

Best Partner for Nuclear Energy

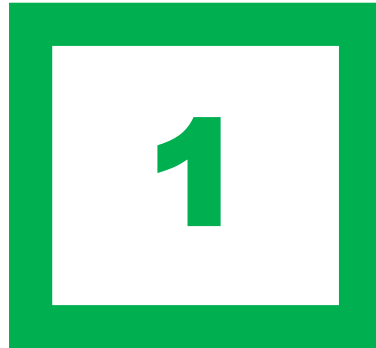
November 20, 2024



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- 1 KHNP Strength - on Time, within Budget**
- 2 What KHNP is preparing for Dukovany**
- 3 i-SMR**





KHNP Strength

On time, within Budget

1. Reliable Partner

‘**30%**’

Produces 1/3 of
Domestic Electricity Demand

‘**100% Carbon Free**’

Energy Producer

Nuclear	24,650 MW
Pump-Storage	4,700 MW
Hydro	608 MW
Solar/Wind	72 MW
	(2022)

12,493 persons
Employees (2022)

€49 BN.

Total Assets (2022)

KHNP

The World's Leading Player
in the Nuclear Power

‘**38GW**’

Total for Nuclear Capacity (Since 1971)
(including 4 units in the UAE)

“36 Units Construction Experience”

27 Units in Operation

6 Units under Construction

* 3 units are long-term shutdown for life extension and decommissioning



1. Reliable Partner

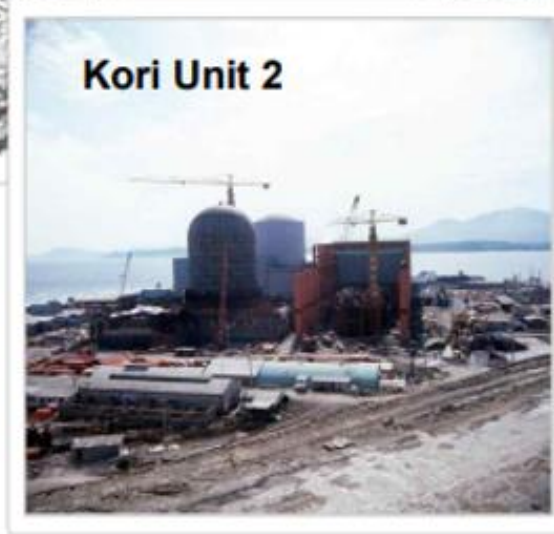
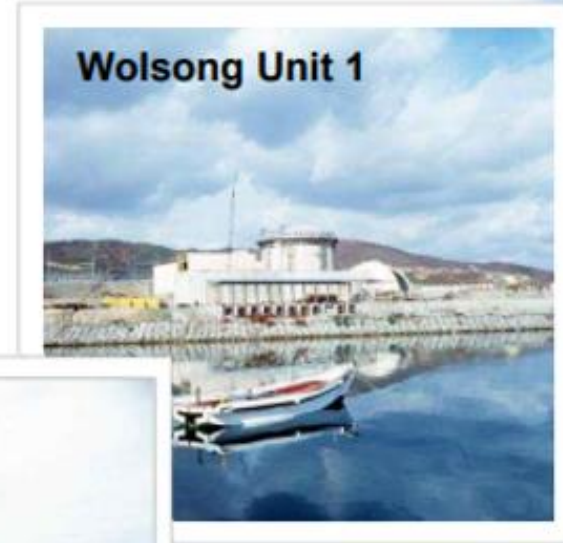


**Conscious build and operate
the nuclear power plant for last 50 years**

1. Reliable Partner

Turnkey phase (1970 ~ 1985)

