

# Nuclear Development in Japan

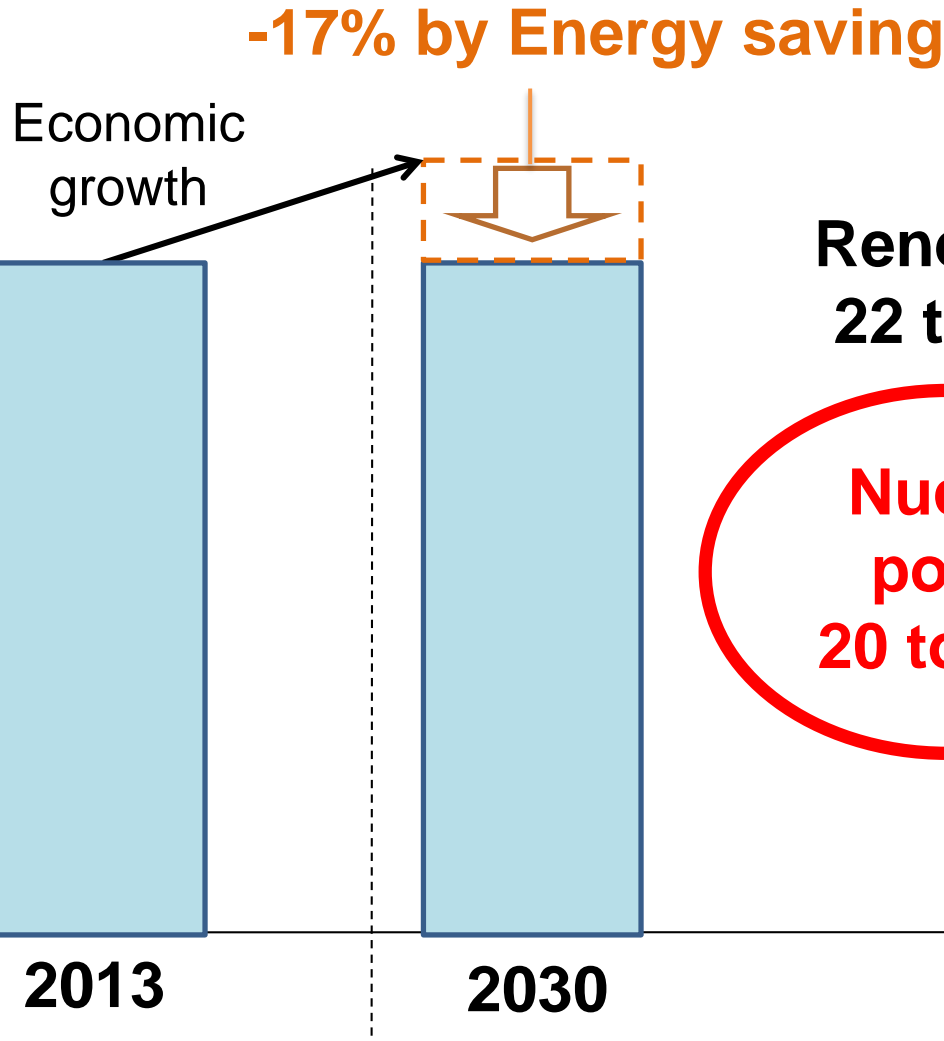
Agency for Natural Resources and Energy, METI

