i-SMR

Innovative Small Modular Reactor

Innovative Small Modular Reactor
Development Agency

Ministry of Science and ICT

Ministry of Trade,
Industry and Energy

i-SMR
Innovative Small Modular Reactor

Innovative SMR Development Agency

(34126) 13th-Floor, Science Center, 1, Expo-ro, Yuseong-gu,
Daejeon, Republic of Korea

Go to the business unit homepage

Go to i-SMR homepage

Go to i-SMR YouTube

Who we are

The Innovative Small Modular Reactor Development Agency (the i-SMR Development Agency) is an incorporated foundation jointly supported by the Ministry of Science and ICT and the Ministry of Industry, Trade and Energy to carry out cross-departmental projects.

The i-SMR Development Agency aims to develop i-SMR and obtain Standard Design Approval from Korean regulatory body by 2028, with the goal of commercializing the world-best carbon-neutral SMR in the 2030s.

The i-SMR Development Agency is currently working to develop i-SMR that can help achieve carbon neutrality by significantly enhancing safety compared to existing nuclear power plants, delivering economic efficiency comparable to large-scale plants through innovative technologies, and providing flexibility by integrating with renewable energy sources.

President of Innovative SMR Development Agency 김학로

Vision

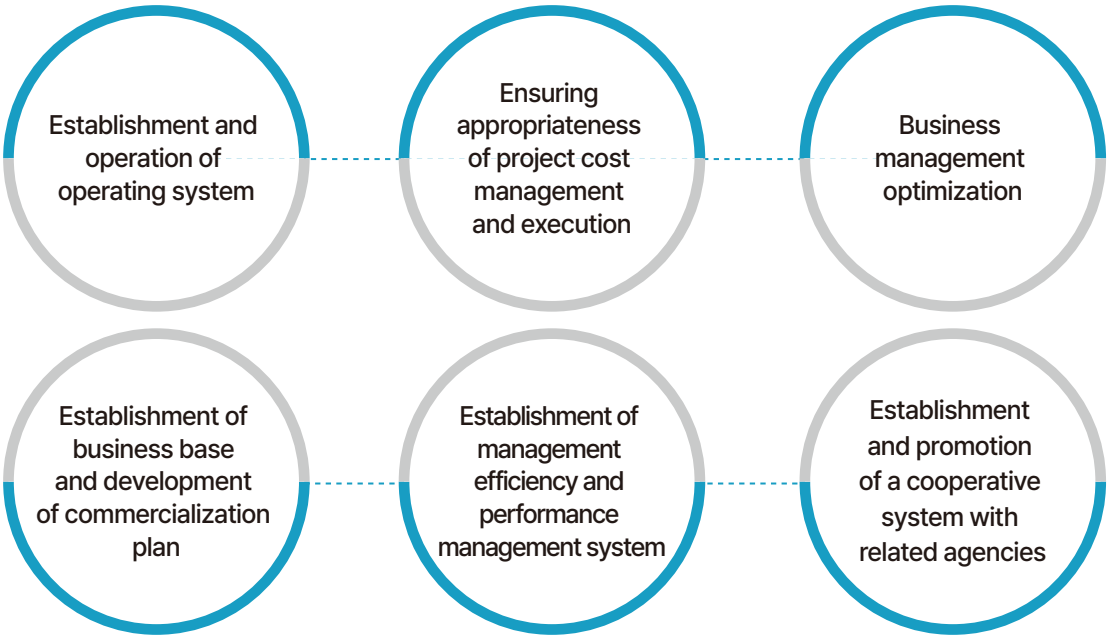
Operating Philosophy

- Driving the success of i-SMR development with independent, fair and passionate performance

Basic Direction

- Development of i-SMR with safety, economy and flexibility and operation of project group
- Promotion of business considering export and commercialization
- Acquisition of standard design authorization timely through communication and cooperation

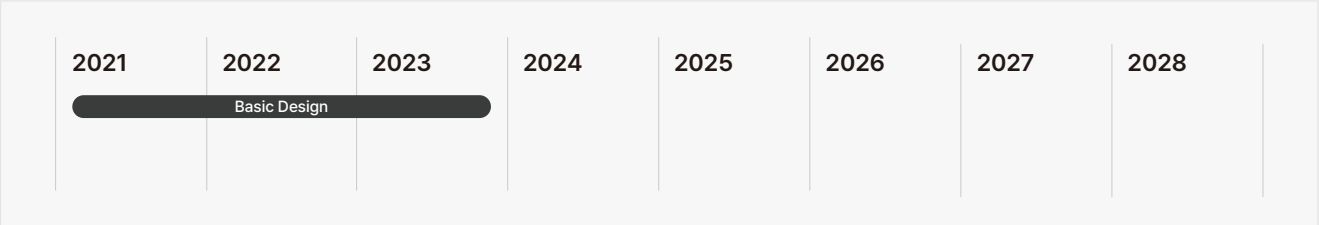
Key Promotions



Project

KHNP Project

- Period : 2021.01.01 ~ 2023.12.31 (36 months)

