5th MDEP Conference

Toshiba's Effort to Maintain and Strengthen Supply Chain

TOSHIBA

Toshiba Energy Systems & Solutions Corporation

PSNN-2023-0272

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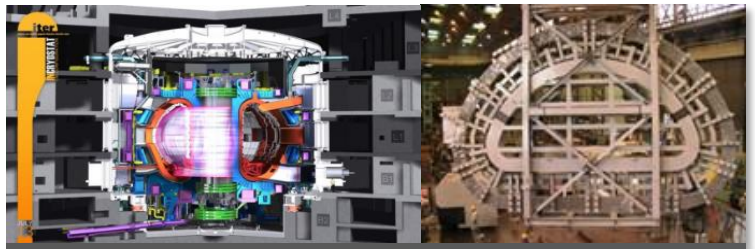
Experience and Promotion of Equipment Delivery to the Global Nuclear Plant Market

Nuclear Power Initiatives

Expanding business across the Nuclear Power Plant（NPP）'s life cycle



ITER

Credit ©ITER Organization ,http://www.iter.org/

Heavy-Ion Therapy System
(Yamagata University Hospital)

Superconducting Motors

Nuclear Fusion

Accelerator New Technology

Uranium／Fuel Manufacturing

Construction

Maintenance Services/ Restart

Fukushima/ D&D

Nuclear Fuel Cycle

Next-Generation Reactor

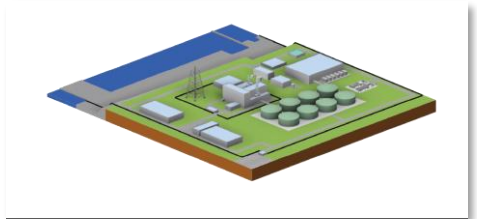
iBR (Next-Generation Reactor)

Kashiwazaki-Kariwa NPPs units 6 & 7
(Tokyo Electric Power Company Holdings)

Generator Repair Work

Underwater ROV
(Remotely Operation Vehicle)

Rokkasho Reprocessing Plant
(Japan Nuclear Fuel Limited)



HTGR
(High Temperature Gas Reactor)

Fukushima Daiichi Decommissioning Initiatives

Contaminated Water Management

MRRS™(*1) treated over 1 MILLION tons of contaminated water at 1F.

