MOVE THE WORLD FORWARD

MITSUBISHI HEAVY INDUSTRIES GROUP

Contributing to Decarbonization with Nuclear Technology

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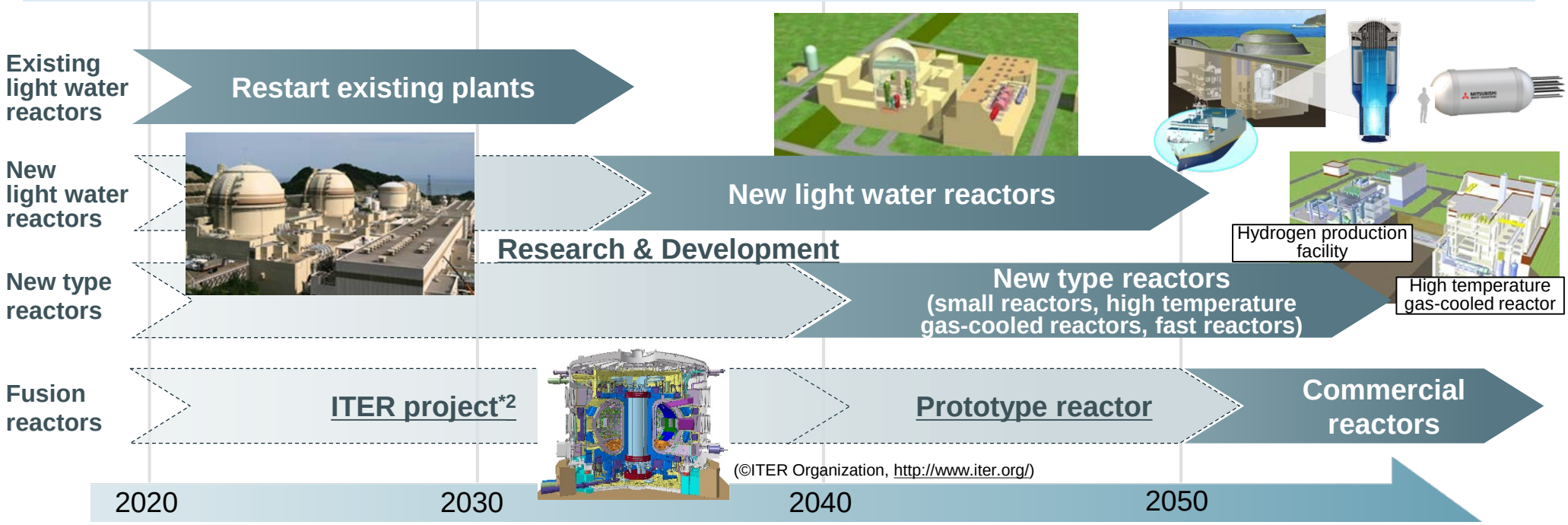
Contributing to Decarbonization with Nuclear Technology

Nuclear energy is an important base load power source as it is a carbon-free, large-scale, reliable power source, and helps achieve energy security. Nuclear energy is a crucial tool to achieve a carbon neutral 2050.

- Focus on the restart of existing plants and installation of "Specialized Security Facilities"*1 and develop new light water reactor designs to contribute to the reduction of CO_2 emissions in power generation
- Develop new reactor types, such as small reactors, high temperature gas-cooled reactors and fast reactors, to satisfy diversifying market needs
- Make fusion reactors a reality, the "dream" energy source



*1 "Specialized Security Facility": Independent large-scale facility to safely shut down the reactor in case of plane strikes, terrorist attacks etc.
*2 ITER project: Large international project to realize experimental fusion reactor supported by governments (Japan, EU, US, Russia, China, Korea, India)

