Westinghouse Status Update

Highlighting the Value of Nuclear Energy and Small Modular Reactors (SMRs) to the U.S. and World

Presented by Michael Richard
Director, Government and International Affairs
Westinghouse Electric Company
Westinghouse Electric Company

- Westinghouse Electric Company provides fuel, services, technology, plant designs and equipment to utility customers in the worldwide commercial nuclear electric power industry
- More than 60 years of nuclear experience
- Nearly 50 percent of the nuclear power plants in operation worldwide, and nearly 60 percent in the United States, are based on Westinghouse technology
- We are only company operating under the name of George Westinghouse’s original company
The Need for Nuclear Continues to Exist

Key Drivers – Not Just An Economic Calculus:

• Energy security/energy independence
• Clean, safe base-load source of energy
• Significant source of jobs and economic benefit
• Long-term reliable energy source/Low operating costs
Moving from a Traditional Loop Design to a Small Modular Reactor

Light Water Reactor (LWR) Integral Reactor Designs provide Enhanced Safety and the Opportunity for Competitive Economics
Why Small Modular Reactors?

- LWR SMRs will **complement large-scale projects**
- SMRs employ enhanced safety/robustness from **simplified designs**
- **Modular construction** will allow these reactors to be built in a controlled factory setting and installed module by module
- SMRs are more **compatible with the needs of smaller utilities**
Benefits of Small Modular Reactors

Ease of Licensing – Enhanced Safety/Security
- Shift from active to passive safety systems
- Smaller source term
- Reactor & safety systems below ground
- Innovative packaging using proven technology and components

Ease of Financing
- Smaller capital cost
- Shorter development time to first revenue
- Lower levelized costs (¢/KWh)

Ease of Deployment
- Simplified on-site assembly
- Shorter deployment times
- Better matching to electricity demand

SMRs have the potential to be a very attractive safe clean economic option...but it will take a joining of vendors, customers, and government to achieve a standardized and factory-built plant
Westinghouse’s SMR 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

Enhanced Safety and Security
- Tested licensed Passive Safety Systems
- Reactor & safety systems below ground

Best opportunity for cost competitiveness
- Most power with the least amount of material
- Single >225 MWe Integral PWR
- Fully modular design using proven technology
- Plant modules are installed in 18 months
- Rail, truck and barge transportable

Speed to market
- Proven ability to design, license & deploy reactors
- Existing supply chain, technical skills & licensed technologies
- Eliminates supply chain bottlenecks
- Leveraging AP1000 plant experience and lessons learned
SMR Safety

• **7 Days of Passive Heat Removal with Onsite Inventory**
  – Capability to add additional inventory to Ultimate Heat Sink (UHS) tanks for indefinite cooling

• **100% reliance on natural forces**
  – Evaporation
  – Condensation
  – Gravity
How Small is Small?

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

Westinghouse SMR NSSS island fits in the AP1000 shield building
SMR Plant Layout Containment Vessel
U.S. Nuclear Leadership

- It is critical for the U.S. to support industry in the development, licensing and deployment of next generation clean economic reactor technology

- World competition is quickly growing and the U.S. needs to be first to market with SMR technology

- What’s at stake is U.S. global leadership in advanced nuclear technology, standards, safety, regulatory standards and economic development

- Working closely with U.S. vendors and manufacturers the Westinghouse SMR will be 100% sourced from the U.S. and U.S. universities are providing the capabilities and skills needed to support testing and analyses for design and licensing

- The development of a U.S. SMR infrastructure, promoting a U.S. supply chain and utilizing advanced manufacturing techniques, will export SMRs to a global market and create a tremendous number of new U.S. jobs!
Government/Private Collaboration

- Support Public-Private Partnerships for Expediting SMR Deployment
  - Small Modular Reactor Funding Opportunity Announcement (FOA)
    - Westinghouse and Ameren MO applied for the 1st SMR FOA
  - Production tax credits
  - Loan guarantees
- Support resource requirements for NRC Licensing efforts and efforts to streamline the licensing process – Focus Areas for SMR Licensing:
  - Integral Reactors/Enhanced Passive Safety
  - Emergency Planning Zone (EPZ)
  - Optimized Staffing Levels
- Provide support for new nuclear R&D
  - Advanced Construction (Modularization)
  - Advanced Manufacturing
  - Advanced Fuel
  - Advanced Materials
- Development of new Codes and Standards

Development and licensing of new nuclear projects is a heavy lift and the industry needs government support and tax payer investment to share the risk and to be competitive with other country sponsored developers.

The justification is a return to the country in terms of economic development and U.S. jobs, as shown with the success of the NP2010 program.
Westinghouse Alliance in Support of First Deployment in U.S.

- On April 19th, Westinghouse and all of Missouri’s electric service providers (cooperative, municipal and investor-owned) announced an unprecedented alliance to partner together to support first deployment of an SMR in the U.S.
  - Westinghouse and Ameren stated in their DOE SMR FOA proposal a commercial operation date (COD) of 2021
- Westinghouse will seek design certification for its SMR from NRC
- Ameren Missouri will be the first utility in the country to seek a Combined Construction and Operating License (COL) from the NRC for the Westinghouse SMR
- Westinghouse will explore SMR economic development opportunities in Missouri, including training, design, and manufacturing and innovative research and education programs
Thank You

AP1000 is a trademark or registered trademark of Westinghouse Electric Company LLC, its affiliates and/or its subsidiaries in the United States of America and may be registered in other countries throughout the world. All rights reserved. Unauthorized use is strictly prohibited. Other names may be trademarks of their respective owners.