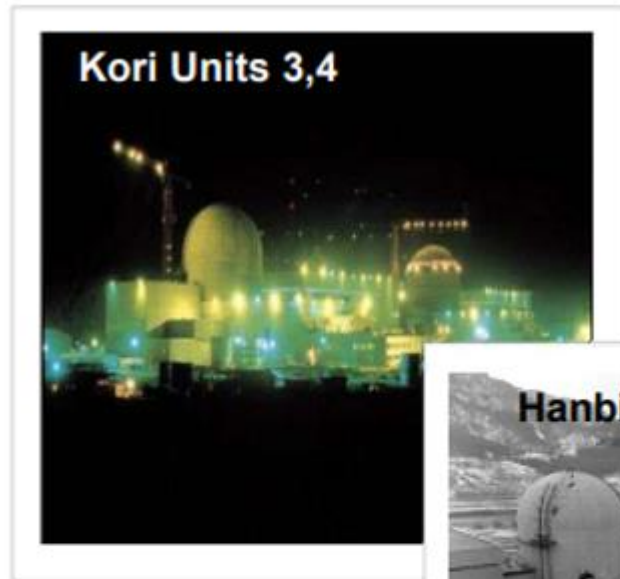
3 Units



- The Korea have to rely on foreign technology

1. Reliable Partner

Localization phase (1980 ~ 1990) 6 Units



- KHNP started to play a leading role in project management and start-up
- Local Companies started to participate in engineering and manufacturing as subcontractors

1. Reliable Partner

Self-reliance phase (1990 ~ 2010) 12 Units

Hanbit Unit 3 to 6



Hanul Unit 3 to 6



OPR1000

Shin Wolsong 1,2



Kori 5,6



- Local companies participated in engineering and manufacturing as prime contractors
- Agreement for technology transfer was made between local companies and foreign suppliers

1. Reliable Partner

Advanced phase (2010 ~ Present)

14 Units



APR1400



- 6 in operation, 2 under commissioning, and 6 under construction

1. Reliable Partner



NSSC (Nuclear Safety & Security Commission)

- Licensing
- Nuclear Safety
- Inspection



- Project Management
- Commissioning
- O&M



Radioactive Waste Agency



Research and Development



Design and Engineering



Nuclear Fuel



Maintenance and Services



Equipment Manufacturing



Construction

Sole EPC supplier, KHNP takes the single responsibility for nuclear in Korea

2. On Time, Within Budget



Contract Date

Dec. 27, 2009

Owner

ENEC

Scope

APR1400 x 4 Units (5,600MW)
Nuclear Fuel (3 Cycles)
Operating Support Service

Ref. Plant

Shin-Kori 3 & 4 in Korea



Unit 4
Construction is completed
(target to early 2024)

Unit 3
Commercial Operation
in Feb. 2023

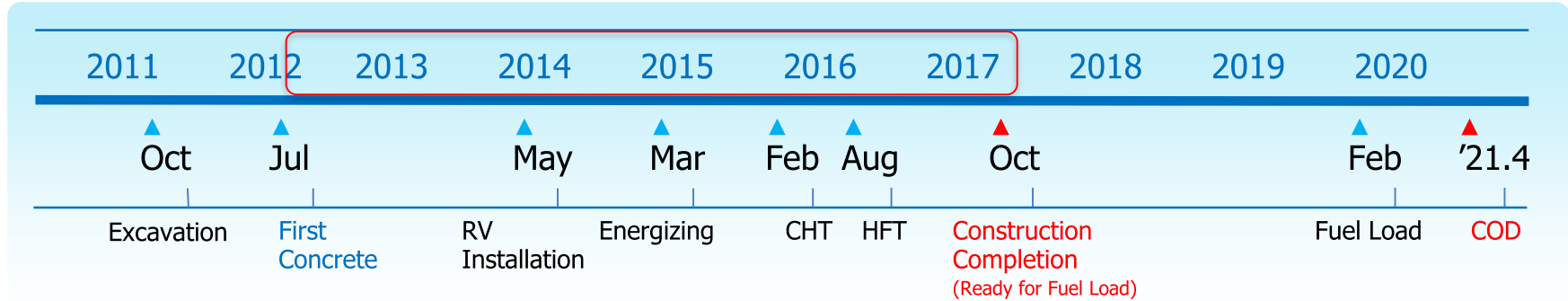
Unit 2
Commercial Operation
in Mar. 2022

