

Current status of i-SMR Standard Design Approval and its FOAK construction plan

SangHee, Kang

SMR development Laboratory, Central Research Institute



KOREA HYDRO & NUCLEAR POWER CO.,LTD

31 March -4 April, 2025

Regional Workshop on Safety Benefits and Challenges in the Development of the Adoption of SMRs (EVT2404165)

Contents

- I | **i-SMR Standard Design Approval**
- II | **i-SMR FOAK Construction Plan**
- III | **SSNC(SMR Smart Net-zero City)**
- IV | **Conclusion & Suggestions**

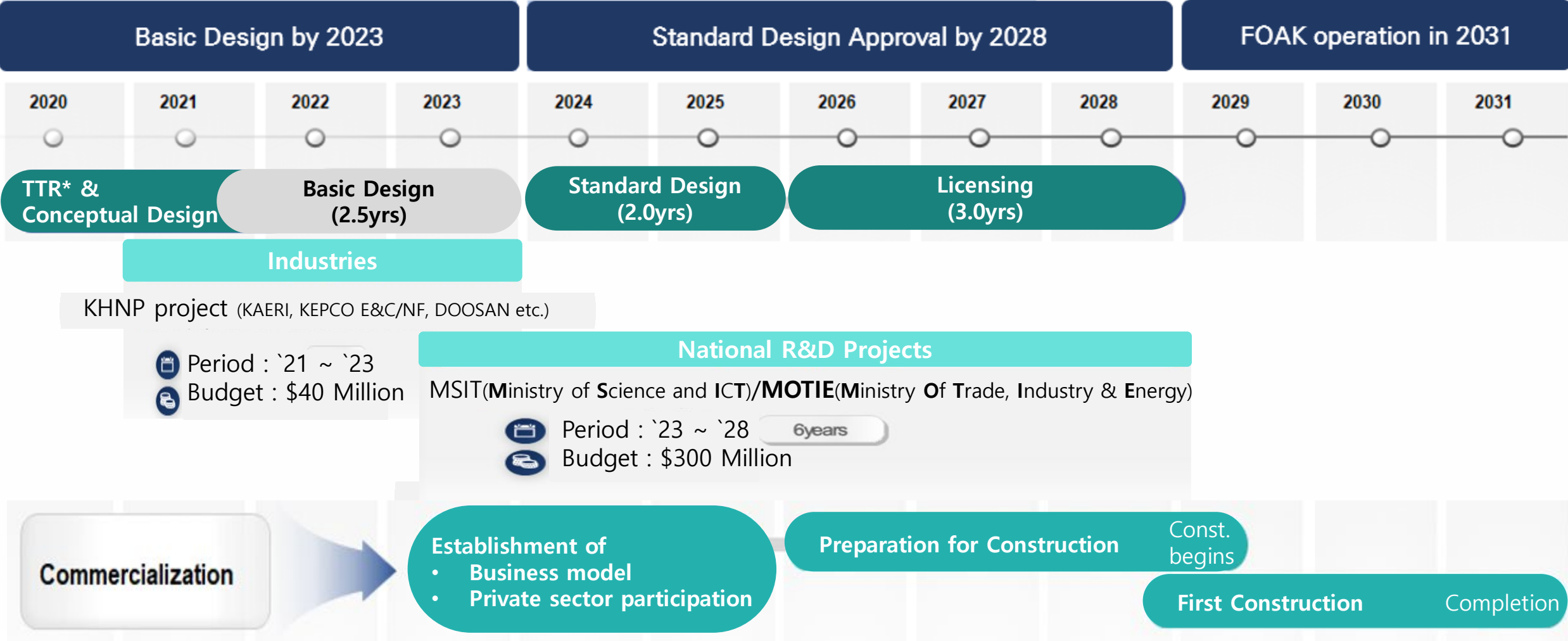


I | i-SMR Standard Design Approval



Recent Development Status of i-SMR

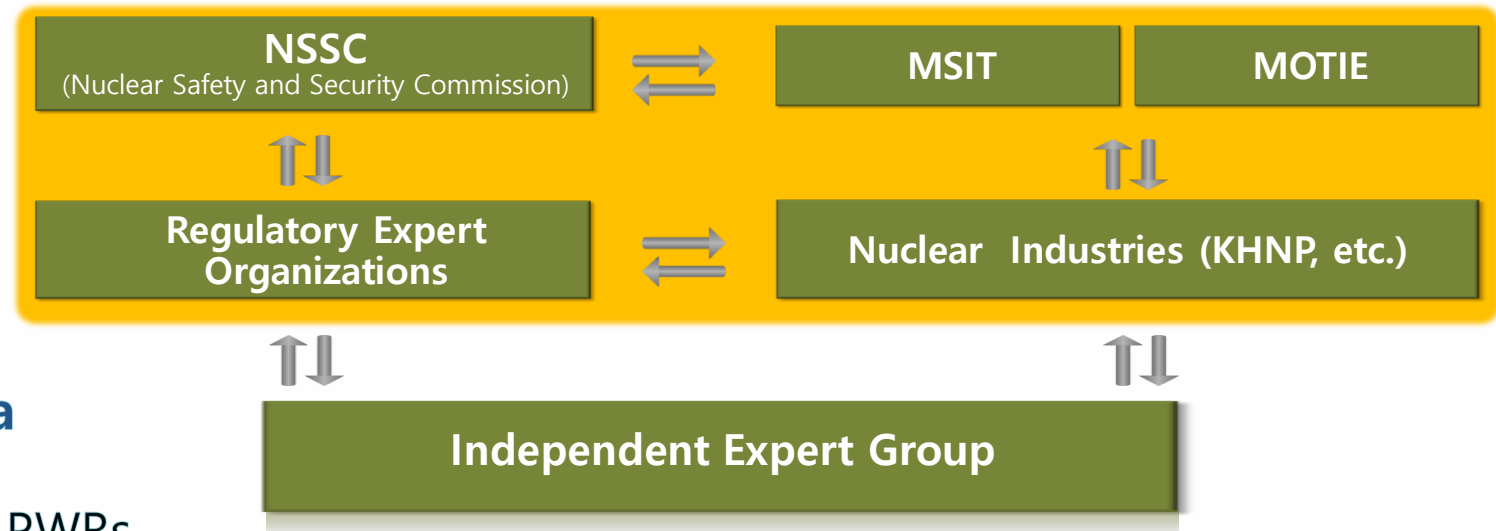
