Present and Future of Nuclear Power in Korea

Oct. 27, 2009

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President & CEO
Korea Hydro & Nuclear Power Co.
I. Current status of nuclear power program
II. Construction of advanced nuclear power plants
III. Advance in reactor technology
IV. Vision and challenges
Chap. I

Current status of nuclear power program
The beginning of nuclear power

Research reactor

TRIGA MARK II (‘59.7)

Commercial reactor

Kori #1

- Capacity: 587MW
- Construction period: 7 years (‘71.3~’78.4)
- Project type: Turn-Key (Westinghouse/USA)
- Construction cost: 320 million $ (foreign capital: 170 million $)

※ Life-extended after 30 years operation (‘07.12)

<1971 vs. 2008, Korea>

<table>
<thead>
<tr>
<th></th>
<th>1971</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNP per capita</td>
<td>290 $</td>
<td>19,230 $</td>
</tr>
<tr>
<td>Export</td>
<td>1 billion</td>
<td>419 billion</td>
</tr>
<tr>
<td>Power capacity</td>
<td>2,628 MW</td>
<td>72,491 MW</td>
</tr>
<tr>
<td>Number of Cars</td>
<td>0.14 million</td>
<td>16.8 million</td>
</tr>
</tbody>
</table>

IAEA (Oct. 27 – 30, 2009)
Nuclear power plants in Korea

- 20 units in Operation
  - 600MW × 2
  - 700MW × 4
  - 950MW × 6
  - 1,000MW × 8

- 8 units under Construction
  - 1,000MW × 4
  - 1,400MW × 4
Status of electric power

Installed Capacity

17,716 MW (24.4%)

- Nuclear: 5,505 MW (7.6%)
- Coal: 23,705 MW (32.7%)
- Gas: 18,476 MW (25.5%)
- Oil: 6,360 MW (8.8%)

*The others: 728 MW (1.0%)

Total: 72,490 MW

Electricity Generation

150,958 GWh (35.6%)

- Nuclear: 5,567 GWh (1.3%)
- Coal: 72,615 GWh (17.1%)
- Gas: 172,554 GWh (40.7%)
- Oil: 21,801 GWh (5.1%)

*The others: 928 GWh (0.2%)

Total: 424,423 GWh

(As of the end of 2008)
Operational performance

**Capacity Factor**

**(Year 2008, %)**

- **Korea**: 93.4%
- **Japan**: 59.2%
- **Canada**: 66.7%
- **Russia**: 73.1%
- **France**: 76.1%
- **USA**: 89.9%

**World Average: 79.4%**

※ Source: Nucleonics Week (2009. 3)

**Unplanned Capability Loss**

**(Year 2008, %)**

- **KOREA**: 0.3%
- **USA**: 1.3%
- **Russia**: 1.9%
- **JAPAN**: 4%
- **France**: 9.4%

**World Average: 5.3%**

※ Source: IAEA
Economical efficiency

- Sales price (¢/kWh): Nuclear is the cheapest (year 2008)

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>2008 Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>49.8</td>
</tr>
<tr>
<td>Oil</td>
<td>14.8</td>
</tr>
<tr>
<td>Gas</td>
<td>11.0</td>
</tr>
<tr>
<td>Hydro</td>
<td>10.3</td>
</tr>
<tr>
<td>Wind</td>
<td>9.7</td>
</tr>
<tr>
<td>Coal</td>
<td>3.9</td>
</tr>
<tr>
<td>Nuclear</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Contribution to national economy

- Consumer price: 221.4% rise
- Electricity price: 10.2% rise

1982 to 2008
Strength of Korea’s nuclear power

Well-organized nuclear infrastructure

Strong & consistent government nuclear policy

Well-qualified workforce to maintain nuclear power program

Close cooperation with international organization
Construction of advanced nuclear power plants
# Construction of nuclear power plants

