INTERNATIONAL FORUM
«ATOMEXPO 2010»

Current Status and Future Prospects for FR Cycle in Japan

June 7, 2010

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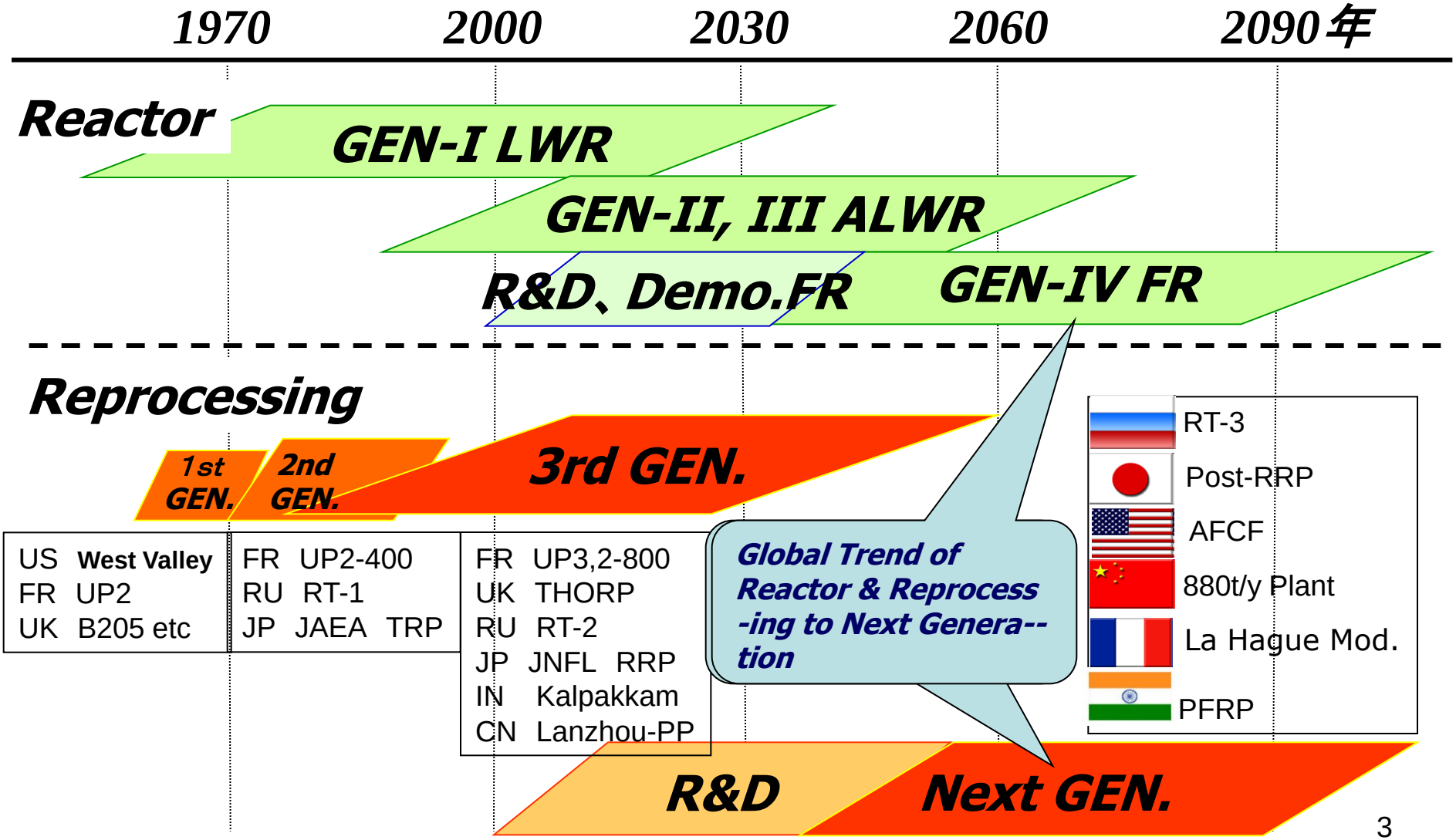
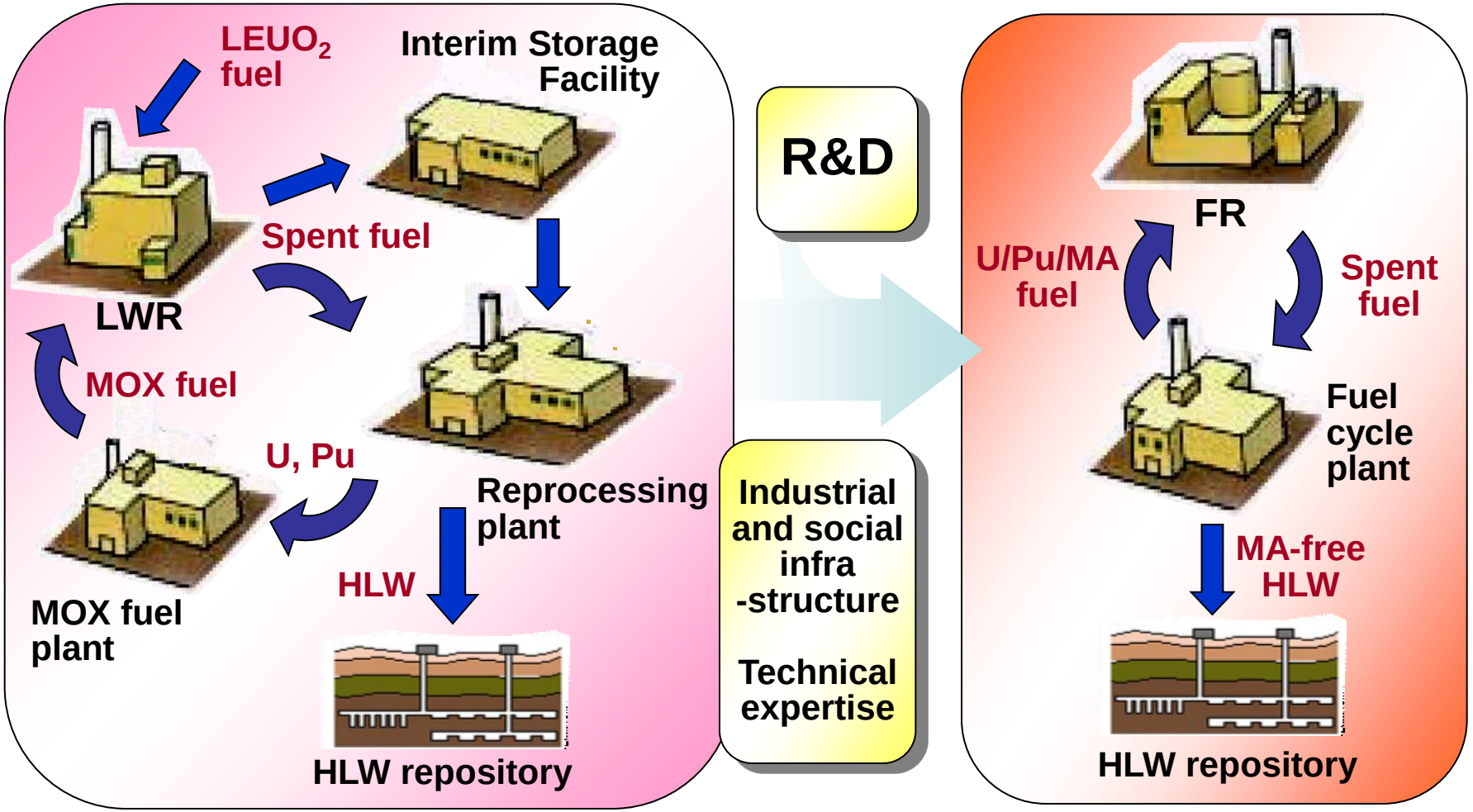
Development Chronology in Reactor & Reprocessing



