Plan of New Research Reactor Construction in Korea

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In-Cheol LIM

KAERI Korea Atomic Energy Research Institute
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Part I

Background
Background - Global Shortage of Mo-99

- Insecurity of Mo-99 Supply in Korea
  - Dependent mainly on import
- Raise in Mo-99 Price
  - Imbalance with health care expenses
- Losing big profit due to raised dollar value
  - Worsening the situation
- Failures in medical diagnosis
  - Delayed medical treatment
- An issue at the Korean National Assembly in 2008
### Background – National Strategy for Mo-99

| Short Term          | (n, y) Mo using HANARO  
<table>
<thead>
<tr>
<th></th>
<th>- 5% of domestic supply</th>
</tr>
</thead>
</table>
| Mid Term            | (n, y) Mo using HANARO & 
|                     | Success in R&D on new generator of 
|                     | higher efficiency 
|                     | - 30% of domestic supply |
| Long term           | Construction of a new reactor having 
|                     | fission Mo production capability |
Capacity of NTD Service in HANARO
- 5, 6 and 8” silicon ingot doping
- 10~15% of world doping demand
- High quality service

Prediction of Future NTD Market
- HEV
- Windmill
- Solar
For HEV

- Estimation of the amount of NTD-Si per an HEV
- Estimation of HEV Market Growth
- KIM et al, 13th European Power Electronics Conf., 2009
- The belief on stable service and capacity building will create larger market.

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEV production [in million vehicles]</td>
<td>1</td>
<td>3</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Need for 6 inch NTD-Si ingot [tons]</td>
<td>16-51</td>
<td>47-153</td>
<td>157-510</td>
<td>786-2550</td>
</tr>
</tbody>
</table>
Background – RR Technology Development

- U-Mo Plate Type Fuel Development
  - Unique technology: Atomization Technique

- Bottom Mounted CRDM Development
  - Necessary for easy-access design

Atomization Process

Bottom Mounted CRDM
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Part II

Progress

Pre-evaluation by MOSF (Ministry Of Strategy and Finance) in Mar. 2010

Site Selection in July 2010

Feasibility Study by an Independent Government Institute from Sept. 2010 to June 2011

Submission of Budget Proposal in Oct. 2011

At present, under the Review of National Assembly
Site Selection in 2010

Prerequisite for Feasibility Study

Reply from 9 local counties to the Government Proposal of Host

Evaluation of Proposals

- Safety
- Public acceptance of the residence
- Support from the local government
- Consideration of emergency preparedness plan execution
- Meteorological conditions
- Possibility of external events
- Local infra for utilization
- Accessibility
- Conditions of inhabitancy

Preliminary Site Evaluation

- Geologic, seismic and hydrologic conditions
Feasibility Study

Period: 2010.9~2011.6

Conducted by KDI (Korea Development Institute)
- A national research institute supporting the Ministry of Strategy and Finance

Evaluation Items
- Maturity of technologies required for the project to see the possibility of success
- Economic study to investigate the cost and benefit of the proposed project and facilities for the lifetime
- Strategic review
Part III

Project Plan
Facilities to be built

- Reactor
- RI Production and Research Facility
- LEU Target Manufacturing Facility
  - Attachment to the existing fuel manufacturing facility in KAERI
- Irradiation Service Facility
- Rad-waste Treatment Facility
- Consideration of Future Demand for Research and Service
## Reactor Characteristics

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactor power (MW)</td>
<td>~20</td>
</tr>
<tr>
<td>Reactor type</td>
<td>Pool type</td>
</tr>
<tr>
<td>Max. thermal neutron flux (n/cm^2s)</td>
<td>(&gt;3.0 \times 10^{14}) (n/cm^2s)</td>
</tr>
<tr>
<td>Operation day per year</td>
<td>~300</td>
</tr>
<tr>
<td>Reactor life (year)</td>
<td>50</td>
</tr>
<tr>
<td>Fuel</td>
<td>LEU U-Mo plate type fuel</td>
</tr>
<tr>
<td>(U loading : 4.8 g/cm(^3))</td>
<td></td>
</tr>
<tr>
<td>Reflector</td>
<td>Beryllium</td>
</tr>
<tr>
<td>Coolant and flow direction in operation</td>
<td>(H_2O), downward forced convection</td>
</tr>
<tr>
<td>Reactor building</td>
<td>Confinement</td>
</tr>
</tbody>
</table>

- PAMS and Emergency Control Room
- Diesel generator in appropriate size

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## Proposed Project Schedule

<table>
<thead>
<tr>
<th>Key activity</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design and engineering</td>
<td></td>
</tr>
<tr>
<td>Long need item procurement</td>
<td></td>
</tr>
<tr>
<td>Site preparation</td>
<td></td>
</tr>
<tr>
<td>Procurement and construction</td>
<td></td>
</tr>
<tr>
<td>Commissioning</td>
<td></td>
</tr>
<tr>
<td>Licensing</td>
<td></td>
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Utilization

Radioisotope Production

- Mo-99
- I-131 and I-125
- Ir-192
- P-33, Co-60 (medical), Re-186, Sm-153

Schedule

- Mo-99: To fulfill national demand in 2017 and increase year by year
- Others: To reach full capacities in 2017

Silicon Doping

- 6” (2 holes), 8” (3) from 2017
- 12” (2): dependent on technology development
Concluding Remarks

Roles

- HANARO-Research, New RR-Service

National Contribution of Korean New RR

- Self sufficiency in RI supply
- Contribution to the strengthening of power device industry and to the competitive power of car making industries
- Validation of element RR technologies

Regional and International Contribution

- Contribution to the RI supply capacity
- Contribution to green economy
- Use and validation of U-Mo fuel
Thank You!