Japan's Nuclear Policy

Ministry of Economy, Trade and Industry

Sep. 2018

METI
Ministry of Economy, Trade and Industry

Strategic Energy Plan and Energy Mix as of 2030

Strategic Energy Plan

(Cabinet Decision in July 2018)

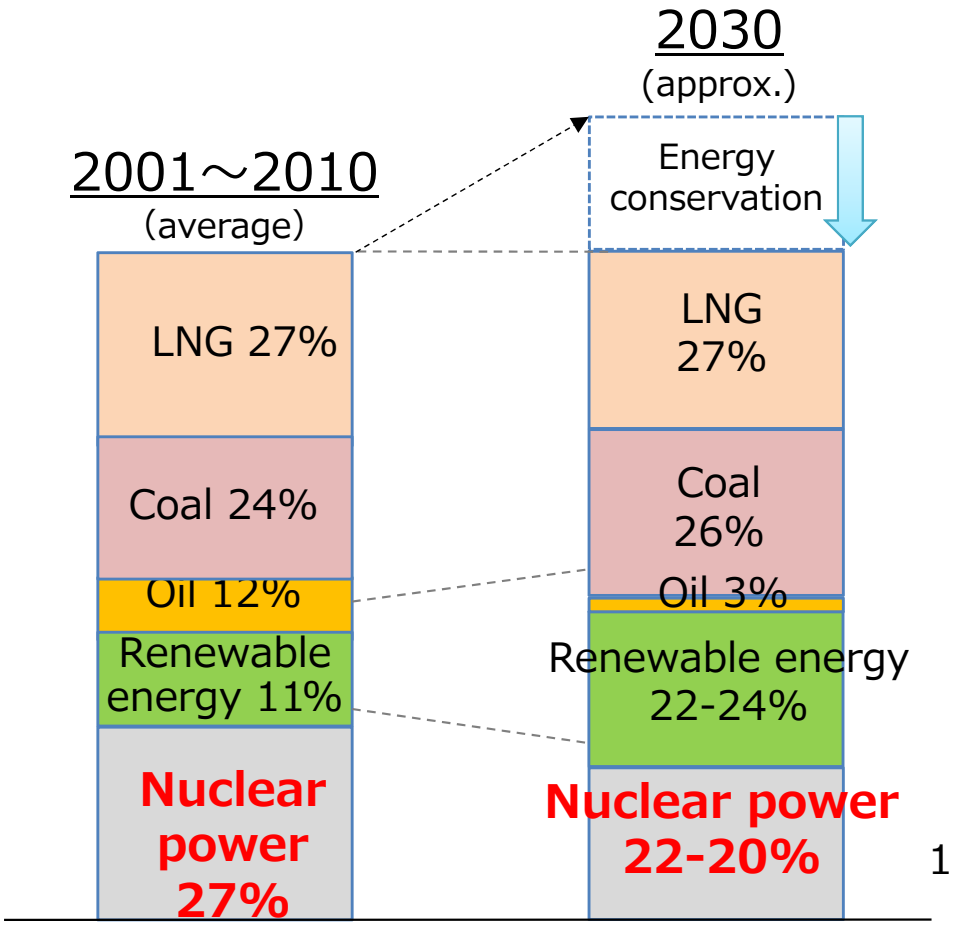
I. Nuclear power is an important base-load power source as a low carbon and quasi-domestic energy source, contributing to stability of energy supply-demand structure.

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.

Target of electricity generation

	2010	2013	2030
Nuclear	29%	1%	22~20%
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