Japan's Fundamental Strategy for Nuclear Fuel Cycle



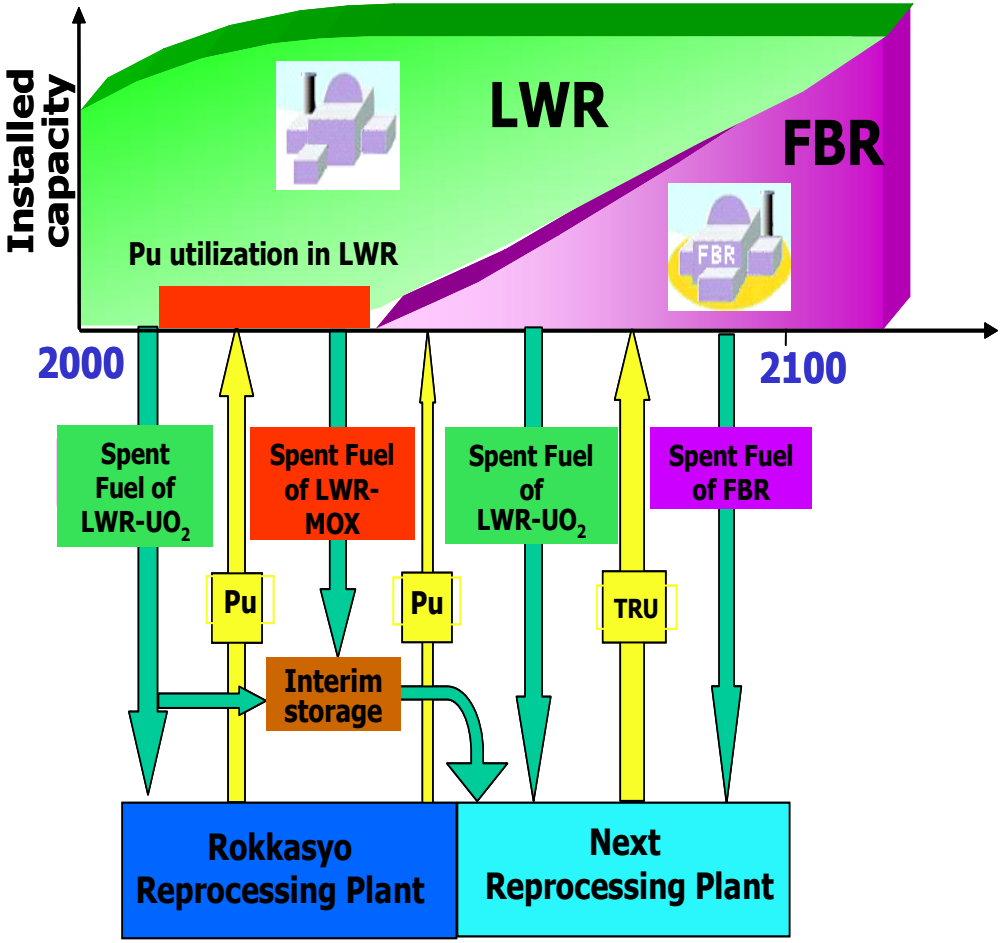
Current LWR fuel cycle

Future FR fuel cycle

Investigation on Transition from LWR cycle to FR cycle

Example of preconditions for transition from LWR cycle to FR cycle

- In order to replace all LWRs with FRs, it will take about 60 years as transition period from around 2050.
- Next reprocessing plant (post-RRP plant) is envisioned around 2050.
- Spent LWR UO2 fuels have to be reprocessed to introduce FRs in next reprocessing.
- Also reprocessing of spent FR fuels and LWR MOX fuels have to start around 2055-2060.
- We need to figure out effective and rational image of next reprocessing plant.