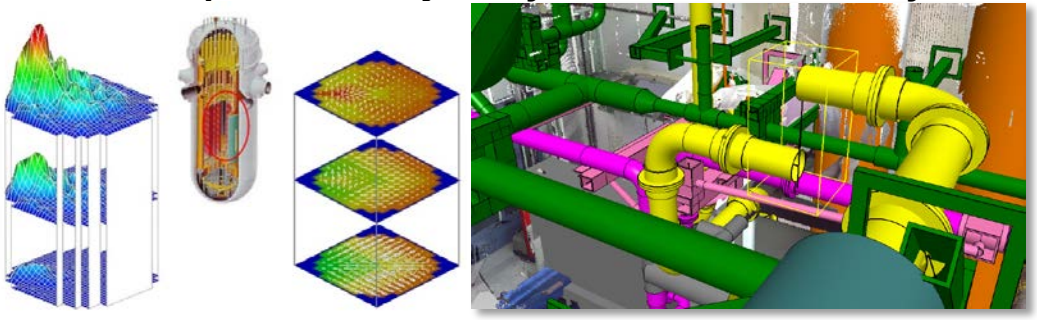
Current Initiatives

Restart and Maintain Existing Plants / Construct "Specialized Safety Facilities"

- Support utility companies through analysis, evaluation and tests to meet the world's highest-level regulatory requirements
- Deliver upgrades to safety measures* and construct "Specialized Safety Facilities" to enable restart of PWRs and BWRs

* Reinforce safety facilities, increase power source reliability, and increase resilience to natural disasters, such as earthquakes and tsunamis

Examples of safety analysis and seismic analysis

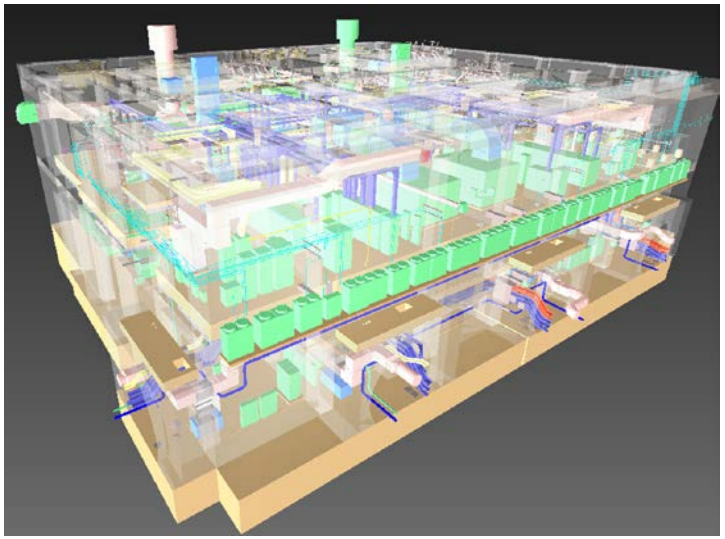


Example of seismic test

Example of reliability increase of power source

Emergency gas turbine generator

Image of "Specialized Safety Facility"



Current Initiatives

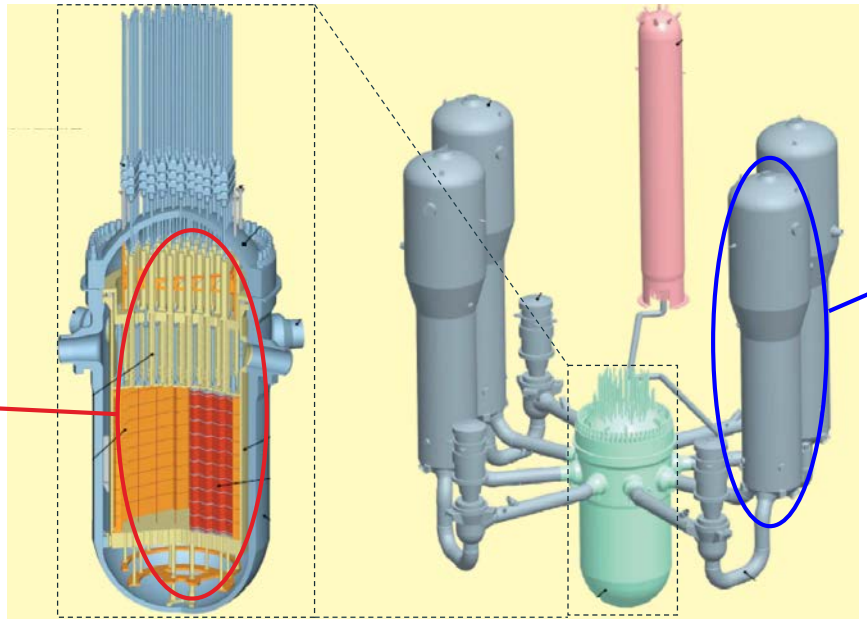
Maintenance Services for Restarted Plants