<table>
<thead>
<tr>
<th>Project</th>
<th>Reactor Type</th>
<th>Capacity (MW)</th>
<th>Model</th>
<th>Commercial Operation</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shin-Kori</td>
<td>PWR</td>
<td>1,000</td>
<td>OPR1000</td>
<td>Dec. 2010</td>
<td>Under Construction</td>
</tr>
<tr>
<td>#1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td></td>
<td>1,000</td>
<td>OPR1000</td>
<td>Dec. 2011</td>
<td></td>
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<tr>
<td>#3</td>
<td></td>
<td>1,400</td>
<td>APR1400</td>
<td>Sep. 2013</td>
<td>Under Construction</td>
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<tr>
<td>#4</td>
<td></td>
<td>1,400</td>
<td>APR1400</td>
<td>Sep. 2014</td>
<td></td>
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<tr>
<td>#5</td>
<td></td>
<td>1,400</td>
<td>APR1400</td>
<td>Dec. 2018</td>
<td></td>
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<tr>
<td>#6</td>
<td></td>
<td>1,400</td>
<td>APR1400</td>
<td>Dec. 2019</td>
<td>In planning</td>
</tr>
<tr>
<td>Shin-Wolsong</td>
<td>PWR</td>
<td>1,000</td>
<td>OPR1000</td>
<td>Mar. 2012</td>
<td>Under Construction</td>
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<td>#1</td>
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<td></td>
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<tr>
<td>#2</td>
<td></td>
<td>1,000</td>
<td>OPR1000</td>
<td>Jan. 2013</td>
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<tr>
<td>Shin-Ulchinn</td>
<td>PWR</td>
<td>1,400</td>
<td>APR1400</td>
<td>Dec. 2015</td>
<td>Under Construction</td>
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<tr>
<td>#1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td></td>
<td>1,400</td>
<td>APR1400</td>
<td>Dec. 2016</td>
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<tr>
<td>#3</td>
<td></td>
<td>1,400</td>
<td>APR1400</td>
<td>Jun. 2020</td>
<td>In planning</td>
</tr>
<tr>
<td>#4</td>
<td></td>
<td>1,400</td>
<td>APR1400</td>
<td>Jun. 2021</td>
<td></td>
</tr>
</tbody>
</table>
**Status of nuclear power construction**

**Shin-Kori #1,2**

<table>
<thead>
<tr>
<th>Rx. type</th>
<th>Advanced OPR1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>1000MW x 2units</td>
</tr>
<tr>
<td>Duration</td>
<td>'06.6/'07.6~'10.12/'11.12</td>
</tr>
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**Shin-wolsong #1,2**

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<tr>
<td>Capacity</td>
<td>1000MW x 2units</td>
</tr>
<tr>
<td>Duration</td>
<td>'07.11/'08.9~'12.3/'13.1</td>
</tr>
</tbody>
</table>

* OPR1000 : Optimized Power Reactor 1000
Shin-Kori #3,4

Shin-Ulchin #1,2

<table>
<thead>
<tr>
<th>Rx. type</th>
<th>APR1400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>1400MW x 2units</td>
</tr>
<tr>
<td>Duration</td>
<td>’08.10’09.8~’13.9’14.9</td>
</tr>
</tbody>
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<tr>
<td>Capacity</td>
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</tr>
<tr>
<td>Duration</td>
<td>’11.3’12.3~’15.12’16.12</td>
</tr>
</tbody>
</table>

* APR1400 : Advanced Power Reactor 1400
Economic efficiency in construction

Project Cost & Period Reduction

Cost

Period

About 30% Cost Reduction

From 64 months to 52 months Period Reduction

Y #3,4 ('95, '96)  U #5,6 ('04, '05)  S-W #1,2 ('12, '13)

Korea has completed 20 NPP projects within the planned schedule & costs.
Korea is one of a few countries in the world that have continuously and aggressively implemented NPP projects up to now since 1970s.
Chap. III

Advance in reactor technology
Introduction of Nuclear Power

The first unit

Technology Accumulation

Units complete: 8 units

1970s

Development of OPR1000

Units complete: 7 units

1980s

Completion of First OPR1000 ('95)

1990s

Development of APR1400

Units complete: 4 units

Units under construction: 8 units

2000s

Completion of First APR1400 ('13)
Major design features of APR1400

NSSS

Digital I&C

Over the top method

Integrated Head Ass’y
APR+ “to the Future, to the World”

General Arrangement

Digital I&C

NSSS
Major design features of APR+

EDG#I
EDG#II
EDG#III
EDG#IV

4 train Safety Injection Sys. (4 EDGs)

Optimization of Safety Injection Flow

LBLOCA
DVI Nozzle
Break Flow

Passive AFWS

4 train Safety Injection Sys. (4 EDGs)
Chap. IV  Vision and challenges
Low-carbon, green growth is mapped out as Korea’s new national vision for a post-oil era

< 4 Strategies>

- Low energy consumption
- Increasing clean energy
- Boosting green energy industry
- Affordable Supply of energy

Increasing the share of nuclear power generation

36% ('08) → 59% ('30)

Some 40 nuclear power plants will be in operation in 2030

IAEA (Oct. 27 – 30, 2009)
Vision and challenges of nuclear power

Vision

Nuclear is Driving force of Green Growth

- Core energy source for energy security
- Measures against climate change
- Contribution to national economy development and enhancement of citizen’s life standards

Challenges

- Securing new plant sites
- Sustainable nuclear fuel supply system
- Promoting Public acceptance
- Advancing the nuclear technology
Global green future with nuclear power

Ensuring the safety of operating NPPs

Closer International Collaboration

Helping infrastructure for new comers
Thank you!