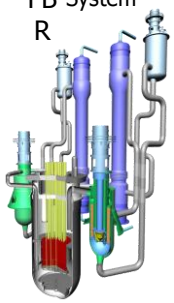
FR Cycle Development Program in Japan

2005 | 2010 | 201- (JFY)

Feasibility Study(1999-2005)

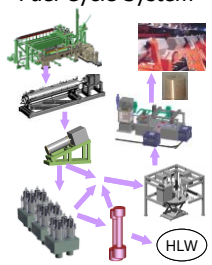
Most Promising Concept

FB System R



Sodium-cooled Fast Reactor

Fuel Cycle System



Advanced Aqueous Reprocessing and Simplified Pelletizing Fuel Fabrication

Review & Basic Policy by MEXT &AEC

Experimental FR "Joyo"

R&D at Prototype

Fast Reactor Cycle Technology Development Project (FaCT)

Decision of Innovative Tech. (2010) | Approved Confirmation (2015)

R&D of Innovative Technologies

Conceptual Design of Commercial & Demonstration FR Cycle Facilities

Commercialized FR Cycle

R&D at "Monju"

- ◆ Demonstrating its Reliability as a Operation Power Plant
- ◆ Establish Sodium Handling Tech.

2015

Conceptual Designs of Commercial Facilities and Demonstration Facilities with R&D Programs

Basic Design & Construction

2025

Start of Demonstration FR Cycle Facilities

Validation of Economy & Reliability

2050

Commercialization of FR Cycle Facilities

◆Cooperation with related Organization ◆International Cooperation (GNEP, GEN-IV, INPRO etc.)

Development Targets and Design Requirements of Fuel Cycle Commercial Facility

Safety and Reliability

- Not influence on the significant radiation risk to public
- Prevent the occurrence of off-site emergency
- Establish the design concept possible to achieve the maintainability and repairability

Sustainability

Environment Protection

- Keep the influence of the radioactive release on the environment through normal operation below the current fuel cycle

Waste Management

- Reduce the amount of radioactive waste to 1/2 - 1/5 of the current fuel cycle facilities
- Recover more than 99.9% of U and TRU

Efficient Utilization of Nuclear Fuel Resources

- Possible to treat the SF with the heat power of 3kW/Assy (inn the case that the out-of core time is around 5 years)

