Experience and Capability of Equipment Manufacturing for Nuclear Power Plant

Doosan Heavy Industries & Construction Co., Ltd.

27 March 2012
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1. Overview of DOOSAN

2. DOOSAN’s Experience for Nuclear Power Plants
Part 1

Overview of DOOSAN

- Introduction of Doosan Heavy Industries
  - History, Business Groups, Sales Info, Global Network
- Doosan Changwon Facility
  - Forging Shop, Turbine Shop, Nuclear Shop, Dock
Established

1980
Changed company name to Korea Heavy Industries and Construction

1981
Acquired ASME N, NPT Certificates

1982
Completed Integrated Manufacturing Complex in Changwon

1984
Participated in self-reliance program of Nuclear Power Plant Technology

2001
Privatized and changed company name to Doosan Heavy Industries and Construction

2005
Acquired American Engineering Service (Currently Doosan Hydro Technology)
- Acquired Mitsui Babcock (Currently Doosan Babcock)
- Acquired Kvaerner IMGB (Currently Doosan IMGB)

2006
- Acquired Skoda (Currently Skoda Power)
- BG : Business Group
- NSSS : Nuclear Steam Supply System
- T/G : Turbine Generator
- BOP : Balance of Plant
- EPC : Engineering, Procurement, Construction
Shareholders & Sales

Shareholders

<table>
<thead>
<tr>
<th>%</th>
<th>Public</th>
<th>Doosan Corp.</th>
<th>KDB</th>
<th>Treasury Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>42.4%</td>
<td>41.2%</td>
<td>1.3%</td>
<td>15.1%</td>
</tr>
<tr>
<td>Shares</td>
<td>106 mil</td>
<td></td>
<td></td>
<td></td>
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</table>

Sales

<table>
<thead>
<tr>
<th>%</th>
<th>Construction</th>
<th>Nuclear</th>
<th>Casting &amp; Forging</th>
<th>Water</th>
<th>Power Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15%</td>
<td>20% ($1,236M)</td>
<td>10%</td>
<td>7%</td>
<td>45%</td>
</tr>
</tbody>
</table>

Dec. 2010

Shareholders:
- Public: 42.4%
- Doosan Corp: 41.2%
- KDB: 1.3%
- Treasury Stock: 15.1%

Sales:
- Construction: 15%
- Nuclear: 20% ($1,236M)
- Casting & Forging: 10%
- Water: 7%
- Power Plant: 45%

Dec. 2010

Shareholders & Sales

Nuclear
Thermal
Turbine & Generator
Water (Desalination)
Casting & Forging
Construction
Global Network

- **28** Branches
- **16** Subsidiaries
- **5** R&D Centers

- Škoda Power
- Doosan Power Systems
- Doosan E&S
- IMGB
- VINA
- Doosan Hydro

Branches
- Subsidiaries
- R&D Centers
DOOSAN in Changwon, Korea has an integrated manufacturing facility which is capable from raw material production to final assembly of components for nuclear power plants worldwide.

* Total Area : 1,100 acres
* Floor Space : 137 acres
Forging Press
Forging Manipulator

Electric Arc Furnace
Vacuum Ladle Refining & Holding Furnace
Turbine Shop

- 400 tons Over Head Crane
- 200 tons Over Head Crane
- CNC Plano Miller
- CNC Horizontal Boring M/C
- CNC Vertical Boring M/C
- CNC Horizontal Lathe
- CNC Rotor Slotting M/C
1000 tons Over Head Crane
800 tons Over Head Crane
Semi Gantry Welding Machine
SAW Strip Cladding Machine
3 Spindle Deep Hole Drilling Machine
6-Spindle Broaching Machine
Automatic J Groove Welding Machine
Shipping of Steam Generator

Gantry Crane: 500 tons X 2 sets → 1,000 tons
Transporter: Multi-wheel Loader
We have fully integrated production lines and management systems for NSSS.
Part 2

DOOSAN’s Experience for Nuclear Power Plants

Doosan’s Nuclear Business
- Organization, Role of Doosan, Major Products

Doosan’s Experience
- New NPPs, Replacement, Domestic, AP1000, RSGs & RVHs
Nuclear Business Group Organization

Number of employees of Nuclear BG: 1,034 persons
DOOSAN is the main contractor for NSSS & T/G in Korean nuclear projects.
Major Products