*1 MRRS: Multi-Radionuclide Removal System

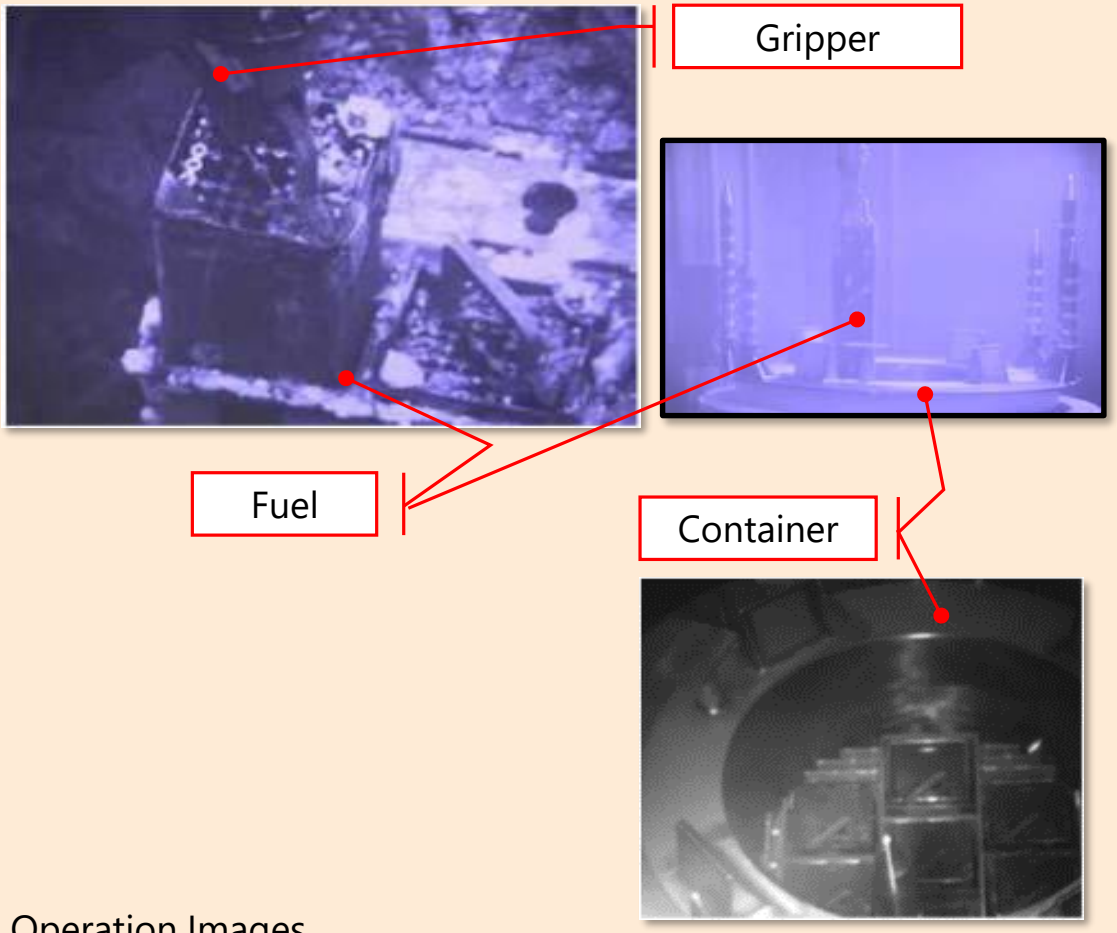
Fuel Debris Retrieval

IRID(*2)/Toshiba succeed in the Units 2 & 3 PCV investigations with Robots.

*2: International Research Institute for Nuclear Decommissioning

Spent Fuel Removal System

Toshiba engages in the world's 1st remotely controlled removal operations.

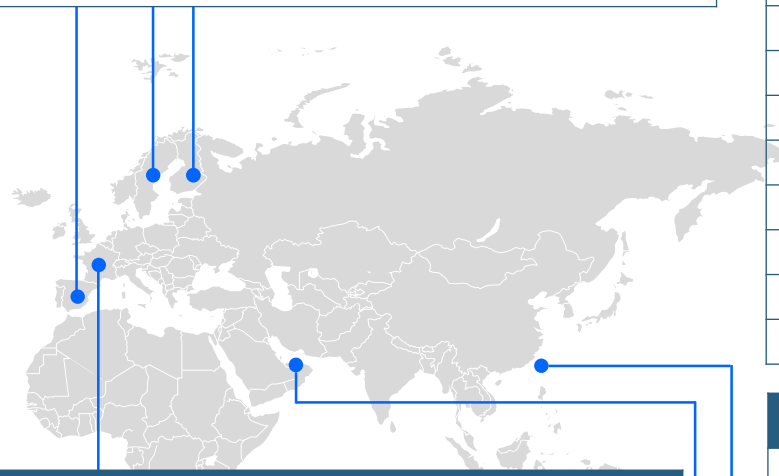


Operation Images

Courtesy of TEPCO

Extensive Experience in more than 30 Overseas NPP Projects

Customer (Operator)	Plant name・Nuclear Reactor type		Details	Delivery date
Iberdrola Spain	COFRENTES	BWR	Traversing Incore Probing System（TIP）	2011
OKG Sweden	OSKARSHAMN-3	BWR	Steam dryer・moisture separator	2012
TVO Finland	OLKILUOTO-1,2	BWR	Traversing Incore Probing System（TIP）	2017