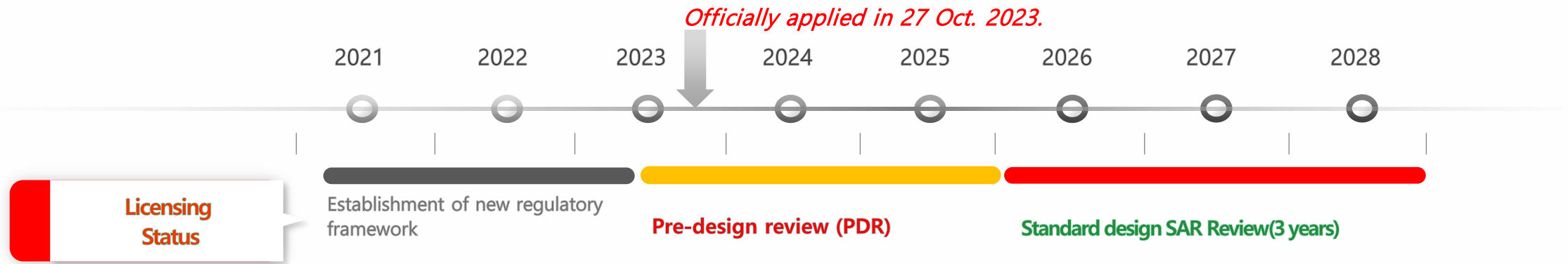
☑ **Target Goal: Standard Design Approval(SDA) by 2028, First Of A Kind(FOAK) Operation in 2030s**



➤ **National BPLE** has determined FOAK operation in 2035and 2036.**

* TTR: Top-Tier Requirement

** BPLE: Basic Plan for Long-term Electricity Supply and Demand



New regulatory framework in Korea

- Current licensing basis are conventional PWRs
- Technology-inclusive regulatory framework needed
- New framework completed before SAR licensing

PDR progress in i-SMR

- Objective of PDR is to identify;
 - (1) Major technical issues, (2) Resolution plan for technical issues.
- Reduction of licensing uncertainty