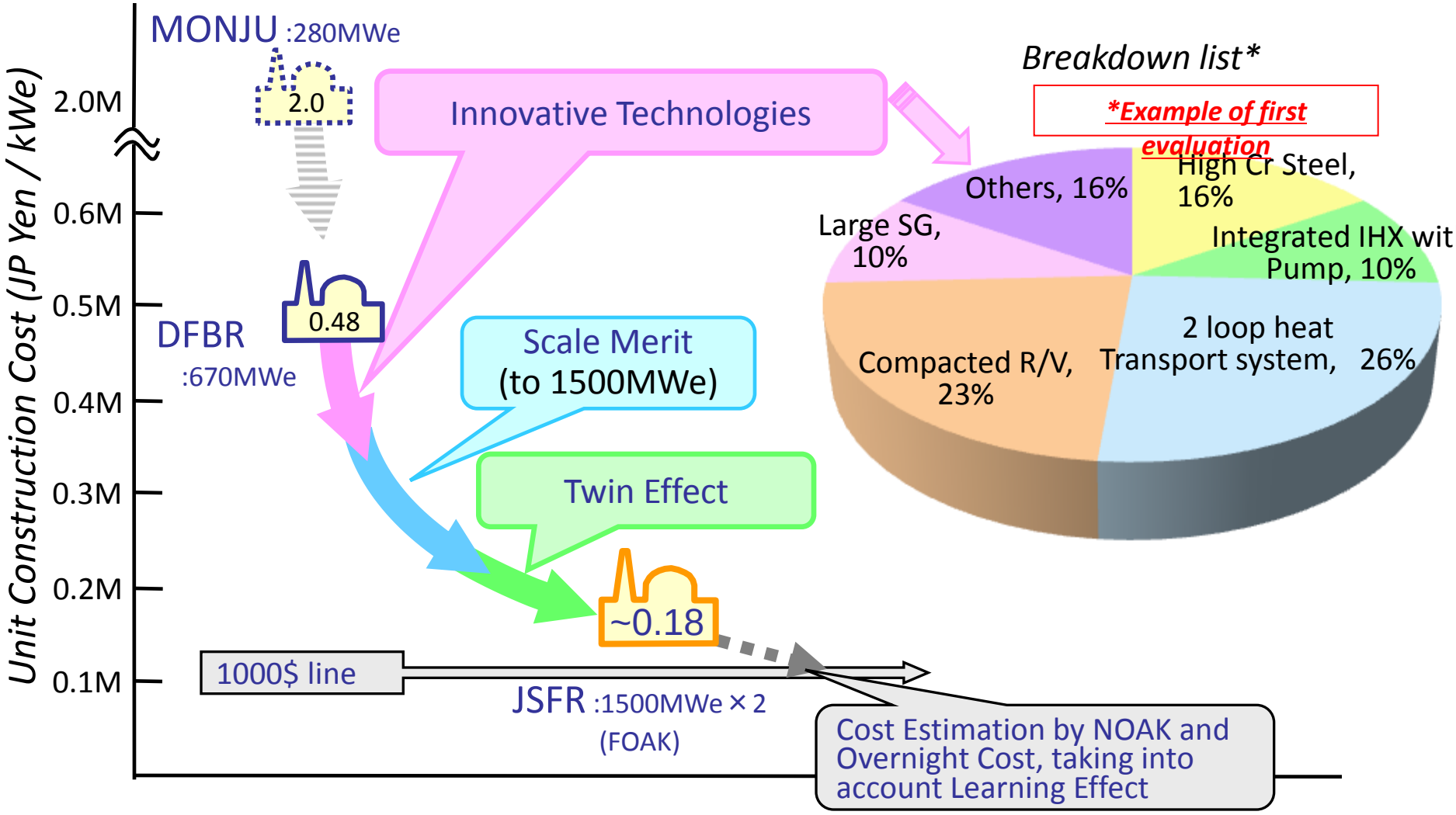
Economic Competitiveness

- Fuel cycle cost should be < 340,000 JPY/kgHM (reprocessing :< 180,000 JPY/kgHM, fuel fabrication :< 160,000 JPY/kgHM

Nuclear Non-Proliferation

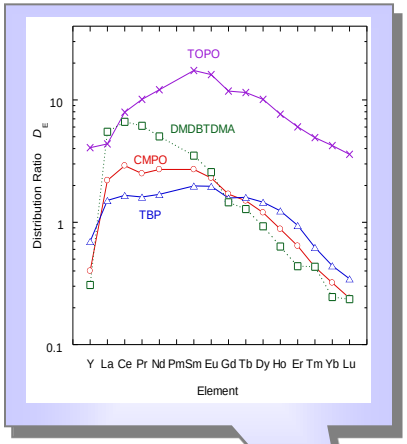
- Pure Pu should appear in any process
- It should be difficult to access the nuclear materials by handling low-decontamination TRU fuel