Customer (Operator)	Plant name・Nuclear Reactor type		Services	Service delivery
EDF	CATTENOM-2	PWR	Generator stator rewinding	2011
EDF	CATTENOM-1	PWR	Generator stator rewinding	2012
EDF	CATTENOM-4	PWR	Generator stator rewinding	2013
EDF	PALUEL-1	PWR	Generator stator rewinding	2013
EDF	(LE) BLAYAIS-3	PWR	Generator stator rewinding	2014
EDF	DAMPIERRE-1	PWR	Generator stator rewinding	2015
EDF	BUGEY-4	PWR	Generator stator rewinding	2016
EDF	GRAVELINES-1	PWR	Generator stator rewinding	2017
EDF	BUGEY-5	PWR	Generator stator rewinding	2018
EDF	BUGEY-3	PWR	Generator stator rewinding	2019
EDF	(spare)	PWR	Generator stator rewinding	2019
EDF	Belleville-1	PWR	Generator rotor rewinding	2020

Customer (Operator)	Plant name・Nuclear Reactor type		Details	Service /delivery date
XCEL	MONTICELLO	BWR	Steam dryer	2011
Exelon	NINE MILE POINT-2	BWR	Jet pump inlet mixer	2012
Exelon	NINE MILE POINT-2	BWR	Shroud-head bolt	2013
Westinghouse	（SPARE）	BWR	Control rod drive mechanism (CRDM)	2013
SNC	VOGTLE -3,4	AP1000	STG & associated equipment	2013, 2014
Dominion	SUMMER -2,3	AP1000	STG & associated equipment	2013, 2015
Dominion	SUMMER -2,3	AP1000	Core-barrel	2014, 2016
Dominion	SUMMER -3	AP1000	CA01 submodule	2016
SNC	VOGTLE -4	AP1000	CA01 submodule	2016
ENTERGY	ARKANSAS NUCLEAR ONE-1	PWR	RV nozzle laser peening	2016
STPNOC	SOUTH TEXAS PROJECT – 3,4	ABWR	Construction and Operating License (COL) acquisition	2016

Customer (Operator)	Plant name・Nuclear Reactor type		Details	Delivery date
CFE	LAGUNA VERDE-1,2	BWR	Spent Fuel Pool Level Instrumentation System(SFPIS)	2016

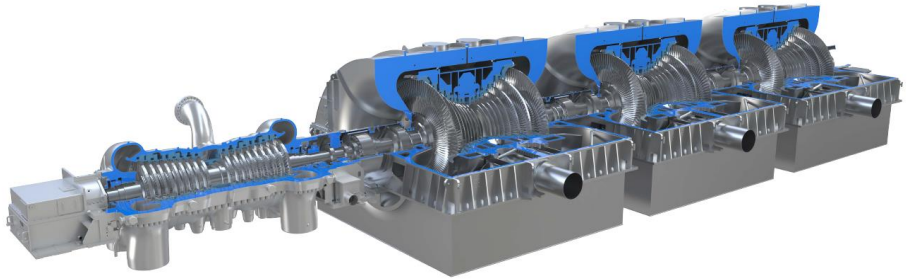
Customer (Operator)	Plant name・Nuclear Reactor type		Details	Delivery date
TPC	LUMGMEN -1,2	ABWR	Control rod drive mechanism (CRDM)	2001
TPC	LUMGMEN -1,2	ABWR	Internal pump	2003
TPC	LUMGMEN -2	ABWR	reactor core internal structure	2003, 2004
TPC	CHINSHAN -1,2	BWR	hydrogen injection equipment	2002, 2003
TPC	KUOSHENG -1,2	BWR	hydrogen injection equipment	2002, 2003

Customer (Operator)	Plant name・Nuclear Reactor type		Details	Delivery date
ENEC	BARAKAH-1,2,3,4	APR1400	STG & associated equipment	2014-2017
ENEC	BARAKAH-1,2,3,4	APR1400	central control room console	2014-2017

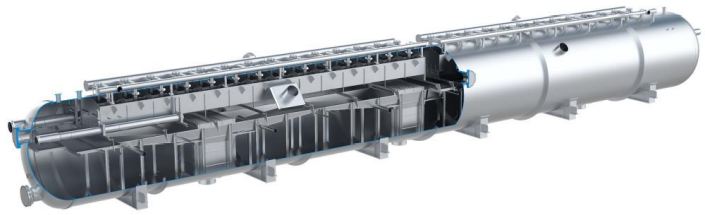
Customer (Operator)	Plant name・Nuclear Reactor type		Details	Service delivery
Non-Disclosure	–	–	Thin turbine generator inspection robot	2022