March, 2017

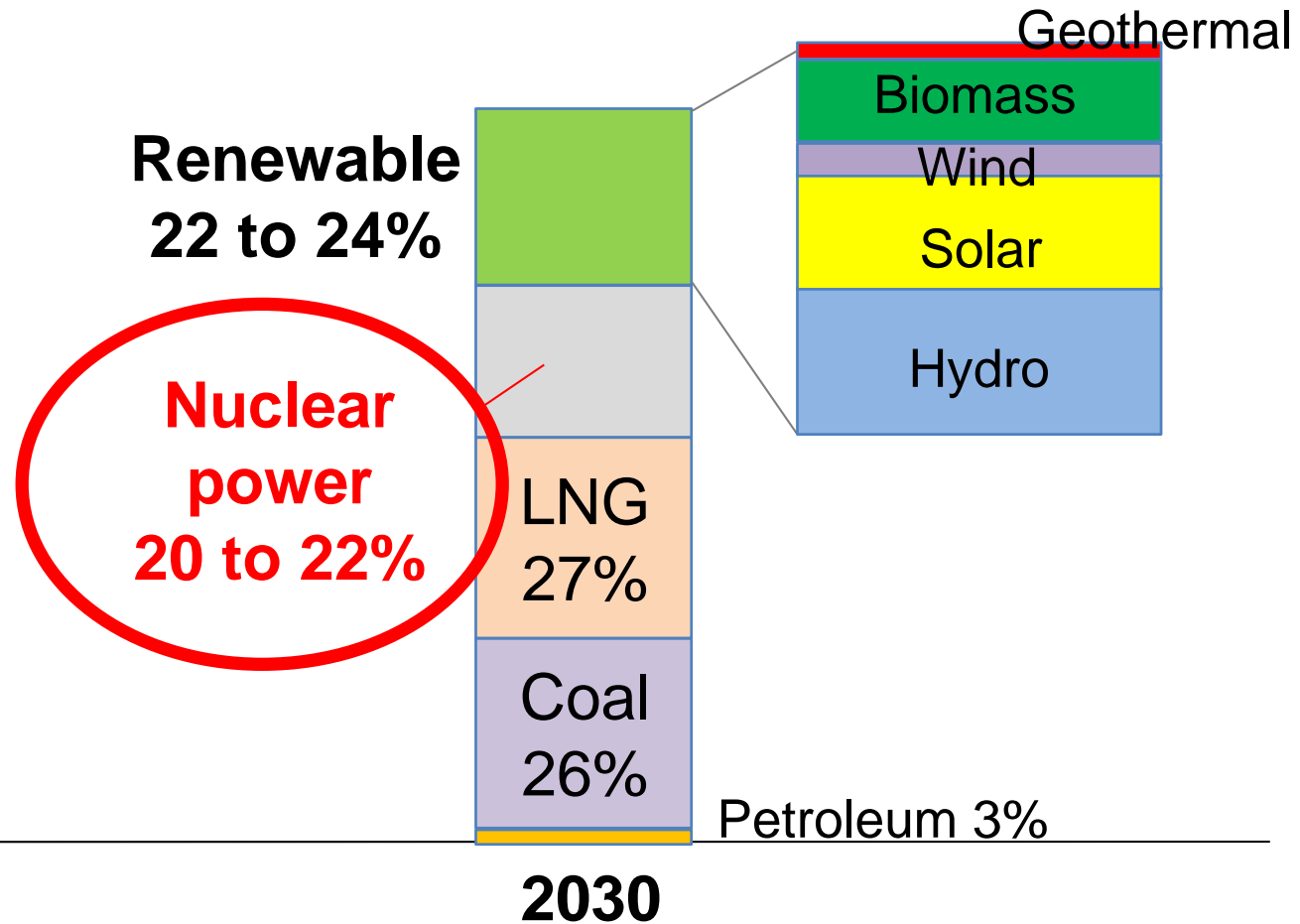
# Japan's Energy Policy after Fukushima accident