♦ Nuclear Steam Supply System
  • Reactor Vessel & Internal
  • Steam Generator
  • Reactor Coolant Pump
  • Man Machine Interface System (I&C)
  • Pressurizer
  • Primary Piping
  • Control Rod Drive Mechanism
  • Fuel Handling System

♦ Fuel Storage
  • New and Spent Fuel Racks
  • Spent Fuel Transportation Cask / Canister

♦ Services
  • Replacement Equipment (SG, RV Head)
  • Field Services

♦ Turbine / Generator (by Turbine BU)
  • 700 ~ 1400 MWe class

♦ Balance of Plant
  • Containment Post-tensioning System
  • Containment Liner Plates
  • Stainless Steel Liner Plates
  • Condenser and Heat Exchangers
  • Pressure Vessels & Tanks
  • Gas Stripper, Boric Acid Concentrator
  • Moisture Separator Reheater, etc.
  • Fuel Rack
Experience on New NPPs

<table>
<thead>
<tr>
<th>Type / Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1400 MWe (APR1400)</td>
</tr>
<tr>
<td>1000 MWe (OPR1000)</td>
</tr>
<tr>
<td>1100 MWe (APR1000)</td>
</tr>
<tr>
<td>900 MWe</td>
</tr>
<tr>
<td>600 MWe</td>
</tr>
<tr>
<td>700 MWe</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Type / Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15</td>
</tr>
</tbody>
</table>

- **Completed**
- **Terminated**
- **In manufacturing**
- **Overseas PJT**
- **UAE APR 1400 1-4**
- **Shin-Ulchin 1&2**
- **Shin-Kori 3&4**
- **Shin-Wolsong 1&2**
- **Shin-Kori 1&2**
- **Ulchin 1&2**
- **KEDO 1&2**
- **Ulchin 5&6**
- **Yonggwang 5&6**
- **Yonggwang 3&4**
- **U.S Levy County (2 units)**
- **U.S. V.C.Summer (2 units)**
- **U.S Vogtle (2 units)**
- **China AP1000 (2 units)**
- **China Qinshan III**
- **Qinshan II 3**
- **Wolsong 3&4**
- **Wolsong 2**
### Experience on Replacement NPPs

| TYPE         | YEAR | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|
| RSG          |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 5000 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 820  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 200  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 90   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 890  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 950  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| RPRZ         |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 880  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 960  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 700  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 1000 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 1200 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 1300 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 1500 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 1700 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 1900 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 2100 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 2300 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|              | 2500 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
In operation
21 units
(18,716 MW)

Under construction
7 units
(8,600 MW)

Kori
8 units

Ulchin
8 units

Wolseong
6 units

Yong-gwang
6 units

Doosan supply

Nuclear Plant in Korea
AP1000 Projects (Sanmen #1 RV)
AP1000 Projects (Sanmen #1 SG)
China Projects

Qinshan Phase III 1&2 (CANDU Reactor)

- Feeder/Header
- Steam Generator
- Pressurizer
- Major Heat Exchangers
- Fuelling Machine Bridge
- Others

Qinshan II Unit 3

- Reactor Vessel
**RSG/RPZR Projects**

- **Sequoyah 1 & 2**
  Steam Generators

- **Watts Bar 1**
  Steam Generator

- **Arkansas Nuclear One 2**
  Pressurizer

- **Kori 1**
  Steam Generator

- **Ulchin 1&2**
  Steam Generators (under fab.)
Various Types of RVs

- **650 MWe** (Qinshan/ China)
- **950 MWe** (Ulchin #1,2/ Korea)
- **1,000 MWe** (OPR1000/ Korea)
- **1,400 MWe** (APR1400/ Korea)
- **1000 MWe** (AP1000/ China, U.S.A)
Various Types of SGs

- 700 MWe CANDU
- 587 MWe Kori#1 RSG
- 950 Mwe Ulchin #1,2 RSG
- 1,174 MWe Sequoyah #1&2 RSG
- 1,167 MWe Watts Bar#1 RSG
- 1,000 MWe OPR1000
- 1,400 MWe APR1400
- 1,000 MWe AP1000
Supplied Units of Major Equipment

**Reactor Vessels**
- Units Completed:
  - ~’05: 14
  - ’06 ~ ’10: 5
  - ’11 ~ ‘15: 19
- Under fabrication:
  - ’11 ~ ‘15: 11

**Steam Generators**
- Sets Completed:
  - ~’05: 54
  - ’06 ~ ’10: 18
  - ’11 ~ ‘16: 72
- Under fabrication:
  - ’11 ~ ‘16: 28
Thank you!