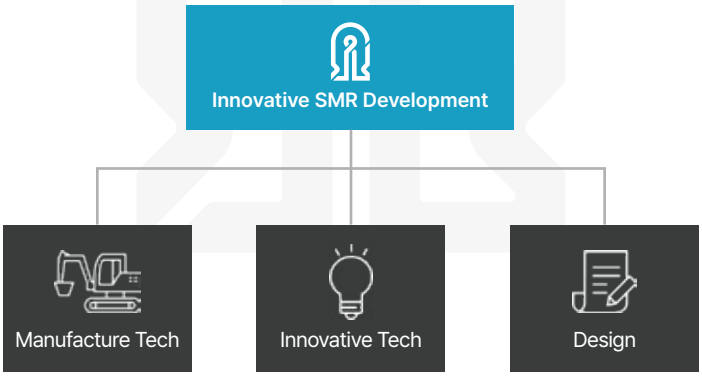


Government Project

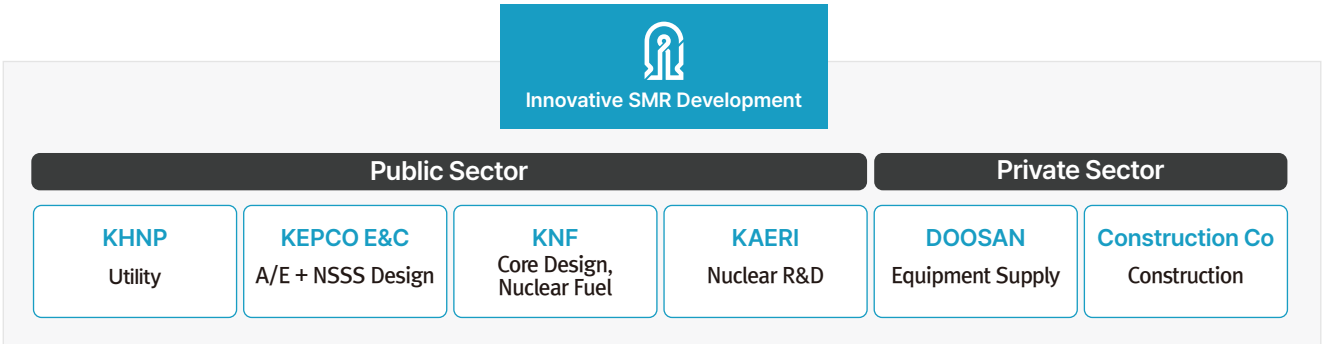
- Period : 2023.01.01 ~ 2028.12.31 (60 months)

Development Strategy

All areas of development are divided into three groups: design, innovative technology, and manufacturing technology, and key areas and detailed tasks are organized for each group.



Development Organization



- i-SMR Development Agency is supported by Korean government and manages entire project.
- All key players of nuclear industry in Korea are actively participating in i-SMR development.

Design Goals of i-SMR

Improved Safety

Safety

- Elimination of LOCA by integrated reactor
- Passive safety system with natural circulation
- Safety system without safety-class DC power
- Reduced the likelihood of failure

Seismic Design 0.5g

- Underground reactor
- Seismic design of major equipment

Reduction of radioactive leakage

- Small reactor
- Low accident probability
- Steel containment

CDF < 1.0e-9 / RY

EPZ < Site boundary

Enhanced Economics

Reduction in construction volume

- Design simplification of system
- Multiple modules in a single reactor building

Modularization and factory manufacturing

- Design optimization for inland transportation
- Reduced construction time and cost

Significant reduction in operators

- 3 operators in one integrated MCR for multiple modules
- Autonomous/Automatic operation and operate support system
- Digital twin and predictive preventive maintenance