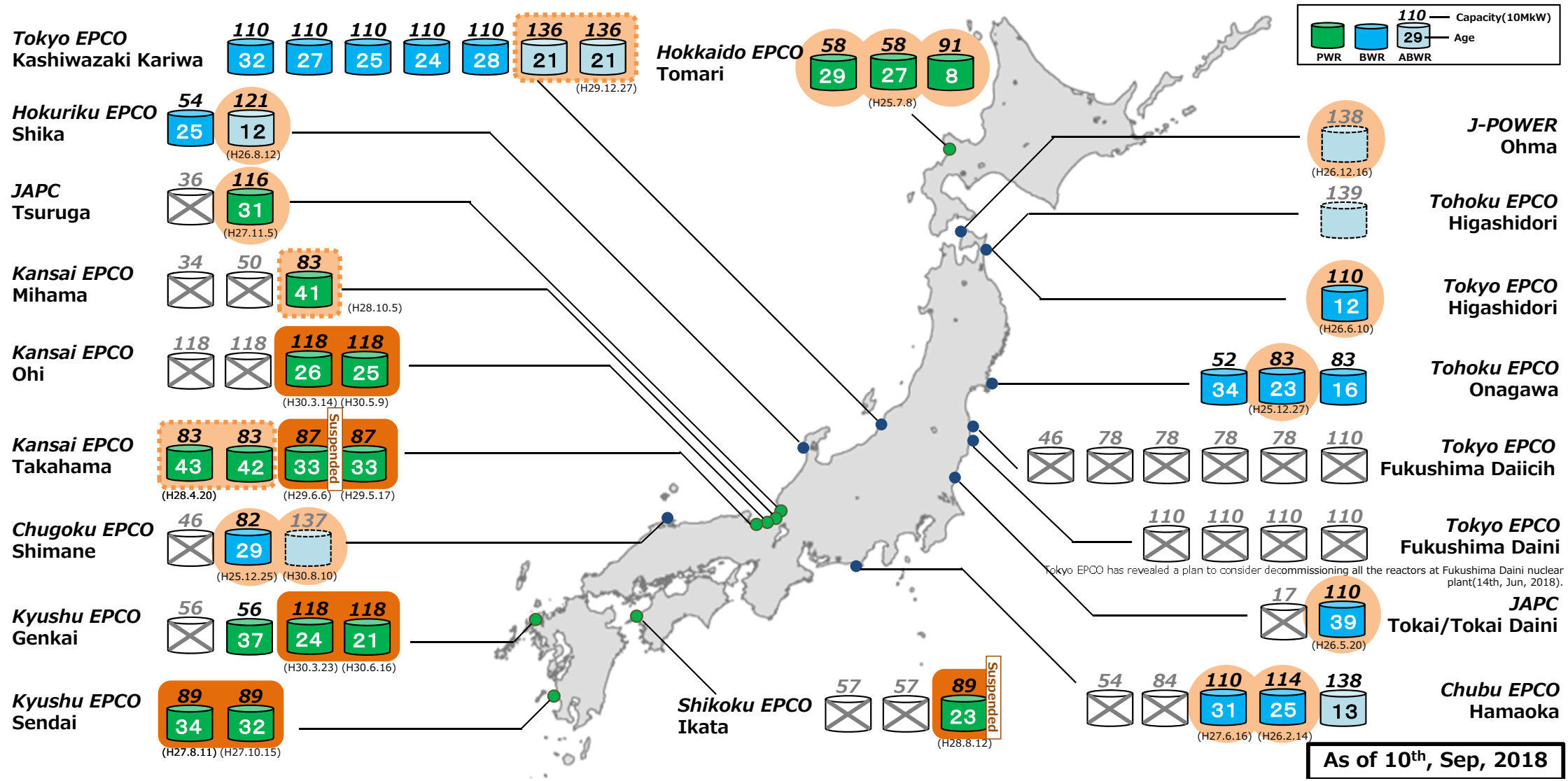
Restarted
9 reactors
(Date of Restart)

In Operation : 7 reactors
Suspended : 2 reactors

Passed NRA Review
for the Permission for Changes in Reactor Installation
5 reactors
(Date of Approval)

Under NRA Review
13 reactors
(Date of Application)

already decided/predicted to **Decommission**
22 reactors



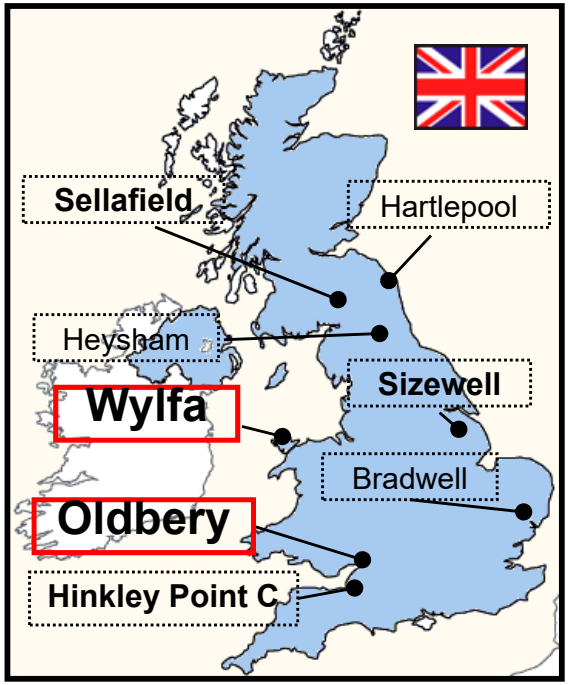
As of 10th, Sep, 2018

Contribution to Peaceful Use of Nuclear Power in the World

- Make proactive contributions to improve 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 June 2018, BEIS announced that HITACHI and the UK Government enter into negotiations in relation to the proposed Wylfa Newydd.



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.

Decommissioning of Nuclear Power Plants in Japan

<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.)

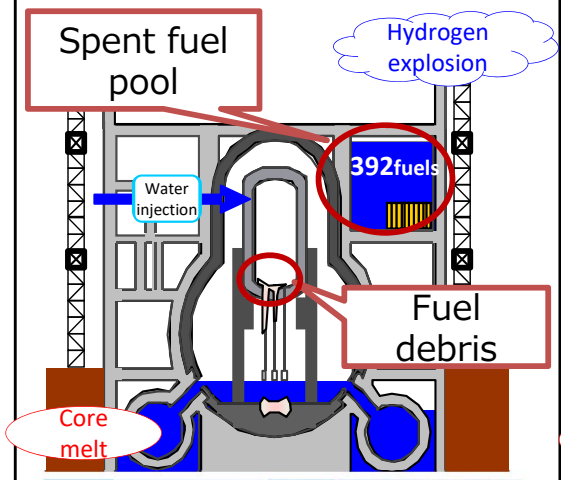
Decommissioning caused by Accident	**Decommissioning already decided/predicted**	**Operating reactors**	**Other reactors**
6 reactors	3 + 1 3 reactors	40 years Operation	Fugen, Monju
(Fukushima-Daiichi #1 - #6)	(Before the earthquake + After the earthquake)	(If life extension is approved, 60 years maximum)	