USA – AP1000® Project – Outline : Turbine Island

- Number of Unit : 4
- Reactor Type : AP1000®
- Turbine Type : TC6F-52” (1800rpm)
- Rated Output : 1200MWe class
- Scope : STG and Heat Exchangers (incl. system design in T/I)



Steam Turbine



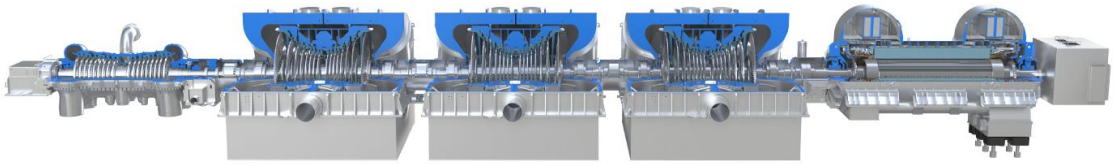
Deaerator

Feedwater Heater

Unit	Status (As of February 2023)
Vogtle 3	Fuel load completed. Under commissioning
Vogtle 4	Turbine: Installation completed Plant: Under construction
V.C Summer 2	Turbine: Delivery completed Plant: Suspended undefined period
V.C Summer 3	Ditto

Middle East NPP Project -Outline

- Number of Unit : 4
- Reactor Type : PWR
- Turbine Type : TC6F-52” (1500rpm)
- Rated Output : 1400MWe class
- Scope : STG, Main valves



Steam Turbine / Generator

Main Stop and Control Valve

Combined Intermediate Valve

Emirates Nuclear Energy Corporation (enec.gov.ae)

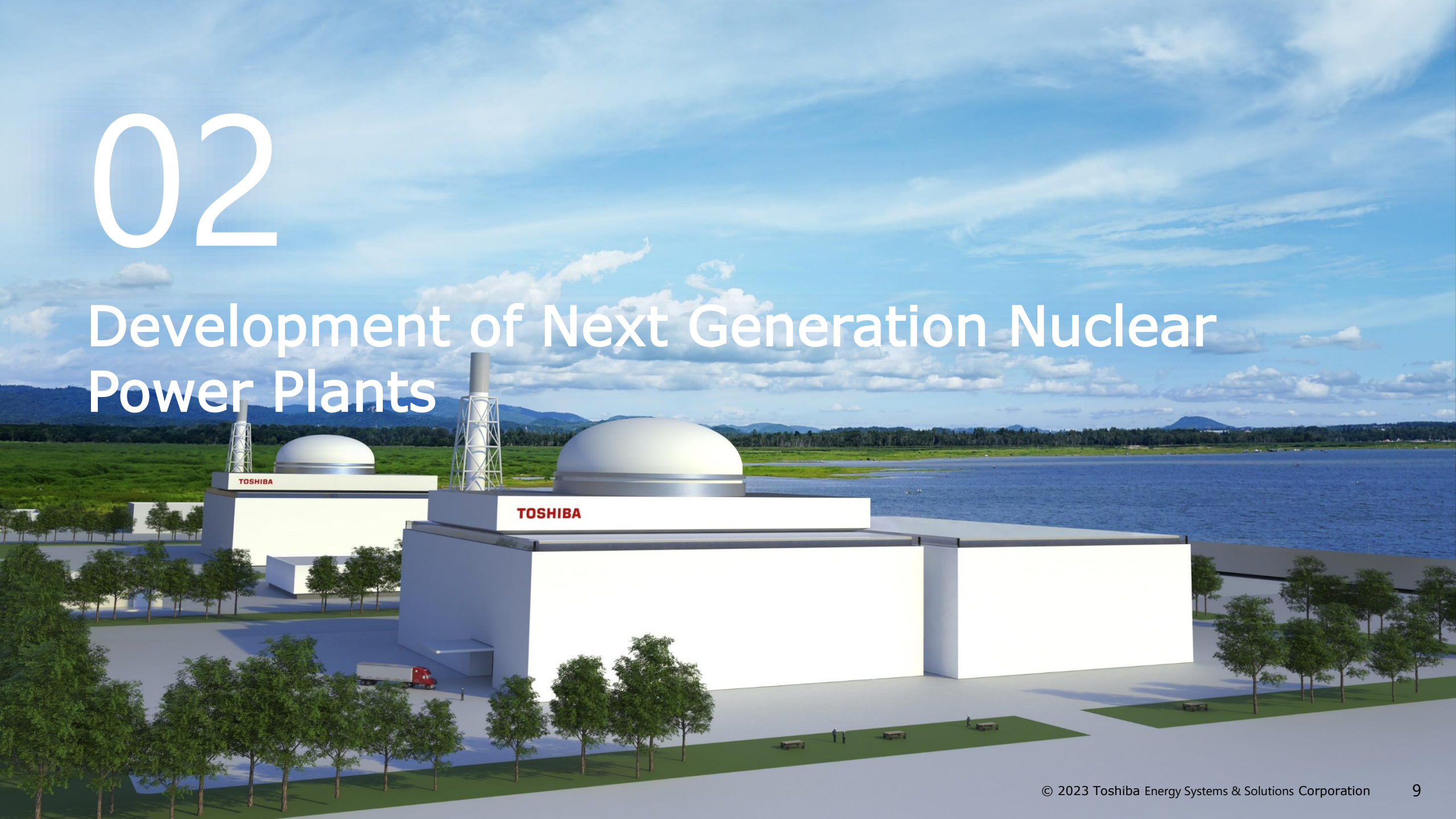
https://www.global.toshiba/ww/news/energy/2021/05/news-20210526-01.html