- Provide major maintenance work, such as SGR, CIR, CBR*1, aiming for plant life extension to 60 years
- Provide evaluation services to continuously improve safety and maintenance services using state-of-the-art technology

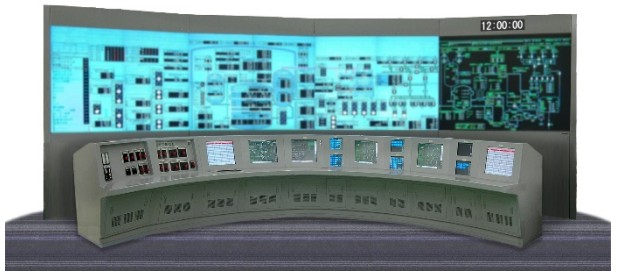
Contribute to the safe and stable operation of nuclear power plants

*1 SGR: Steam Generator Replacement, CIR: Core Internals Replacement, CBR: Control Board Replacement

Examples of major maintenance works



Steam Generator Replacement (SGR)



Control Board Replacement (CBR)

the latest digital control system technology

Core Internals Replacement (CIR)

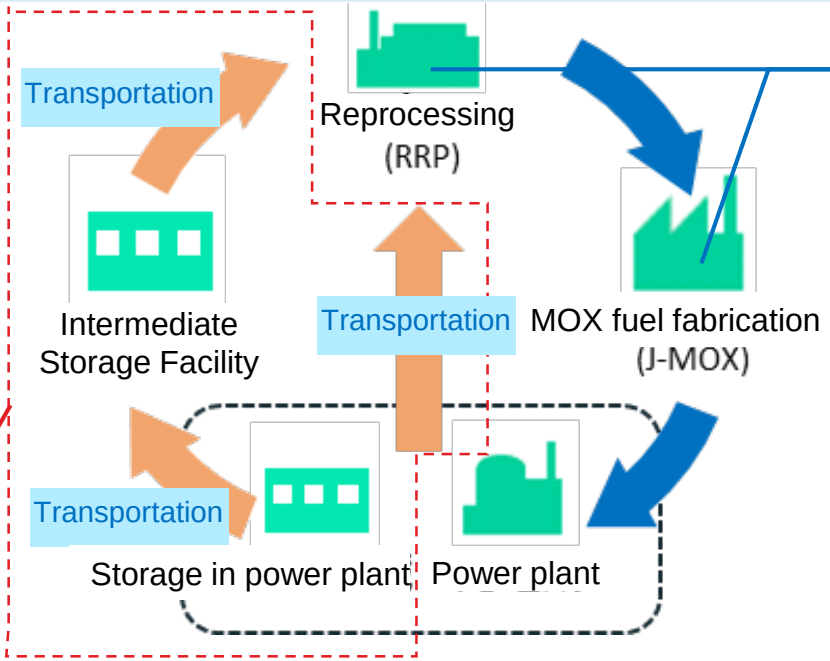
Current Initiatives

Establishment of Nuclear Fuel Cycle

- Continue construction works for Rokkasho Reprocessing Plant and MOX fuel fabrication facility (J-MOX) as a lead contractor
- Actively propose the use of spent fuel casks for interim storage before reprocessing of spent fuel

⇒Provide **maintenance planning** to support safe and **stable operation of Rokkasho Reprocessing Plant and MOX fabrication facility**