Unit 1
Commercial Operation
in Apr. 2021

"Obtain Op. License from Regulator, 17/11/2023"

2. On Time, Within Budget

● BNPP unit 1 construction completion : 6 years as planned



● Expected BNPP Project Cost : 20 → 24 bil. USD as contracted

- Due to the contract condition, 20% increase is mainly cost escalation by yearly inflation

(Sourced in Wikipedia)

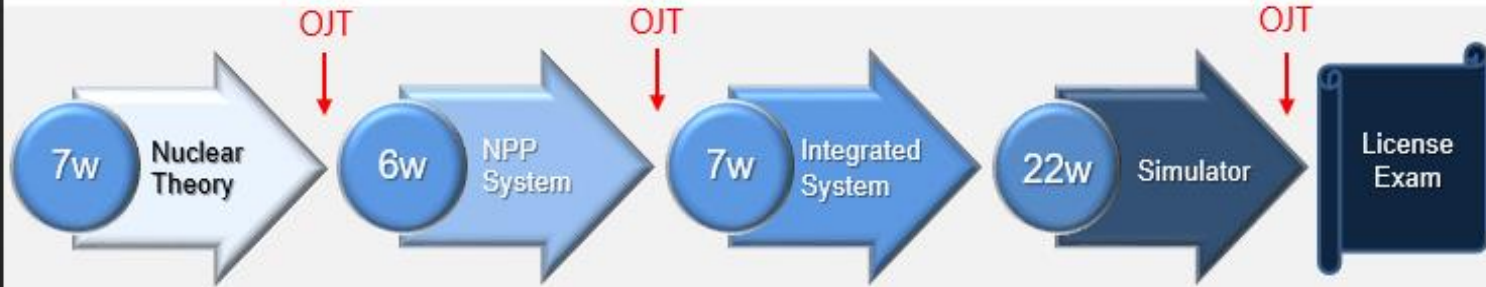
● How did we overcome the BNPP challenges?

- Timely action to address risk factors, using our **One Team** approach and depth of knowledge
- Provided qualified and experienced engineers in advance (**1,200 KHNP employees** in peak)
- Systematically managed multinational laborers from third-countries
(**18,000 laborers from 15 countries**)

