Nuclear Energy Systems Business Presentation Meeting

[Document 1]

July 23, 2007

Nuclear Energy Systems Headquarters

Mitsubishi Heavy Industries, Ltd.

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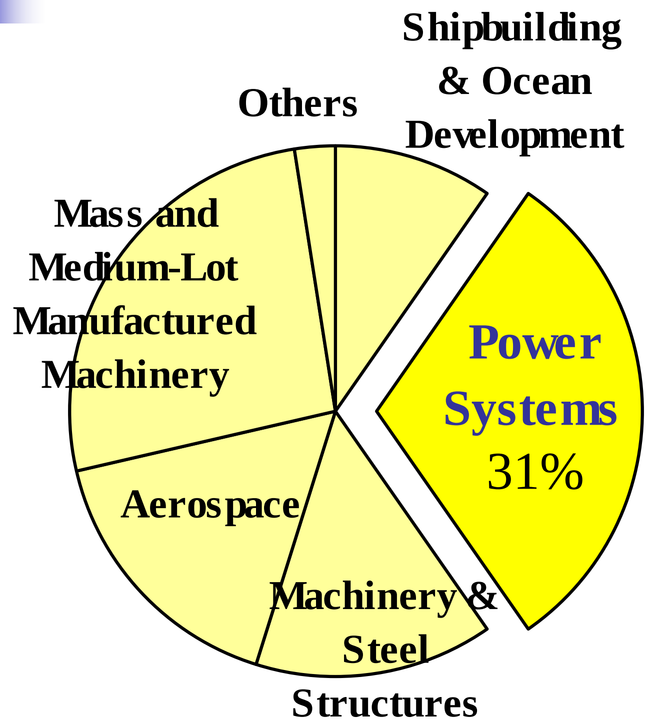
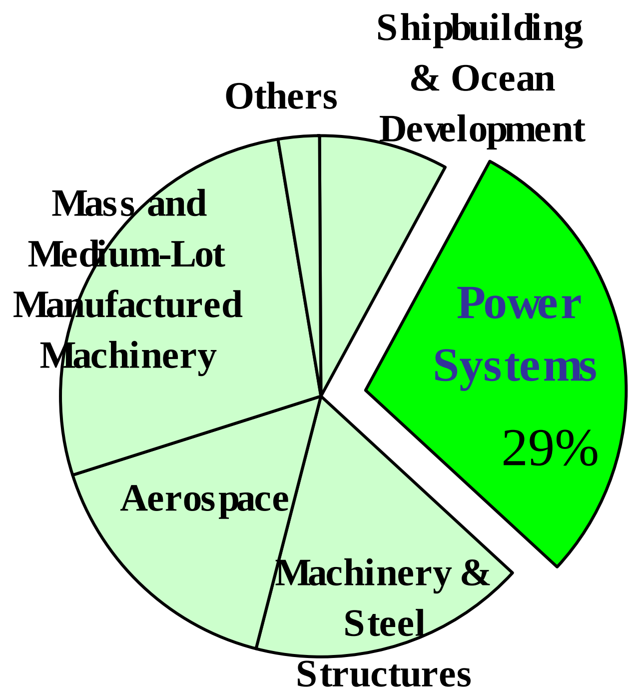
1. Overview of Nuclear Energy Business

(1) Position of Power Systems segment

1. (1) a) Position of Power Systems segment





Orders received in 2006 (consolidated)

¥1,008.2 billion

(MHI Total : ¥3,274.7 billion)

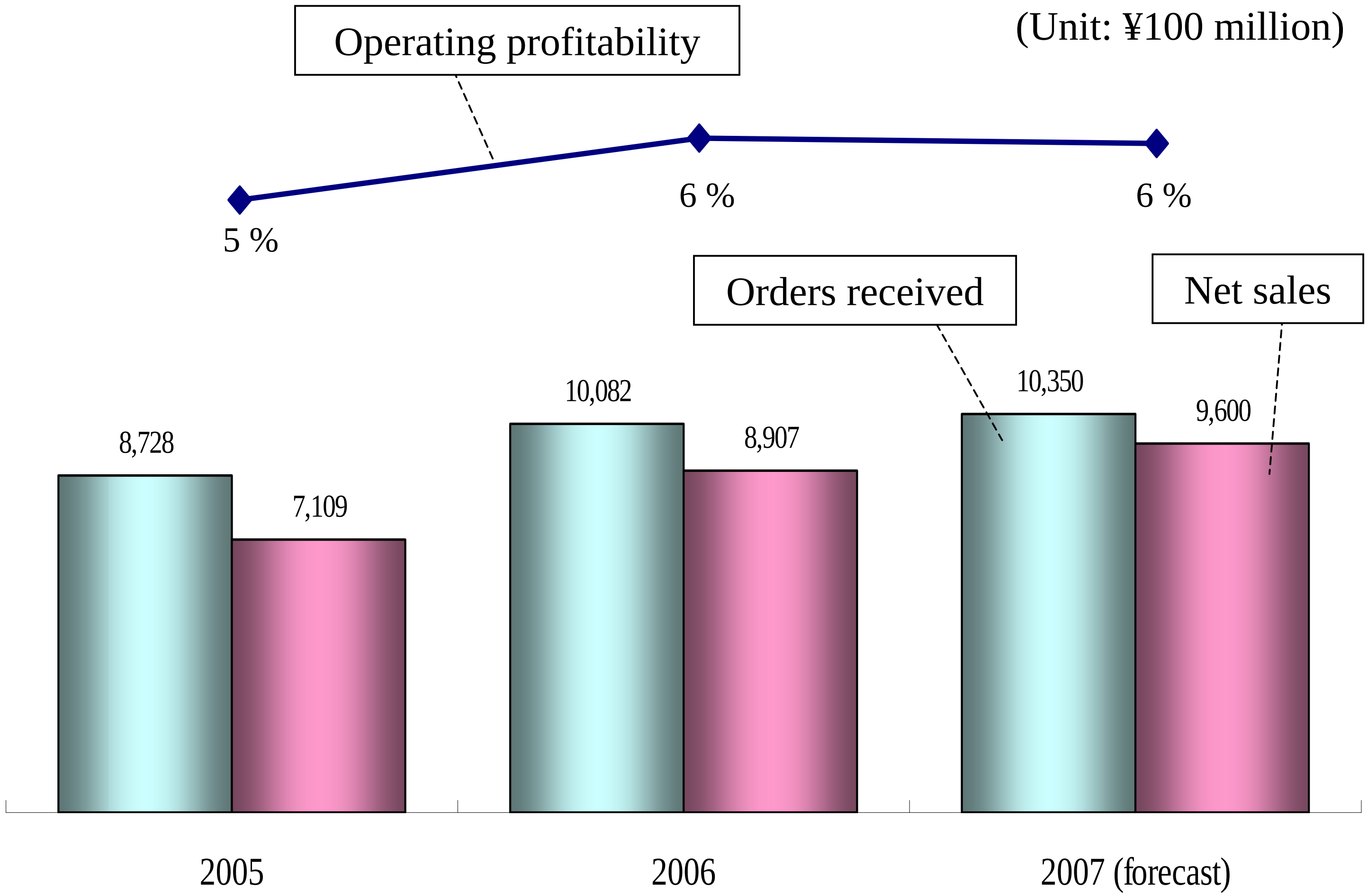
Net sales in 2006 (consolidated)

¥890.7 billion

(MHI Total : ¥3,068.5 billion)

1. (1) b) Business Output
(consolidated figures of Power Systems segment)

(Unit: ¥100 million)



<u>Profitability</u>

6 %

<u>Business</u>

¥1 trillion

1. Overview of Nuclear Energy Business

(2) Activities on Nuclear Energy Business

1. (2) a) Vision of Nuclear Energy Business

Vision:

"A comprehensive nuclear energy systems company" that leads the world

A company that leads "safety" and "security" with own technology throughout the whole life of nuclear power plants

Development, design, manufacture, construction and maintenance

Design and Development Center Building
at MHI Kobe Shipyard & Machinery Works

1. (2) b) Field of Nuclear Energy Business

◆ “A comprehensive nuclear energy systems company” that covers all fields

PWR (pressurized-water reactor) Power Plant

Development, Design, Manufacture, Construction, Maintenance and Repair services

Advanced Reactor Plant

Fast Breeder Reactor (FBR)

High-Temperature Gas Cooled Reactor

Nuclear Fusion Reactor

Nuclear Fuel

Uranium Fuel

MOX Fuel

Advanced Reactor Fuel

Nuclear Fuel Cycle

Spent Fuel Reprocessing Plant

Waste Disposal System Equipment

Radioactive Material Transport Cask

1. (2) c) Organizations of Nuclear Energy Business

(Overall Control)

Nuclear Energy Systems Headquarters of Mitsubishi Heavy Industries, Ltd.

MFBR (Mitsubishi FBR Systems, Inc.)

[United States]: MNES (Mitsubishi Nuclear Energy Systems, Inc.)

MHI (persons)

Total 3,200
Eng'g Div 1,300
Mf'g Div 1,600

5,000 (consolidated)

MHI Kobe Shipyard & Machinery Works

Nuclear Island

(Reactor Loop)

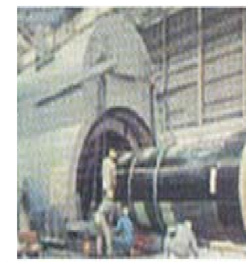
MHI Takasago Machinery Works

Conventional Island

(Turbine Loop)

Mitsubishi Electric Corporation

Electrical Equipment



Mitsubishi Nuclear Fuel Co., Ltd.
- Nuclear fuel manufacture

Nuclear Fuel Transport System Co., Ltd. (NFTS)
- Nuclear fuel transportation

Nuclear Development Corporation
- Research and development of nuclear fuels

Nuclear Plant Service Engineering Co., Ltd.
- Maintenance services

Nuclear Power Training Center Ltd.
- Operator Training

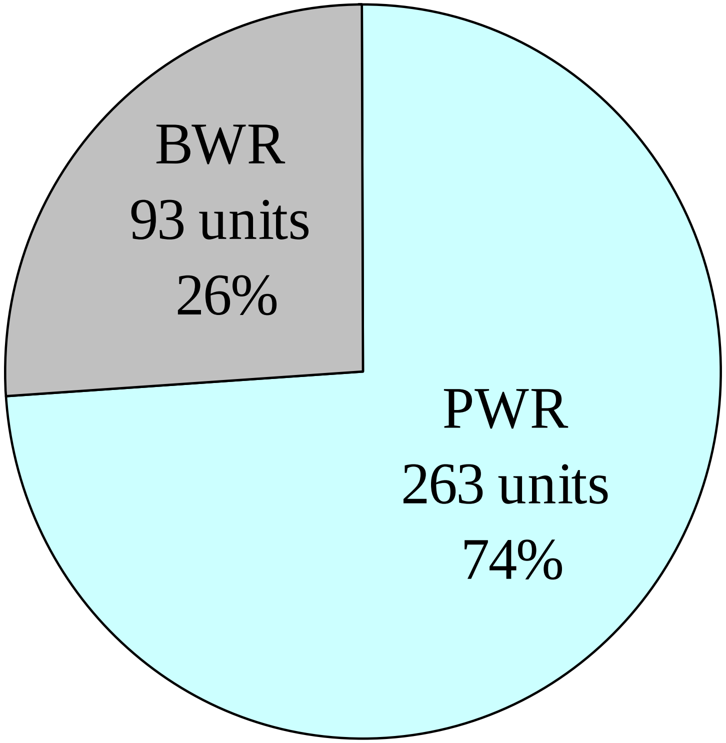
MHI Takasago R&D Center

Mitsubishi Electric Corporation
- Advanced Technology R&D Center

2. Current Status of Nuclear Plants both Domestic and Overseas

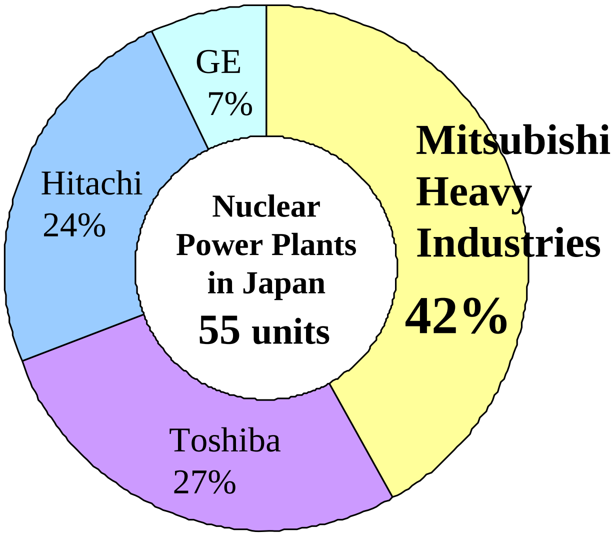
2. (1) Reactor share of World Nuclear Plants

PWR is in the mainstream.



