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I. The Status of KOREA Nuclear Power

- Development History of Korea Nuclear Power
- NPPs in Operation, under Construction and Planned
- Long-term Nuclear Power Program
The Status of KOREA Nuclear Power
/ Development History of Korea Nuclear Power

1970
Foreign Technology Dependence

Completion of Kori #1 (1978)

1980
Technology Accumulation

Non-Turnkey Approach

1990
Technology Self-reliance

Development of OPR1000

Completion of the First OPR1000 (1995)

2000
Technology Advancement

Development of APR1400

Export to UAE (2009)
First APR1400 is under construction (2014)
The Status of KOREA Nuclear Power
/ NPPs in Operation, under Construction and Planned

- **In Operation**: 23 units / 20,716MW
- **Under Construction**: 5 units / 6,600MW
- **Planned**: 6 units/8,400MW

- Nuclear: 20.7GW
- Coal: 6GW
- Oil: 6.3GW
- LNG: 5GW
- Hydro: 2.7GW
- Renewable: 6GW

Installed Capacity (31-Dec-2013)
Considering energy security, environment protection and industrial competitiveness, share of nuclear energy will gradually increase to **29%** in 2035


[Effective Capacity by Year in Korea]
II. Infrastructure of Korea Based on INPRO Methodology

- UR 1. Legal and Institutional infrastructure
- UR 2. Industrial and Economic Infrastructure
- UR 3. Political Support and Public acceptance
- UR 4. Human Resources
- UR 5. Minimization of Infrastructure
- UR 6. Regional and International Arrangement
Infrastructure of Korea Based on INPRO Methodology

/ UR 1. Legal and Institutional Infrastructure

CR 1.1 Legal Aspects

- Act
- Enforcement Decree
- Enforcement Regulations (Prime Minister’s Regulation)
- Technical Standards (NSSC Regulations)
- Regulatory Standards
- Regulatory Guidelines
- Guideline for Safety Review & Inspection
- Industrial Code and Standards

[Legal and Regulatory Structure]
Government Organizations concerning Nuclear Energy

NSSC (Nuclear Safety and Security Commission)
- Regulatory enforcement authority
- Independent, stand-alone, vice minister-level government agency

KINS (Korea Institute of Nuclear Safety)
- Quasi-government agency, entirely dedicated to nuclear safety regulation

KINAC (Korea Institute of Nuclear Nonproliferation and Control)
- Quasi-government agency, for maintaining the efficient implementation of safeguards, export/import controls and securities related to nuclear facilities and materials
Infrastructure of Korea Based on INPRO Methodology

/ UR 1. Legal and Institutional Infrastructure

CR 1.2 Institutions (Cont’)

[Nuclear Industries (KEPCO, KHNP, etc)]

[Nuclear Safety & Security Commission (NSSC)]

[Technical Committee]

[Technical Expert Organizations (KINS & KINAC)]

[General Structure of Nuclear Regulation & Licensing]
Infrastructure of Korea Based on INPRO Methodology
/ UR 2. Industrial and Economic Infrastructure

CR 2.1 Financing of Total Investment

Unit: Billion $

<table>
<thead>
<tr>
<th>Year</th>
<th>Investment (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>5.3 Bil. $</td>
</tr>
<tr>
<td>2004</td>
<td>5.4 Bil. $</td>
</tr>
<tr>
<td>2005</td>
<td>3.2 Bil. $</td>
</tr>
<tr>
<td>2006</td>
<td>4.0 Bil. $</td>
</tr>
<tr>
<td>2007</td>
<td>4.3 Bil. $</td>
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<tr>
<td>2008</td>
<td>6.7 Bil. $</td>
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<td>2009</td>
<td>7.8 Bil. $</td>
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<tr>
<td>2010</td>
<td>8.1 Bil. $</td>
</tr>
<tr>
<td>2011</td>
<td>8.3 Bil. $</td>
</tr>
<tr>
<td>2012</td>
<td>8.0 Bil. $</td>
</tr>
</tbody>
</table>

[Total Investment Trend in Nuclear Sector between ‘03~’12]
Infrastructure of Korea Based on INPRO Methodology

CR 2.2 Size of Nuclear Facility

[Expansion Plan and Peak Demand by Year]
Health, Safety and Security, Engineering & Cost, Environmental Factors, etc., all are considered and scrutinized during Siting.
Infrastructure of Korea Based on INPRO Methodology
/ UR 2. Industrial and Economic Infrastructure