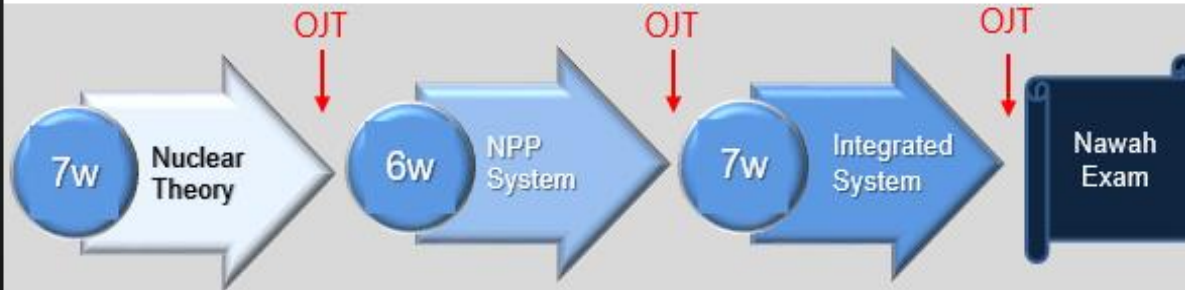
3. HRD program – proven in UAE

SAT into BNPP Project

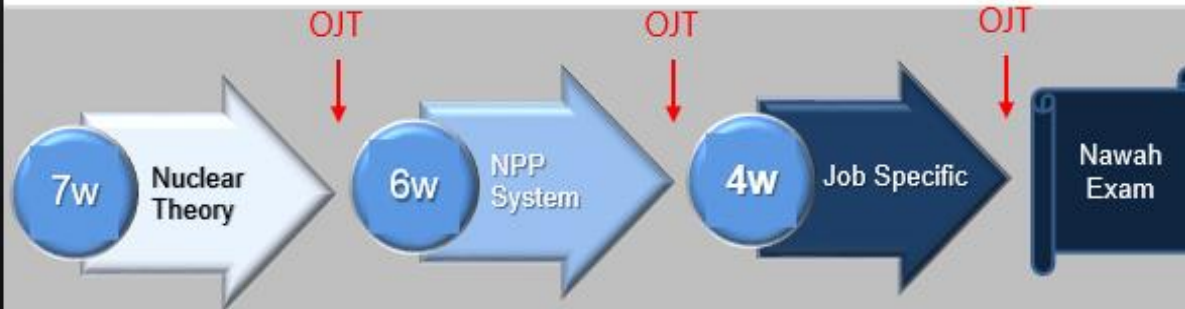
MCR Operator
(Total 102 weeks
incl. OJT 60weeks)



Local Operator
(Total 57 weeks
incl. OJT 37weeks)



Engineer
(Total 56 weeks
incl. OJT 39weeks)



3. HRD program

Improved the SAT program

- KHNP's SAT program for domestic only → global standard SAT program: a good model for future overseas projects

The screenshot shows the IAEA website interface. At the top left is the IAEA logo and name. To the right are links for 'Press centre', 'Employment', and 'Contact'. Below the logo is a navigation menu with 'TOPICS', 'SERVICES', 'RESOURCES', 'NEWS & EVENTS', and 'ABOUT US'. A search bar is on the right. The main content area features a blue header with the article title: 'Systematic Approach to Training Programmes Helps Enhance Business Performance of Nuclear Facilities, IAEA Meeting Highlights'. Below the title are the authors: 'David Drury, IAEA Department of Nuclear Energy' and 'Elisabeth Dyck, IAEA Department of Nuclear Energy'. A date box on the left indicates 'NOV 9 2017'. A large photo shows several people in a control room setting. To the right of the photo are sections for 'Related Stories' and 'Related Resources'. The 'Related Stories' section includes three items: 'Encouraging Careers in Nuclear: The UK's Strategy for a Sustainable Nuclear Workforce', 'IAEA Hosts Meeting on the Human Performance Requirements of a Nuclear Workforce', and 'IAEA Assisting Member States in Nuclear Power Human Resources Planning'. The 'Related Resources' section includes 'Managing Human Resources in the field of nuclear energy'.

IAEA
International Atomic Energy Agency

Press centre Employment Contact

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Systematic Approach to Training Programmes Helps Enhance Business Performance of Nuclear Facilities, IAEA Meeting Highlights

David Drury, IAEA Department of Nuclear Energy
Elisabeth Dyck, IAEA Department of Nuclear Energy

NOV
9
2017

Future reactor operators at a training session at the Simulator Training Centre of the UAE's Barakah Nuclear Power Plant, February 2016. (Photo: L. Potterton/IAEA)

Related Stories

- Encouraging Careers in Nuclear: The UK's Strategy for a Sustainable Nuclear Workforce
- IAEA Hosts Meeting on the Human Performance Requirements of a Nuclear Workforce
- IAEA Assisting Member States in Nuclear Power Human Resources Planning

Related Resources

- Managing Human Resources in the field of nuclear energy

3. HRD program

Fulfilled the Owner's Needs

- **Successfully Fulfilled the Owner's Needs** according to the prime contract by providing training service based on the SAT
- First Barakah operators received **Official Certification in time for Operating License**



Energy & Environment | New Nuclear | **Regulation & Safety** | Nuclear Policies | Corporate | Uranium & Fuel | 1

First Barakah operators receive regulatory certification

08 July 2019



The United Arab Emirates' Federal Authority for Nuclear Regulation (FANR) has officially certified Nawah Energy's first group of operators for the Barakah nuclear power plant. Certification of operators is a key requirement for the issue of the plant's operating licence.



The UAE's first certified nuclear operators (Image: Nawah)

3. HRD program – KINGS Int’l Nuclear Graduated School

Current No. of Alumni in 2023 : 502

(241 Internationals from 32 countries, 261 Domestic candidates)



From Czech Republic, 26 students have been studying for nuclear power, energy policy, and global business, etc.