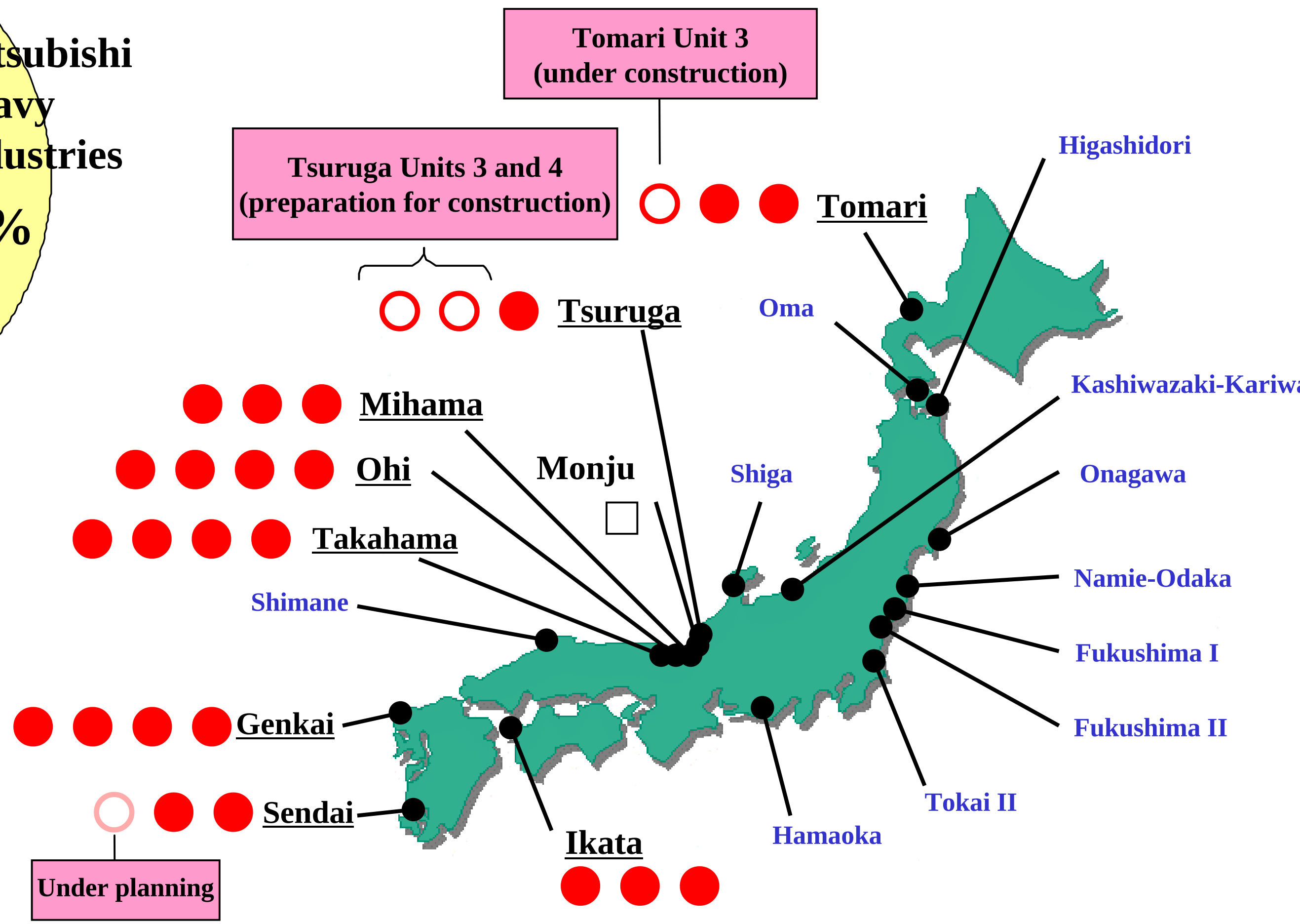
Source: Nuclear News March 2006,
World List of Nuclear Power Plants
(as of December 31, 2006)

2. (2) Nuclear Power Plants in Japan



	In operation	Under construction
PWR	23 units ●	3 units ○
BWR	32 units	3 units
FBR		1 unit □

(As of March 31, 2007)



3. Activities on Nuclear Energy Business in Japan

3. (1) Activities on Nuclear Energy Business in Japan

(1) New plants:

Hokkaido Electric Tomari Unit 3 : under construction
The Japan Atomic Tsuruga Units 3 and 4 (APWR)
Kyushu Electric Next plant

(2) Existing plants: expansion of maintenance business
(focus on preventive maintenance)

(3) Expansion of fuel-related business
(high burnup fuels and MOX fuels)

(4) Global leadership in FBR development
(selected by the government as the core company
→ established MFBR → Leadership in GNEP as well)

3. (2) Activities on PWR

Applying all Mitsubishi's "engineering capabilities" and "manufacturing capabilities"

New plant construction

1970s	1980s	1990s	2000s	2010s	～ 2030
[9 units]	[7 units] / 16 units in total	[7 units] / 23 units in total			

Introduction of WH technology in 1959

Establishment of Mitsubishi own technology

Improvement in economy, operability and maintainability

Enhance further "safety and security" technology including foreign information

Tomari Unit 3

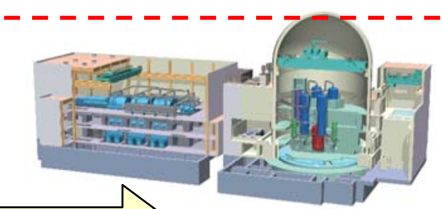
Tsuruga Units 3 and 4

APWR

Sendai Unit 3

Replacement plants

Operational launch of the Mihama No.1 reactor (MHI's first PWR) in 1970



Overseas plants

- Established MNES
- Entry in the U.S. market
- Expansion of US-APWR

US-APWR for TXU #1 #2

Succeeding US-APWR project

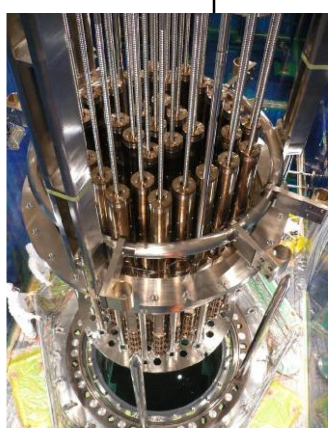
- Joint development of a strategic reactor with AREVA of France

Joint development with AREVA

3. (2) Activities on PWR

Providing continuous high-level maintenance services for "safe and secure" operation of existing plants

	1970s	1980s	1990s	2000s	2010s	～ 2030
Maintenance						



Replacement and renewal of large components

(Steam generators, core internals, reactor vessel heads etc.)

Comprehensive maintenance against aging of plants

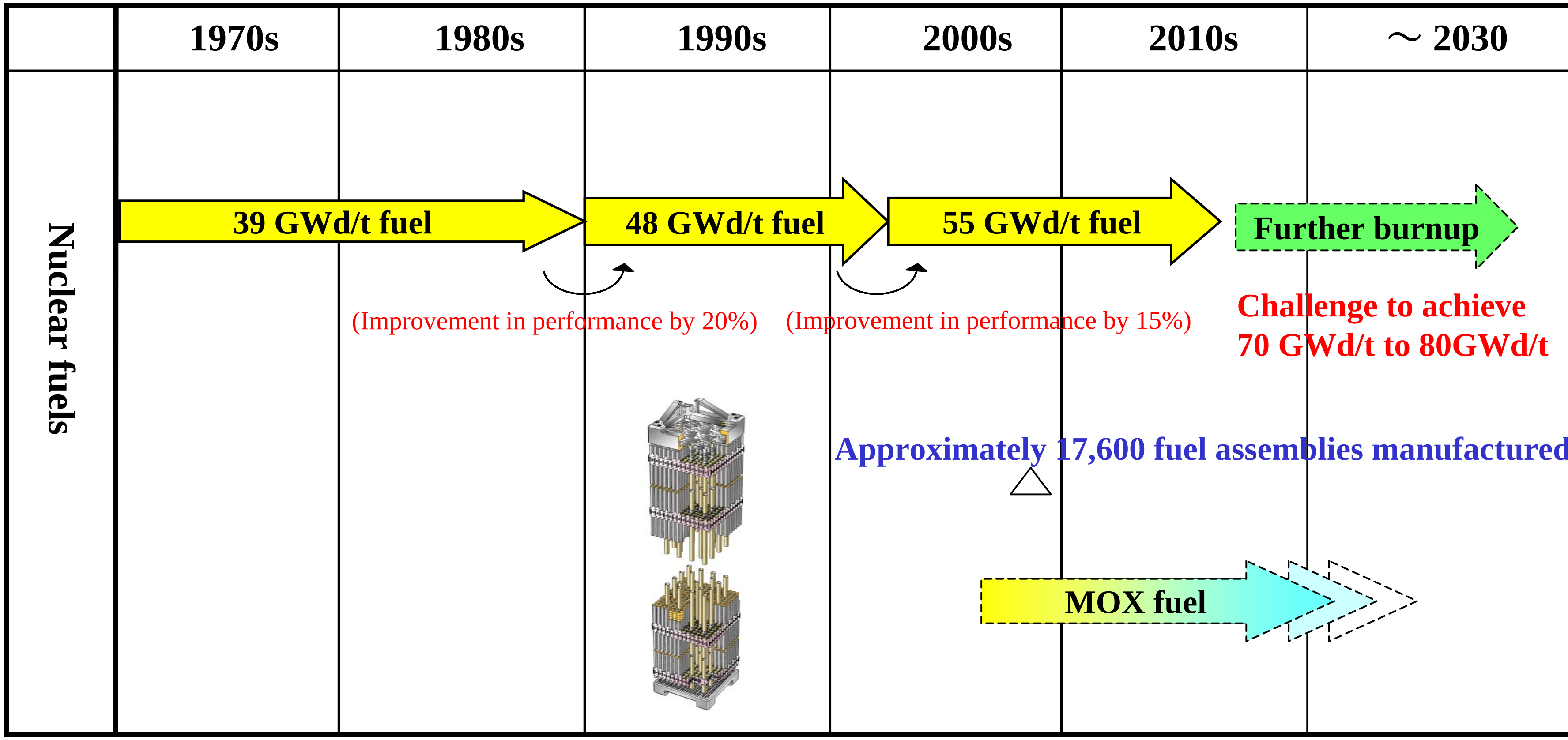
(High-level inspections and facility renewal)

Rated thermal power operation and long-cycle operation

(Improvement of performance)

3. (3) Activities on Nuclear Fuel

Realizing economical plant with highly reliable and improved burnup fuel



3. (4) Activities on Nuclear Fuel Cycle

Reprocessing is an indispensable technology for the future
→ Accumulating own technology to all fields

		1970s	1980s	1990s	2000s	2010s	～ 2030

Nuclear fuel cycle

Reprocessing

(Development of spent fuel reprocessing technology) Construction of the Rokkasho Reprocessing Plant

Maintenance business

(In charge of the main reprocessing process)

Construction of the second reprocessing plant

FBR fuel cycle

Construction of the Rokkasho MOX Fuel Plant

to reprocess MOX fuel

Casks

In Japan

Manufactured approximately 140 casks

(49 casks for transportation of spent fuel and high-level radioactive waste inclusive.)

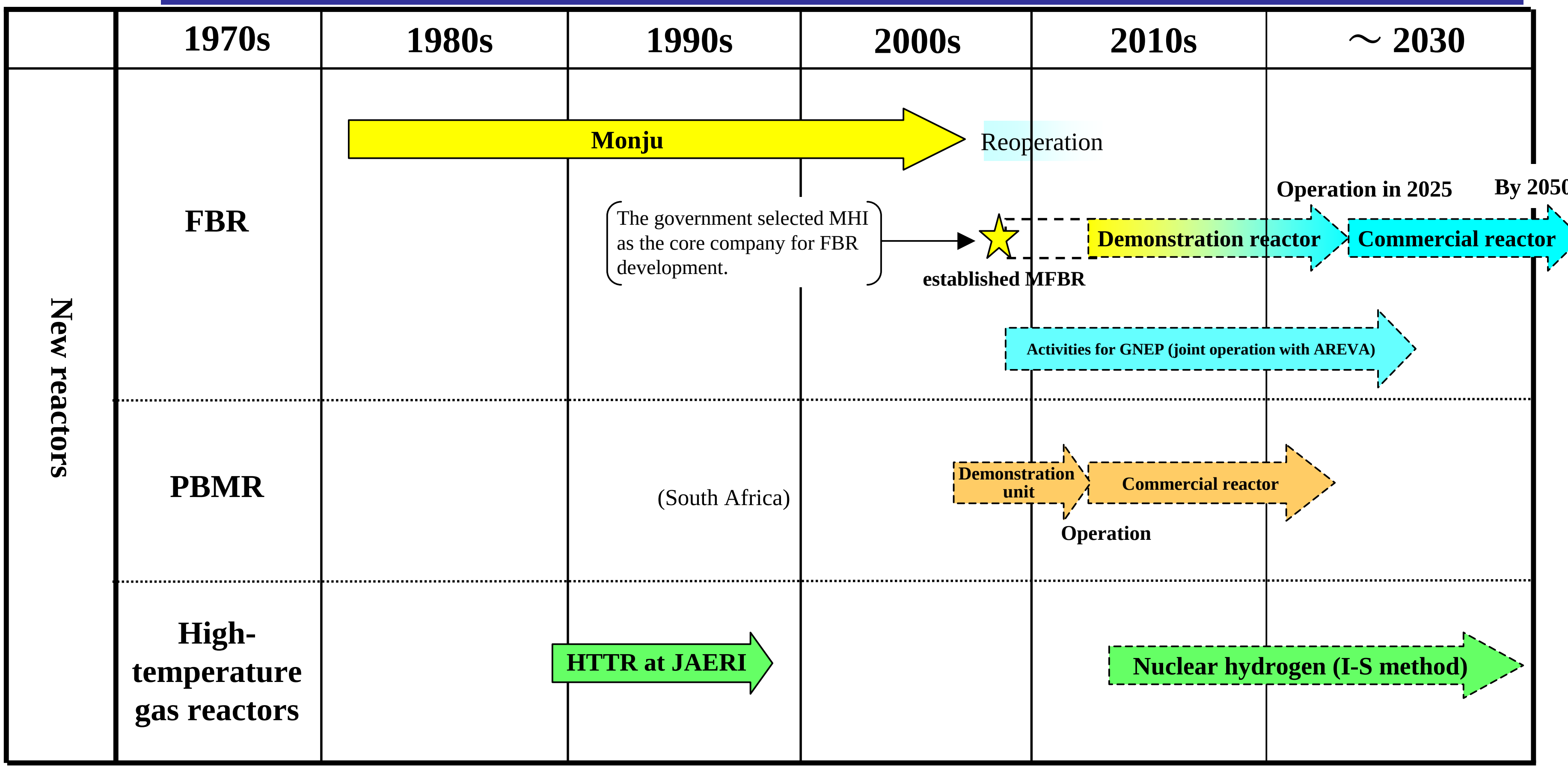
4 units / year

Overseas

3 to 5 units / year

3. (5) Activities on Advanced Reactors

Realizing next-generation technologies (FBR, PBMR and nuclear hydrogen)



