30～ 11:00 Opening ～Keynote (30 min)



■**Noriaki Ozawa** :
Director-General for Energy and Environmental Policy ANRE,METI



■**William D. Magwood** : Director-General, OECD/NEA

11:00～11:45 Current Situation of the Ongoing Decommissioning



■**Toyoaki Yamauchi** : Senior Executive Officer,
The japan Atomic power Company
"Current Status and Issues of D&D of NPPs in Japan"



■**Okamoto Koji** : Professor, The University of Tokyo
"Safety Standards for decommissioning Activities"



■**Masahiro Aoki** : DG for Nuclear Regulation, NRA
"Regulatory Framework for decommissioning of NPP in Japan "

13:20～15:00 Case Examples from Oversees



■**Adrian Simper** (UK) : Strategy and Technology Director, NDA

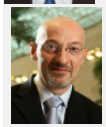


■**Bertrand Martelet** (Fr)
: EDF Senior Vice President

■**Pual T.Dicken** (US)
: Senior Policy Fellow, Argonne National Laboratory



■**Arnaud Gay** (Fr)
: Director, International Operations Recycling Business Unit, New AREVA Holding



■**Evgeny Komarov** (RF)
: Senior Manager, State Corporation ROSATOM



15:00～ 15:40 Poster session

OECD/NEA, NDA, CEA, ROSATOM, Energy Solutions, McKinsey &Co. Arthur D Little, The University of Tokyo and So on

15:40～ 17:10 Panel Discussion

【TOPIC】 the Optimizing the decommissioning in japan



<Moderator> ■**Jochen Latz**
: Partner, McKinsey and Co.

<Panelist>



■**François Gauché** (Fr)
: Director Commissariat Nuclear Energy Division, CEA



■**Colin Austin** (US)
Senior Vice President Energy Solutions



■**Mark Rouse** (UK)
: Business Director-Japan, Cavendish Nuclear Limited



■**Mykyta Konstantinov** (RF)
: Adviser to Director General JSC

■ **Toyoaki Yamauchi** : Senior Executive Officer, The japan Atomic power Company

17:10～ 17:30 Closing Remarks

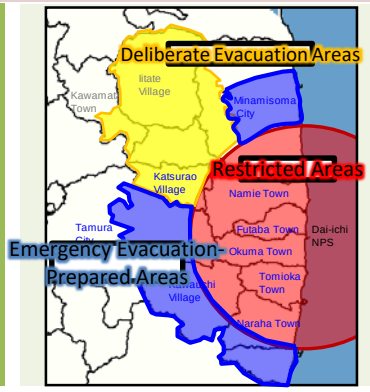
■ **Daisuke Matsuno** : Director, Nuclear Energy Policy Planning Division, ANRE, METI



Efforts for Contaminated Water Management and Decommissioning at Fukushima Daiichi

April 2011 (Immediately after the accident) | **2017** (6 years after the accident) | **2018** (7 years after the accident) | **Future**

Off-site



Tomioka Town **25mSv/year**
Namie Town **16mSv/year**
Tamura City **7mSv/year**

Physical decay + Weathering effect + Decontamination

0.5mSv/year
1.1mSv/year
1.6mSv/year

Above data (mSv/year) is estimated by the rate of air dose under a condition.

All of the orders of Habitation Restricted Areas and Preparation Areas for Lift of Evacuation Order were lifted by spring 2017, except for the evacuation orders in Okuma town and Futaba town.

Preparation of the environment for Return

- Promoting Fukushima Innovation Coast Framework.
- Supporting the business and livelihood restoration.
- Eliminating reputation damage.
- Prepairing Zone Designated for Reconstruction and Recovery. etc

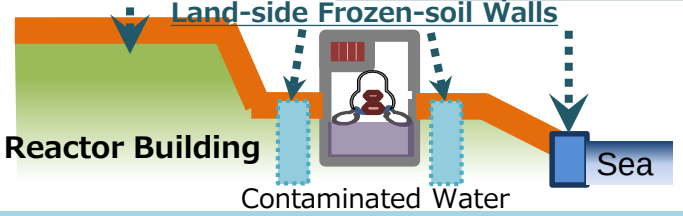
Contaminated Water Management

March 2011 (Immediately after the accident)
10,000Bq/L
※Radioactive materials concentration in surrounding sea area

Less than 1/10,000

Contaminated Water Management

Waterproof pavement
Sea-side impermeable walls
Land-side Frozen-soil Walls



March 2016 (5YEARS after the accident)
Extremely low and undetectable (Under 0.7Bq/L)

IAEA review report (May 2015)
- Many important tasks on decommissioning and contaminated water management has been done. A large improvement was made.

Decommissioning

Mid-and-Long- term Roadmap (Dec. 2011)

International Research Institute for Nuclear Decommissioning (Aug. 2013)

Nuclear Damage Compensation and Decommissioning Facilitation Corporation (Aug. 2014)

Ongoing Activity toward decommissioning- Decide the policy for debris retrieval (Sep.2017)

Removal of fuels from Unit 3 will begin (Mid. FY2018)

Toward Reconstruction
Toward Sustainable measures
Toward Decommissioning

Thank you for your attention!

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