- 1 graduated, 2 in study, and 23 exchange students from BUT, CTU, UWB, CEZ



4. Government Strong Support

- **President, Mr. Yoon, approved the new 『 Energy Policy 』 in Jul. 2022**
 - Increase the portion of Nuclear Power to target **over 30%**
- **Gov. noticed the 『 State Basic Plan for Electricity Supply 』 in Aug. 2022.**
 - By 2030, the portion of nuclear to be increased **24% (2022) → 33%**
→ 6 Units for new builds (Incl. Shinhanul 3,4) + 10 Units for Life extension



- **Gov. established the committee for nuclear export strategy promotion』 in Aug. 2022 (Leading by MIT, Ministry of Industry and Trade)**
 - The control tower for nuclear export together with Ministries, Industry, Academy and Financial sector
- **MIT established the Prompt Support Center for nuclear companies in Sept. 2022**
- **MOU with KHNP and K-Exim, K-Sure and K-Commercial bank to financial support for nuclear export in Dec. in 2022**
- **KHNP has been ordering the procurement for Shinhanul 3,4 project since Jan. 2023**
- **Gov. approved the implementation plan of construction of Shinhanul 3,4 in June 2023**

4. Government Strong Support



Sep. 2023, New York



Sep. 2023, Prague



Mar./Jun. 2023, Seoul / Prague



2

Preparation for Dukovany

EUR Certification for APR1000 (March 2023)



- 1. Assessment Duration : 2019 – 2022 (3 years)
- 2. Assessment Team



EUR
HARMONISED REQUIREMENTS FOR
NEW NUCLEAR POWER PLANTS

**EUR
Compliance
Certificate**

The EUR Association hereby certifies that the:

APR1000 standard design

has successfully passed all the steps of the analysis of compliance against the EUR Document Revision E with the contribution of: *KHNP, KEPCO E&C, KEPCO NF and Doosan.*

Following this analysis, a specific subset of the EUR Document Volume 3, dedicated to the APR1000 design, has been published by the EUR

Association
March 2nd 2023
Manuel Carrasco
Manuel Carrasco
President of the EUR Association

Dukovany Site Visit (2021 & 2022)



October
2021



June
2022



- To understand site condition and investor's requirements, KHNP team visited at Dukovany Site in 2021 & 2022

Technical meeting (2023)



- 3 times in CEZ HQ and Temelin NPP, with over 80 engineers from Team KHNP

Cooperation with Local Companies (MOU, B2B, round table...)



- Survey 200 Czech companies and sign 50 MOUs and Agreements, since 2018
- Supplier Days, B2B meeting and Round table, every year
- Registering and evaluating Czech companies to utilizing, for other nuclear projects

Localization – Target to 60%

Category	Area	Led by	Scope	Localization Contract Form
Components	NSSS	Doosan	<ul style="list-style-type: none"> Reactor, Steam Generator, Pressurizer, RCP MMIS, NSSS I&C Control sys, etc. 	Subcontracting
	TG	Doosan	<ul style="list-style-type: none"> Turbine, Turbine Control sys, MSR, etc. 	Subcontracting
			<ul style="list-style-type: none"> Generator, Excitation sys, Auxiliary sys 	
BOP	KHNP	<ul style="list-style-type: none"> Pump, Valve, Diesel Generator Transformer, Motor, Instrument, etc. 	Direct Contract With KHNP	

- NSSS : Nuclear Steam Supply Sys
- TG : Turbine Generator
- BOP : Balance of Plant
- RCP : Reactor Coolant Pump
- MMIS : Man-Machine Interface Sys