JAERI : Japan Atomic Energy Research Institute

4. Activities on Nuclear Energy Business Overseas

4. (1) Activities on Nuclear Energy Business Overseas

(1) Expanding sale of large-sized strategic reactor ⇒ **United States**
(1700 MWe class US-APWR: independent development)

(2) Development and introduction of mid-sized strategic reactor ⇒ **Europe, United States, Southeast Asia**
(1100 MWe class: joint development with AREVA of France)

(3) Development of small-sized strategic reactor ⇒ **South Africa**
(170 MWe class PBMR 〔pebble bed modular reactor〕)

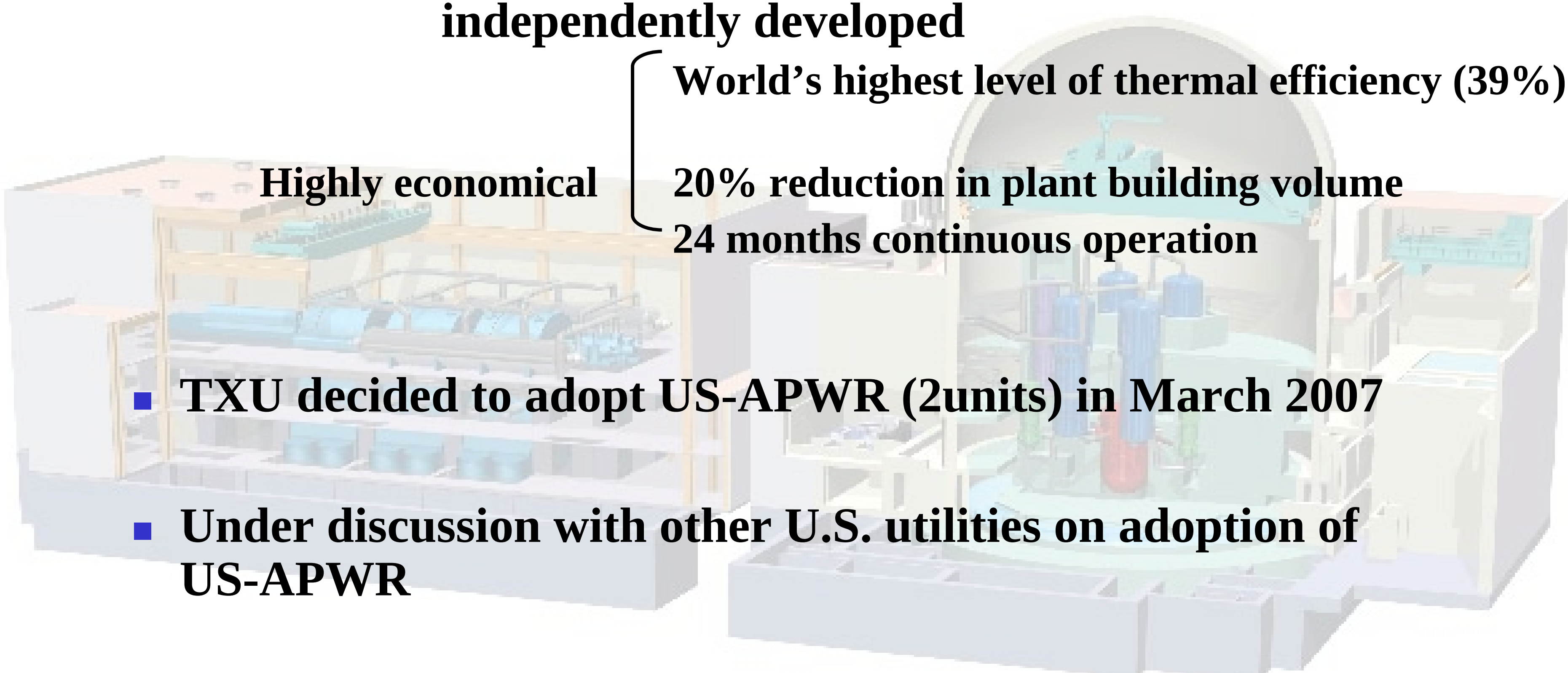
(4) Expansion of major components export
(steam generators, reactor vessels, turbines etc.)

(5) Aggressive proposal to GNEP
(Lead the world with fast reactor and reprocessing)

4. (2) Activities on the Large Strategic Reactor US-APWR

- **US-APWR: world's largest class (1700 MWe) reactor independently developed**

  Highly economical
  - **World's highest level of thermal efficiency (39%)**
  - **20% reduction in plant building volume**
  - **24 months continuous operation**



- **TXU decided to adopt US-APWR (2units) in March 2007**
- **Under discussion with other U.S. utilities on adoption of US-APWR**

4. (3) Activities on developing Mid-sized Strategic Reactor

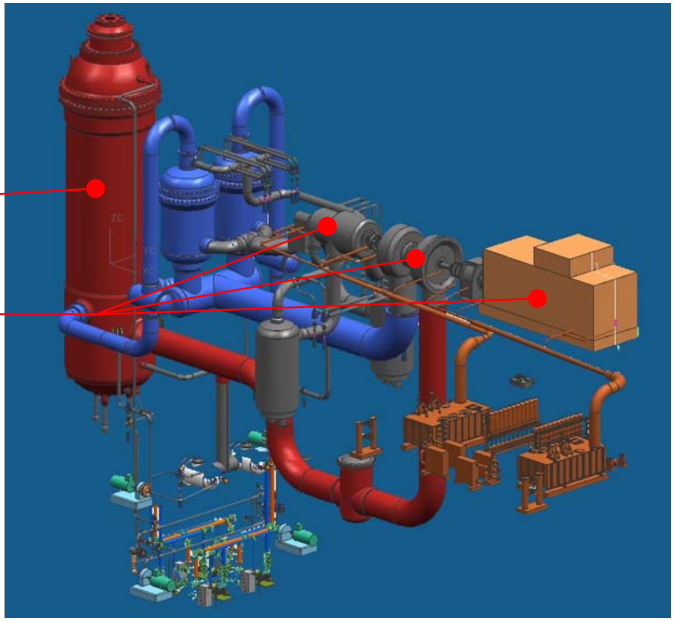
- **Under development on 1100 MWe class PWR jointly with AREVA**
- **Development at double speed by integrating both companies' latest technologies**
  (Excelling in safety, economy, efficiency and construction period)
- **MOU for JV establishment executed on July 10, 2007**
  (Acceleration of development and marketing)

MHI President Tsukuda and
AREVA Chairman Lauvergeon

4. (4) Activities on developing Small-sized Strategic Reactor (PBMR for South Africa)

Mitsubishi Scope

- **Core barrel** (core internal)
- **Helium turbine generator**



Koeberg
(PBMR demonstration site)

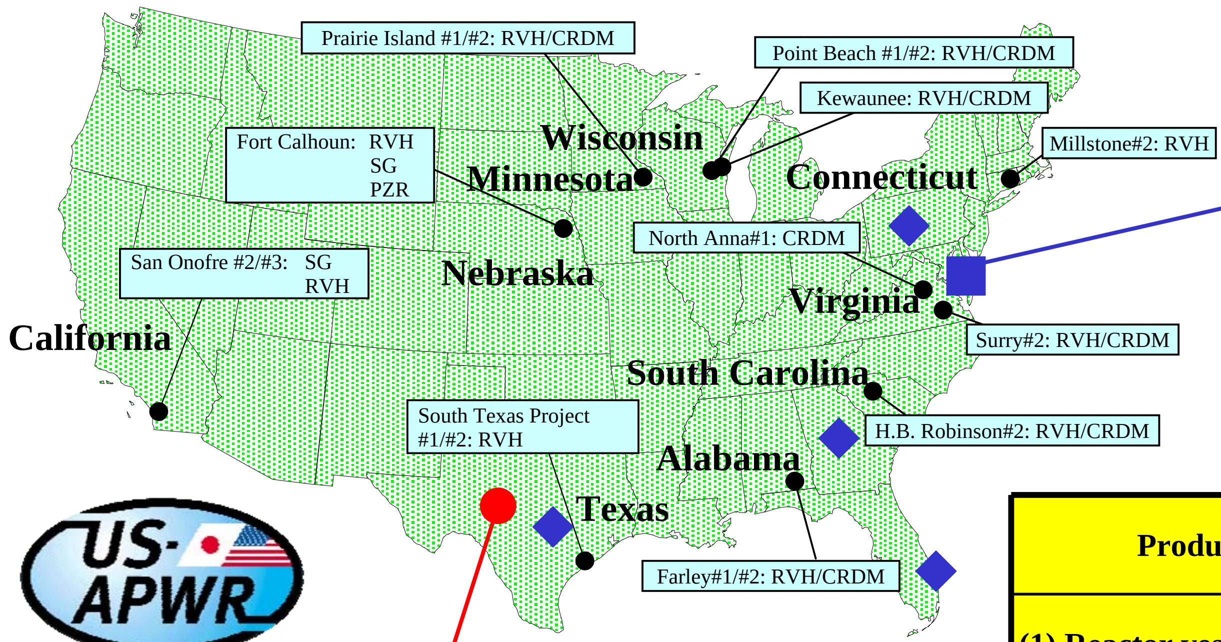
- **Operation of demonstration unit in 2012**
- **3 units/year from 2013 to 2020**

(scheduled to construct 24 units in total)

4. (5) Activities in the U.S. market

By many experiences of exporting major components to U.S., expanding U.S. market activity with MNES (a liaison company in USA).

➡ **both maintenance services and new plant business**



MITSUBISHI NUCLEAR ENERGY SYSTEMS, INC.

■ Headquarter

◆ Office

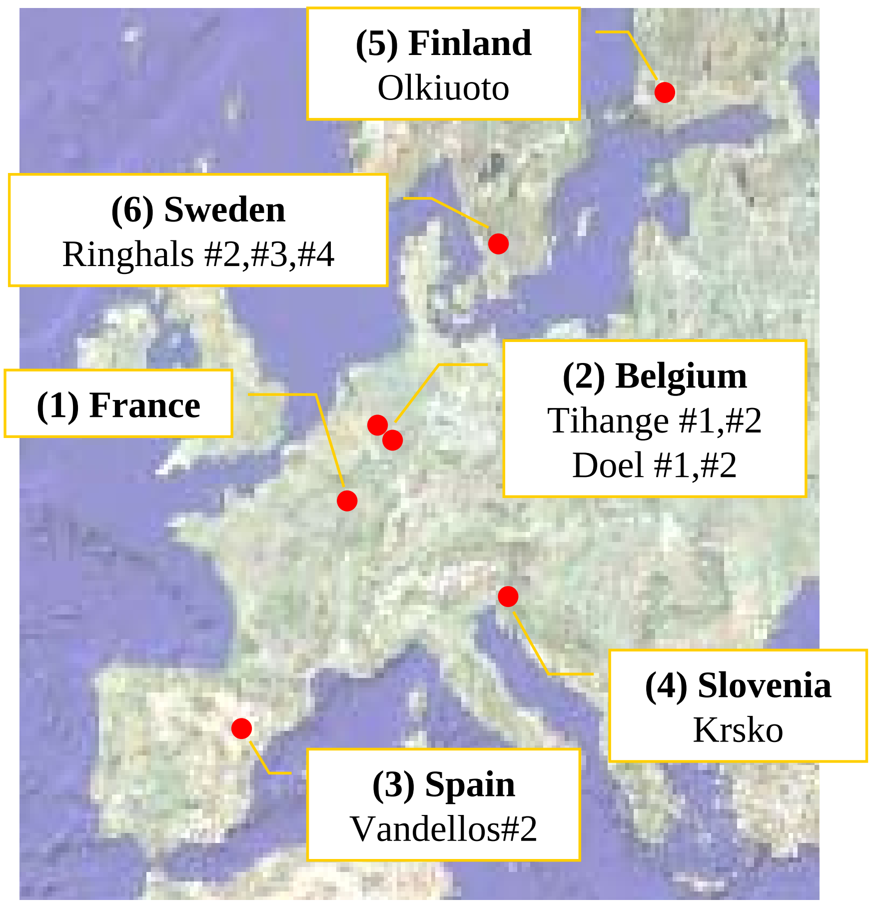
US-APWR

Product	Delivered	Under Manufacturing	Total
(1) Reactor vessel head	11	4	15
(2) Steam generator	2	4	6
(3) Pressurizer	1	-	1

4. (6) Activities in the European market

Based on component delivery records and good customer relations in many countries

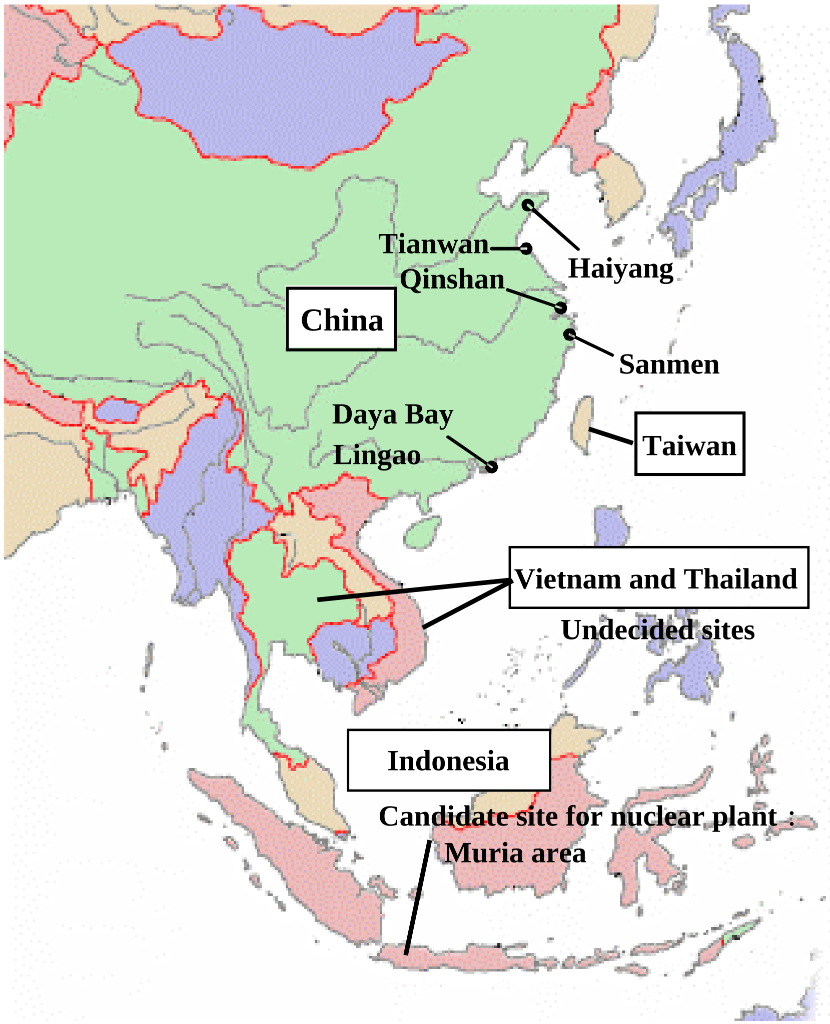
expanding both component and new plant business