Construction unit price < $3,500/kWe

Power generation unit price < $65/MWh

Increased Flexibilities

Multipurpose utilization

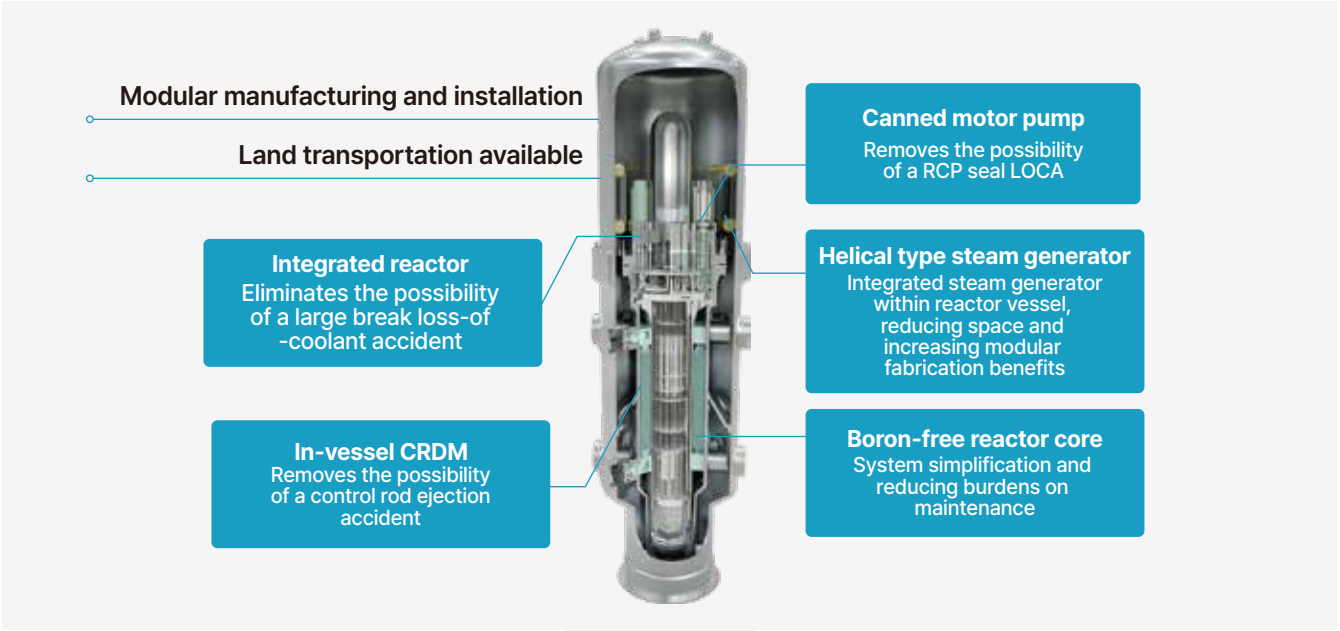
- Replacement of aging coal-fired power plant
- Distributed power supply
- Hydrogen production (HTSE)
- Process heat, district heat, desalination, etc.

Load following operation

- Easy flexible operation
- Carbon-free auxiliary power is required to complement intermittent of renewable energy

Harmonization with Renewable Energy

Innovative Design



Electrical power	170 MWe (per Module)	Steam generator	Helical type
Total power	680 MWe (4 Modules)	Reactor coolant pump	4 (per Module)
Fuel assembly	UO_2 17×17	Safety system	Fully passive
Core damage frequency	≦1.0e-9 / MY	DC power	Non-safety
Construction cost	≦$3,500 / kWe	Design life	80 years
Neutron absorber	boron-free	Seismic design	0.5g
CRDM	In-vessel type	Construction time	24 months (Single Module)

Innovative Technology

Infinite cooling	Passive safety system that does not require operator action and power supply	**Integrated control room**	Integrated control room that can reduce operating costs through multi-module integrated control technology
In-vessel CRDM	In-vessel CRDM design to eliminate the possibilities of a control rod ejection accident	**Innovative manufacturing technology**	Reduction of manufacturing time through the introduction of innovative manufacturing technologies such as EBW
Innovative nuclear fuel	Nuclear fuel and burnable absorber for boron-free operation	**Boron-free operation**	Nuclear system simplification by eliminating the boron control system and reducing burdens on maintenance
Modularization	Modular technology to reduce construction time and increase economics	**Automation**	Improvement of the automation level of operation
Predictive diagnosis	Plant availability increase through O&M performance improvement	**Connection with renewable energy**	Flexible operation for compatibility with renewable energy

Nuclear Reactor with Fully Passive Safety System

The i-SMR™ has secured inherent safety with a simpler design than before by applying passive safety systems using natural circulation.