Doosan Škoda Power



chemcomex



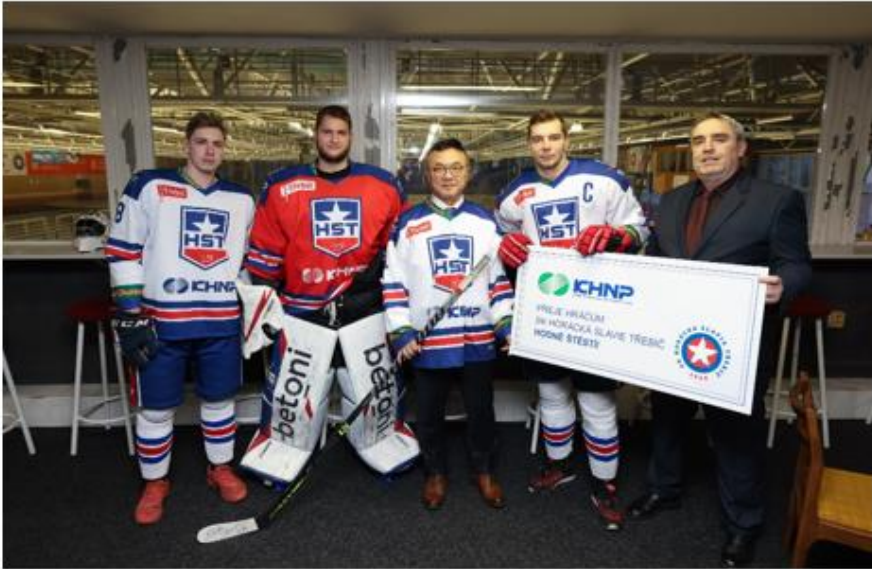
Global Volunteer Activities (2017~ present)



Pyeongchang Winter Olympics (2018)



Sponsorship of SK Horácká Slavia Třebíč (2018~)



City Partnership between Gyeongju-Třebíč (2023)



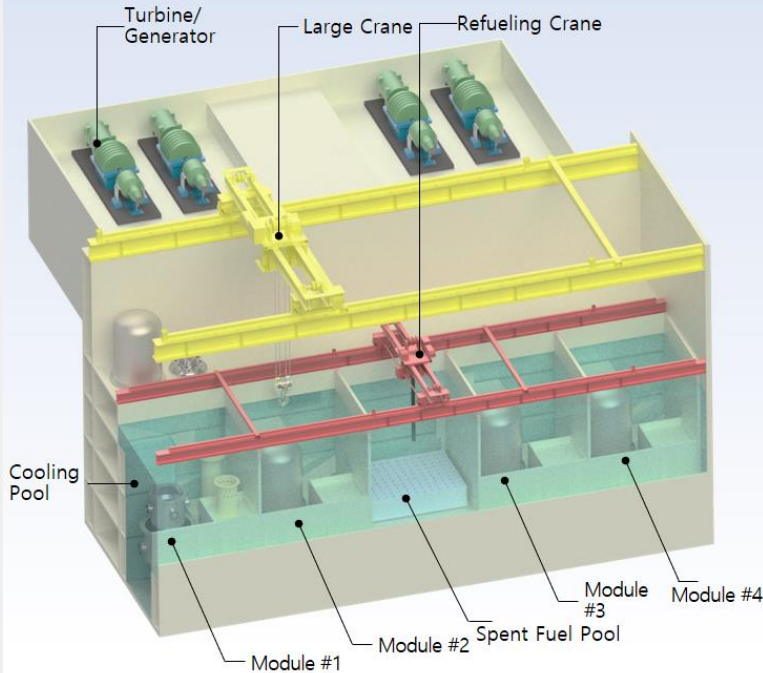


3

Innovative SMR (i-SMR)