CR 2.4 Support Infrastructure

Government

Ministry of Foreign Affairs

Trade, Industry & Energy Committee

Government

Industry

Overseas Project
Operation & Management
Design & Engineering
Equipment Manufacturing

Maintenance & Services
Nuclear Fuel
Construction

Institutions

Korea’s Wholehearted Commitment & Support for Nuclear Power

R&D
Public Acceptance
Radwaste Management

Korea Atomic Energy Research Institute
Korea Nuclear Energy Commission
KORAD

Export Control
Nuclear Safety
Nuclear Medical
Education & R&D

KINAC
Nuclear Safety Foundation
KIRAMS
KAIST

Associations

Korean Nuclear Society
The Korean Society for Nondestructive Testing

Women Interested in Nuclear
Korea Atomic Industrial Forum

Korea Coating Experts Society
Infrastructure of Korea Based on INPRO Methodology
/ UR 2. Industrial and Economic Infrastructure

CR 2.5 Added Value

Security of Energy Supply
- Power Source Covering Base Load
- High Capacity Factor (Over 80%)

Stimulating All Industries
- Heavy industry
- Construction
- OA System
- I&C System
- Medicine, etc.

Reduction in GHG Emissions
- Nuclear Contribution

Contribution to Economic Growth
- Electricity Price (18.5%) vs Consumer Price (240%)
- Cheapest Electricity Source
  - Nuclear: 3.94 /kWh
  - Coal (5.88), Oil (22.17), LNG (16.08)

Added Value

(source: KPX “2013 Power Market Statistics”
(source: White Paper on Nuclear Power Generation 2013)
Infrastructure of Korea Based on INPRO Methodology
/ UR 3. Political Support and Public Acceptance

CR 3.1 Public Information

For General Public & Residents in the Vicinity of the Facilities

- White Paper
- Safety Zone: Nuclear Energy
- Safety Zone: Energy Zone

Safety Zone: Energy Camp
- Teacher Training Camp
- Nuclear Knowledge Concert
- Olympiad, etc.

- Email
- Newsletter
- Official Website
- SNS (Twitter, ..)
- Nuclear Hub Site “Atom Story”

- Program informing Nuclear Policy, safety

- Forums of experts and opinion leaders
- Policy of opening NPPs to the public (via Official web-site)
Infrastructure of Korea Based on INPRO Methodology

/ UR 3. Political Support and Public Acceptance

CR 3.2 Public Participation

Public Hearings/Inquiries for Siting
- Opinions are reflected in EIA

Participation in Gov’ Meetings
- Deliberation on issues
- Workshops
  ......  

Proposals and Recommendation
- by online or mail
- The Ombudsman System
- Panel of experts committee

Participation as Local Residents
- Nuclear Safety Committee
- Civil Environmental Monitor
- Running a Hot-line
CR 3.3 Survey of Public Acceptance

- Periodically conducted by the professional survey research agency.
  - Results show general public’s high understanding on the need, usefulness, contribution of nuclear power (May. 2014)

**Survey Target**
- General Public

**Agency**
- Korea Research
- Korea Gallup, etc.

**Respondents**
- 1,000~1,500

**Note**
- People over the age of 19
- By home phone or mobile

1. Nuclear power is Necessary
   - Aug. 13: 86%
   - Oct. 13: 84%
   - May. 14: 75%

2. Increasing /maintaining NPPs
   - Aug. 13: 78%
   - Oct. 13: 75%
   - May. 14: 69%

3. Nuclear as electricity source
   - Aug. 13: 74%
   - Oct. 13: 70%
   - May. 14: 77%

4. Nuclear power contributes stable power supply.
   - Aug. 13: 88%
   - Oct. 13: 90%
   - May. 14: 87%
Infrastructure of Korea Based on INPRO Methodology
/ UR 3. Political Support and Public Acceptance

CR 3.4 Policy Support (Cont’)

The 6th Basic Plan for Long-term Electricity Supply & Demand
(BPE, Feb. 2013)
- For Electricity Planning
- 11 nuclear units (15GW) is planned

The 2nd Master Plan for National Energy (MPNE, Jan. 2014)
- For Comprehensive energy planning
  (Oil, Gas, Coal, Electricity)
- Gradual nuclear expansion is planned

(source: The 6th BPE)

(source: The 2nd MPNE)
Infrastructure of Korea Based on INPRO Methodology
/ UR 3. Political Support and Public Acceptance