Country	Product	Delivered	Under Manufacturing	Total
(1) France	Steam generator	-	6	6
(2) Belgium	Steam generator	8	2	10
(3) Spain	Turbine HP x 1, LP x 3	4	-	4
(4) Slovenia	Turbine LP	2	-	2
(5) Finland	Reactor vessel	-	1	1
(6) Sweden	RVH	3	-	3
	CRDM	-	55	55

HP: high pressure LP: low pressure RVH: Reactor vessel head
CRDM: control rod drive mechanism

4. (7) Activities in Chinese and Southeast Asian markets



China

Cooperate with China’s nationalization and self-reliance policies
(responding through component export)

Taiwan

Two turbines for ABWR delivered already

Indonesia

International cooperation through long-term plans
Independent MHI seminars since 2004

Vietnam and Thailand

Active participation in the Japanese government plans for international cooperation

Continue to promote activities carefully

4. (8) Activities on GNEP

- **GNEP is a concept announced by the U.S. Department of Energy (DOE) in February 2006.**

  Partners (United States, Japan, France, United Kingdom, Russia, China, etc.) study the development and use of advanced fast reactors and the reprocessing cycle

- **In May 2007, DOE invited application the engaging in studies to realize the concept from the public.**

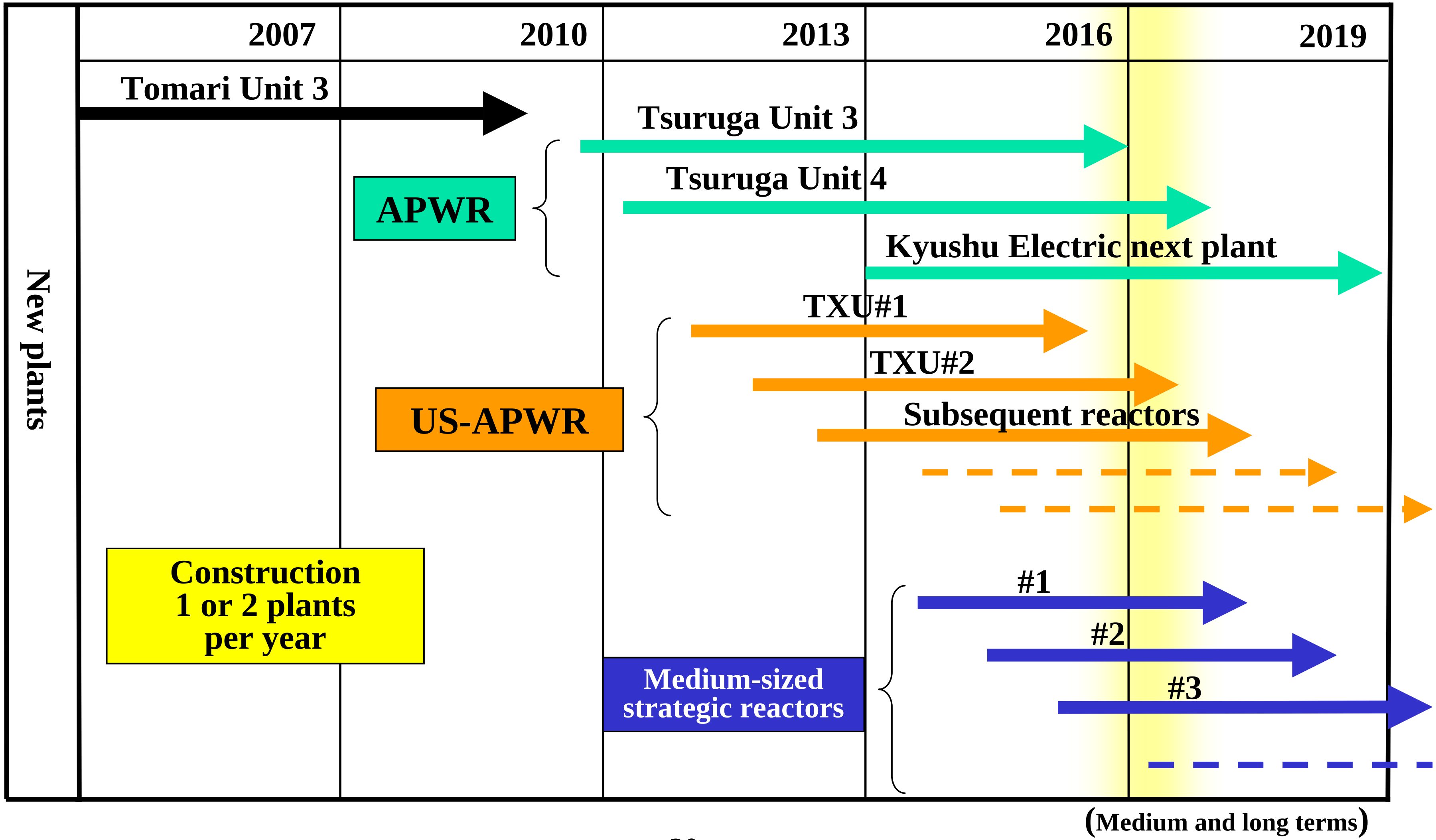
  (study how to proceed the business plan etc.)

- **In June 2007, MHI and AREVA proposed a joint application to DOE**
  (MHI as the fast reactor leader and AREVA as the reprocessing leader)

5. Medium and Long Term Plan

5. (1) New PWR plant construction schedule

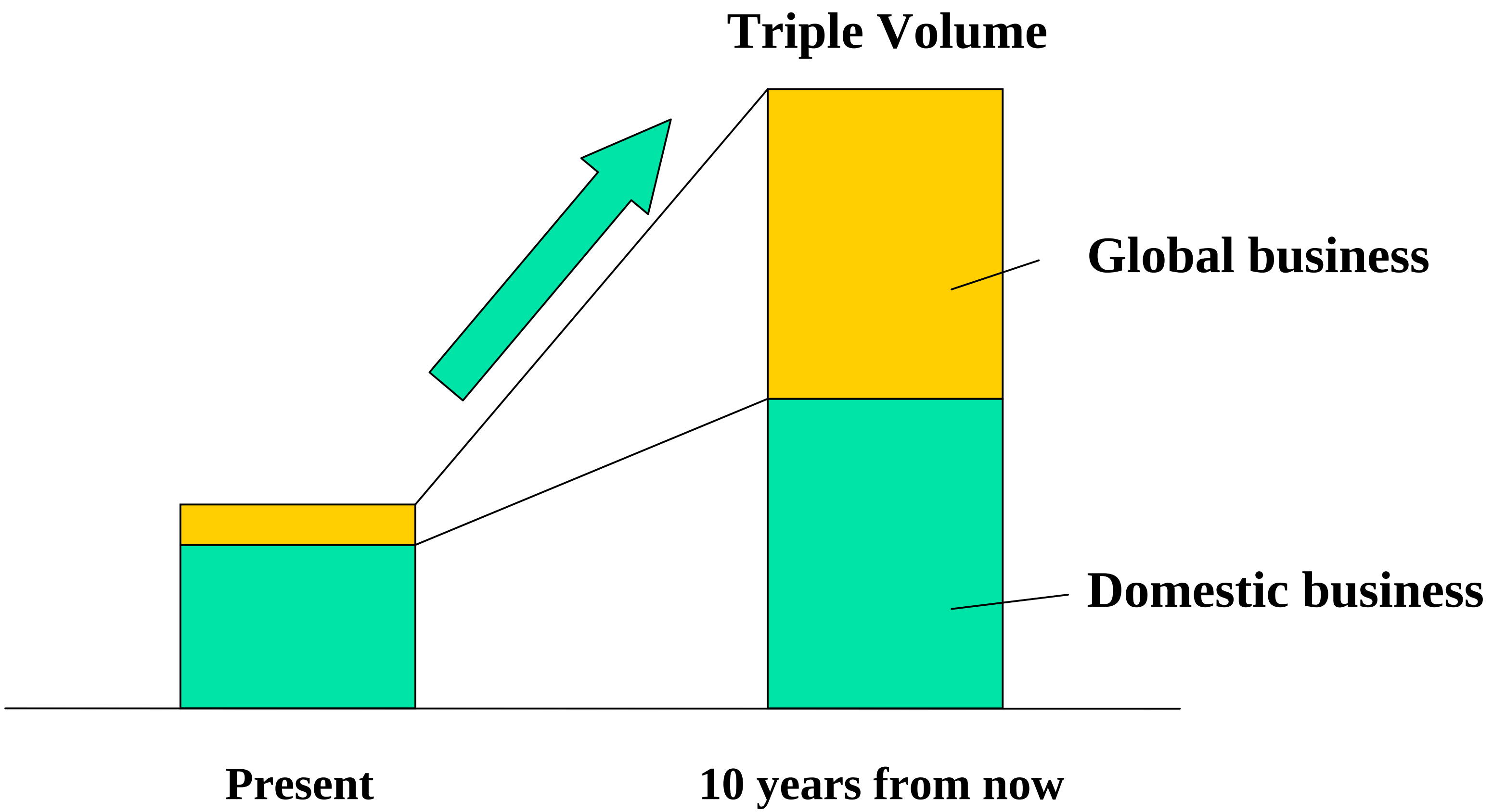
Substantial increase in new plant construction over medium and long terms (10 years)
→ Expansion in business scale

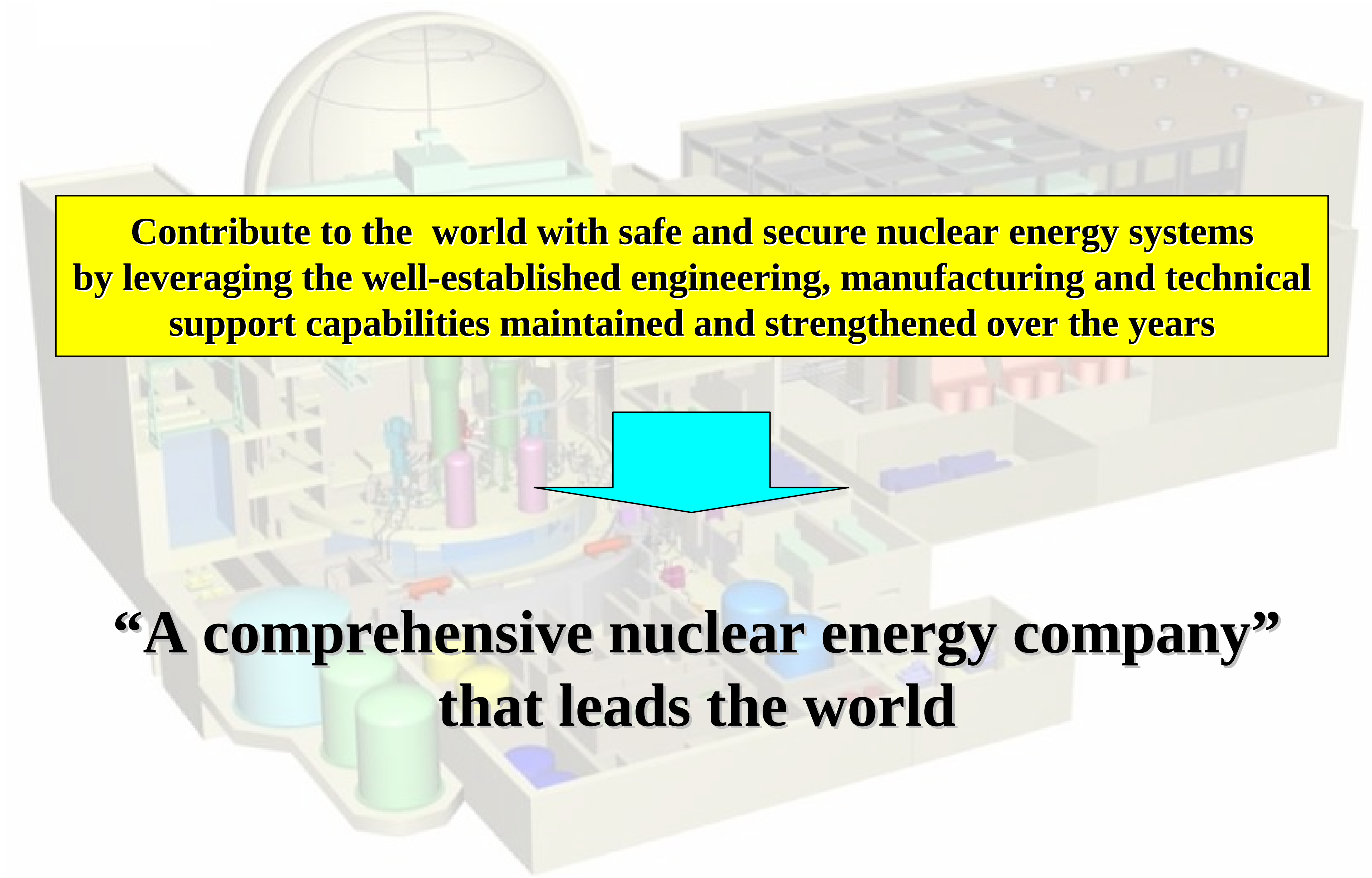


MITSUBISHI HEAVY INDUSTRIES, LTD.