Unit	Status (As of February 2023)
1	Commercial operation (COD: April 2021)
2	Commercial operation (COD: March 2022)
3	Commercial operation (COD: February 2023)
4	Under construction (Progression rate: 92%)

Continuous production of components leads to maintain and strengthen supply chain.
Toshiba is trying to keep providing components to the global nuclear plant market.

02

Development of Next Generation Nuclear Power Plants



Toshiba's Line-up of Next Generation and Innovative Reactors

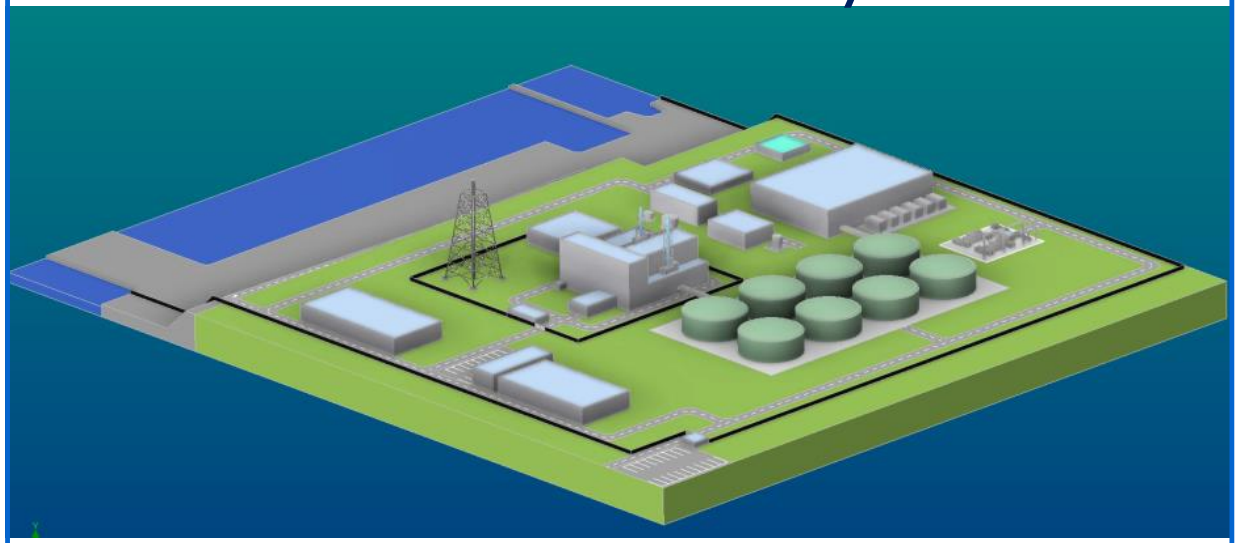
Next Generation BWR, iBR

Innovative Safety Reactor can Coexist with Local Community and Provide Excellent Economical Efficiency