CR 3.5 Political Environment & Investor Risk

**Stance of Leading Opposition Party on Nuclear Power**
- Critically supportive
- Nuclear power is consistently pursued during the current leading opposition’s regime (Feb.’98 ~ Feb.’08)

![Graph showing planned nuclear expansion](image)

**Status of Anti-nuclear Political Party**
- Poor supporting rate (3%)

![Pie chart showing support rates](image)

(source: Korea Gallup)

[Support Rate (1st Week . Jul. 2014)]

[Planned Nuclear Expansion (1st ~ 3rd BPE)]
Infrastructure of Korea Based on INPRO Methodology

/ UR 4. Human Resources

CR 4.1 Human Resources

Distribution by each Sector
- Well distributed human resources

Trend of employment in the nuclear Industry
- Broadly growing trend

(source: The 18th Survey on the Status of Nuclear Industry in 2012)
CR 4.1 Human Resources (Cont’)

Personnel Structure: 80% (20s~40s)
- The majority of the employees are young generations

Permanent Employee: 91%
- Attractive for future job seekers

(source: The 18th Survey on the Status of Nuclear Industry in 2012)
Infrastructure of Korea Based on INPRO Methodology / UR 4. Human Resources

CR 4.1 Human Resources (Cont’)

[Institute / Academy]

KAERI (Korea Atomic Energy Research Institute)
Nuclear Training & Education Center (NTC)

KINS (Korea Institute of Nuclear Safety)
International Nuclear Safety School (INSS)

KINAC (Korea Institute of Nuclear Non-proliferation & Control)
International Nuclear Non-proliferation & Security Academy (INSA)

Universities
14 Universities with Nuclear related Dept.
5 Universities with Energy related Dept.
45 Universities with Radiology Dept.
11 Research Institutes

[Utility/Industry/Association]

KEPCO
KEPCO International Nuclear Graduate School (KINGS)
  - Master’s / Doctoral Courses

KHNP
KHNP Nuclear Power Education Institute
Nuclear Site Training Center (4facilities)

KPS (Korea Plant Service & Engineering Co.)
Nuclear Maintenance Training Center

KNA (Korea Nuclear Association for International Cooperation)
Human Resource Development Center

Effective Education System in Place
Infrastructure of Korea Based on INPRO Methodology

CR 5.1 Personnel & 5.2 Prefabrication of components

Pre-fabrication & Modularization
- Reinforcing Bar of Basement
- RCB Exterior Wall 3-tiered CLP Module
- MSIV Room Piping & Valve
- MCR Ceiling Structural Steel, etc.
- Installing 1 or 2 Pieces-dome Liner Plate
- MCR Ceiling Structural Steel

Other Advanced & Optimized Process
- Steel Deck Plate Method
- Automatic Welding of RC Loop
- Concurrent Installation of RC Loop Pipe & RV Internals
- Shortened Post-tensioning Period
- 3D CAD Models for Construction
- 4D Simulation, etc.
Infrastructure of Korea Based on INPRO Methodology

/ UR 6. Regional and International Arrangements

CR 6.1~4 Options to Reduce the related Infrastructure

Material Program (IAEA, OECD/NEA)
- Technical Cooperation
- Cooperative Research Program
- Joint Collaborative Project

Regional Program (RCA, FNCA)
- Nuclear Community for Technical Exchange in Asia

Bilateral Program (US, Japan, France, etc.)
- Peaceful Usage of Nuclear Power
- Exchange of Policy and Technical Issue

Government Ministries (MOTIE / MOFAT / MSIP)

Utility, Industry

Technical Exchange Program (WANO, INPO)
- Self-Assessment of Nuclear Industry
- Sharing Operating Experience
- Technical Exchange Visit

Exchange of Technical Information (WNA, NEI, etc.)
- Exchange of the Technical Information
- Participating in Meetings/Workshop

Benchmarking Training, etc. (Other Countries, Organizations)
- Contribution to NPP development through training, technical visit, etc.

[Regional & International Arrangement in Korea]
III. Conclusion

Conclusion
Korea has achieved comprehensive nuclear infrastructure for efficient construction & safe operation through steady nuclear expansion.

Korean nuclear infrastructure is adequate when assessed by INPRO Methodology, which results from:

- Strong commitment from the Korean Government
- Continuing NPP construction
- Consistent R&D

UR1. Legal & Institutional
UR2. Industrial & Economic
UR3. Political Support & Public Acceptance
UR4. Human Resources
UR5. Minimization of Infrastructure
UR6. Regional & International Arrangement
THANK YOU
Korea Electric Power Corporation