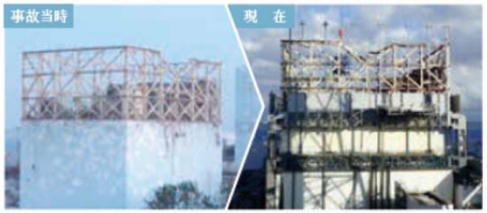
✓ Progress of decommissioning is the key to acquire social acceptability

Progress on Decommissioning of Fukushima Daiichi NPS

- Maintain cold shutdown state
- Proceed with preparation for spent fuel removal

Unit 1

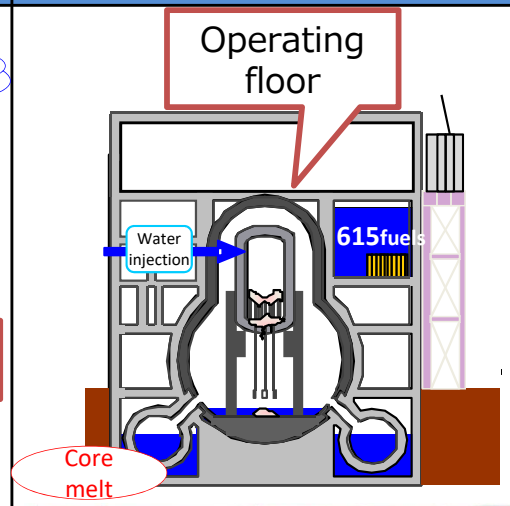


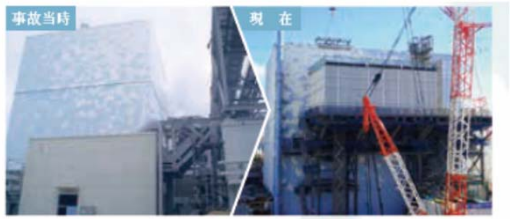


The removal of the rubble on the operating floor started from January 2018

Start of spent fuel removal: FY2023

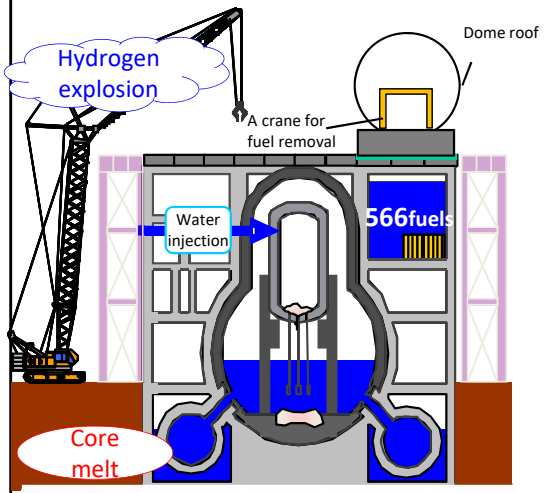
Unit 2





The investigation of the operating floor was conducted in July 2018.