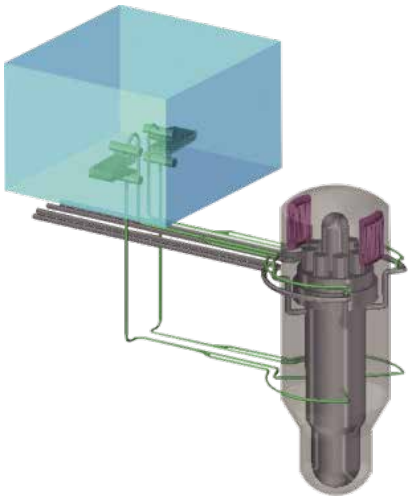
PCCS Test Facillty

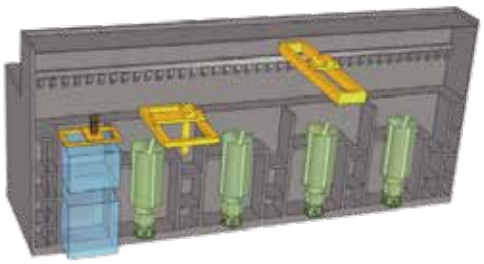
PAFS Test Facility

- Under all accident conditions including severe accidents, the reactor can be safely shut down and indefinitely maintain long-term cooling without operator action, power supply, or additional coolant supply.
- Passive Containment Cooling System (PCCS) and Passive Auxiliary Feedwater System (PAFS) were applied to the safety system. The heat removal (cooling) performance was validated through testing conducted at test facilities.

Containment Vessel to Facilitate Maintenance

The i-SMR™ reactor module is installed and maintained in a dry reactor builing, thus removing problems associated with system submersed during long-term power plant operation.





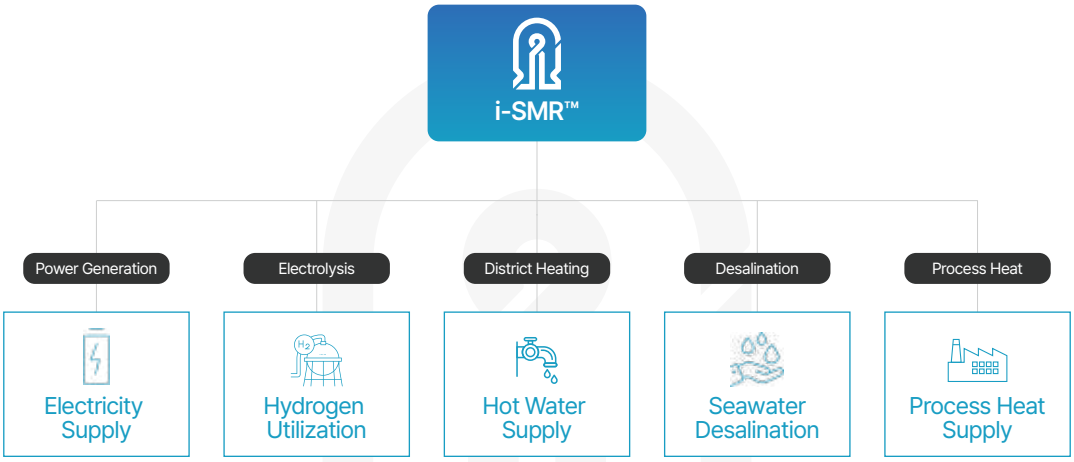
- The reactor building where the integrated reactor is located and the coolant tank for the safety system are designed to be separated.
- Dry reactor building can reduce operating delays and cost by eliminating time consuming charging and draining water for maintenance.
- The production cost of the containment vessel can be reduced since material corrosion will not occur due to cooling water. It means that the stainless steel cladding of the containment vessel can be removed.

Boron-free Operation to Simplify The System and Improve O&M Performance

Boron-free operation employed in the i-SMR™ can simplify chemical volume and control systems (CVCS) and improve O&M performance.

- Integrated reactor modules manufactured at the factory are readily assembled and installed at the construction site through land transportation such as trucks and railroads.
- The construction time of i-SMR™ is 24 months, shorter than that of a conventional nuclear power plant. This is possible by applying modulization of the components/structures and innovative manufacturing technology.
- Through the deployment of multiple modules and simplification of design, the unit cost for construction is less than $3,500/kWe, and the levelized cost estimate (LCOE) is estimated at $65/MWh.

Multi-purpose Utilization Capability



- In addition to power generation, it can be used for multiple purposes such as district heating, desalination, and hydrogen production near the demand site.
- The i-SMR™ can produce 680MWe (4 Modules) with its modular design and provide flexible power options from 170MWe (1 Module) to 1,360MWe (8 Modules).