PDR activities

- Kick-Off meeting for PDR in April, 2023
- PDR officially applied in 27 Oct. 2023
 - ✓ Gap Analysis Report (Deviation between design and requirements)
 - ✓ Plant Design Description(PDD)
 - ✓ 7 Technical Reports (ex, LOCA/Non-LOCA methodology etc.)
- Issued 13 Technical Reports by 2024
- RAIs completed by the end of 2025



Technical meeting(July `23) with regulators

Standard Design Management and Licensing (KHNP)



- Standard design by 2025 and Licensing (Standard Design Approval) by 2028 in Korea (Supported by National R&D Project)

Major Milestone

Standard Design

2024

2025

Standard Design Management

- NSSS Design (KEPCO E&C (SD))
- Fuel Design (KNF)
- BOP Design (KEPCO E&C (AE))
- Component Design (Doosan)

Licensing

Documentation preparation for SDA

- SSAR(Standard Safety Analysis Report)
- SDS(Standard Design Certified Design Material)
- PAMP(Preliminary Accident Management Plan)
- TeR (Technical evaluation Report)

2026

2027

Submission of Design Documents

- SSAR, SDS, PAMP

2028

SDA

RAI (Request for Additional Information) support

|| i-SMR FOAK Construction Plan



BUSINESSKOREA

HOME > INDUSTRIES > ENERGY

11th Basic Plan for Electricity Supply Passes National Assembly Committee

Jung Suk-yeon | © 승인 2025.02.20 10:08

Construction of 2 New Nuclear Power Plants and **1 SMR Approved**



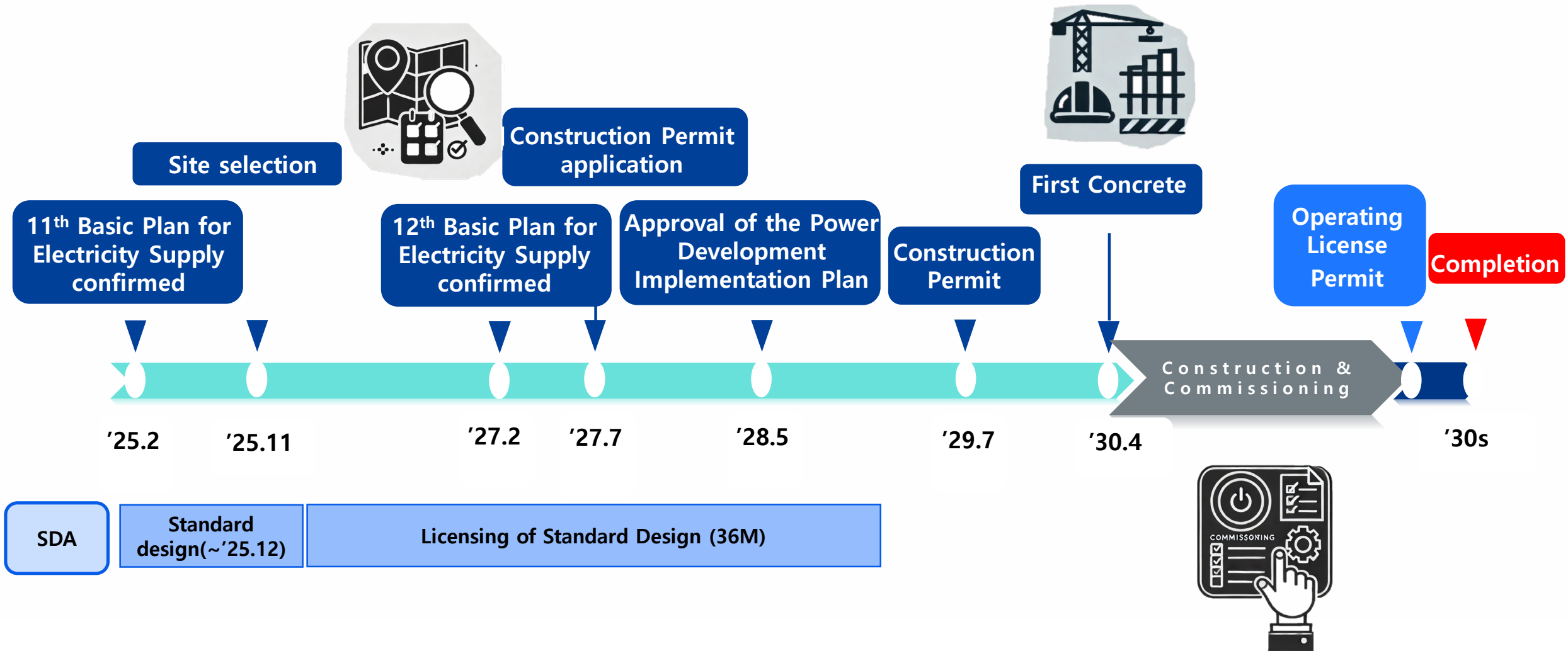
Minister of Trade, Industry, and Energy Ahn Duk-geun attends a full meeting of the National Assembly's Trade, Industry, Energy, SMEs, and Startups Committee on Feb. 19. (Captured from KBS News)