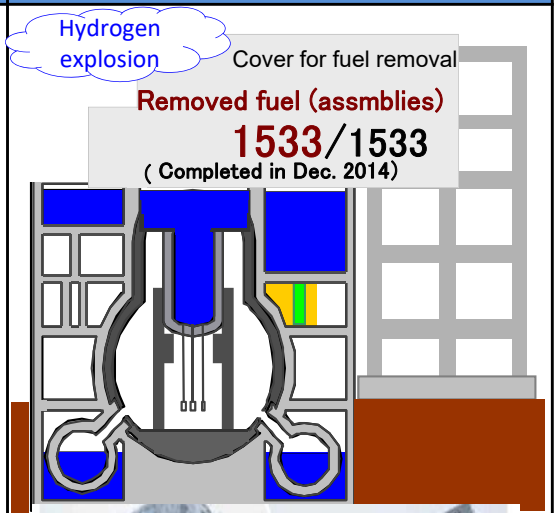
Unit 3



A trial run of the crane stared in March 2018

Start of spent fuel removal: Nov. 2018

Unit 4



Removal of the spent fuel was completed in Dec.2014

No fuel debris

Contaminated Water Management in Fukushima Daiichi NPS

Three Basic Principles for Water Management

1. **"Isolating" groundwater from the contamination source**

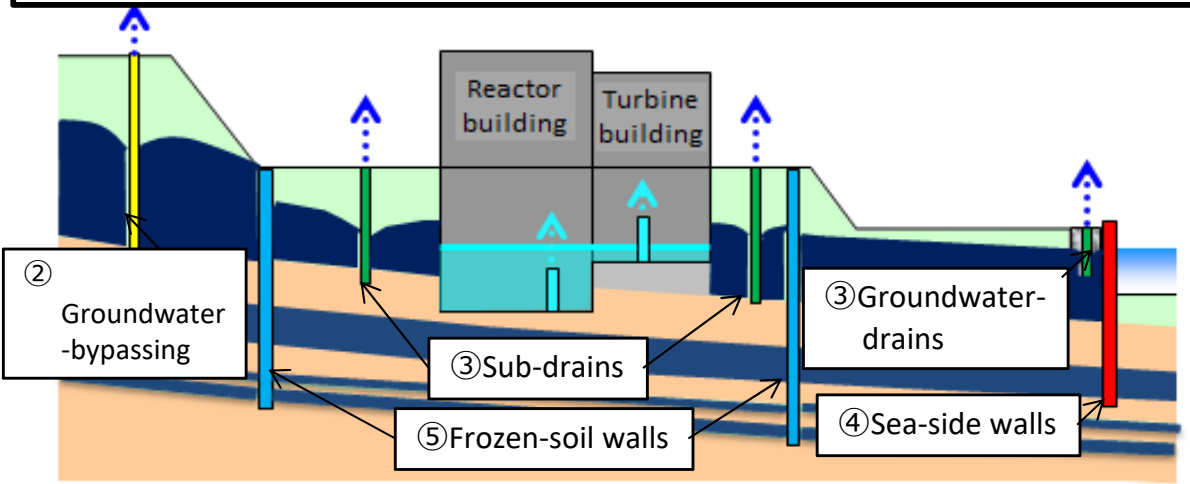
   Measures are taken to reduce the generation of contaminated water. (①②③⑤)

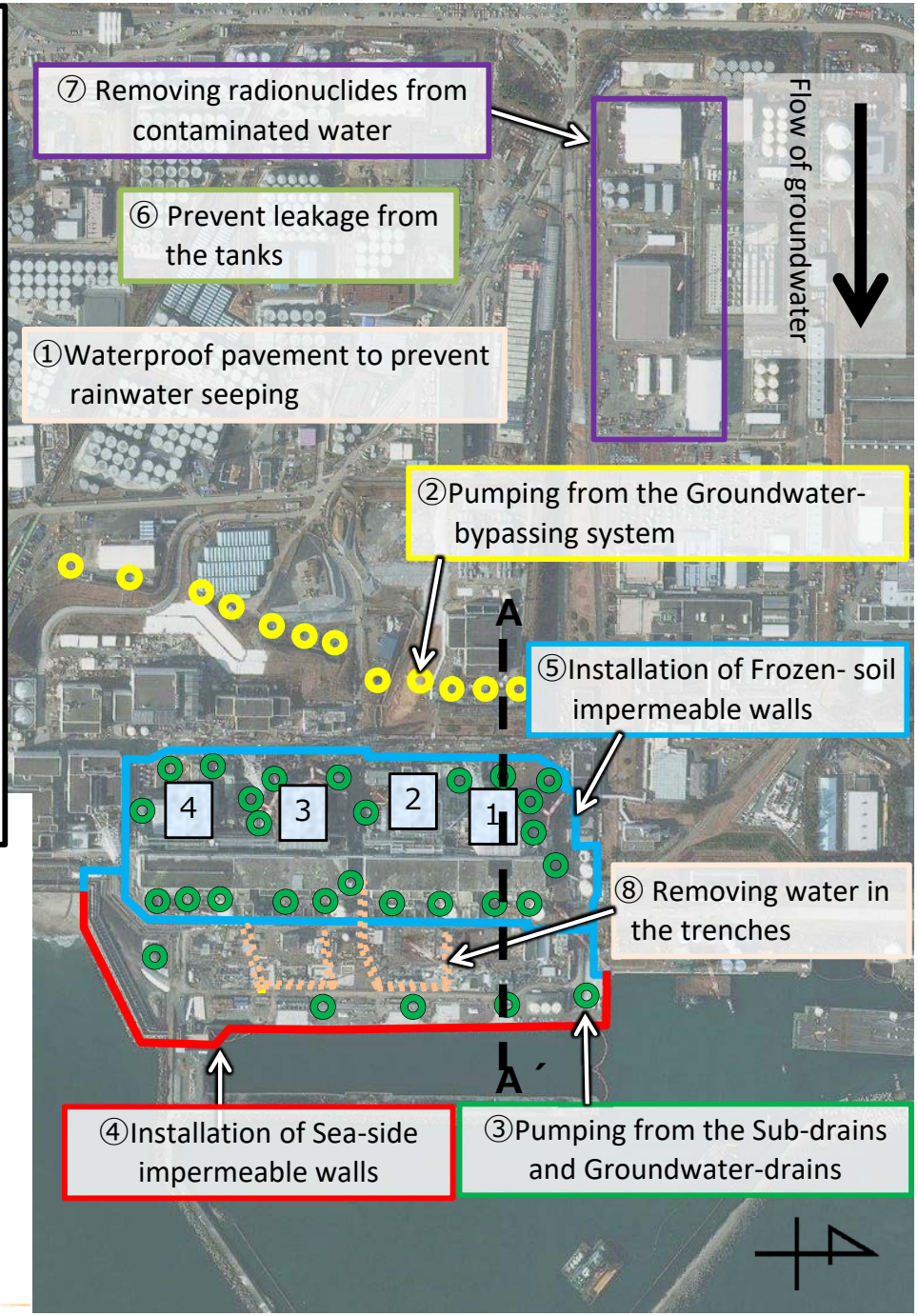
2. **"Preventing leakage" of contaminated water**

   Measures are taken for preventing leakage of contaminated water to the sea. (④⑥)

3. **"Removing" the contamination source**

   Measures are taken for removing the radioactive nuclides from the contaminated water in the tanks and in the trenches. (⑦⑧, etc.)



