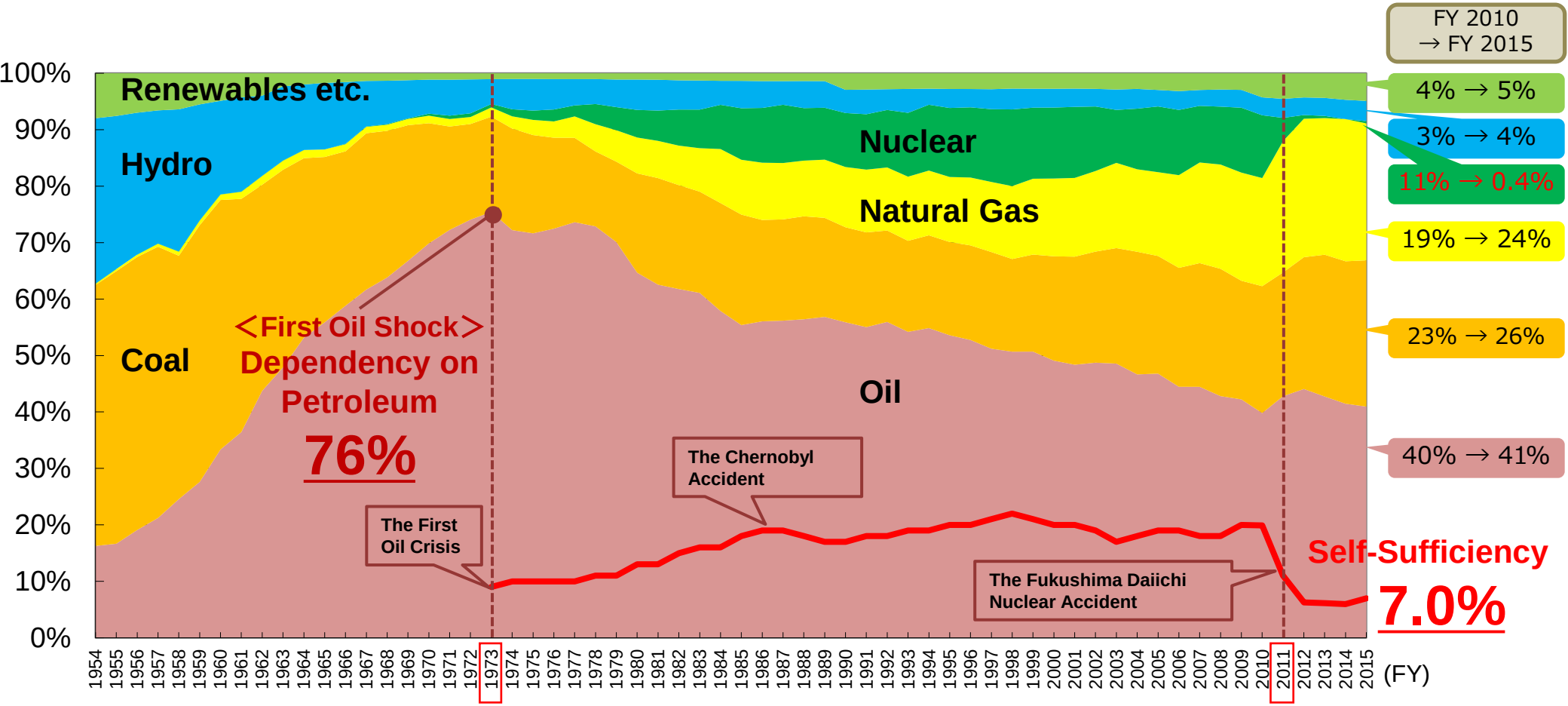
Japan's Nuclear Policy

Ministry of Economy, Trade and Industry

Sep. 2017

METI
Ministry of Economy, Trade and Industry

Japan's Primary Energy Supply



Self-sufficiency rate

1973 (1st oil shock)	2010	2015	2030
9%	19.9%	7.0%	24.3%

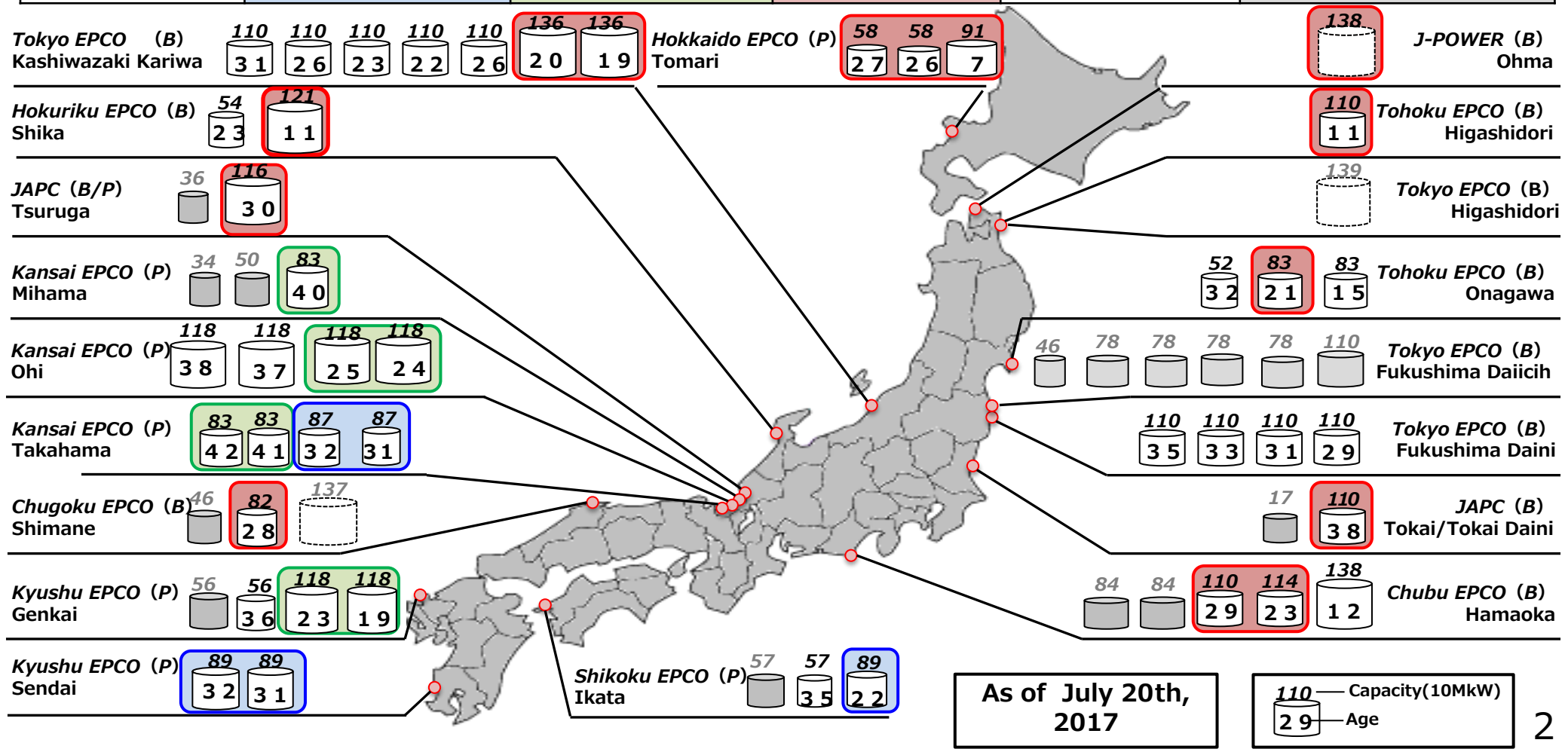
* The actual results are based on IEA Energy Balances.

Dependence on fossil fuels (On the basis of power source composition)

76%	65%	84%	56%

Restart of PWR NPPs

	In Operation	Passed NRA Review	Under NRA Review	To be Determined	Decided to Dicommission
PWR	5	7	4	4	4
BWR	0	0	10	15	11(1 GCR)



-2014- Redefine Nuclear Energy in "Strategic Energy Plan"

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.

