Nuclear Power Development
History and Self-Reliance Practice in China

August, 2013
Rio, Brazil

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1. China Nuclear Power Development History
1.1 History

China’s nuclear industry originated from the end of 1950s, when Peking University and Tsinghua University successively offered disciplines of nuclear science and nuclear engineering. After 60 years of development, China has established a complete nuclear industry system.

Chinese government decided to develop 300MWe PWR nuclear power in 1970 and completed research, verification and engineering design after 15-year exploration and innovation.

Qinshan Phase 1, 300 Mwe NPP, the first nuclear power plant in China, started Construction on March 20, 1985, connected to the grid on December 15, 1991. Qinshan Phase 2, 650MWe PWR, designed and built by China then.
1.1 History

◆ Per request of the Pakistani government, China built Chashma NPP on the basis of 300MWe nuclear power units. The first unit was connected to the grid on June 13, 2000. IAEA commented that the Chashma NPP met international standards and was safe and reliable. Afterwards, Pakistan built Chashma NPP Unit 2, 3 and 4 in succession.

◆ Chinese introduced French M310 PWR to build Daya Bay and Lingao NPP; Canadian CANDU PHWR to build Qinshan Phase 3 NPP and Russian VVER PWR to build Tianwan NPP.
China has 17 units in operation until July 2013, 14000MWe, with safe operation for more than 20 years. Globally 65 units, China 28 units under construction, 28000MWe.

- By 2015, installed nuclear power capacity would reach **40GW**, with 18GW under construction. By 2020, installed nuclear power capacity would reach **58GW**, with **30GW** under construction.
- It is required that new NPP projects should apply the highest safety standard in the world and must conform to G3 safety standards.
- Technology route decided: New NPP projects will mainly be AP1000 or innovated technology based on AP1000.
2. China AP1000 Self-Reliance Supporting Project Construction Practice
1.1 Background

- Since 2003, Chinese government had organized international bidding for 3rd generation nuclear power technology.
- After more than 3 years of rigorous and scientific verification by experts, China finally decided to introduce AP1000 advanced passive nuclear power technology from American Westinghouse and cooperate with Westinghouse to build 4 self-reliance supporting project units.
- SNPTC was formally founded in May 2007 to execute these self-reliance NPP projects. Its two primary subsidiaries: SNERDI was founded in 1970, focus on nuclear engineering & research; SDEPCI were founded in 1958, focus on EPC & PM.
1.2 SNPTC Roles in First 4 Units AP1000 in the world

- On behalf of China, SNPTC signed contract of AP1000 technology transfer, project engineering and main component supply with Westinghouse consortium.
- EPC Construction of 4 units
- Technology transfer (TT)
- Innovation on the basis of TT
- (SNPTC launched the research and development of CAP1400 in 2007.)
1.2 SNPTC Roles in First 4 Units AP1000 in the world

Target schedule:

• Sanmen Unit 1 connection to grid by the end of October, 2014
• Haiyang Unit 1 connection to grid by the end of December, 2014

Locations of Sanmen & Haiyang AP1000 Projects
1.2 SNPTC Roles in First 4 Units AP1000 in the world

Current Sanmen Unit 1 bird’s-eye view

Aug 13, 2013
1.3 SNPTC Roles in China Follow-on AP1000 Projects

- SNPTC will be the EPC contractor for China AP1000 follow-on projects.

- SNPTC is negotiating contracts for 8 units with the owners of Sanmen Phase 2, Haiyang Phase 2, Lufeng Project and Xudapu Project.

- PSAR of Sanmen Phase 2 and Haiyang Phase 2 projects are under review.
## 1.4 SNPTC Experience

After 6 years of the self-reliance projects, SNPTC and its subsidiaries have built up capacities in following areas:

<table>
<thead>
<tr>
<th>Capacity Area</th>
<th>Company</th>
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</thead>
<tbody>
<tr>
<td>NI Engineering &amp; Design</td>
<td>✔ Shanghai Nuclear Engineering Research and Design Institute</td>
</tr>
<tr>
<td>CI Engineering &amp; Design</td>
<td>✔ State Nuclear Power Planning Design &amp; Research Institute</td>
</tr>
<tr>
<td>EPC &amp; Project Management</td>
<td>✔ State Nuclear Power Engineering Company</td>
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<td></td>
<td>✔ Shandong Electric Power Engineering Consulting Institute</td>
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<td>Equipment Manufacturing</td>
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<td>Fuel Supply</td>
<td>✔ State Nuclear Baotai Zirconium Industry Company</td>
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<td>✔ State Nuclear WEC Zirconium Hafnium Company</td>
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<tr>
<td>Instrumentation &amp; Control</td>
<td>✔ State Nuclear Power Automation System Engineering Company</td>
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<tr>
<td>Operation &amp; Maintenance</td>
<td>✔ State Nuclear Power Plant Service Company</td>
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<tr>
<td>NPP Operation</td>
<td>✔ State Nuclear Power Demonstration Plant Company</td>
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</tbody>
</table>
1. 4 SNPTC Experience

During AP1000 execution, SNPTC and Chinese nuclear industry have gained rich experience in:

• Modular construction
• Main equipment manufacturing
• Equipment qualification
• Project management
• Material localized substitution

Per request of Shaw Group, the first group of 6 senior engineers from SNPTC will be sent to Vogtle AP1000 NPP site in US to share their experience by participating in project management.
3. CAP1400: China Advanced Passive 1400 Nuclear Power Technology
1.1 What’s CAP1400

Chinese government decided to implement the “Science & Technology Major Project of Large Advanced PWR Nuclear Power Plant”, incorporating the independent innovation and development of nuclear power technology into the national strategy of building an innovative country.

This major project aims to, based upon the established experience concerning R&D, designing, construction and operation of PWR nuclear power plants within China, develop large advanced PWR nuclear power technology in an independent manner, and to build the CAP1400 Demonstration Project.
1.1 What’s CAP1400

- CAP 1400 is named China Advanced Passive 1400.
- A two-loop advanced passive pressurized water reactor nuclear power technology, with a generating capacity about 1500 MWe for a single unit, researched and developed by SNPTC based on the assimilation of AP1000 technology.
- CAP1400 further enhances nuclear safety and plant economic competitiveness, improves environmental compatibility and optimizes the convenience for operation & maintenance.
- CAP1400 meets the latest international and Chinese requirements for nuclear power plant accidents following the Fukushima crisis.
1.2 SNPTC Roles in China CAP1400 Projects

- Owner and operator of demonstration plant
- Owner of intellectual property
- Platform of technology innovation
- In charge of the engineering, project management
- Main entity for overseas market development for CAP 1400
1.3 Key milestones of CAP1400 demonstration plant

- **2010** Conceptual Design Completed
- **2011** Basic Design Completed
- **2014** First Concrete
- **2018** Connected to Grid
- **Shidao Bay**
4. Conclusion
SNPTC has rich experience on introduction, digestion, absorption and re-innovation of nuclear technology, as well as Localization.

SNPTC is happy to share G3 nuclear power experience and lesson learned with Brazil.

SNPTC is ready to participate in the nuclear power program in Brazil, by providing the most advanced and safest G3 nuclear power technology – CAP1400.

SNPTC welcomes Brazil government, industries and universities to visit China’s AP1000 and CAP1400 sites and manufacturers for first-hand information and further exchanges.
5. CAP1400 Video
Safe Nuclear Power
Together Created

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Thank you!