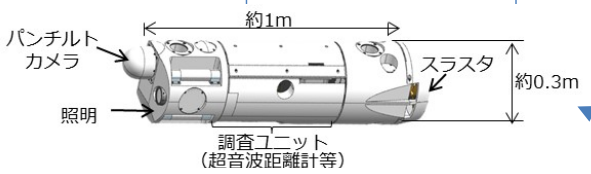
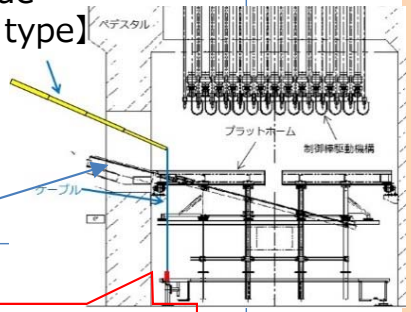
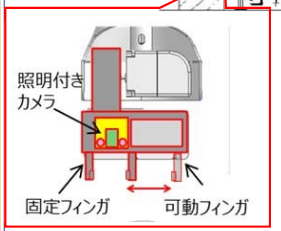
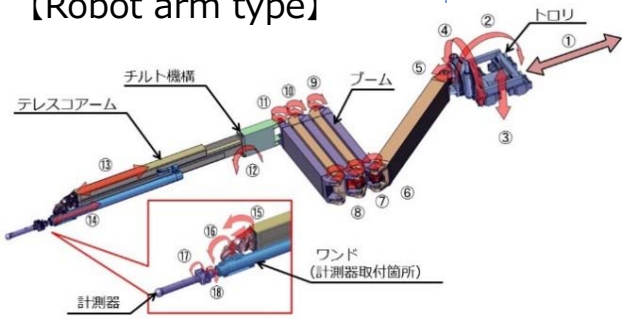


Investigation for Fuel Debris Retrieval in Fukushima Daiichi NPS

・Unit1 : Investigation of the distribution situation of deposits will be done in the first half of FY2019.
Collection and analysis of the deposits will be done.

・Unit2 : Besides the mobility investigation of deposits, a small amount sampling of deposits probably including fuel debris will be started in the later half of FY2019. Then, the amount of the collecting sample will be increased after FY2020.

・Unit3 : Measures to reduce water level in the PCV and detailed investigations by Underwater Vehicle Robot are under consideration.

	FY2018		FY2019		FY2020	FY2021
	First half	Latter half	First half	Latter half		
Unit 1	 【Underwater boat type】		Investigation of the distribution situation of deposits at the bottom of PCV 【Underwater boat type investigation equipment 】		【Guide-pipe type】 	
Unit 2			mobility investigation of deposits at the bottom of PCV 【Guide-pipe type investigation equipment】			
		【Robot arm type】 		Investigation of the distribution situation of deposits (including a small amount sampling of deposits) 【Robot-arm type imp】		Start sampling with larger amount	
Unit 3			(TBD) Detailed investigation of the bottom of PCV 【Underwater Vehicle type】			

Decision on the method for fuel debris retrieval from the first implementing Unit

Start of fuel debris retrieval from the first implementing Unit

Nuclear Fuel Cycle & Plutonium Management Policy

Excerpt from Strategic Energy Plan

Promotion of the nuclear fuel cycle

- The basic policy of Japan is to promote a nuclear fuel cycle that reprocesses spent fuels and effectively utilizes the plutonium etc. retrieved, from the viewpoint of effective utilization of resources and reduction of the volume and harmfulness of high-level radioactive waste.
- Specifically, GOJ will promote plutonium use in LWRs, and proceed with such measures as completion of the Rokkasho Reprocessing Plant, construction of a MOX fuel fabrication plant, and completion of the Mutsu interim storage facility on the underlying premise of ensuring safety.

Plutonium Management

- The Japanese government remains committed to the policy of not possessing plutonium without specific purposes on the premise of peaceful use of plutonium and work to reduce of the size of plutonium stockpile, thereby contributing to nuclear non-proliferation and steadily proceeding with such efforts while gaining international understanding.
- In order to achieve this policy effectively, the government will appropriately manage and utilize plutonium through further promotion of plutonium use in LWRs and the Government's involvement based on the framework of the Spent Nuclear Fuel Reprocessing Implementation Act newly introduced in 2016 while paying due consideration to an appropriate balance between the separation and utilization of plutonium.