GOJ will follow NRA's judgment and will proceed with the restart of the nuclear power plants.

III. GOJ will make efforts to reduce the volume and harmfulness of radioactive waste and create a nuclear fuel cycle that contributes to effective utilization of resources.

a. promote reprocessing and plutonium use in LWRs.

b. Complete the Rokkasho reprocessing plant, JMOX fuel processing plant and Mutsu interim storage facility.

c. promote R&D of fast reactors etc., through international cooperation with the U.S. and France etc.

-2015- Set the Target of Nudclear Energy Source as of 2030

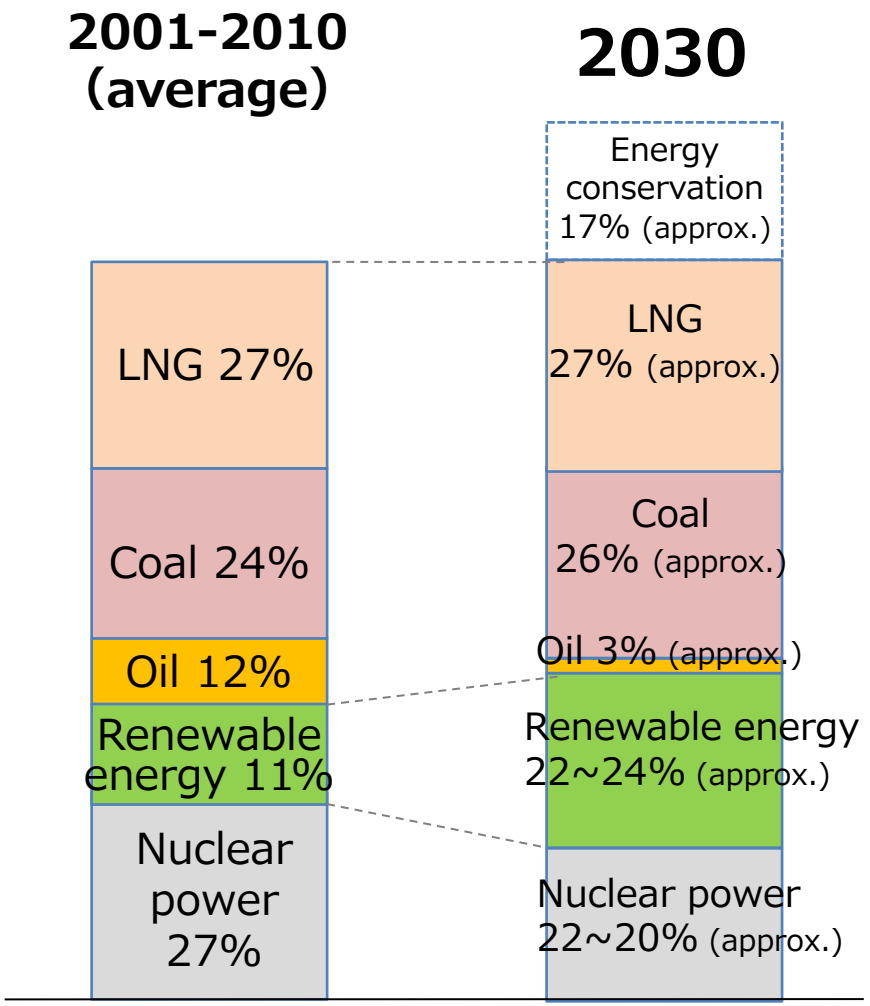
- METI officially decided and announced the “Energy Mix” on 16 July 2015, with the number of 20-22% in 2030 as for the share of nuclear power generation.

