WESTINGHOUSE ELECTRIC COMPANY

Innovating and Delivering for the Future of Nuclear Power

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Westinghouse Non-Proprietary Class 3

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WESTINGHOUSE HISTORY

- Founded by George Westinghouse in 1886
- Westinghouse established 59 other companies
- He received over 360 patents for his work
- Responsible for some of the world’s greatest advances in energy technology
- World’s first commercial pressurized water reactor (PWR) in 1957 in Shippingport, Pennsylvania, U.S.

THE INNOVATION CONTINUES

130 YEARS LATER
Westinghouse continues to drive nuclear research & development:

- Focused on technology exploration and development to deliver value for our customers and enable Westinghouse growth
- A broad portfolio of commercially driven innovation projects
- Works across the global Westinghouse organization and with our industry partners to develop products and services for both future and existing clean energy markets
## COMPREHENSIVE PORTFOLIO OF PRODUCTS & SERVICES

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<thead>
<tr>
<th>Nuclear Fuel</th>
<th>Instrumentation and Control</th>
<th>Staffing Services</th>
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<td>Components and Manufacturing</td>
<td>Field Services and Plant Modifications</td>
<td>New Plants</td>
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<td>Engineering Services</td>
<td>Decontamination &amp; Decommissioning Solutions</td>
<td>Stone &amp; Webster</td>
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Multiple Paths for Nuclear Power’s Future

Commercial Nuclear Power Solutions Need to be Adaptable

- There is an increasing desire to look for smaller power plants as a solution
  - SMRs
  - Micro-Reactors
- Large new power plants like AP1000 still have place in meeting electricity demands
Multiple Paths for Nuclear Power’s Future

Commercial Nuclear Power Solutions Need to be Adaptable

- Asset preservation through license renewal and long-term operations (LTO)
  - For example, in the US 87 of the 98 currently operating plants have been granted license renewals (40 to 60 years)
  - Subsequent License Renewal (SLR) applications have now been submitted (60 to 80 years)

License Renewals Granted for Operating Nuclear Power Reactors

Licensed to Operate (98)
- Original License (11)  - License Renewal Granted (87)

Note: The NRC has issued a total of 91 license renewals; four of these units have permanently shut down. Data are as of September 2018. For the most recent information, go to the Dataset Index Web page at https://www.nrc.gov/reading-rm/doc-collections/datasets/.

Source – US NRC Website
AP1000® Plant

Completed Westinghouse AP1000® Reactors

In early 2019, Westinghouse completed four AP1000 nuclear power plants at the Sanmen and Haiyang, China sites.

Each site has two AP1000 units, all of which safely and successfully achieved commercial operation.
New Plants

The Westinghouse AP1000® plant, a Generation III+ two-loop pressurized water reactor (PWR), is considered the most advanced commercially available plant, offering an industry-leading design featuring passive safety systems.

Westinghouse provides the development, licensing, detailed engineering, project management, component manufacturing and startup support for new nuclear power plants.

Westinghouse currently has two AP1000® units progressing through construction at the Alvin W. Vogtle Electric Generating Plant near Waynesboro, Georgia, U.S.
Westinghouse eVinci™ Micro Reactor

Product attributes:

- Combined heat & power: 0.2-5 MWe, up to 600ºC
- Transportable energy generator
- Fully factory built, fueled and assembled
- Up to 10-year life
- < 1 month onsite installation
- Inherent safety
- High proliferation resistance
- Physics-based with no operator action or mechanical actuations
- Autonomous load-follow capability
- Heat pipe technology
- Solid monolithic core block
- Minimal moving parts
- Greenfield decommissioning

Demonstration Strategy

- 2019: 2 years Electrical Demonstration Unit (EDU)
- 2021: 3 years Nuclear Demonstration Unit (NDU)
LWR-SMR

- Westinghouse, EDF, & CEA signed a Framework Agreement for SMR Collaboration at IAEA General Conference
  - Agreement signed by each party’s chief executive
  - Aligns support from French and US Governments
- Additional French partners, TechnicAtome & Naval Group, are supporting the collaboration
# Long-Term Operations and License Extension

## Years of Operation

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## License Extension

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## Plant Asset Management

- **RCP**
- **SG**
- **RVH**
- **MRF-227**
- **I&C NS SYSTEM**
- **CAPSULES**
- **TURBINES**
- **GENERATORS**
- **FEEDWATER HTRS**

## Workforce Optimization & Management

- **INSPECTIONS**
- **MONITORING**
- **WORKFORCE OPTIONS – CO-SOURCE, DIGITIZATION, PROCESS INNOVATION, SMART SYS**
- **TRAINING**

## Performance Improvement

- **UPGRADES – SHUTDOWN SEAL, FMS, SIMPLIFIED RVH, UPGRADE RVH**
- **EFFICIENCY IMPROVEMENTS – SIGMA SEAL, RISK-INFORMED OPERATIONS, SUBCRITICAL STARTUP TESTING**
New Nuclear Horizons

- **INAC’s theme “New Nuclear Horizons: Fueling our Future” is very appropriate for Brazil at this time**
  - Angra 1 has 35 years of operation and planning to extend its operating license to 2044
  - Angra 3 completion is a Brazilian government priority
  - Brazil is seriously considering a long term energy plan that will add new nuclear power plants
Thank You