# “Energy mix” in 2030

## Power demand



## Power source composition



# Three NPPs restarted & in operation



**Takahama #3 and #4**

**Under provisional injunction**

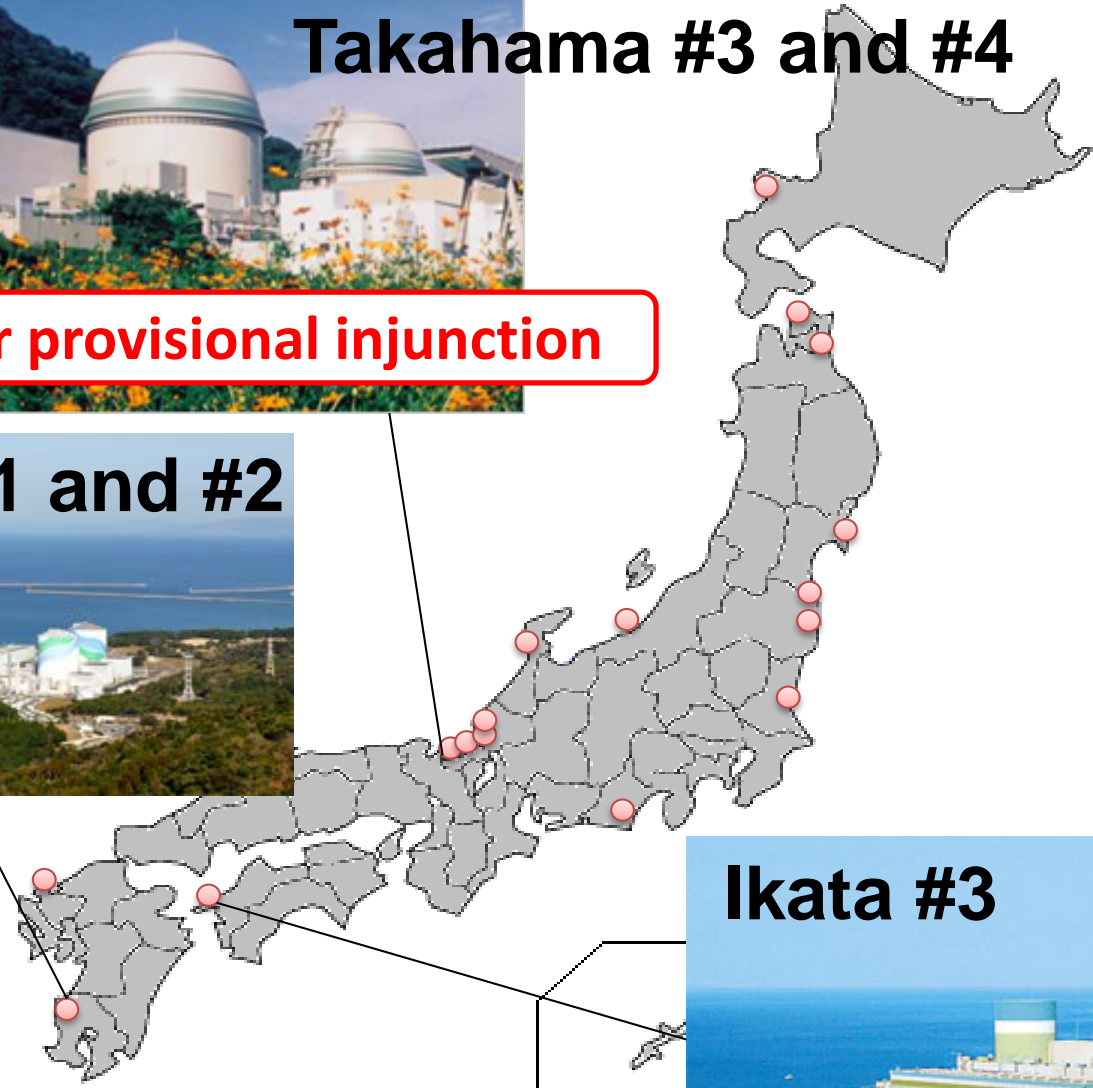
**3**

**45 Units**

**Sendai #1 and #2**



**Ikata #3**



# Nuclear Fuel Cycle Policy

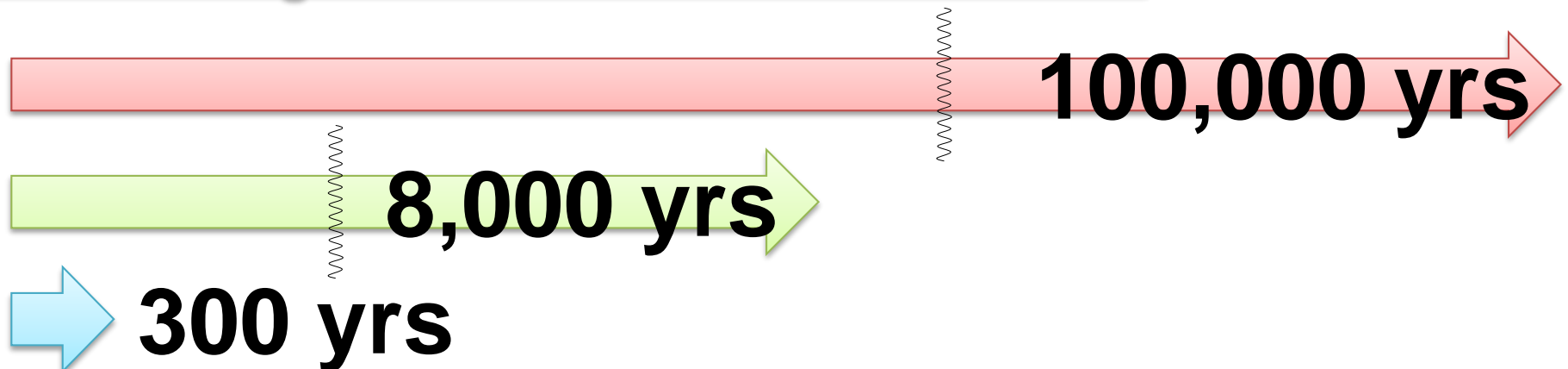