The introduction of SMRs, with a capacity of 0.7 GW planned between 2035 and 2036, represents a strategic shift towards next-generation nuclear technology. SMRs offer potential benefits in terms of safety and flexibility, aligning with global energy trends towards sustainable and secure energy systems.

**Construction Acceleration needed
for early 2030s deployment
to Achieve “Time-to-Market Goals”**

Preparation Status of i-SMR FOAK Construction

Key Milestone



Site selection process



👉 Optimal site selection is required for the accelerated process of i-SMR initial deployment.

Key Considerations

- **Business Feasibility:** Site approval process duration, construction timeline feasibility
- **Licensing:** Regulatory zone (EPZ) changes, streamlined licensing procedures
- **Infrastructure:** Proximity to power grid, water supply, roads, and port facilities
- **Public Acceptance:** Support from local governments and residents



Objectives

- ✓ Develop an optimized i-SMR model for efficient construction and global market competitiveness
(For ensure construction feasibility for future project feasibility evaluation)

✎ Conducting standard design and design optimization in parallel to Achieve i-SMR FOAK construction goals

Lesson Learned

Despite acquiring SMART technology development and standard design approval, commercialization is difficult due to marketability, innovation, and economic limitations (\$8,000/kWe).



■ Key Review Areas

1. Technology Enhancement

- Optimization of core design for enhanced performance and transportability
- Development of compact reactor components (RCP, primary pump, etc.)
- Review and conceptual update of modular safety systems
- Improvement of auxiliary systems design

2. Process Optimization

- Optimization of modularized nuclear power plant construction process
- Structural and seismic design optimization for building blocks
- Introduction of new welding techniques in construction
- Evaluation of technology development and licensing feasibility

3. Economic Enhancement

- Optimization of equipment layout and structural configuration
- Expansion of modularization consideration
- Reduction of operational costs (operation/maintenance convenience and ALARA principles)

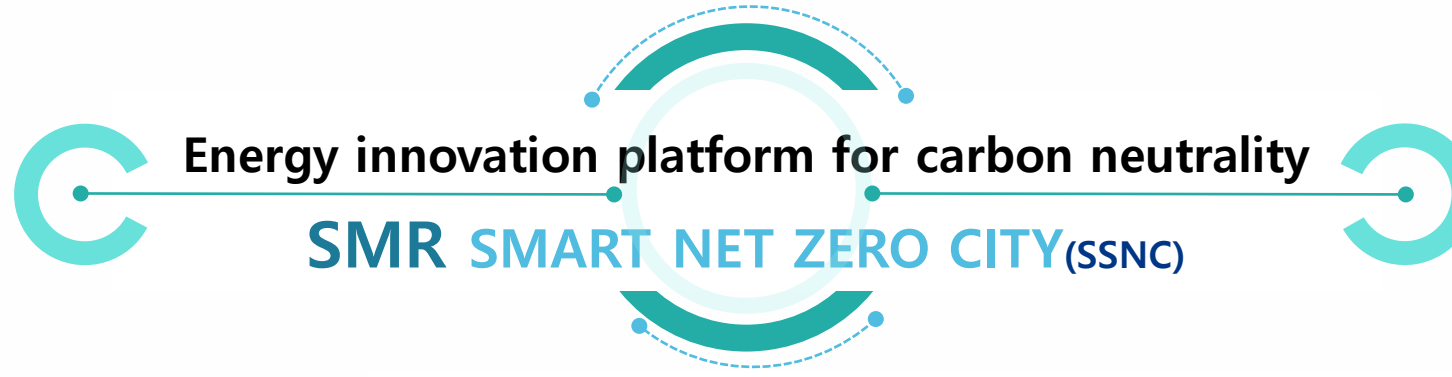


☞ Strengthening i-SMR Competitiveness

III | SSNC(SMR Smart Net-zero City)