Composition of electricity sources and electricity generation (billion kWh)

	2030	
Oil	31.5	3%
Coal	281.0	26%
LNG	284.5	27%
Nuclear power	216.8～231.7	22～20%
Renewable energy	236.6～251.5	22～24%
Total	1065.0	100%

	2030	
Solar	74.9	7.0%
Wind	18.2	1.7%
Geothermal	10.2～11.3	1.0～1.1%
Hydropower	93.9～98.1	8.8～9.2%
Biomass	39.4～49.0	3.7～4.6%

※All the numbers are approximately



【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

-2017- The Strategic Policy Committee & Round Table for Studying Energy Situations

Major changes in situations; forecasting future changes as an important perspective

- ○ Price down of oil and renewables
- ○ Development of storage batteries
- ○ Some countries phase out nuclear; others not
- ○ Full liberalization of markets; more renewables
- ○ US withdrawal from Paris Agreement; no trend change
- ○ Expansion of global energy and electricity demand
- ○ Presence of emerging companies & financial sector
- ○ Rising geopolitical risks; needs for strategies

○Progress toward goals to be achieved by 2030 (as of FY2016)

- ➢ Zero-emission power source rate (44% in 2030):
  10% in 2013 → 17% in 2016
  (renewables:15%, nuclear: 2%)
- ➢ Self-sufficiency rate (24% in 2030)
  6% in 2013 → 8% in 2016
- ➢ Cutting electricity costs as soon as possible
  Electricity bill compared with one in 2010
  +30% in 2011 → +10% in 2016

○Identifying issues to be solved

○Realize the goal toward 2030

Strategic Policy Committee for Natural Resources and Energy

- ➢ First meeting was held on August 9, 2017

○ Paris Agreement

- ➢ Very ambitious goals
  Japan: -80% GHG reduction by 2050
- ➢ Common factors toward the achievement
  -Technological innovations (nuclear, renewables, CCS, energy efficiency, etc.)
  -Contribution to overseas
  -HR development; accelerated investment

○ Establishment of industrial structures and policies to realize these factors

○ Pursue all possibilities toward 2050

Round Table for Studying Energy Situations

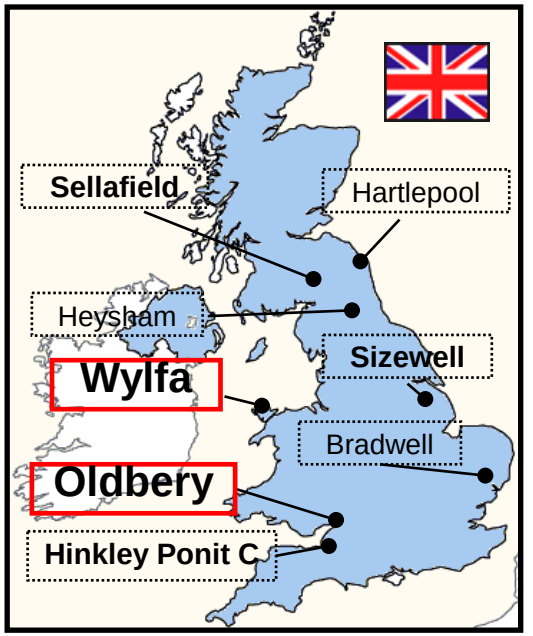
- ➢ First meeting was held on August 30, 2017

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.

On-going Decommissioning Activities of NPPs

Decommissioning caused by Accident

6 reactors

Fukushima-Daiichi #1 - #6

Decommissioning already decided

3 + 6 reactors

Before the Earthquake

Tokai
Hamaoka #1/#2

After the Earthquake

Tsuruga #1
Mihama #1/#2
Shimane #1
Genkai #1
Ikata #1

Other reactors

40 years Operation

* If life extension approved, 60 years maximum

Decommissioning

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 of Fukushima Daiichi NPP

Contaminated Water Management

“Isolating” groundwater from the contamination source

- Measures are taken to reduce the generation of contaminated water. ((1)(2)(3)(4) of the right figure)

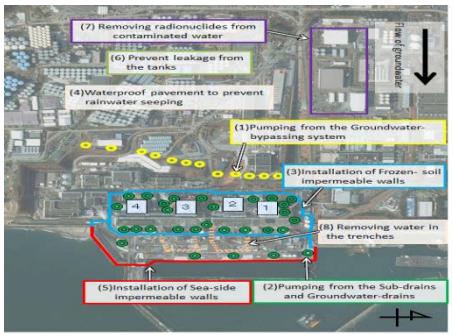
“Preventing leakage” of contaminated water

- Measures are taken for preventing leakage of contaminated water to the sea. ((5)(6) of the right figure)

”Removing” the contamination source

- Measures are taken for removing the radioactive nuclides from the contaminated water in the tanks and in the trenches. ((7)(8), etc.)