# Merits of Fuel Cycle for Japan

## 1. Effective utilization of resources

## 2. Volume reduction of HLW



## 3. Shortening of duration of harmfulness



# Japan's Fuel Cycle Policy

## Fundamental policy on promoting nuclear fuel cycle

### LWR fuel cycle

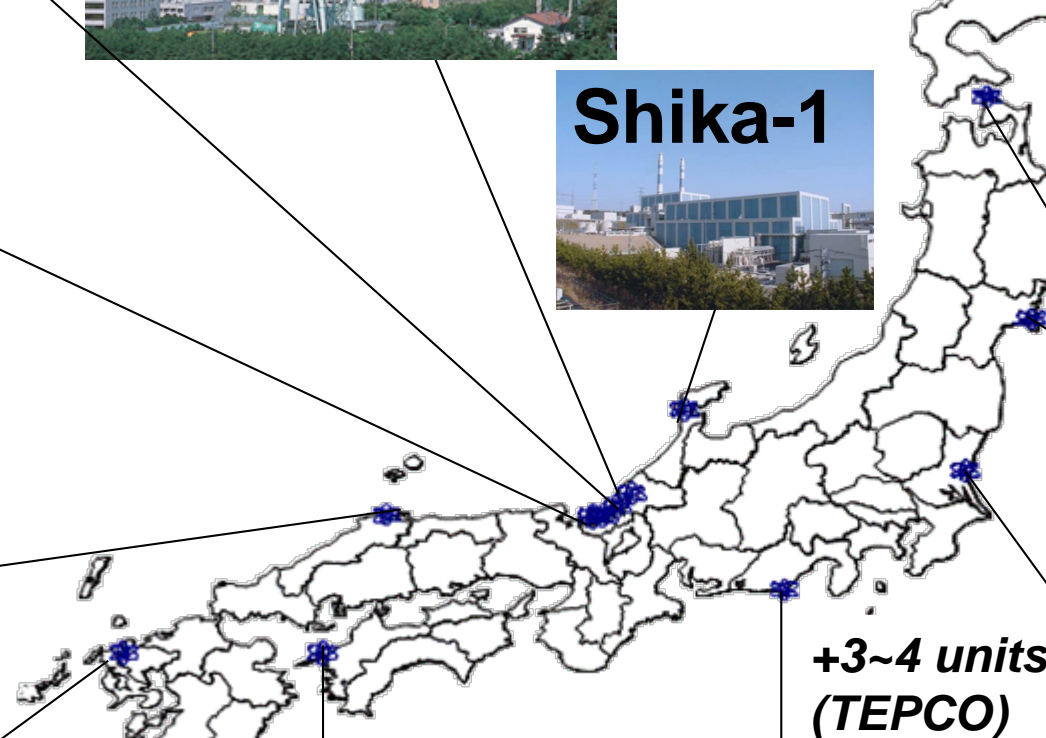
- Plutonium use in LWR
- Completion of Rokkasho Reprocessing Plant & MOX Fuel Fab. Plant
- Appropriate management of plutonium reserves