- No Containment Venting even in Sever Accident
- 7-day Grace Period by Double Cylindrical Containment Vessel and Built-in Passive Safety Systems
- Proven Construction Method based on ABWR

High Temperature Gas Reactor

Supports "harmonization with hydrogen society" and "contribution to various demands" with inherent safety



- No fuel melting
- No need for immediate action in accident
- No chemical reaction with fuels (No hydrogen/vapor explosion)
- Decay Heat Removal System by Natural Circulation

Development and promotion of new reactors encourages suppliers to continue their business.

Toshiba Next Generation BWR : iBR

◆ *iBR* : innovative, intelligent and inexpensive BWR

- ➢ **GenIII.7 reactor** incorporating the **lessons learned from Fukusima Diichi accident**.
- ➢ Power Lineup of 800-1600 MWe class

■ Safety Concept : No Need for Emergency Evacuation

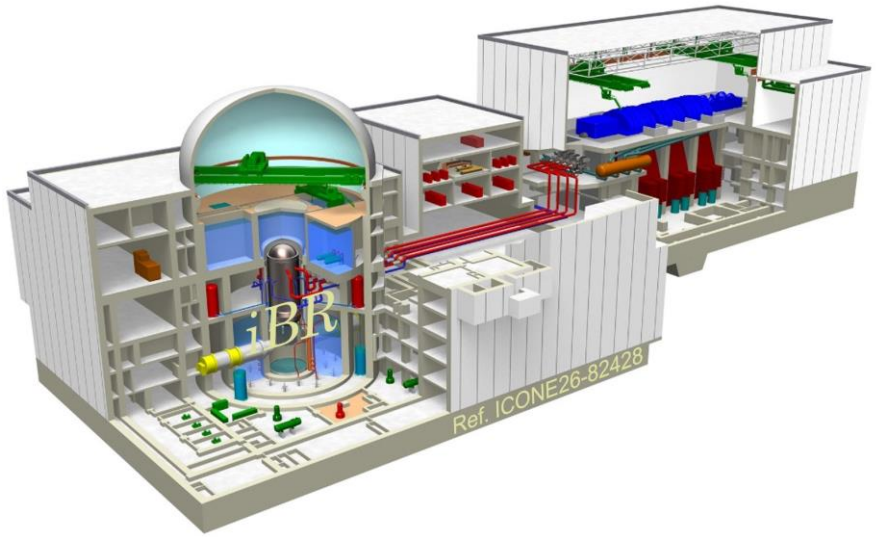
- ✓ Double Confinement and Passive in-Containment Filtration

■ Grace Period : 7 days

- ✓ Double Cylindrical Containment Vessel
- ✓ Built-in Passive Safety Systems

■ Proven Construction Method

- ✓ Based on ABWR Construction Experiences



■ High Economical Efficiency

- ✓ Containment Building designed for Aircraft Impact and Built-in Passive Safety Systems. iBR can eliminate specialized safety facilities outside of reactor building.
- ✓ Adopting ABWR Proven Technology. iBR eliminated SGs, pressurizer, accumulators, cold legs and hot legs.