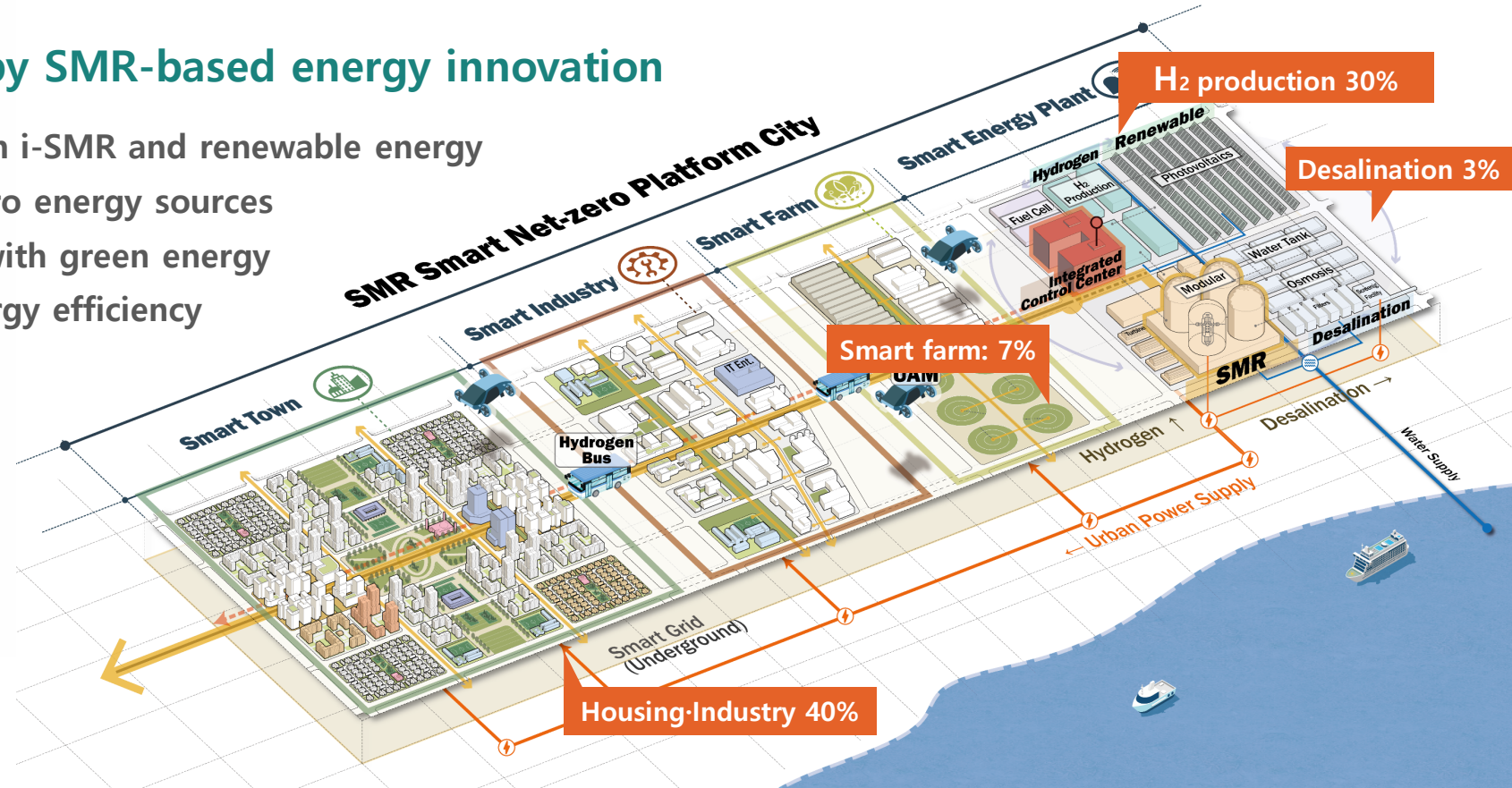
Sustainable energy
innovation



Green energy-based
city economy
innovation

Net-Zero City Platform enabled by SMR-based energy innovation

- **Smart Energy Plant:** achieve Net-Zero with i-SMR and renewable energy
- **Smart Industry:** promote 4IR with Net-Zero energy sources
- **Smart Town:** build Net Zero smart town with green energy
- **Smart Control:** integrated control for energy efficiency