5. (2) Medium and long-term business scale

Medium and long terms (after 10 years):
Triple expansion in scale





Contribute to the world with safe and secure nuclear energy systems by leveraging the well-established engineering, manufacturing and technical support capabilities maintained and strengthened over the years

"A comprehensive nuclear energy company" that leads the world

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[Document 2]

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Mitsubishi Heavy Industries, Ltd.

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1. Technologies for making sure "safety and security" and improving economy

Comprehensive technological capabilities for whole plant life

Capabilities

Engineering

- High-level design technologies for reactor core design and safety analysis
- Development and design technologies for entire plants
- R&D technologies for manufacture, construction and maintenance
- High-level development and design technologies for fuel

Manufacturing

- Manufacturing technologies based on cutting-edge engineering and welding technologies
- Plant construction technologies based on half-century experience

Technological support

- Response to aging, maintenance and inspection efficiency improvement
  ·Preventive maintenance technologies for more sophistication
- Design and maintenance technologies to bolster safety

[Social needs]

○ Safety and security of nuclear power plants

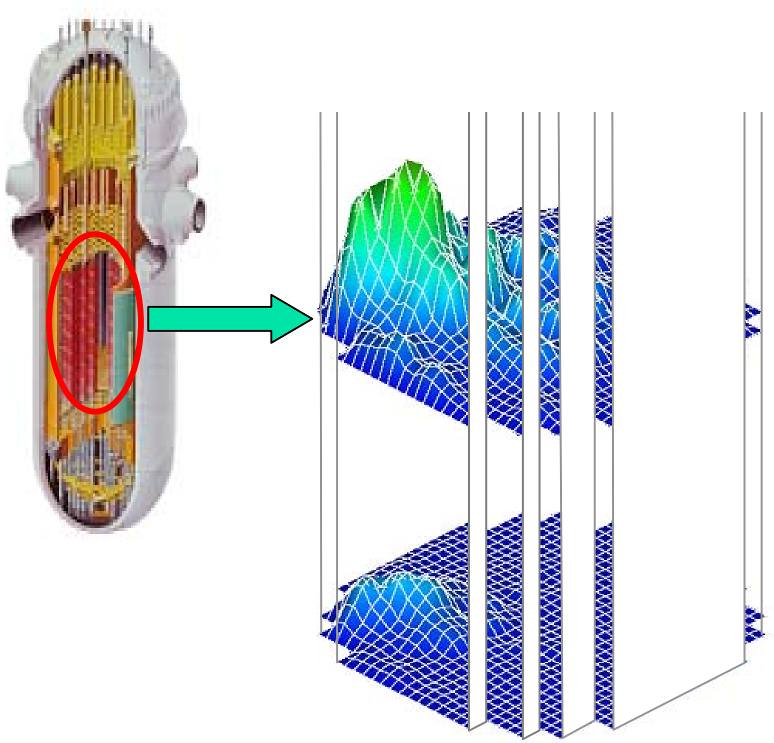
○ Improvement in economy

1. (1) Engineering capabilities

[Technologies for reactor core design and safety analysis]

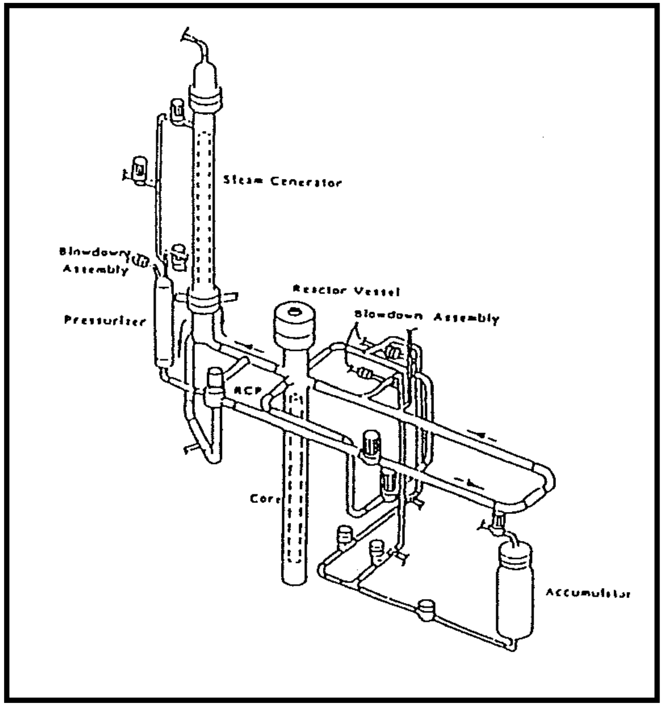
The only company capable of consistent reactor core design and safety analysis services

- **Developed the most advanced analytic program in the world**
- **Proved the analytic program using a large demonstration equipment**



Safety analysis example

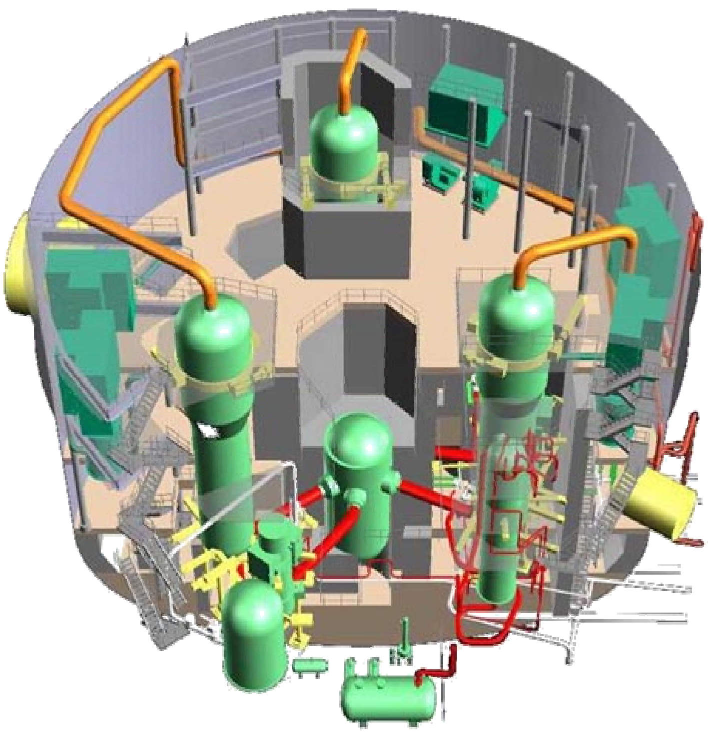
- **A demonstration equipment for a LOCA (loss-of-coolant accident) analyzing program**



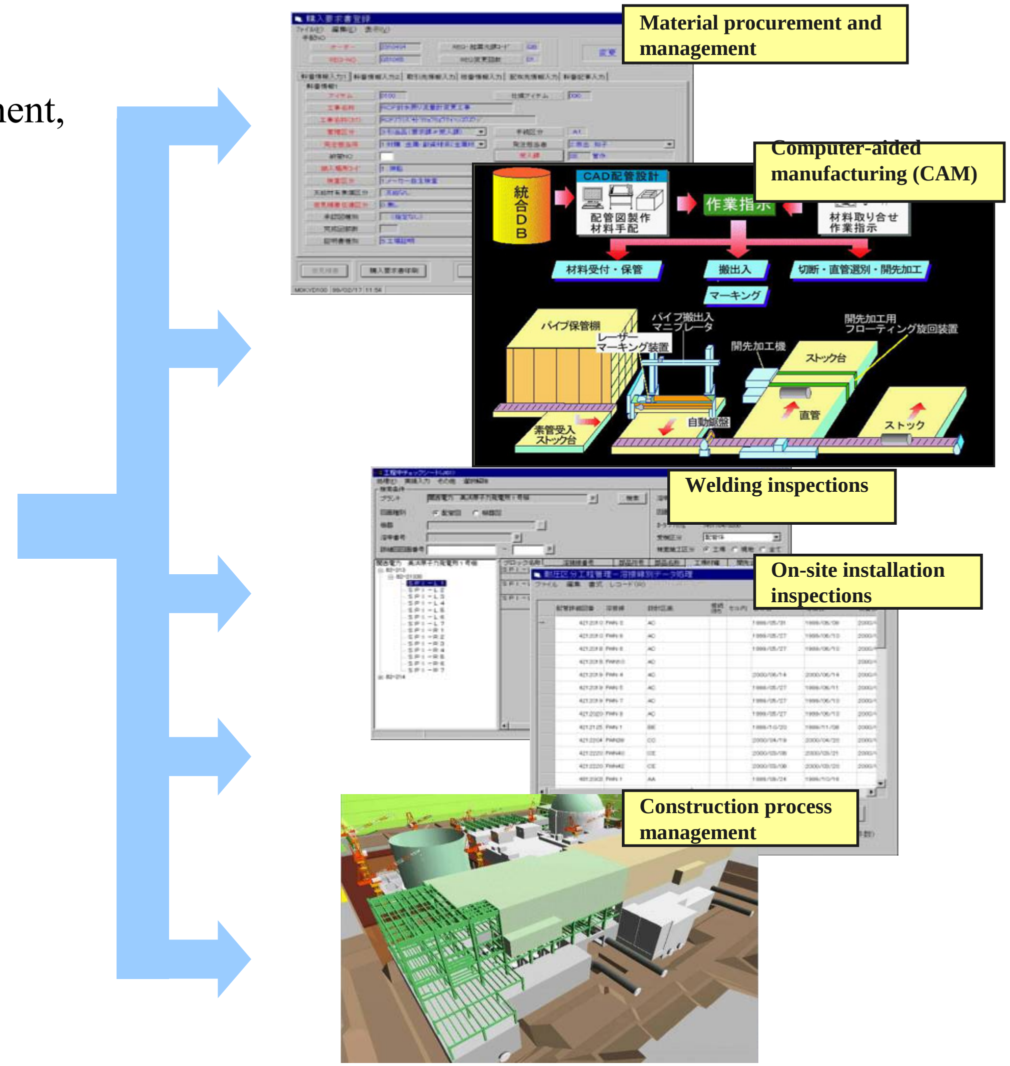
1. (1) Engineering capabilities

[Plant development and design technologies]

Manufacture and construction support using consistent common database for plant development, design, manufacture and construction



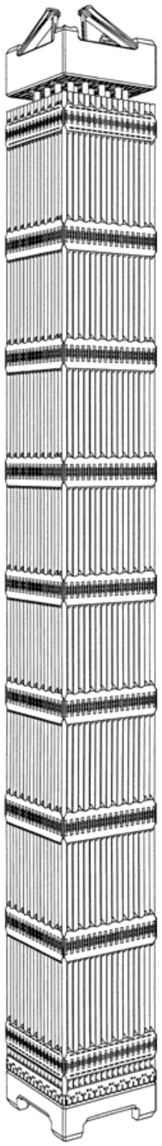
Common database example



CAM: Computer aided manufacture

1. (1) Engineering capabilities

[Technologies for PWR fuel development and design]



Abundant supply and high reliability

(Only one reconversion process in Japan)

- Experience of numbers of Fuel Assembly: approx. 17,600 (as of July 1, 2007)
- Leakage rate of fuel rod

  MHI ; ~ 10^{-6} Overseas ; ~ 10^{-5}

Development for economic and flexible plant operations

- High burnup fuel : 39→ 48→ 55GWd/t * (Current level)

  ➡ Further burnup improvement (targeted 70-80GWd/t)
- Extended cycle length and up-rate of reactor power

Effective use of reprocessed Pu and U

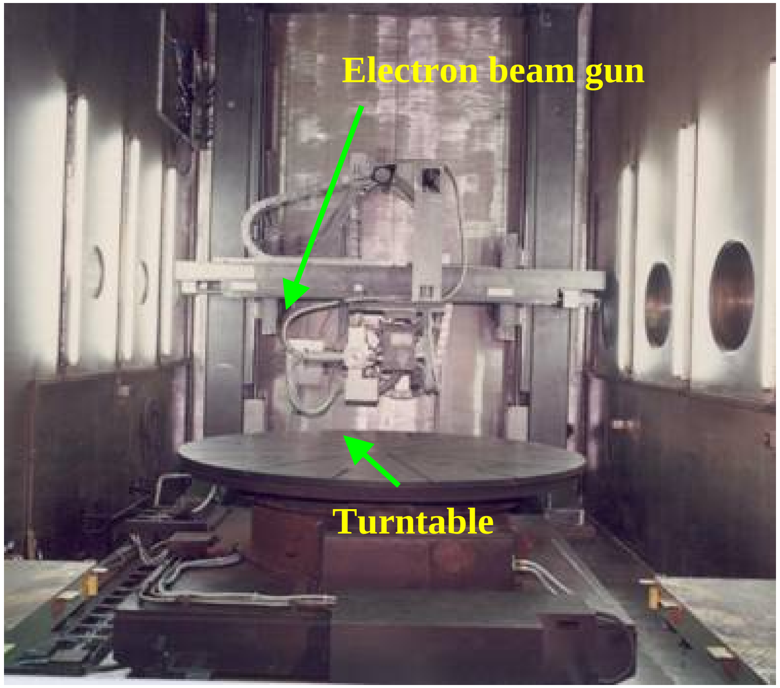
- MOX fuel supply
- Supply of recycled uranium fuel