Review and Revision of FR Development

Review

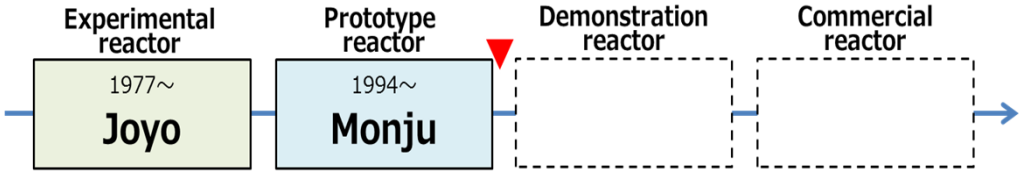
Decision by the Ministerial Meeting for the Nuclear Energy Policy

(Sep. 21, 2016)

Main points of the Decision

- **Japan will firmly maintain its nuclear fuel cycle policy** and R&D of FR
- The Council on Fast Reactor Development will be established
- New strategy for FR development will be finalized by the end of 2016.
- **Reviewing the role of FBR Monju that may lead to possible decommissioning will be finalized by the end of 2016.**

(cf.) Steps of FR Development in Japan



Revision

Decision by the Ministerial Council for Nuclear Power

(Dec. 21, 2016)

New strategy for FR development

- **Nuclear fuel cycle policy**
  → **firmly maintained**
- 4 principles:
  - ✓ Domestic resources
  - ✓ World's knowledge
  - ✓ Cost-efficiency
  - ✓ System for the responsibilities
- Alternative methods to Monju
- **Roadmap for FR development**
  → **around 2018**

The New Government Policy on Monju

- Technologies and knowledge obtained
- **Monju will not restart as a reactor**
- Steady and safe decommissioning
- Alternative functions as:
  - ✓ Center for FR development
  - ✓ Nuclear research
  - ✓ HR development

FR Project: Working Group on FR Development

- The first meeting held in March 2017 and it has held 12 times in total.
- Until now, collection of feedbacks from various experts both in Japan and from abroad has been conducted.

<Points of feedbacks collected as of August 2018>

Mr. Magwood, Director-General of OECD/NEA（3rd meeting, July 4th ）
- In the field of fast reactors, there is no resource for each country to do research and development independently.
- International cooperation to maintain technology does not go well if countries think differently. It is important to firmly share future strategies among stakeholders including overseas.

Mr. Yang, Director of CIAE（4th meeting, Sep. 14th ）
- In fast reactor development, the main strategy is utilizing equipment domestically produced in China in principle.
- Priority of development in the 4th generation reactor is not determined at the present time, and research and development are done in parallel at the same time.

Fast reactor development in Russia and India（5th meeting, Oct. 31th : feedbacks from JAEA）

【Russia】
- Under the stance of utilizing the most efficient plutonium in a fast reactor, they have a wealth of development experience in fast reactors so far. They aim to reduce the power generation cost of the fast reactor by making the reactor vessel compact.

【India】
- Based on French fast reactor technology (Rhapsodie), they have been developing independent routes. They promote the use of plutonium by fast reactor cycle. After that, they plan to replace it with thorium which exists abundantly in the country.

Mr. Herczeg, Deputy Assistant Secretary of DOE（8th meeting, Mar. 1st ）
- We focus not only on one technology but on various technologies such as fuel, reactor type and simulation.
- The US government / DOE is promoting partnership between the public and private under the guidelines of President Trump and pursuing the next advanced type reactor.

Mr. Devictor, Program manager (Generation IV reactors) of CEA （10th meeting, Jun. 1st ）
- Assume the period of commercial use of sodium cooled fast reactor around 2080.
- The ASTRID program considers a change to a new SFR simulation program that develops simulation tools and acquires data using laboratory facilities such as demonstration reactors of 100MW to 200MW scale.

International cooperation in fast reactor development

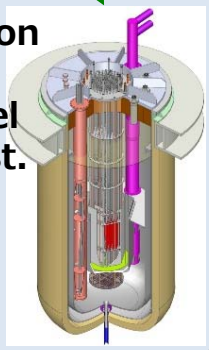
- The Working Group on FR Development plans to make the “Strategy Roadmap” within 2018 for next decade FR development, utilizing the best combination of domestic and international resources/facilities.

Experimental Fast Reactor ”JOYO”

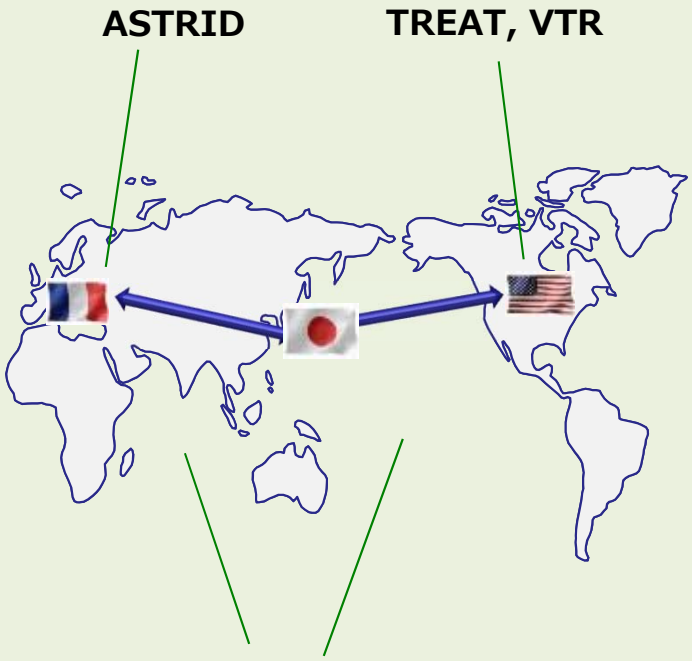
- Application to NRA in March 2017 for alteration of reactor installation to verify the conformity to the new regulatory requirement.
- Use for fuel/material irradiation test, human resource development, etc.