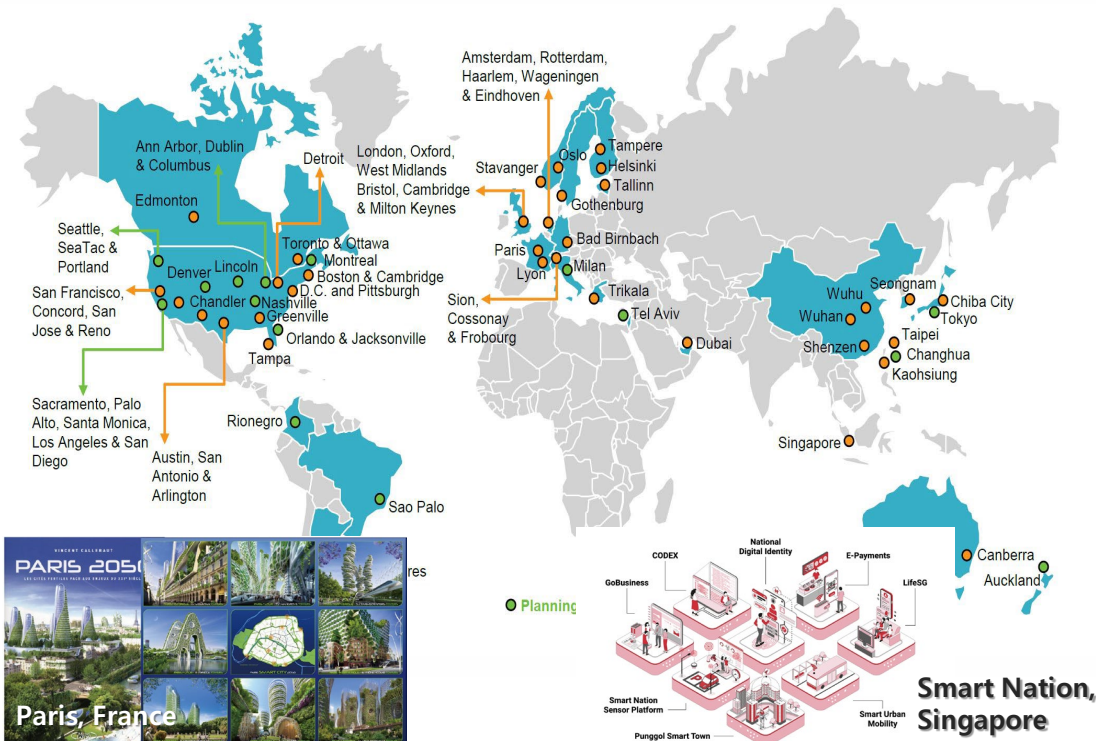


Combining i-SMR & Smart city to materialize advantages and visualize model

→ Carbon-neutral city design & Feasibility evaluation centered on i-SMR

i-SMR Smart Net-zero City “SSNC” Vision

Smart City Development



Flexible power control

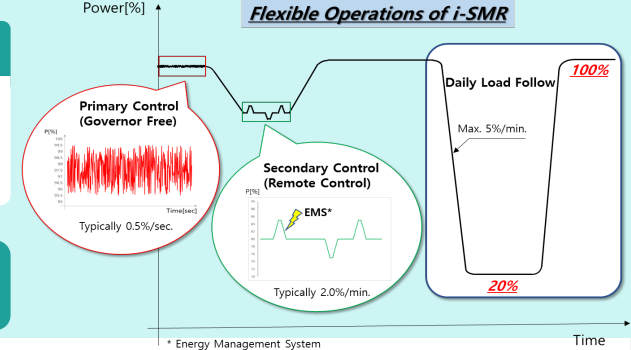
power control

Power range 100%-20%-100%

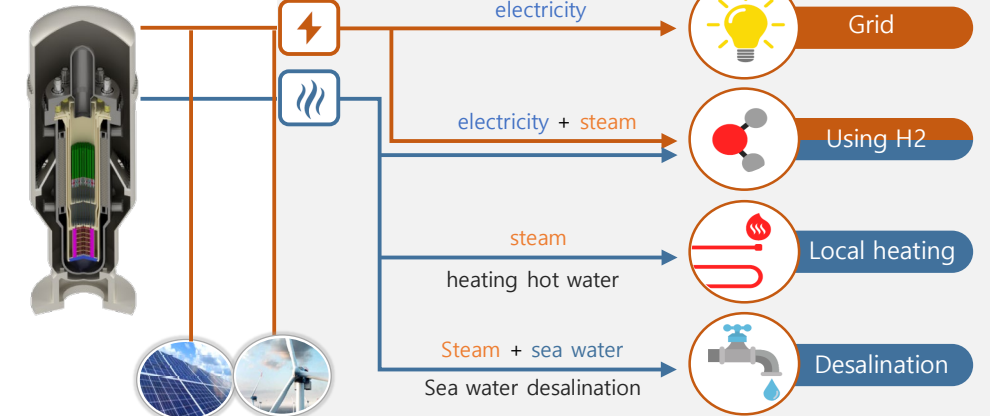
change rate 5%/min

H2 production, desalination, thermal load control

Flexible Operations of i-SMR



SMR



< renewable energy >

SSNC Features

- Carbon-free, eco-friendly energy for the city by utilizing i-SMR and renewable energy
- Optimal energy mix composition considering urban development plans, industrial composition, etc.
- Possibility of reducing carbon emission in various fields other than electricity (heat, hydrogen utilization)

Necessity of SSNC

- Various **social problems** arise due to increase in urban population
- Conversion to **carbon-free energy** to achieve carbon neutrality
- Intermittency of **renewable energy** due to weather changes

Advantages of SMR Smart Net-zero City(SSNC)

- **Eco-friendliness** : Achieving zero carbon emission, Minimize infrastructure
- **Economic efficiency** : Reduced electricity cost and Carbon emission cost
- **Flexibility** : Renewable energy, Repurpose energy(desalination, heating, etc.)



SSNC Integrated Control Center

Purpose

- ✓ A service center that comprehensively analyzes and controls energy demand and supply information in smart cities the operate the energy network stably and economically

Main Functions



Smart City Energy Grid Management

- Real-time control and analysis of smart city energy networks centered on SMRs
- Optimization of energy mix by predicting energy demand and supply through combining weather and disaster prediction information



Operation through optimal energy mix

- Complementing the intermittency of renewable energy with excellent elastic operation, securing the sustainability of stable and economical smart city energy network