- **Type certification received**
- **Fabrication ready for mass-production**




Reprocessing plant

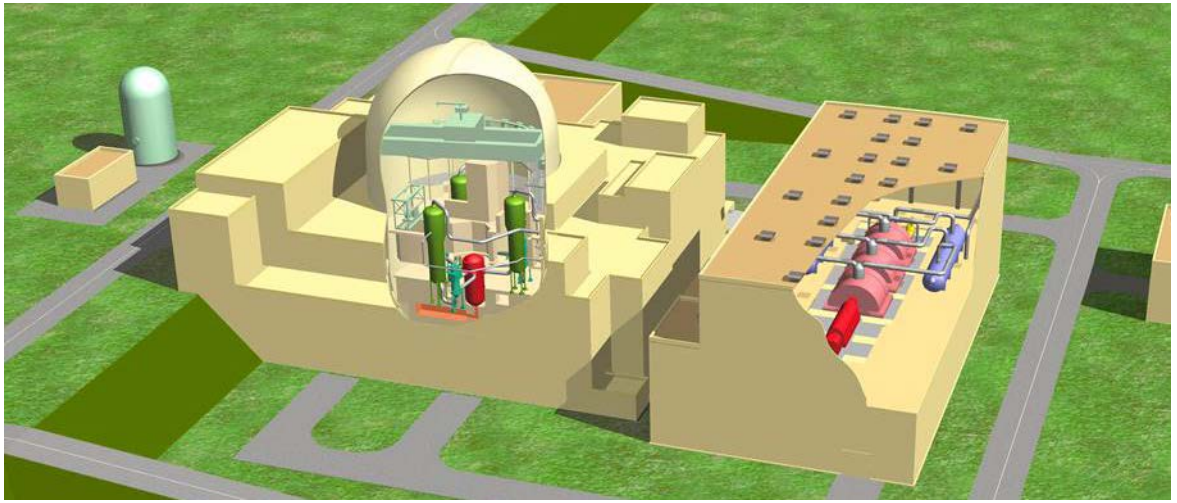

MOX fuel fabrication facility

- **Support for early commissioning**
- **Support for safe and stable operation**

Future Nuclear Technology Initiatives

New Model of Light Water Reactor (World's Safest Reactor)

- We believe nuclear power will be a crucial tool in achieving both carbon neutrality and energy security
- Drive forward R&D of world's safest reactors using evolutionary technologies with high economical efficiency (aiming for commercial operation in mid 2030's)



- Reinforce safety based on experiences from Fukushima accident
- Introduce new safety concepts leveraging latest technical capabilities and evolutionary technologies
  ⇒ Example: no resident evacuation required
- Maintain and utilize Japan's domestic nuclear supply chain

→ **World's Safest Reactor**

Future Nuclear Technology Initiatives

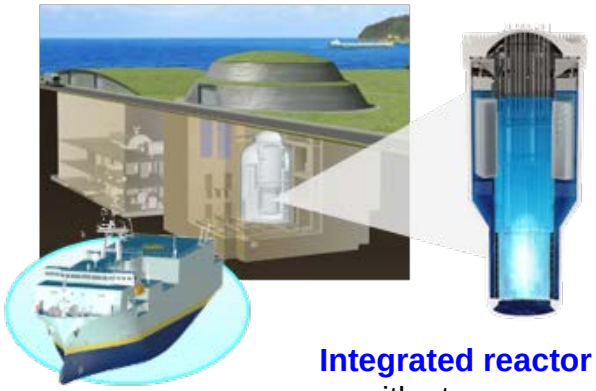
New-Type Reactors (responding to diversifying market needs)

- Nuclear power has huge potential, for example in heat utilization and for independent power supply to isolated, remote areas, islands and in space
- Proceed with development of new-type reactors to satisfy diversifying market needs

Small Reactors / Micro Reactors
(multi-purpose power source)

- Develop mobile reactors to supply power to isolated, remote areas, islands and in space

Small light water reactor
(power generation reactor / ship-propulsion reactor)



Integrated reactor vessel
with steam generator

Disaster-stricken area

Energy security (Power storage)

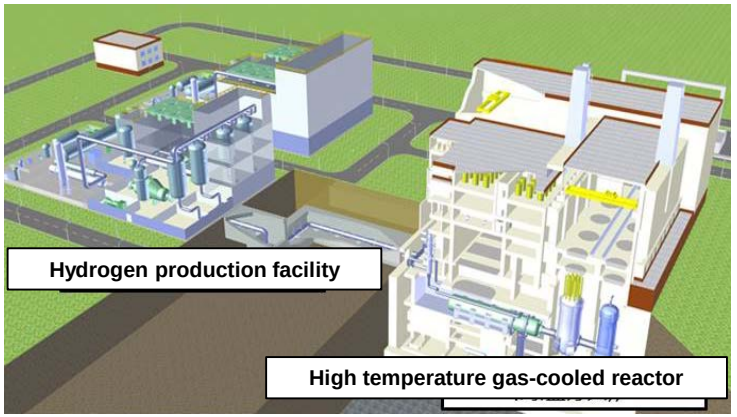
Micro reactors (container storage type)