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)

New Basic Policy for Final Disposal

- 2000, Final Disposal Act was enacted.
  → NUMO (Nuclear Waste Management Organization) established as an implementor.
- 2002, NUMO started open solicitation for all municipalities to accept site investigations.
- 2007, Toyo Town in Kochi Prefecture submitted a formal application.
  →withdrawn after the mayoral election
- To date, no municipalities have accepted site investigations.

Review under the Ministerial Meeting

The New Basic Policy(2015) ～Cabinet decision on the following directions

- The current generation bears the responsibility for the final disposal of high-level radioactive waste and should pursue the geological disposal as the best and internationally-accepted solution.
- National government will play an active role and for its first step present a nationwide map of scientific features for geological disposal.

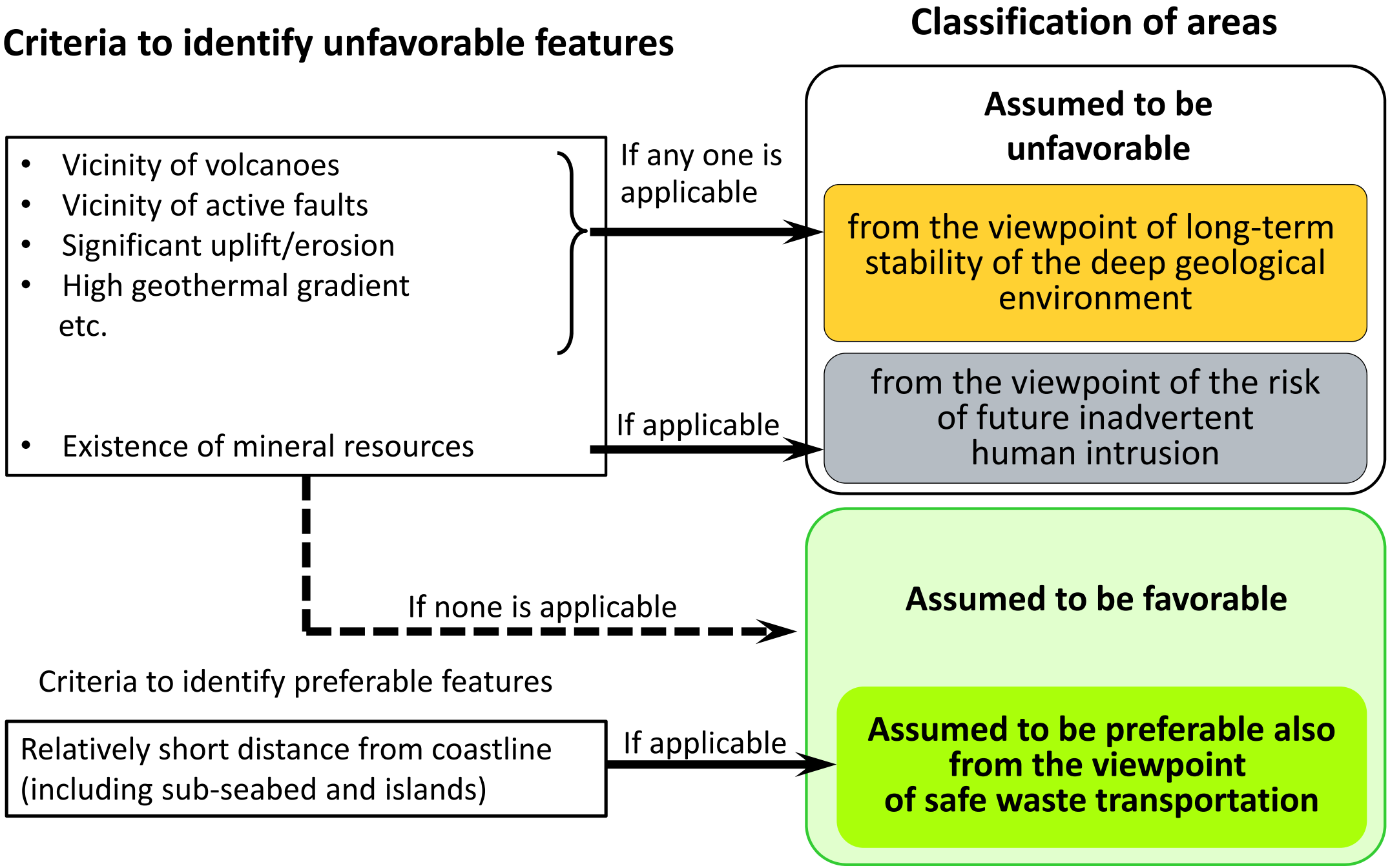
Experts' discussion on requirements and criteria for the "Nationwide Scientific Map"
(Advisory Committee on Natural Resources and Energy)