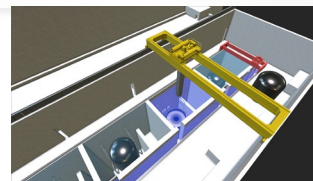
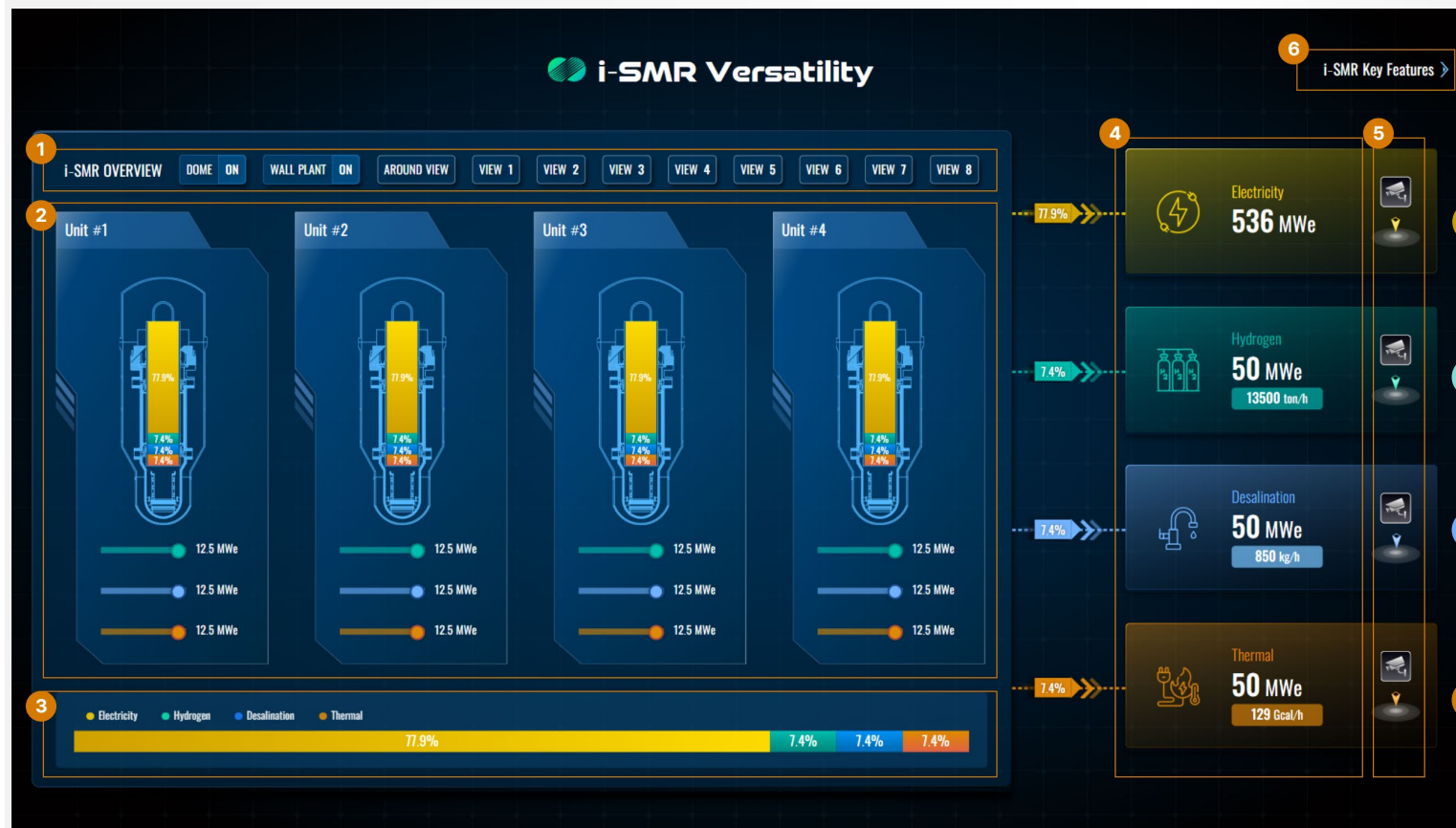
Ensuring Sustainability

- Realizing carbon neutrality by reducing greenhouse gas emissions
- Responding to rapidly increasing smart city energy demand



SSNC “ Development of Simulation Software ”

i-SMR Versatility Simulation



Key Functions

- ✓ SSNC Control Center enables monitoring operation information on electricity and heat energy consumption in the SSNC target cities at a glance



- ✓ SSNC Total Energy Optimization Platform



Global Technical Support Service

Purpose

- ✓ Provide global technical support services to share various plant operation experiences and urban control technologies centered on the SSNC Owner Group

Main Functions

Digital Twin

- Operation of power plant early warning technology
- Operation of facility prediction diagnostic technology
- Operation of robot maintenance technology

Cyber Security

- Blockchain-based data transmission
- Integrated security challenges across resources



Monitoring

- Monitoring climate and weather information
- Disaster monitoring

SSNC Owners Group

- Share Power plant operation and SSNC Urban Control Experience
- Analyze the economy

24 x 7 Service

- Services for stable operation of customer systems

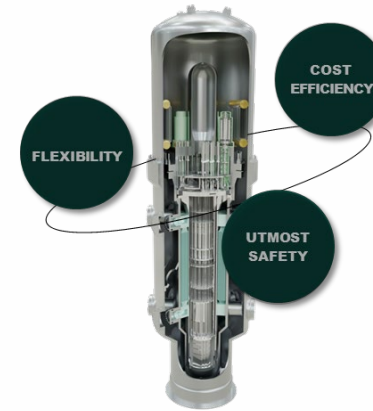


IV | Conclusion & Suggestions



1. Sustainable Energy Solutions for CARBON NEUTRALITY

i-SMR & SSNC



2. What should we do to accelerate the commercialization of SMR?

- 1) Need to Establish a collaborative system between licensing agency, Design, Construction, Operation company and Suppliers.
- 2) Need to Establish global regulations and industry standards



ALL in i-SMR, i-SMR for ALL

ALL innovative technologies and components are encapsulated in i-SMR,
i-SMR runs for ALL purposes to address climate crisis.