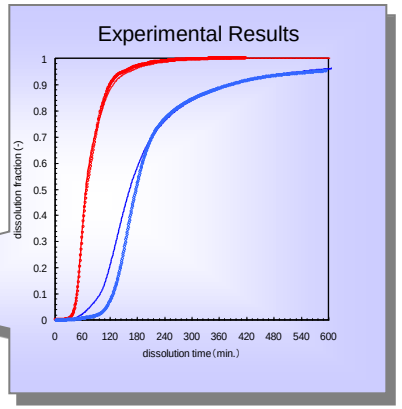
Improvement of Economics for JSFR

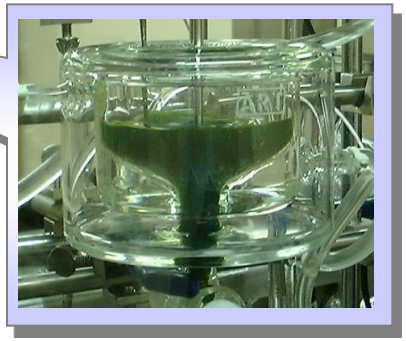


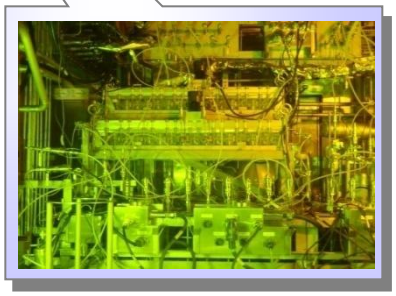
The unit construction cost of Monju is expressed as the construction cost divided by electric power.
The unit construction cost of DFBR and JSFR are evaluated value

Typical Advanced Reprocessing Test in CPF









Spent fuel

Disassembling/ Shearing

Dissolution

Clarification

U Crystallization

Np valence adjustment

Co-extraction

MA recovery

Extraction chromatography

Co-stripping (U/Pu/Np recovery)

Solvent regeneration

Am, Cm

U/Pu/Np

High level liquid waste

Concentration

U

Adjusting Pu content

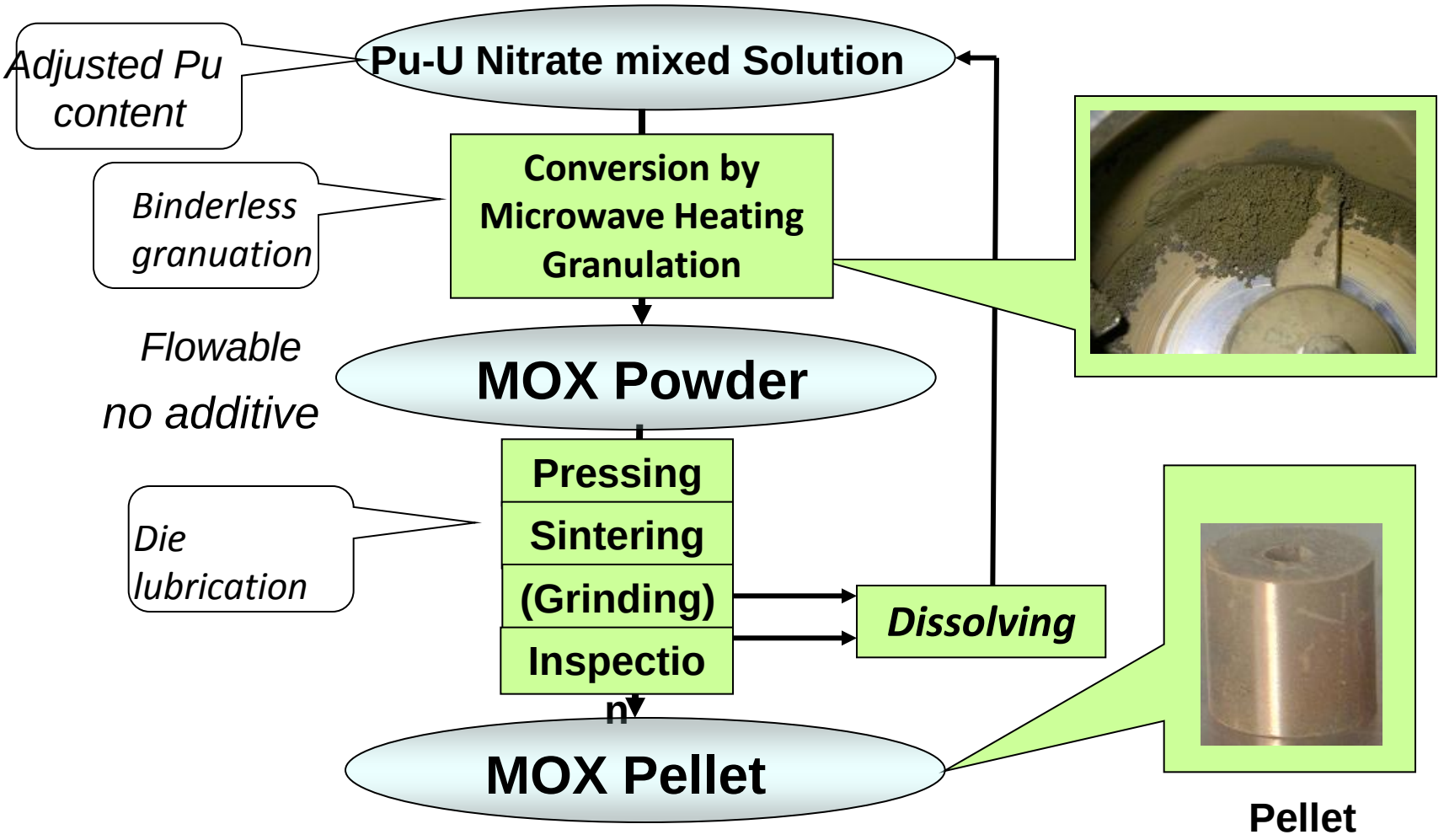
U/TRU (product)