•*iBR* is a Gen. III.7 reactor that can Coexist with
•local community and Provide Excellent Economical Efficiency

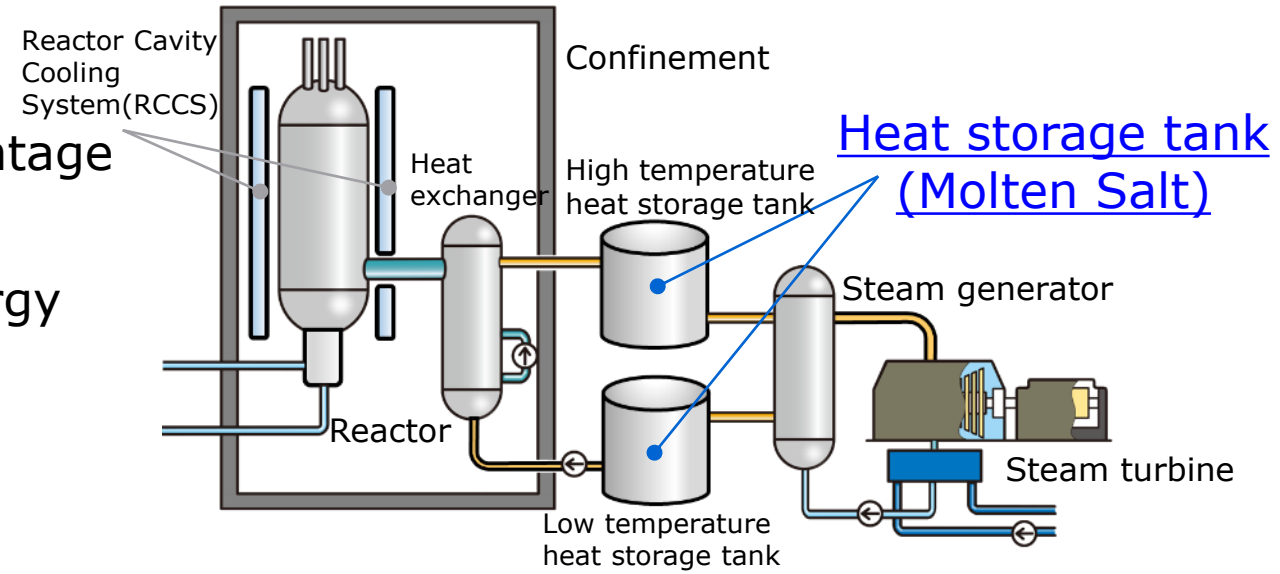
HTGR　Heat Storage System

■ Various heat utilization

- Hydrogen production, desalination, industrial heat source, etc.

■ Load Following (Flexibly)

- ✓ Heat storage system with the advantage of high temperature process heat
- ✓ Flexible response to renewable energy output fluctuations
- ✓ Already performed in solar thermal power generation system



Support 'harmony with hydrogen society' and 'contribution to various demand' with inherent safety

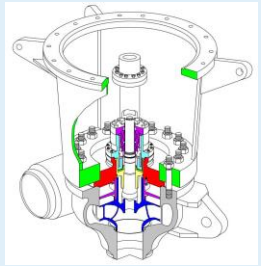
03

Other Efforts

Other Efforts to Maintain and Strengthen Supply Chain

1. Monitoring System of Suppliers' Business Environment

- ✓ Established monitoring system that enables us to reveal suppliers' business environment and identify high risk suppliers that would withdraw from nuclear business.



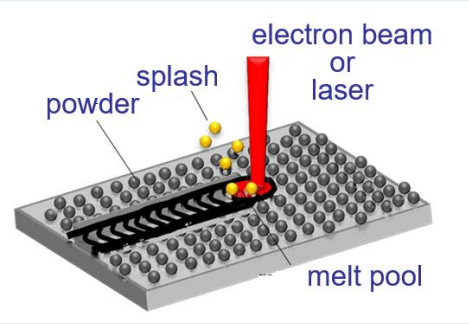
Example of high risk item: PLR pump

2. Utilization of Commercial Grade Items

- ✓ Developed a guideline to utilize commercial grade items to nuclear power plants after demonstration of quality that is applicable to nuclear power plants.

3. Additive Manufacturing (AM) Technologies

- ✓ Developing Additive Manufacuring process using 3D printers to be applied to the nuclear power plant instead of items withdrawn from nuclear business.



Example of AM process

Toshiba keeps trying to participate in global and domestic projects to maintain and strengthen supply chain.
It is highly appreciated for OECD/NEA to enhance harmonization of regulatory requirements in order to make it easier to join in the global market.


Committed to People,
Committed to the Future.