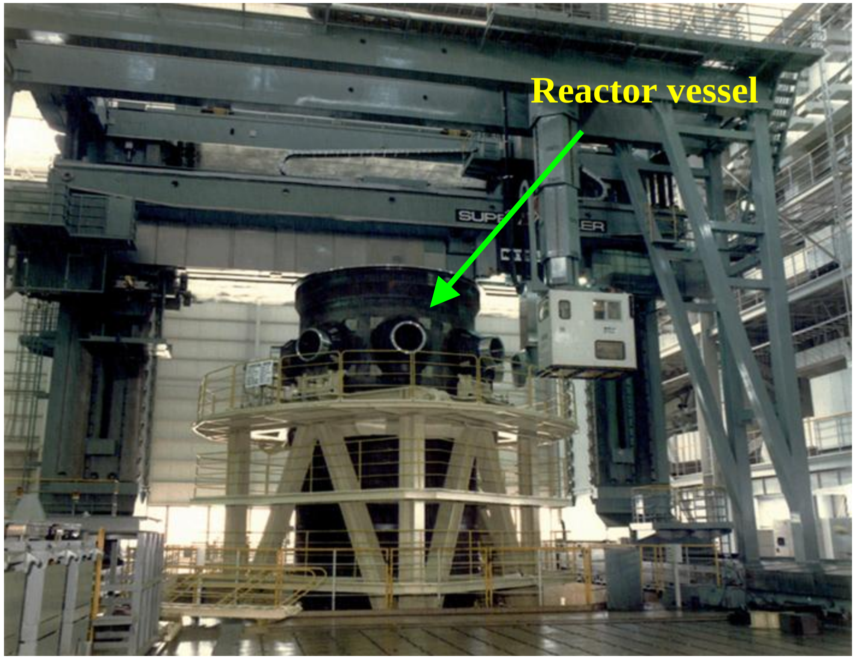
*GWd/t: Energy production per ton of uranium

1. (2) Manufacturing capabilities

- **Keep innovating high-accuracy, high-efficiency, high-quality manufacturing technologies**

150 kW electron beam welding component	**Super-large combined machine tool "Super Mirror"**
Application of the world's highest accuracy welding technologies to large structures	The only super-large machine tool in the world offering high-accuracy, high-quality processing in upright installation position





1. (2) Manufacturing capabilities

Welding of integrated reactor vessel-barrels and nozzles

Develop super large rotating fixture

Weld the rotating fixture weighing 200t in total

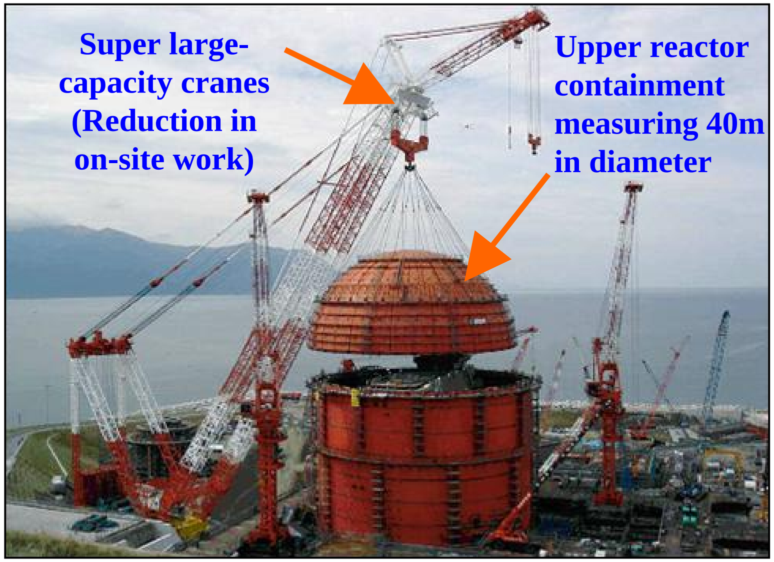
Insertion of heat transfer tubes to steam generators

Insert approx. 10,000 heat transfer tubes to a heat generator with high accuracy

1. (2) Manufacturing capabilities

[Plant construction technologies]

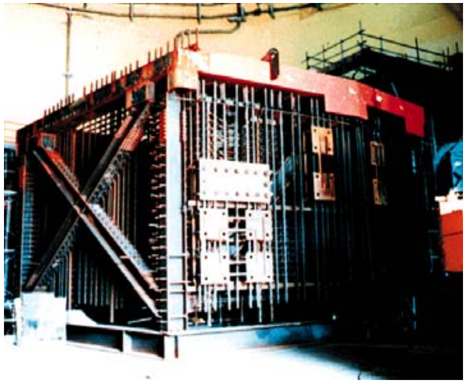
♦ Reduction in on-site work



Super large-capacity cranes

Comprehensive project management for civil engineering and construction work

Internal structures using SC (steel plate reinforced concrete)



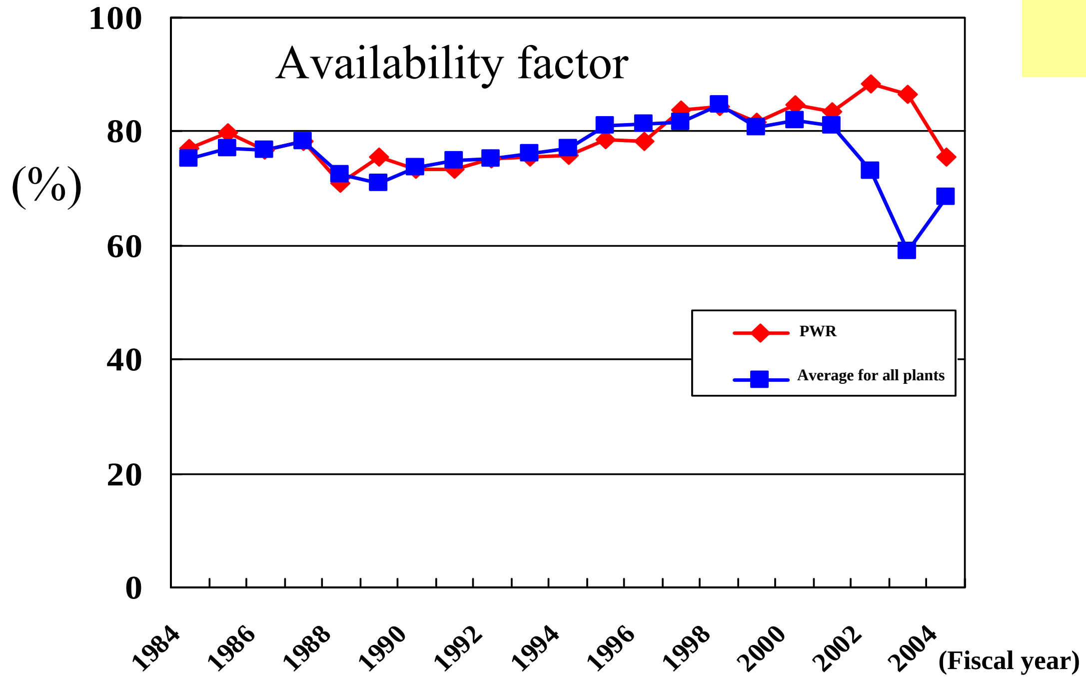
Large prefabricated blocks

[Record of construction periods]
(First Concrete to fuel loading)

Ikata Unit 2 (2 loops)	:	34.5 months
Takahama Unit 3 (3 loops)	:	37.5 months
Ohi Unit 3 (4 loops)	:	40.0 months

1. (3) Technological support capabilities

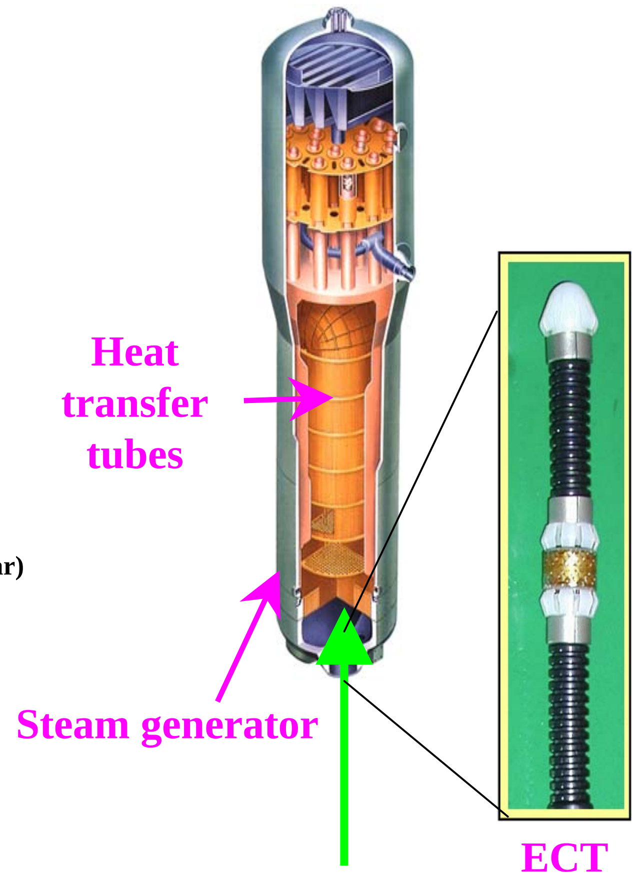
[Support for maintenance technologies]



Source: "Annual Report about the Status of Nuclear Facilities in Japan" issued by Japan Nuclear Energy Safety Organization

Increase the plant availability factor with high-level inspection, preventive maintenance, repair and component replacement technologies

Fastest and most precise intelligent eddy current test (ECT) in the world



1. (3) Technological support capabilities

[Support for maintenance technologies (large component replacement)]

- **Comprehensive plant engineering**
- **Manufacturing technologies (high accuracy, high quality, quick manufacturing capabilities)**

Steam generator replacement backed by solid record

29 units in Japan
Many orders received from abroad

World's first replacement of reactor internal

Quick, highly-precised installation in a high radiation environment

World's first replacement of main control board

Simultaneous digitalization of control units and central control panel replacement.

Reliability improvement and lifetime extension for aging component

Substantial operability improvement

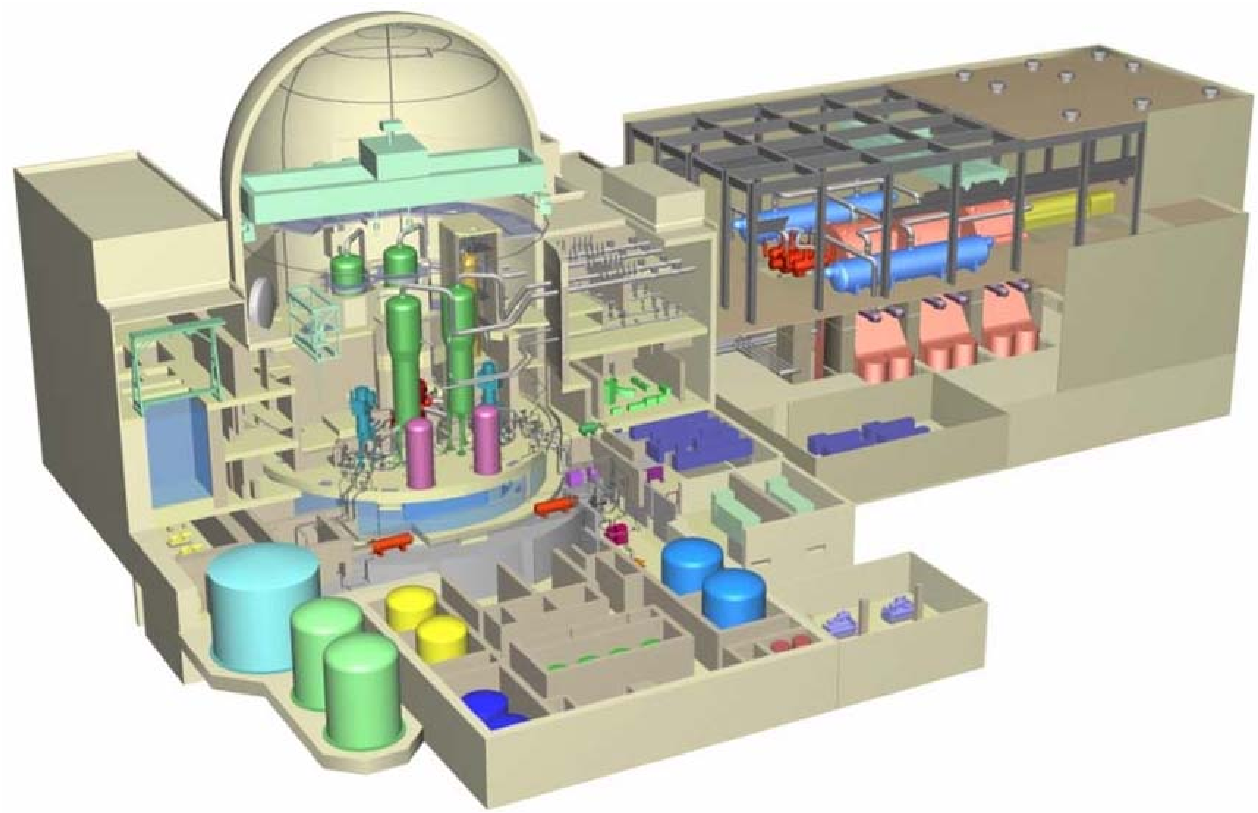
2. Development and market introduction of global strategic reactors

Acceleration of strategic reactors using cutting-edge technologies

- **Market introduction of large-sized strategic reactor (US-APWR)**
  - **Large, highly-advanced reactors able to handle large output demand**
  - **Independently developed reactors using verified APWR technologies**
  - **U.S. certificate acquisition and early market introduction**
- **Joint development of mid-sized strategic reactor with AREVA**
  - **1100MWe class PWR in high demand worldwide**
  - **Early market introduction of jointly-developed mid-sized reactor (incorporating cutting-edge technologies of the two companies) that boast leading performance**
- **Development of small-sized strategic reactor (PBMR)**
  - **Small, decentralized reactors close to power demand sites**
  - **Early construction of demonstration units using Mitsubishi's comprehensive technologies**