i-SMR, Design Concept

i-SMR Module Layout



1 Module 170 MWe

Basic Unit

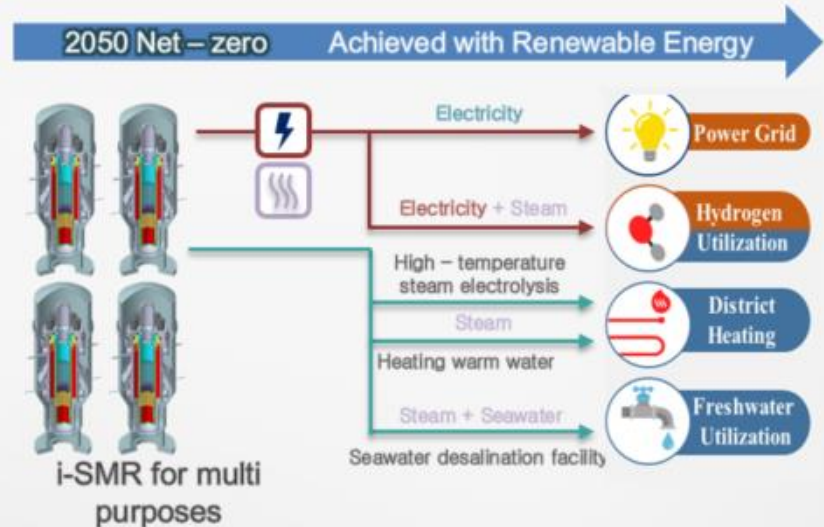
4 Module : 680 Mwe

→ Optimal capacity to replace coal-fired power
(Capacity adjustable depending on number of the modules)

Multi Modules (optional)

- 1 Module 170MWe : Low economic, but beneficial in remote areas
- 4 Module 680MWe : Replacement of Coal-fired Power Plant
- 8 Module 1,360MWe ~ : High economical & can be option for replacement of old NPP and new NPP

Eco-friendliness and diversity



i-SMR, Project Implementation Plan

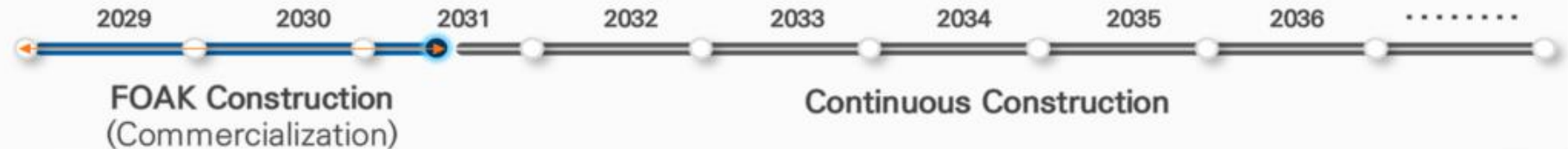
Started from 2020, National R&D Project from 2023, SDA approval by 2028, FOAK operation in 2031

Preliminary Design led by KHNP

National R&D Projects Supported by the Government



Commercialization and construction led by KHNP



- i-SMR project started by KHNP in 2020 with the goal 'Best SMR of global SMR market in 2030s
- i-SMR project received a feasibility study for 8 months by the national review agency and passed in May 2022, becoming national R&D project with the full support of the government from 2023
- A little late, however, we have confidence in commercialization of i-SMR in early 2030s, which is superior to competing SMR models with our own strengths
- Korea will establish new regulatory standards/guidelines suitable for SMR to enhance the safety and economy.

i-SMR, World Best SMR in 2030s

Complete Development of i-SMR with the world's highest level of safety, flexibility and economy and obtain Standard Design Approval by 2028



The highest level of safety

CDF : 1.0×10^{-9} /M·Y



The highest level of Economic efficiency

Construction cost : \$3,500 /kWe
LCOE : \$65 /MWh



The highest level of load following ability

Output Range : 100%-20%-100%
Linear Power change rate: 5%/min

Experience, capability

The only company continuously constructing NPPs for the last 51 years
→ Sufficient experience in design, construction & operation for decades

Robust Nuclear Ecosystem

KHNP is center of NPP Ecosystem in Korea and has strong supply chain.
→ All key nuclear organizations in Korea are actively participating in i-SMR development.

Full Support

The full support of the government and the National Assembly, Improvement of regulatory system



4

Closing Remark

Best Partner for Each Other



Korea and Czech 100 years partnership for Nuclear Industry





DĚKUJI

The APR1000!

