Westinghouse AP1000® PWR: Meeting Customer Commitments and Market Needs in Europe

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Europe, Middle East & Africa

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Outline

• Westinghouse Overview

• Global Market Assessment

• **AP1000** Features
  – Safe, Simple and Standardized
  – Operations & Maintenance (O&M)
  – Certainty, Opportunity

• **AP1000** Construction Update
Our Business Today: Four Product Lines ...

Engineering And Large Projects

Nuclear Power Plants

Nuclear Fuel

Nuclear Automation And Field Services
Westinghouse in Europe Today

• Westinghouse technology is the basis for over one-half of Europe's operating nuclear plants.
• Westinghouse has more than 4,000 employees in the EMEA Region.
• Two nuclear fuel facilities (Springfields & Västeras).
• EMEA operations in:
  – **Belgium:** Brussels, Nivelles
  – **Bulgaria:** Sofia
  – **Czech Republic:** Prague, Temelín
  – **France:** Orsay, Marseille
  – **Germany:** Mannheim
  – **Spain:** Madrid, Tarragona
  – **Sweden:** Västeras, Täby
  – **Ukraine:** Kiev, Kharkov
  – **United Kingdom:** Chorley, Springfields
  – **South Africa:** Capetown, Johanesburg
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Global Market Assessment

● **New plant construction is proceeding worldwide**
  – 70 nuclear reactors currently under construction around the globe
  – Westinghouse **AP1000** projects underway in China (4), United States (4)

● **Additional nuclear demand has been delayed**
  – Global recession
  – Low natural gas prices in North America
  – Low interest in low-carbon energy policies
  – Fukushima

● **Long-term nuclear demand strong; additional 250GW by 2030**
  – Carbon-constrained world
  – Replacement of aging infrastructure
  – Development of emerging economies
  – Intermittent renewable energy delivery
  – Natural gas dependence and volatility
Global Interest in New Nuclear Plants Continues...

Westinghouse New Plant Activity

Active  Near-Term Opportunities
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AP1000 Plant:
Simple, Practical, Standardized and Innovative

The AP1000 Plant is Different!
Innovative Passive Safety Features

**Passive Safety-Related Systems**
- Use “passive” processes only; no active pumps, diesels ....
- One-time alignment of valves
- No support systems required after actuation
- Greatly reduced dependency on operator actions

**Active Defense in Depth-Related Systems**
- Reliably support normal operation
- Redundant equipment powered by onsite diesels
- Minimize challenges to passive safety systems
- Not necessary to mitigate design basis accidents
Simplification of Design

- Reduces seismic category 1 buildings
- 80% less concrete and rebar
- Safety rated equipment within nuclear island

- Eliminates components, reduces cost
- Reduces construction, O&M, D&D costs
- Localizes supply chain (greater percentage of non-safety related components)

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<thead>
<tr>
<th></th>
<th>Concrete, m³</th>
<th>Rebar, metric tons</th>
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<tbody>
<tr>
<td>Active plant</td>
<td>400,000</td>
<td>60,000</td>
</tr>
<tr>
<td>AP1000</td>
<td>&lt;100,000</td>
<td>&lt;12,000</td>
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Modular and Open-Top Construction

- More than 300 modules
- Reduces construction schedule
- Reduces construction costs
- Takes operations off site
- Mitigates harsh site conditions
- Increases control of quality

Site Development: 18 months
Construction: 36 - 48 months
Commissioning: 6 months
AP1000: A Case Study

Modules Designed into AP1000 from the Beginning

<table>
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<tr>
<th>Module Type</th>
<th>Number</th>
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<tbody>
<tr>
<td>Structural</td>
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<tr>
<td>Piping</td>
<td>154</td>
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<tr>
<td>Mechanical Equipment</td>
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<tr>
<td>Electrical Equipment</td>
<td>11</td>
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<tr>
<td>TOTAL</td>
<td>342</td>
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Regulatory Certainty

- EUR confirms **AP1000** can be successfully deployed in Europe (May 2007).

- **AP1000 only Generation III+** commercial reactor to receive Design Certification from the U.S. Nuclear Regulatory Commission (NRC) (December 2011).

- Most **thoroughly reviewed and tested plant design (AP1000)** in the history of the U.S. NRC.