2. (1) Market introduction of large-sized strategic reactor

US-APWR deployment in the United States

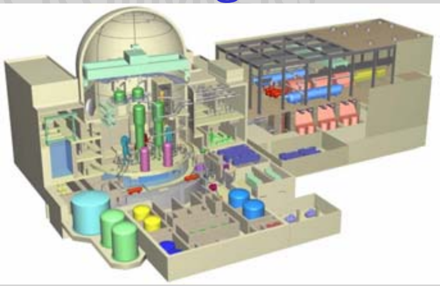


Characteristics of US-APWR

Response to early realization requested by U.S. power companies

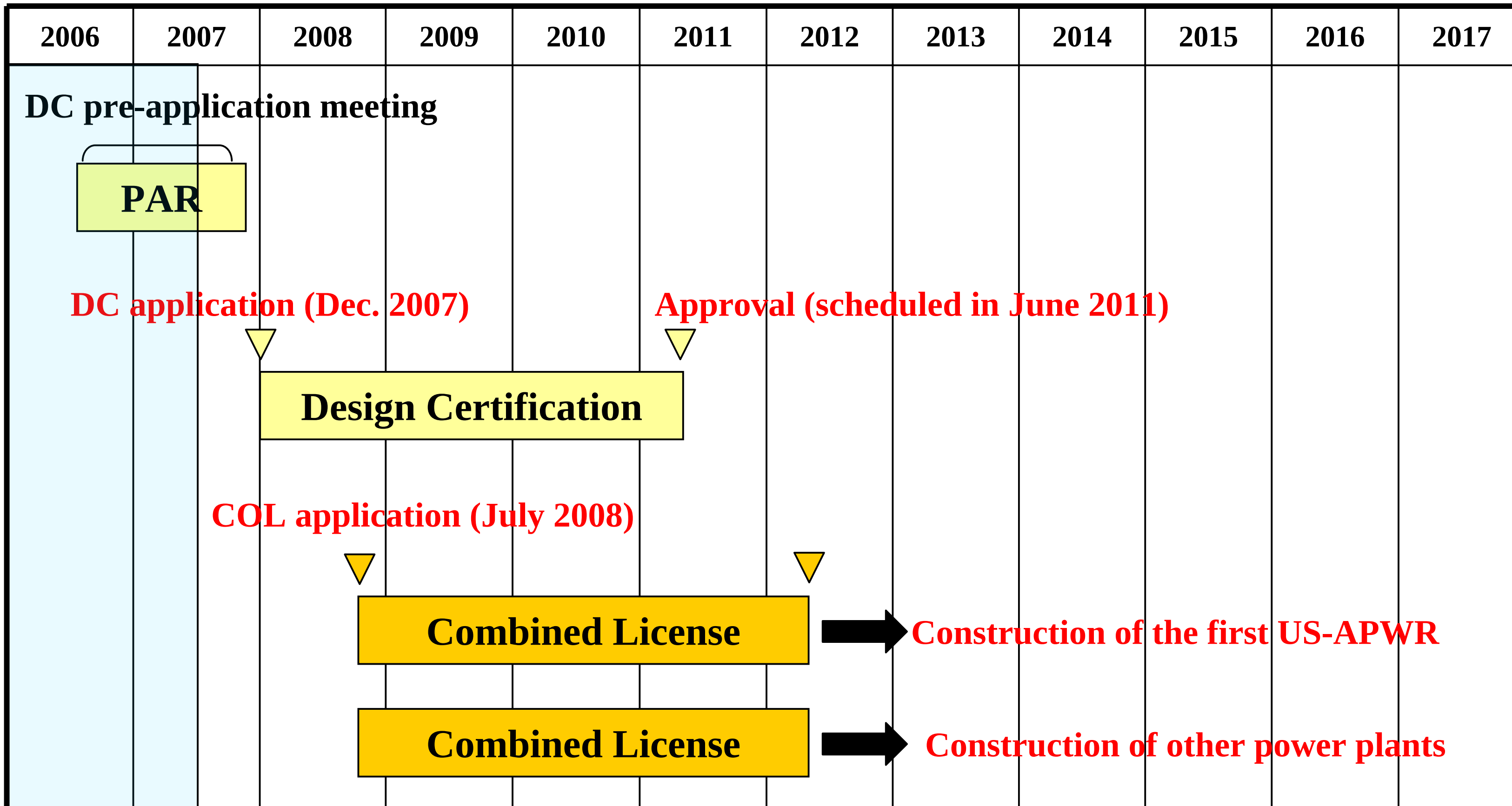
Output expansion based on APWR in Japan

- **Largest power output in the world (1700 MWe class)**
- **Fuel economy improvement through 24-month continuous operation**
- **Highest safety and reliability levels in the world**
  - **Best combination of passive and active technologies**
  - **Measures against airplane clash**
- **Target construction period: 41 months**



Early introduction of US-APWR to the U.S. market

- Speedy DC application based on technologies verified at APWR in Japan
- Application for COL in parallel with DC with customers



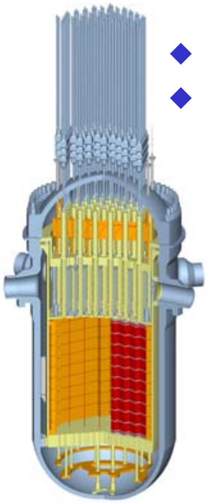
DC：Design Certification　COL：Combined Construction and Operating Licenses
PAR: Pre Application Review

US-APWR major technologies

Large output and fuel economy

Improvement in safety, reliability and maintainability

Reactor core

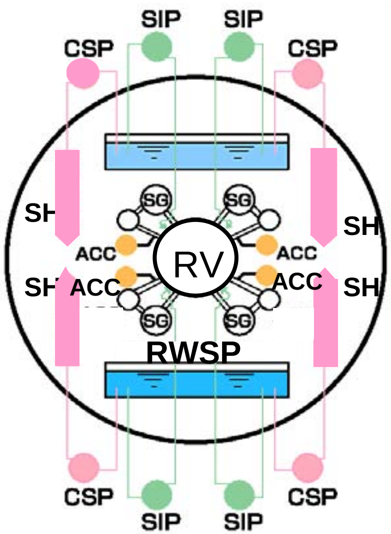


- 14ft fuel
- Neutron reflector

Steam generator

- High-performance steam-water separator
- High-function moisture separator
- Compact size

Emergency core cooling system

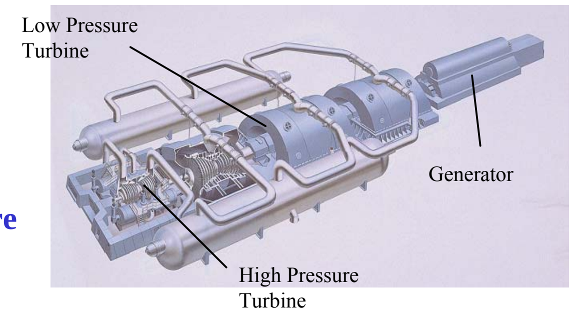


- Four trains system
- Best passive and active combination

  (Advanced accumulator)
- Refueling water storage pit (RWSP) inside containment vessel

Turbine

- 70-inch class long last blades, low-pressure turbine
- Integral shroud blade structure



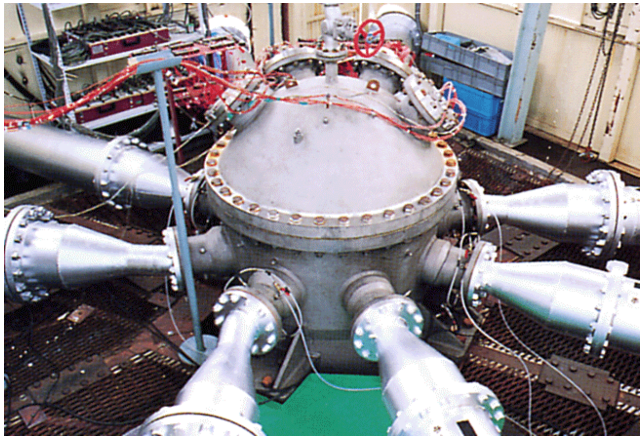
I & C

- Digital control & protection system
- Compact consoles

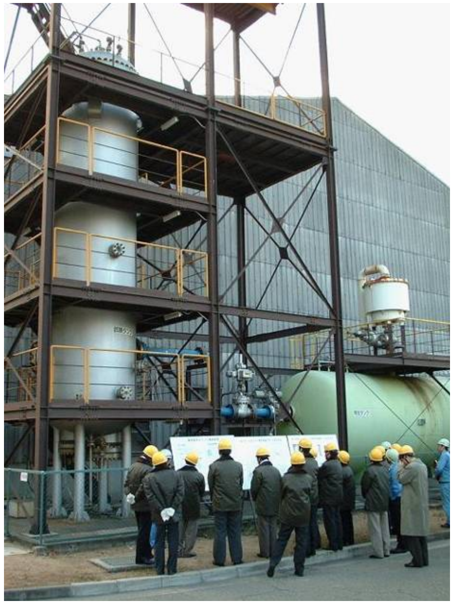
Verification of US-APWR major technologies

- ➢ **Verification tests for major technologies**

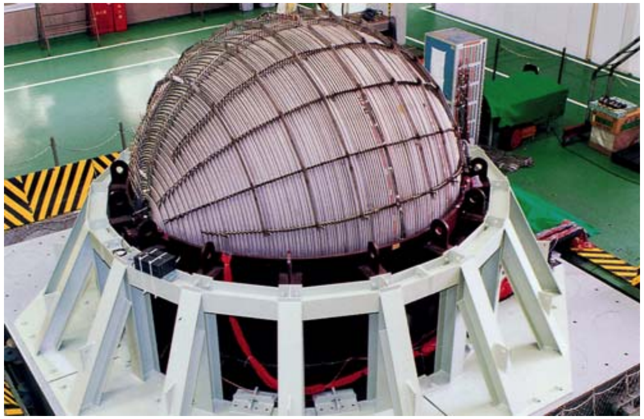
High pressure high temperature tests for steam-water separators of steam generator



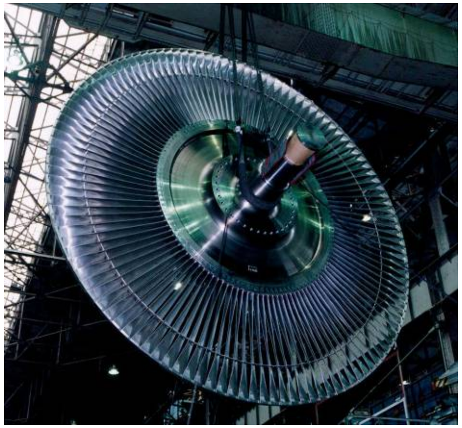
Comprehensive flow tests for reactor internals



Pressure application tests for high-performance accumulators



Anti-vibration bar seismic tests for steam generators



Rotational vibration tests for low-pressure turbines

Major US-APWR major performance

Highest performance in the world

		US-APWR
Power output		1700 MWe class
Plant efficiency		Up to 39%
Reactor core function (uranium consumption)		18% reduction from existing reactors
Safety (reactor core damage ratio)		1×10^{-7}/reactor/year or lower
Reliability	Availability factor	95.7% or higher
	Unplanned plant shutdown rate	0.1/reactor/year or lower
Operational maintainability		Online maintenance by 4-train system
Construction period		41 months

3. (2) Development of mid-sized strategic reactor

Joint MHI-AREVA development

Reactor jointly developed by MHI and AREVA

Cooperation of two nuclear plant manufacturers in collective strength that lead the world

(1) Integration of the latest technologies (US-APWR, EPR)

(2) Sharing of know-how and human resources → Enabling quick market introduction

(3) Realization of synergy

- 12 factories in nuclear fields → Bottleneck prevention in component manufacture, etc.
- Construction experience from more than 120 commercial nuclear power plants

Conceptual design already completed	: Oct. 2006 to June 2007
Agreed to establish JV for development and sales expansion	: July 10, 2007

→ **Early market introduction by halving the development period**

Reactor jointly developed by MHI and AREVA

Basic Plant Concept

- Power output: 1100 MWe class
- 3-loop, pressurized water reactor (PWR)
- Response to customer needs
  - Flexible operability and economy
    - Respond to long-cycle operations
    - Respond to MOX fuels (mixed uranium-plutonium oxide fuels)
  - Safety
    - Resistance and durability against airplane clash
  - Environmental measures
    - Substantial reduction in spent fuel and waste volumes

PBMR development

PBMR development PBMR: Pebble Bed Modular Reactor

[Characteristics of PBMR] **High-temperature gas reactor close to power demand site**

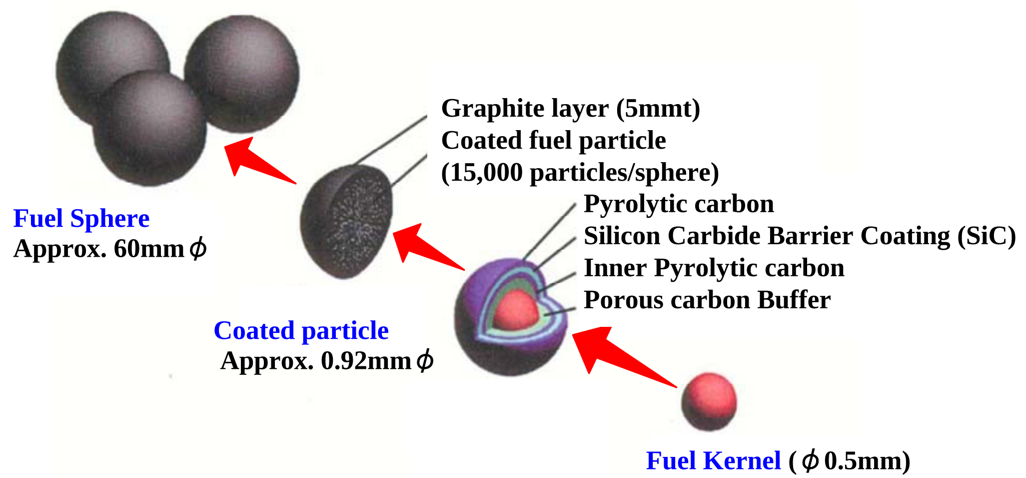
- **Safety: Inherent safety with no chance of reactor core dissolution**
- **Operability: able to supply and remove fuel without suspending reactor operation**

Coolant: helium gas (nonradiative medium)

Modular type: able to extend according to power demand

Fuel: pebble bed fuel

(Uranium oxide particles + graphite powder⇒ compaction molding into a spherical shape)



PBMR project

MHI participates in PBMR project since 2001

- MHI's gas turbine technologies, design and manufacturing technologies for nuclear components