U (product)

Revolutionary Type

Evolutionary Type

MOX Pellet Fabrication Tests by Simplified Pelletizing Method



Additional fabrication tests including Am-MOX fuel is going on. Fuel pin irradiation tests are planned, too.

International Cooperation of R&Ds on FR Cycle

France

- CEA/JAEA Cooperation on Nuclear R&D
  - ✓ Reactor Research & Advanced Nuclear Energy System
  - ✓ Advanced Fuel Cycles, etc.
- EDF/JAEA Cooperation on Fast Reactor System
  - ✓ Design of Prototype/ Demonstration Reactor
  - ✓ Operation/Maintenance, etc.

Russia

- ODS cladding irradiation, etc.

Kazakhstan

- Re-criticality elimination mechanism (EAGLE project)

U.S.A.

- U.S.-Japan Joint Nuclear Energy action Plan (JNEAP)
  - ✓ Fast Reactor Technology
  - ✓ Fuel Cycle Technology
  - ✓ Simulation & Modeling
  - ✓ Safeguards & Physical Protection
  - ✓ Waste Management

IAEA

- ➢ INPRO
- ➢ TWG-Fast Reactors
- ➢ TWG-Nuclear Fuel Cycle Options

GIF

- ➢ Sodium-cooled FR
- ➢ Gas-cooled FR
- ➢ Very High Temperature Reactor

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- ➢ Super Critical Water Reactor
- ➢ Lead-cooled FR
- ➢ Molten Salt Reactor

Trilateral Collaboration

- ➢ Sodium-Cooled FR
  - ✓ design goals and high level requirements for the prototypes
  - ✓ common safety principles
  - ✓ infrastructure needs, etc.
- ➢ Irradiation test of MA bearing fuels (GACID project in GIF)

Conclusions

Japan is promoting the nuclear energy to supply stable energy and reduce CO_2 emission.

- **Medium to Long-term plan around 2050 and beyond**

  Basic policy in Japan is closed fuel cycle. Therefore, in order to make the transition of LWR cycle to FR cycle around 2050 smoothly, intensive discussion in JAEC will be started in 2010.

- **Near-term plan around 2015 in FaCT Project**

  Design study and R&D of innovative technologies are now in progress aiming at adopting of innovative technologies by judging of their applicability in JFY2010.

  Furthermore, study of future reprocessing technology would be discussed not only as FaCT project but also in the field of transition from LWR cycle to FR cycle.

- **International collaboration**

  International collaboration is indispensable to efficient development of

  FR fuel cycle. JAEA expects further collaboration with concerned countries on FR fuel cycle by sharing the R&D items on the same target.