Completion of treatment of stagnant water in the building until 2020



Decommissioning

“Removal of fuel from spent fuel pools”

- Fuel removal from Unit 4 SFP was completed
- Preparations are underway for the removal of fuel from SFPs at Units 1-3

“Retrieval of fuel debris”

- Examination of the inside PCVs using a camera and a robot.
- Continue to conduct R&D based on knowledge and wisdom gathered from within and outside Japan

Decision on methods for the treatment and storage of SF around 2020.

Start of fuel debris retrieval from the 1st implementing Unit in 2021

<Example of the progress>

Immediately after the accident (March 18, 2011)

March 18, 2011: Outside of Unit 4

Current situation (December 2014)

On December 22, 2014, all (1533) fuel removal from Unit 4 SPF was completed

Reconstruction

“Lift evacuation orders”

- Except for the evacuation orders in Okuma town and Futaba town, all of the order of Habitation Restricted Areas and the order of Preparation Areas for Lift of Evacuation Order were removed by spring 2017.

“Innovation Coast Framework”

- Fukushima Innovation Coast Framework is in progress toward the building of a new industrial base in the Hamadori area, with decommissioning, robot technologies, and energy, etc.

“Supporting business restructuring towards the realization of self-reliance ”

- Public-Private Joint Team for Fukushima-Soso Reconstruction Corporation.(established on 24 August , 2015) has visited over 4,600 individual business entities to support their reactivation through tailor-made approach.

Reconstruction and revitalization of Fukushima

(e.g.) Narana Town:
A prefectural clinic (internal medicine and orthopedics) opened on Feb.1, 2016.

(e.g.) Innovation Coast Framework Minamisoma City and Namie Town were decided in April,2016, as the locations of Fukushima Robot Testing Fields, which are under construction.

(e.g.) Kawauchi Village:
“YO-TASHI”, a new commercial facility including a convenience store, opened on Mar.15, 2016.

Current Status of Each Unit

Unit 1

✓ Hydrogen explosion
✓ Core melt

<At the Time of the Accident> <Now>

・ The building cover was installed to prevent dispersion of radioactive materials.
・ Dismantling of the cover was completed in November 2016 for the fuel removal operation.

Unit 3

✓ Hydrogen explosion
✓ Core melt

<At the Time of the Accident> <Now>

- As preparation for the fuel removal in around mid-FY2018, installation of the fuel removal cover dome roof will start from July 22.

Unit 2

➢ No hydrogen explosion
✓ Core melt

<At the Time of the Accident> <Now>

- Installing a gantry to access the top floor of the building started in September 2016.

Unit 4

✓ Hydrogen explosion
➢ No core melt

<At the Time of the Accident> <Now>

- On December 22, 2014, all (**1533**) fuel removal from Unit 4 SFP was completed.

Complete 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 from foreign reprocessors

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

MOX Fuel

JNFL
Rokkasho Reprocessing Plant

Plutonium over 4tPuf/y

MOX Fuel Fabrication Plant **JNFL**

(start of construction : 2010
Plan of operation : FY2019 1H)

Spent Fuel

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

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 : 2018 2H)

Vitrified Waste

Geological disposal repository

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~)

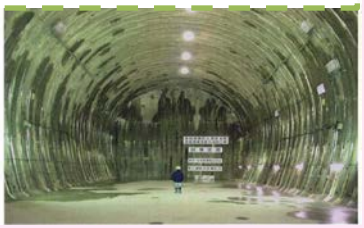
Waste (from Spent Fuel Reprocessing) returned from UK and France

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

Rokkasho Reprocessing Plant／ MOX Fuel Fabrication Plant

- Applications for compliance with the new safety regulations were filed in January 2014 and are **currently in the final stage** of the NRA review