- UK interim Design **Acceptance Confirmation** (December 2011).
AP1000 Offers Improved and More Efficient Operations

- Lower staffing requirements.
- Lower annual O&M costs than benchmark LWRs.
- Minimized waste generation.
- Lower spare parts inventory requirements.
- Projected long-term high availability factor.
- Shorter outage periods.
- Most equipment and commodities are non-nuclear safety class.
- Excellent leak-free plant rate for Westinghouse-supplied fuel.
Localization is a Key **AP1000** Plant Feature

Local companies can deliver **60-70%** of an AP1000 plant project

Westinghouse has a proven and reliable experience of technology transfer
AP1000 Plant Sets the Standard in Design and Construction

- **Standard Design**: lessons learned from initial units transferred to future units
- **Passive design**: smaller footprint and less plant & equipment
- **Modular Design**: improves QC and shortens construction schedule
- **Horizontal supply chain**: reduces costs and eliminates shortages of key components

Experience from building **eight plants simultaneously** in China and the U.S. will provide valuable insights as additional plants are built across the world.
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AP1000® Plant Global Fleet Delivery

**AP1000** units under construction worldwide
- Four units in China
- Four units in the United States
- Eight additional units in China to begin late 2013
AP1000 Plant Delivery: China Highlights

- Major equipment delivered and installed at Sanmen Unit 1 and Haiyang Unit 1 includes:
  - Reactor Vessel
  - Steam Generators
  - Reactor Vessel Internals
  - Polar Crane
  - Integrated Head Package
- Containment Vessel Top Head (CVTH) was set at Sanmen Unit 1 on January 29, 2013, and Haiyang Unit 1 on March 29, 2013.
- Digital I&C delivery and installation is in progress.
- Two classes of potential Sanmen operators have completed simulator training; Haiyang operators start simulator training in July.
Sanmen Site Progress: Time Lapse View

2009 to 2013
AP1000 Plant Delivery: U.S. Highlights

- First nuclear concrete (FNC) placement completed in March 2013 for V.C. Summer Unit 2 and Vogtle Unit 3.
- CR10 module, the support structure for the Containment Vessel Bottom Head (CVBH), installed in April 2013 at V.C. Summer Unit 2 and Vogtle Unit 3.
- CVBH installed May 22 at V.C. Summer Unit 2 and June 1 at Vogtle Unit 3.
- Assembly of CV rings and condensers for initial units in progress at both sites.
- Cooling towers under construction for initial units at both sites.
- Component and module fabrication proceeding.
AP1000 Plant Global Fleet

FCD 2009
Sanmen 1

FCD 2009
Haiyang 1

FCD 2009
Sanmen 2

FCD 2010
Haiyang 2

FCD 2013
V.C. Summer 2

FCD 2013
Vogtle 3

FCD 2013
V.C. Summer 3

FCD 2013
Vogtle 4

FCDs 2013/14
Xudapu 1&2

FCDs 2013/14
Lufeng 1&2

FCDs 2014/15
Sanmen 3&4

FCDs 2014/15
Haiyang 3&4
SMR: An Alternative Clean, Economic Generation Source for Rapidly Changing, Diverse Markets

● **Best opportunity for cost competitiveness**
  – Most power with the least amount of material: >225 MWe
  – Fully modular design
  – Plant modules that are installed, not constructed
  – Rail and truck transportable

● **Speed to market**
  – Proven ability to design, license and deploy reactors
  – Existing technical skills, licensed technologies and supply chain
  – Designing to eliminate supply chain bottlenecks
  – Leveraging AP1000 plant experience and lessons learned

Safety and simplicity. Proven technologies in an innovative package.
Summary

- Westinghouse has a strong footprint on both sides of the Atlantic and is preparing for continued success in Europe with strong regional partners.
- Positive support remains for new nuclear build.
- The AP1000 PWR:
  - features innovative passive safety systems
  - builds and improves upon established technology
  - saves money and time with a simplified plant design and an accelerated construction time period
- The AP1000 was developed to help reduce uncertainties for customers, and to provide a high degree of confidence that nuclear can be a good long-term investment.
- Construction projects are progressing in China and the U.S.

The AP1000 will bring back the trust of the Financial Community to Nuclear New Build.
A Toshiba Group Company

You can be sure... if it's Westinghouse