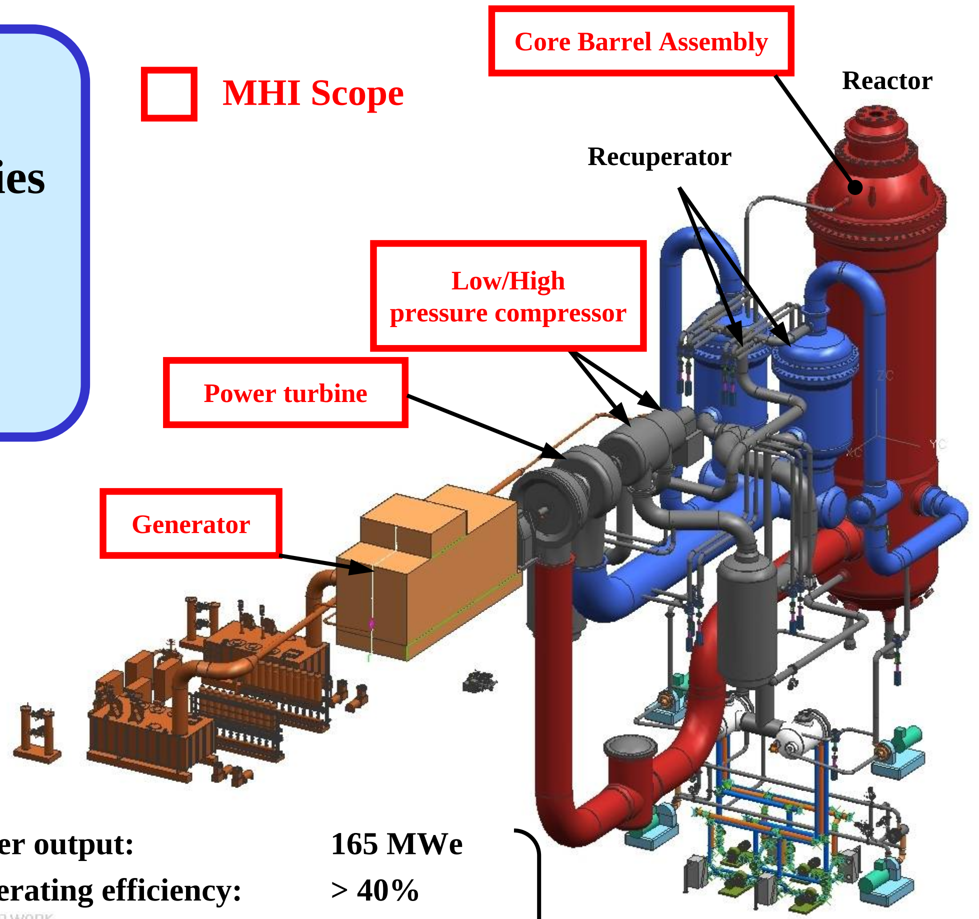
  +

- PBMR's gas reactor technologies

[Customer]: Eskom

(South African power company)

Demonstration unit: scheduled for construction in Koeberg
Operation Start: 2013



- Power output: 165 MWe
- Generating efficiency: > 40%
- Temperature at reactor outlet/inlet: 900°C/500°C

3. Establishment of the nuclear fuel cycle

Contribution to the development of nuclear recycle technologies by reflecting with results of the passed R&D and the cutting-edge technologies

(1) Development of Fast Breeder Reactor (FBR)

- Effective use of FBR technologies based on the results of "Joyo" and "Monju"
- Establishment of Mitsubishi FBR Systems, Inc. (MFBR)
  ⇒ Perform development of FBR demonstration and commercial reactors
- Joint application to international program (GNEP) with AREVA

(2) Activities for the fuel cycle

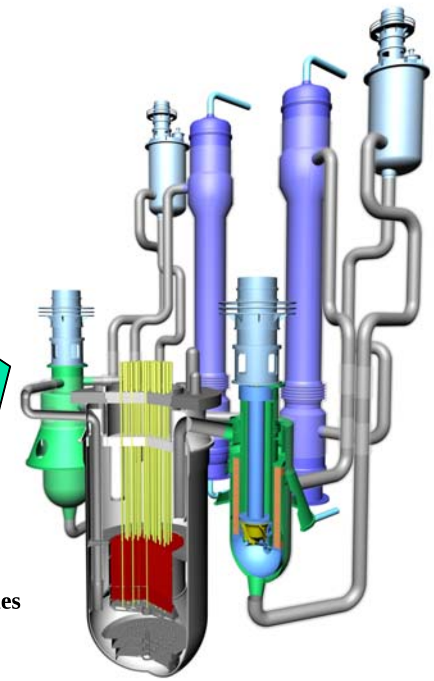
- Participation in all fuel cycle fields ⇒ Contribution to establishment of fuel cycle
- Design and manufacture of major equipments with the advanced technologies at Rokkasho reprocessing plant
- Participation in construction of 2nd reprocessing plant and Rokkasho MOX fuel plant

3. (1) Development of Fast Breeder Reactor (FBR)

Activities for Development of Commercial FBR

- Improvement of economy
- Power generation demonstration
- Fast neutron technologies
- Sodium handling technologies

Commercial reactor [by 2050]
(Power output: 1500 MWe)



Prototype reactor "Monju"
(Power output: 280 MWe)

- Power generation demonstration
- Establishment of sodium handling technologies

Experimental reactor "Joyo"
(Power output: 140 MWt)

- Proof of Breeding
- Irradiation Test

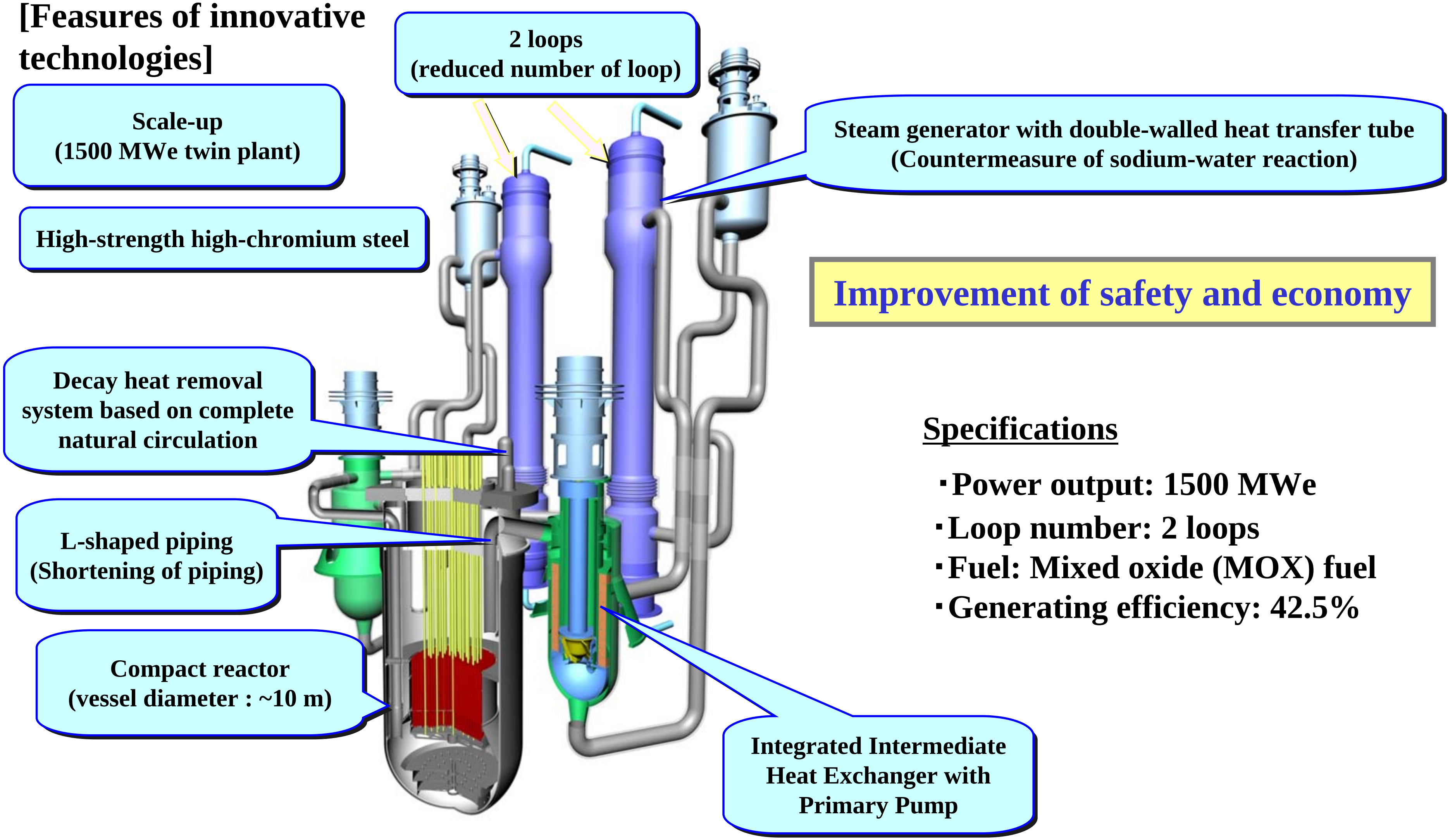
Demonstration reactor
[Operation start in 2025]

- Demonstration of innovative technologies

Being performed mainly by MFBR

"Advanced sodium-cooled loop type reactor" proposed by MHI ⇨ selected as commercial reactor in Japan by adoption of innovative technologies

[Feasures of innovative technologies]



Improvement of safety and economy

Specifications

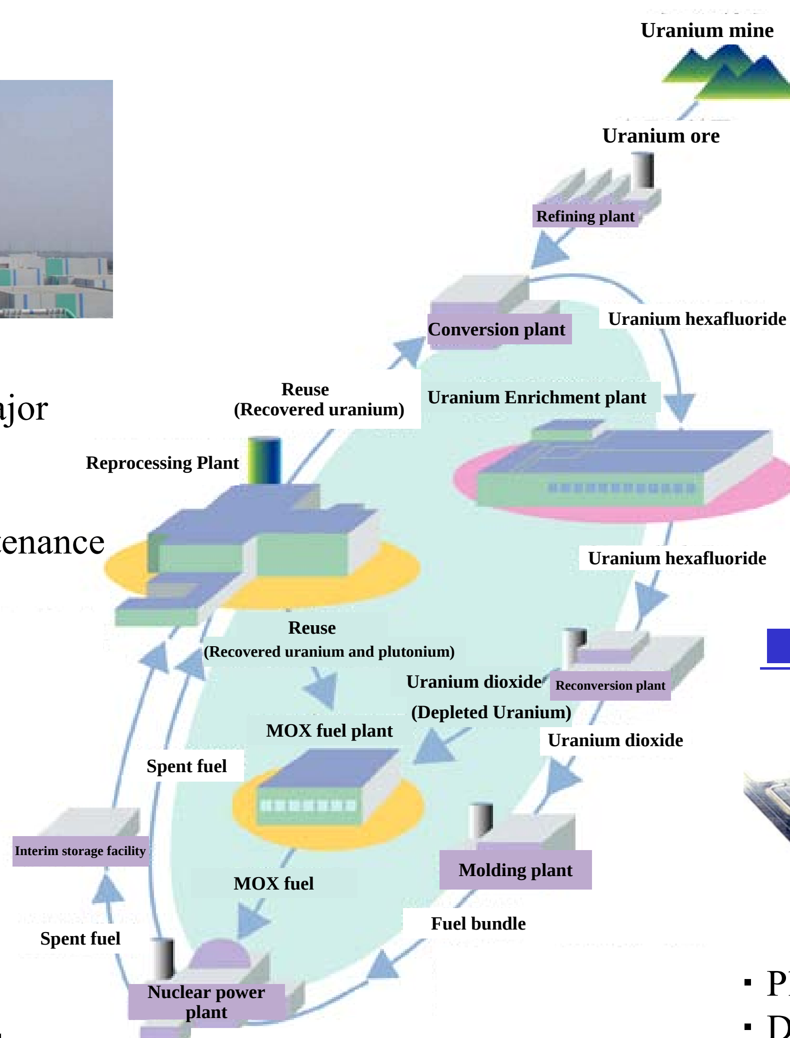
- Power output: 1500 MWe
- Loop number: 2 loops
- Fuel: Mixed oxide (MOX) fuel
- Generating efficiency: 42.5%

3. (2) Activities for nuclear fuel cycle

Participation in nuclear fuel cycle fields

■ Reprocessing plant

- Plant engineering
- Design and manufacture of major processing (shearing and dissolution) equipment
- Operational support and maintenance



■ Uranium Enrichment plant

- Design and manufacture of peripheral facilities for centrifuge renewal

■ Fuel transportation and storage

- Fresh fuel transportation casks
- Spent nuclear fuel transportation and storage casks

■ MOX fuel fabrication plant

- Plant engineering
- Design and manufacture of fuel rod processing and fuel assembling facilities

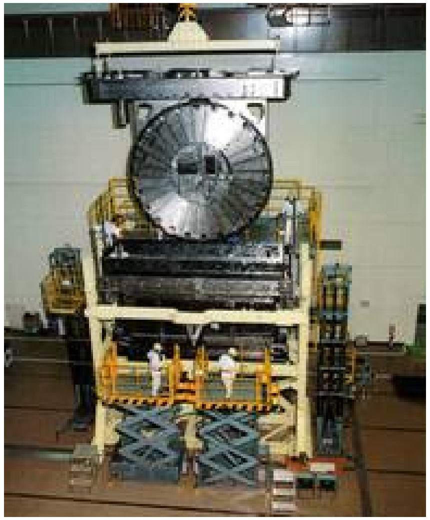
Design and manufacture of major processing equipment at Rokkasho reprocessing plant

Major processing equipment manufactured by MHI

- Fuel assembly shearing equipment
- Dissolution equipment
  - Equipment for fuel pellets dissolution and waste separation (fuel cladding tubes, etc.)

- Construction coordination by MHI
- Reprocessing plant completion under global attention
- Latest processing technologies in non-proliferation level
  → mixed denitration
- Participation in 2nd reprocessing plant

Spend nuclear fuel assembly shearing technologies



Manufacturing technologies using nitric acid resistant material (zirconium)

"A comprehensive nuclear energy company" that leads the world