Space

Isolated areas / polar region

High Temperature Gas-Cooled Reactors
(for hydrogen production)

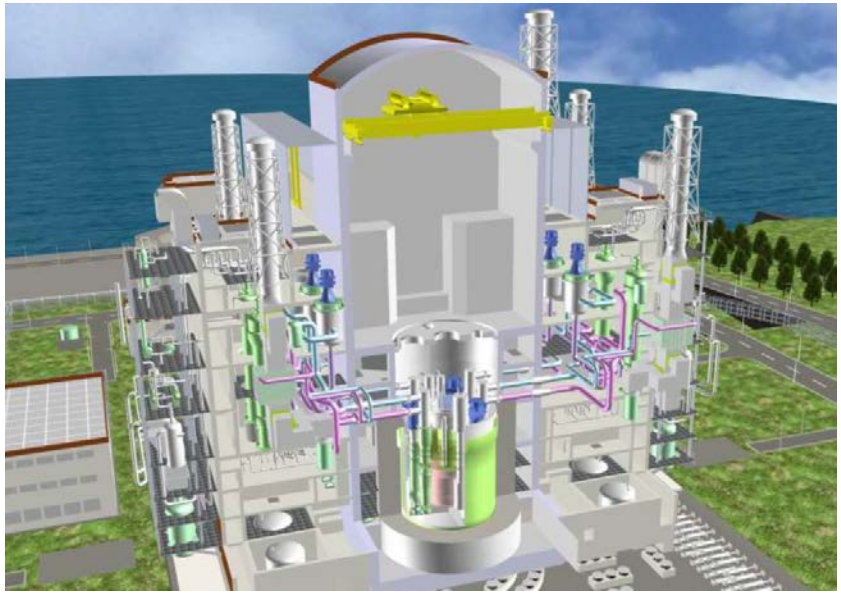
- Stably produce a large amount of hydrogen with a high temperature of 900 °C or higher
- Prevent CO_2 emissions in steelmaking through hydrogen reduction



Future Nuclear Technology Initiatives

Fast Reactors (Power generation reactors)

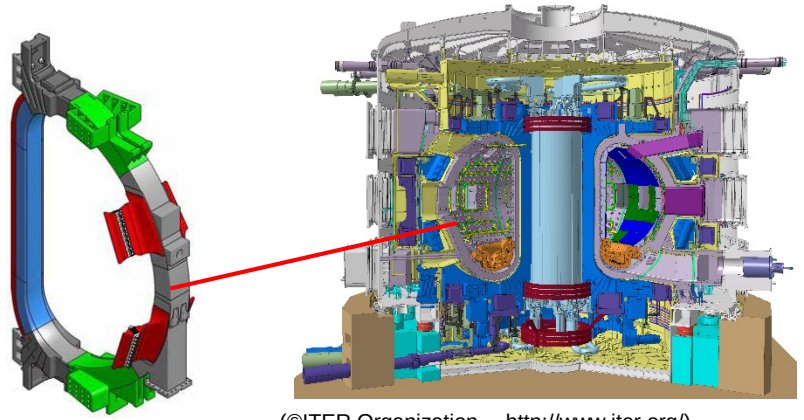
- Power generation using nuclear fission energy with fast neutrons
- Ability to effectively use nuclear fuel resources and to reduce volume of high level radioactive waste
- Development program in progress under international collaboration (Japan-France, Japan-US)



(Source: Technical development program on a fast reactor international cooperation, etc.)

Fusion Reactors (ITER project)

- Fabrication of major components including toroidal field coil for the first time in the world
- Active involvement in development study for fusion reactor realization



Toroidal field coil

(©ITER Organization, http://www.iter.org/)

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