Westinghouse
Small Modular Reactor
Design and Application

Ryan Blinn
Manager, SMR Technical Development
Westinghouse Electric Company

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The Westinghouse Vision

Westinghouse will be the first to deploy a safe, economic SMR to meet the many needs of existing and new to nuclear customers

- Working within constraints
  - Land, grid, cooling water, financing, distributed service territory

- Offering clean energy
  - Offset owner costs for infrastructure development: land, cooling, T&D
  - Generation diversity
  - Operational flexibility

- Providing project certainty
  - Reduced licensing risk
  - Short-construction durations
  - Cost predictability and certainty

New applications for nuclear...

Aging Fossil Plants
District Heating
Remote Markets
Small Grid Markets
Desalination
Process Heat
Westinghouse SMR Product Philosophy

Best opportunity for cost competitiveness

- Most power with the least amount of material
- Fully-modular design
- Plant modules that are installed, not constructed
- Rail & truck transportable

Speed to market

- Proven ability to design, license & deploy reactors
- Existing technical skills, licensed technologies & supply chain
- Designing to eliminate supply chain bottlenecks
- Leveraging AP1000® plant development and lessons learned

Westinghouse is leveraging its recent experience to achieve these goals with the SMR
SMR Development & Licensing Collaboration

- Westinghouse is partnered with the NexStart SMR Alliance to seek up to $452 million in U.S. Department of Energy funds targeted to aid the development of small modular reactors.
Commercial Deployment in Canada

• **Market/Customer Base**
  – Ideal for the replacement of coal-fired generation baseload units
  – Applications in remote locations for electricity and process heat (e.g., oil sands)

• **Canadian Content**
  – Increased Westinghouse focus on Canadian market
    – Westinghouse Electric Canada, Inc. subsidiary formed earlier this year for Nuclear Services support and **AP1000** & SMR Business Development activities
    – $70+ million spent with Canadian suppliers over the past 5 years, increasing at ~10% annually – Buy Where We Build

• **Licensing the SMR in Canada**
  – Will build on licensing efforts of the **AP1000** with the CNSC
  – Commercial operation date for SMR in Canada – early 2020s
The Westinghouse SMR

- An integral PWR
- Innovative packaging of proven components
- The highest levels of safety with fewer accident scenarios
- Industry-proven system designs
- Compact reactor coolant system and containment
- An engineered solution for today’s clean energy challenges

The Most Economic SMR Design
Westinghouse SMR Plant Design

- Single > 225 MWe reactor (standalone plant design)
- Fuel – Modification of standard Westinghouse product (17x17 RFA)
- Forced flow with 8 reactor coolant pumps
- Internal CRDMs
- Compact/high pressure containment vessel below grade
- Recirculating straight tube steam generator with steam drum location outside of the containment vessel
- 24-month cycle length
- Spent fuel pool below grade
- Load follow capability
- Total site area: 15 acres
Existing Designs used in the SMR

• Fuel Assemblies
  – Based on existing Westinghouse design with decades of proven performance

• Internal CRDMs
  – Three-coil magnetic jack-based AP1000 design with high-temperature modifications

• Reactor Vessel Internals
  – Referencing detailed designs from AP1000 with addition of patented intermediate ring from previous small reactor programs
Leveraging Passive Safety in our Design

• 7 Days of Passive Heat Removal with Onsite Inventory
  – Capability to add additional water inventory for indefinite cooling

• 100% reliance on natural forces
  – Evaporation, condensation, gravity

www.westinghousenuclear.com/smr
Driving Down Plant Costs

25 Westinghouse SMR Containment Vessels fit in a single AP1000® Containment Vessel

215 ft.

130 ft.
SMR Plant Layout

Site Requirement: Less than 15 Acres

- **Annex Building:**
  - Security
  - Offices
  - Restrooms
  - RCA entry

- **Turbine Building:**
  - Turbine system
  - Auxiliary systems
  - Drain systems

- **Nuclear Island:**
  - Containment and reactor
  - Safety-related systems
  - Defense-in-depth systems
  - Radwaste systems
  - Control room
  - HVAC

- **Radwaste Building:**
  - Hot machine shop
  - Low level radwaste storage
  - Truck bay
Westinghouse Project Certainty

• **Product Design**
  – Leveraging 50+ years of nuclear design & operating plant experience
  – Most power with the least amount of material
  – Simplified modular design with less on-site assembly
  – Shortened installation duration – 18-24 months

• **Licensing Experience**
  – 3 *certified* ALWR designs, licensed fuel designs
  – Regulatory requirements understood, multitude of licensed topical reports
  – Valued relationships with US NRC and CNSC

• **Project Implementation**
  – Continuous, successful reactor deployment experience
  – Established resources and organization for deployment
Thank You!