### FR fuel cycle

- Promotion of R&D of FR and related technologies, utilizing international networks
- International cooperation with U.S. and France

Monju

# Plutonium utilization in LWR planned





# Reprocessing & MOX Fuel Fab. Plants

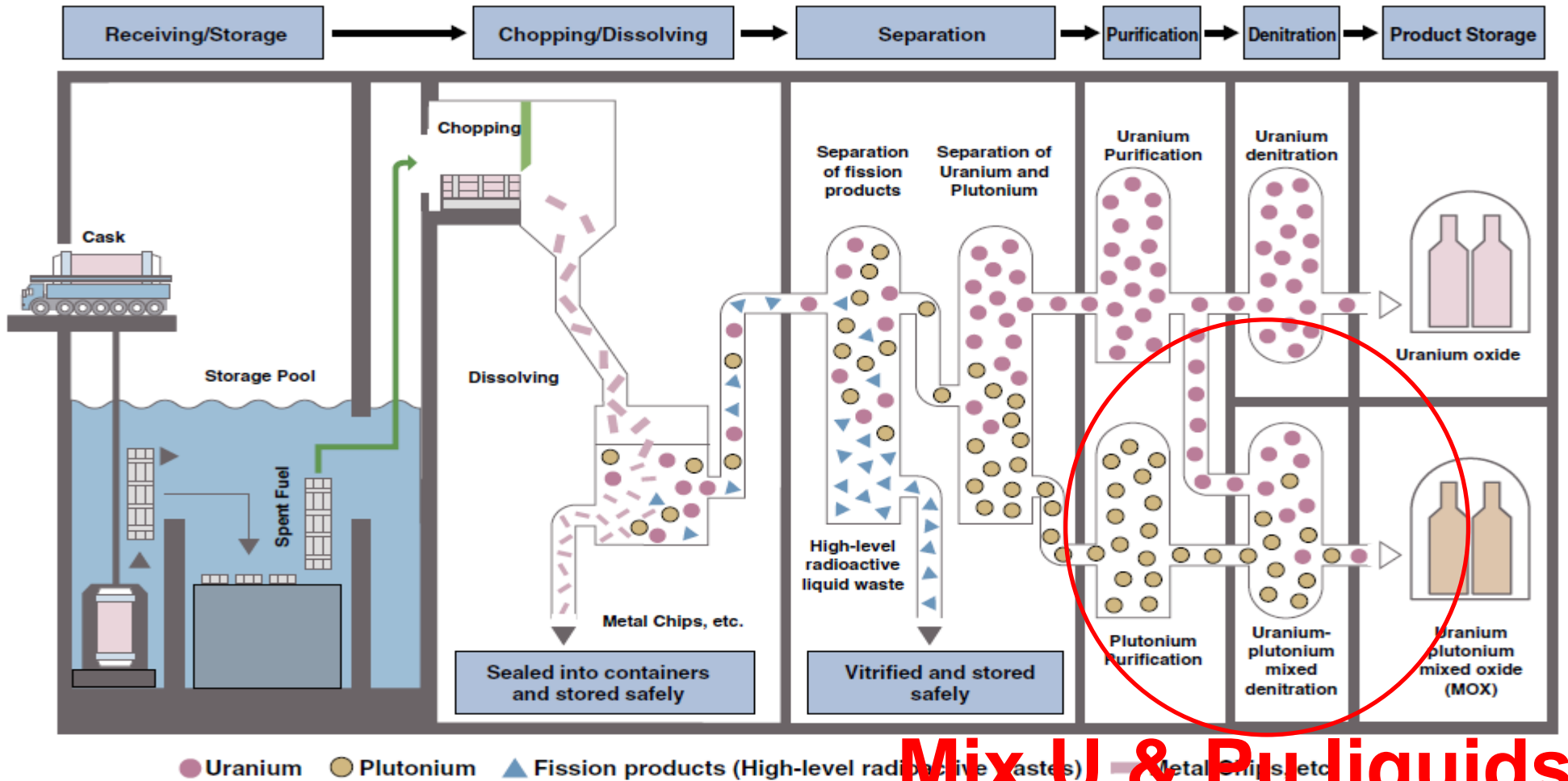
Rokkasho  
Reprocessing  
Plant



MOX Fuel  
Fabrication  
Plant

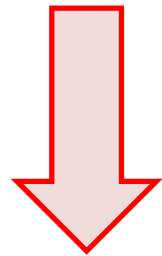
# State-of-the-Art Safeguards

- Monitoring by IAEA on-site inspector
- No separation of pure Pu powder



# “NuRO” established 2016

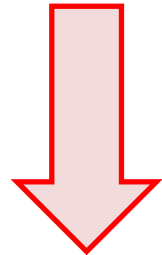
Each electric power utility



Contributions for reprocessing, etc.  
(required to contribute funds)

**NuRO**  
使用済燃料再処理機構

Authorized org.  
(w/ fund mgt. system)



Payments  
(Contract out the reprocessing operation)

JNFL

# Statement by Minister

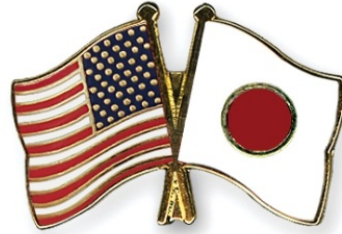
Principle: not to possess plutonium  
without specific purposes



**I NEVER approve a plan  
not in line with the principle**

# US – JPN cooperation on nuclear security

(From US - Japan fact sheet on Dec 5, 2016)



- ✓ **Fuel cycle policy: national choice**
- ✓ **Goal: reducing JP's Pu stockpile**
- ✓ **Appreciate JP's efforts**
- ✓ **Model of transparency**
- ✓ **No concern about JP's Pu mgt.**

# Fast Reactor Development

# Steps of FR Development

Stage	Experimental reactor	Prototype reactor	Demonstration reactor		Commercial reactor
Main purpose	Examining basic tech	Establishing tech For power gen.	Examining economic efficiency		Commercial production
Items to be done	<b>Joyo (1977~)</b>	<b>Monju (1994~)</b>	<b>Domestic reactor</b> <b>ASTRID Cooperation (2014~)</b>		<b>Commercial reactor</b>
Actors	JAEA	JAEA	JAEA Manufacturer Utilities	TBD	Utilities

# Review of Fast Reactor Development

**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 fast reactor (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.**





# Discussion Points at the Council

## <Change in circumstances>

### Drastic Reinforcement of Safety Standards

(reinforcement of countermeasures against severe accidents, earthquake, tsunami)

### Electricity market reform

(end of regulated electricity price system)

### Progress of FR development in the world

(expansion of international cooperation network, start of cooperation with France)

### Review of Energy Policy

(review of the ratio of nuclear power generation)



## Discussion points

1. Revisit development goals for demonstration reactors  
(enhanced safety, improved economy, reduction of volume of waste)
2. Reconsider concrete specification (reactor type, power output scale, etc.)
3. Explore international cooperation

# Revision of Fast Reactor Development Policies

Ministerial Meeting for the Nuclear Energy Policy (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