【Rokkasho Reprocessing Plant】

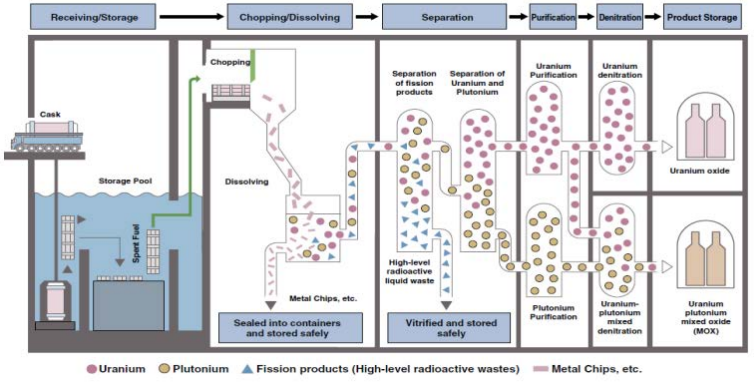
- **Completion of the construction of the reprocessing plant is scheduled in the first half of FY 2018.**

【MOX Fuel Fabrication Plant (JMOX)】

- **Completion of the construction of the facility is scheduled in the first half of FY 2019.**

Reprocessing (Main Process)

Capacity : max.800tU/y
Construction progress: **99%**



MOX Fuel Fabrication Plant

Capacity : max.130tHM/y
Construction progress: **11.8%**
(as of June 2017)

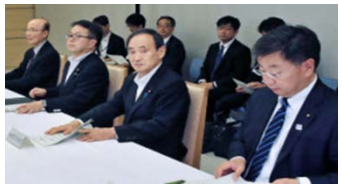

MOX Fuel Fabrication Plant
Construction Site (April 12 2016)

Review and Revision of FR Development

Review

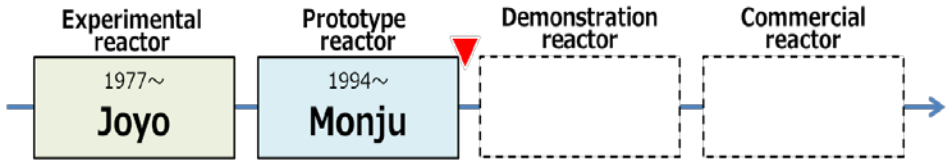
Decision by the Ministerial Meeting for the Nuclear Energy Policy
(Sep. 21, 2016)

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 Working Group plans to make the "Strategy Roadmap" within 2018 for next decade FR development, utilizing the best combination of domestic and international resources/facilities.

Members

- METI (ANRE), MEXT, MHI, FEPC (utilities), JAEA

Ongoing discussion schedule

- Within 2017 : Policy issues (significance, process, etc.)
  → Collect feedbacks from foreign countries activity
- Early in 2018 : Technical issues (review & identification of R&D)
- Mid–2018 : Other issues (project implementing body, governance, etc.)
- Within 2018 : **"Strategy Roadmap"**

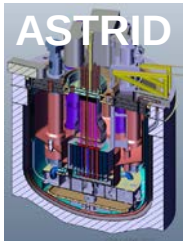
Recent event

- March 30th — 1st meeting to determine members & topics for review
- June 15th — 1st collect feedbacks from knowledgeable persons (Dr. Kondo, President of NUMO, and Prof. Yamaguchi, the Univ. of Tokyo)
- July 4th — 2nd collect feedbacks (Mr. Magwood, Director-General of OECD/NEA)
- Sep. 14th — 3rd collect feedbacks (Mr. Yang, Director of CIAE)

Utilization **Utilization**

Domestic

Inter-national



Stepwise Approach toward Site Selection and Final Disposal Completion

- Publication of the “Nationwide Map of Scientific features for Geological Disposal” (July 2017).
- The publication of the map is the first step in a long way toward final disposal completion.
- Aiming that multiple regions will accept the site investigations, we will continue to hold public dialogues to ensure a deeper public understanding of the issue.

Publication of “Nationwide Scientific Map”

Deepen national and regional comprehension

Nationwide explanatory meetings using the map

Listening to public voices

- Prioritized activities focusing on “green(costal area)”
- Supporting regional deliberation
- Promotion of R&D,
- International cooperation & contribution

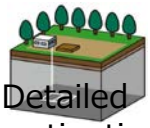
aims that multiple regions will accept the site investigations

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