Conducting international review by OECD/NEA and asking for public comment

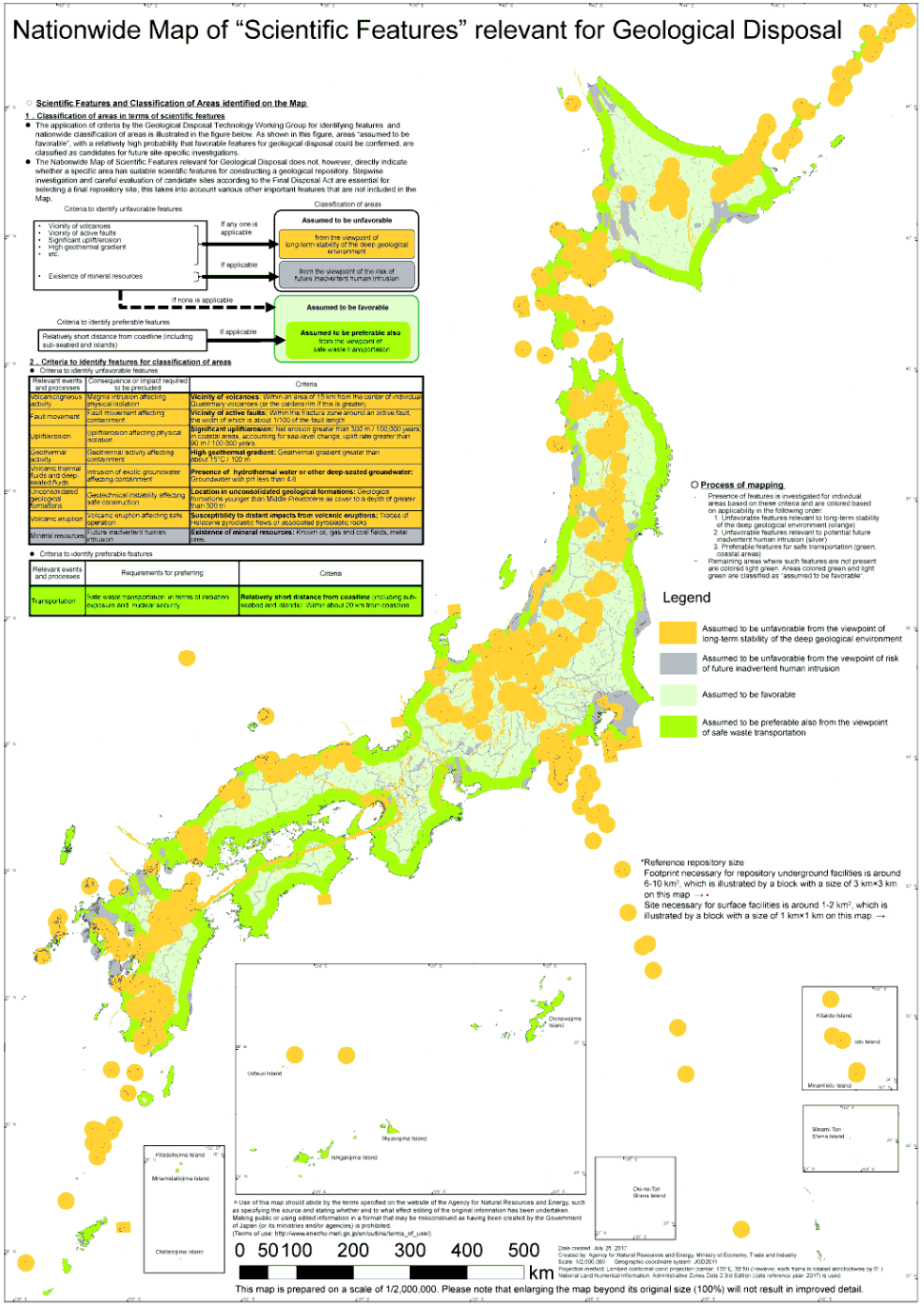
Finalization of the report "Requirement and Criteria for Nationwide Map of Scientific Features for Geological Disposal". (Apr. 2017)

Publication of the "Nationwide Map of Scientific features for Geological Disposal" (July 2017)

Status of the "Nationwide Map of Scientific Features for Geological Disposal"



“Nationwide Map of Scientific Features”



Step-by-step approach toward site selection and geological disposal

- The publication of the map is **the first step on a long way toward completion of geological disposal.**
- With the aim that multiple municipalities will undertake site investigations**, we will continue to hold public dialogues to ensure a deeper public understanding of the issue**.

Publication of Nationwide Map of Scientific Features

Deepen national and regional comprehension

Nationwide explanatory meetings using the map

Listening to public voices

- **Prioritized activities focusing on "green (coastal area)"**
- Supporting regional deliberation
- Promotion of R&D
- International cooperation & contribution

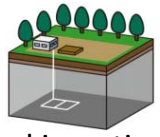
With the aim that multiple municipalities will accept site investigations

Site investigations

Conducted by NUMO based on regional comprehension

Literature survey

Preliminary investigation
(borehole survey, etc.)



Detailed investigation
(construction & studies in underground facilities)

Selection of final disposal site