# Revision of Fast Reactor Development Policies

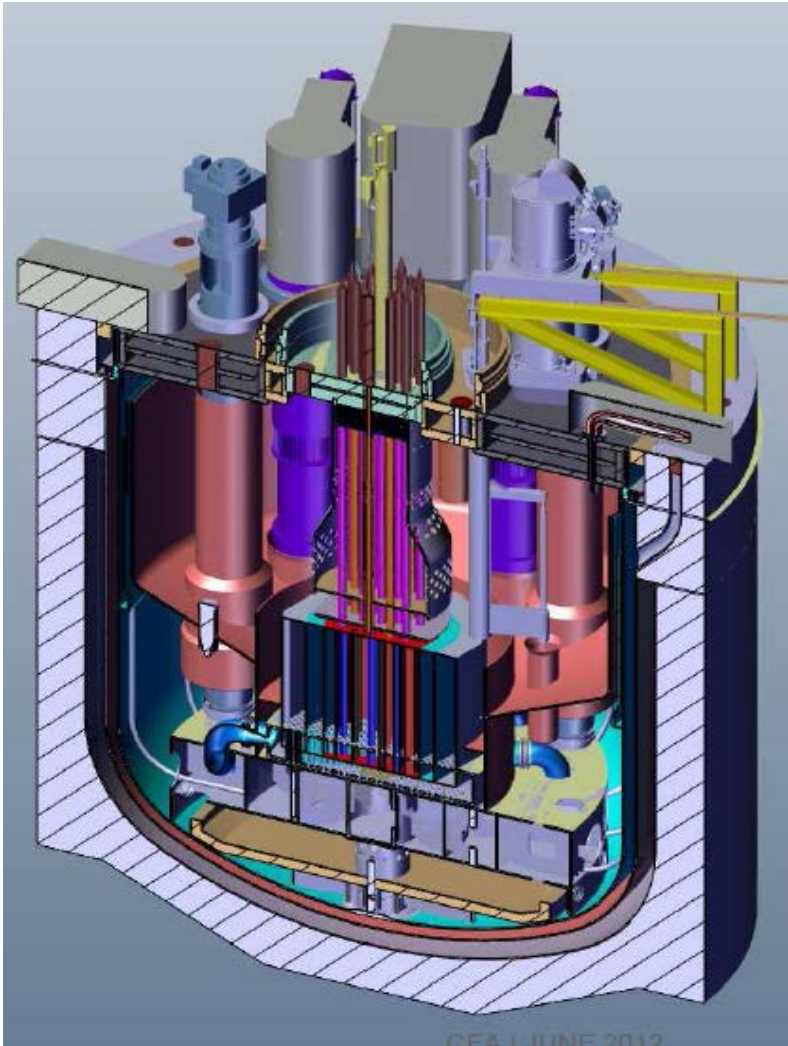
Ministerial Meeting for the Nuclear Energy Policy (Dec. 21, 2016)

## Review of the role of Monju

- ✓ Technologies and knowledge obtained
- ✓ Monju will not restart as a reactor
- ✓ Steady and safe decommissioning
- ✓ Alternative Functions as:
  - Center for FR development (cold test)
  - Nuclear research
  - HR development

# ASTRID Project

## Advanced Sodium Technological Reactor for Industrial Demonstration



- Cooperation between France and Japan since 2014
- Main Features
  - ✓ Pool-type Sodium cooled fast Reactor
  - ✓ Output: 600 MWe
  - ✓ Strategy for severe accident (Core catcher, etc.)
  - ✓ DHRS (Decay Heat Removal System)
  - ✓ Long-life nuclides transmutation capability

# U.S. – Japan Cooperation

# Examples of US-Japan Cooperation

## (Industrial Cooperation)

- Manufacturing: Hitachi – GE, Toshiba – Westinghouse
- Cooperation in the third country projects
  - Bechtel's participation to Horizon project in UK
  - Exelon – JAPC cooperation on plant operation

## (Decommissioning)

- Fukushima-Daiichi
- Other NPPs (eg. Energy Solution – JAPC cooperation)
- Forums for further cooperation

## (G to G Cooperation)

- US-JP Bilateral Commission on Civil Nuclear Cooperation
- R&D cooperation under the Bilateral Committee  
(eg. accident tolerant fuel, seismic analysis, test data exchange...)