NuScale Power
Small Modular Reactors

World Nuclear Exhibition
Paris, France
Mike McGough, Chief Commercial Officer
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NuScale Power History

- NuScale first of current US SMRs to begin design of commercial NPP.
- NuScale technology in development and design since 2000 (DOE) MASLWR program, with INL, lessons from AP600/1000 ¼-scale testing facility built and operational
- Electrically-heated 1/3-scale Integral test facility first operational in 2003
- Began NRC design certification (DC) pre-application project in April 2008
- Acquired by Fluor in October 2011
- US DOE SMR Grant Awardee, 12/12/13
- ~380 FTE’s currently on project, ~$230MM spent project life-to-date
- ~35 positions currently open, adding 100+
- 158 patents pending/granted, 17 countries
$217MM over 5 years
- NuScale matches DOE contribution
- Design Engineering and Testing
- Design Certification Application (DCA)
- Design Certification Process
A NuScale Power Module (NPM) includes the reactor vessel, steam generators, pressurizer and containment in an integral package that eliminates reactor coolant pumps and large bore piping (no LB-LOCA).

Each NPM is 50 MWe and factory built for easy transport and installation.

Each NPM has its own skid-mounted steam turbine-generator and condenser.

- Each NPM is installed below-grade in a seismically robust, steel-lined, concrete pool.
- NPMs can be incrementally added to match load growth - up to 12 NPMs for 600 MWe gross (~570 net) total output.

What is a NuScale Power Module?
Comparison size envelope of new nuclear plants currently under construction in the United States

126 NuScale Power Modules

Typical Pressurized Water Reactor

NuScale’s combined containment vessel and reactor system

*Source: NRC
Coolant Flow Driven By Physics

**Convection** – energy from the nuclear reaction heats the primary reactor coolant causing it to rise by convection and natural buoyancy through the riser, much like a chimney effect.

**Conduction** – heat is transferred through the walls of the tubes in the steam generator, heating the water (secondary coolant) inside them to turn it to steam. Primary water cools.

**Gravity** – colder (denser) primary coolant “falls” to bottom of reactor pressure vessel, cycle continues.
Site Aerial View

- annex building
- warehouse
- cooling towers A
- cooling towers B
- reactor building
- turbine building A
- turbine building B
- control building
- switchyard
- radwaste building
- ISFSI (dry cask storage)
- administration building
- security ingress/egress
- parking
- protected area
- fence
- controlled area
The Safety Case
NuScale design has achieved the “Triple Crown” for nuclear plant safety. The plant can safely shut-down and self-cool, indefinitely, with:

- **No Operator Action**
- **No AC or DC Power**
- **No Additional Water**

Safety valves align in their safest configuration on loss of all plant power.

Details of the Alternate System Fail-safe concept were presented to the NRC in December 2012.
Typical LWR Safety Systems

- **Systems and Components Needed to Protect the Core:**
  - Reactor Pressure Vessel
  - Containment Vessel
  - Reactor Coolant System
  - Decay Heat Removal System
  - Emergency Core Cooling System
  - Control Rod Drive System
  - Containment Isolation System
  - Ultimate Heat Sink
  - Residual Heat Removal System
  - Safety Injection System
  - Refueling Water Storage Tank
  - Condensate Storage Tank
  - Auxiliary Feedwater System
  - Emergency Service Water System
  - Hydrogen Recombiner or Ignition System
  - Containment Spray System
  - Reactor Coolant Pumps
  - Safety Related Electrical Distribution Systems
  - Alternative Off-site Power
  - Emergency Diesel Generators
  - Safety Related 1E Battery System
  - Anticipated Transient without Scram (ATWS) System
NuScale Safety Systems

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What About Customers?

- NuAB—NuScale Advisory Board
- 24 member firms representing nearly two-thirds of US installed nuclear capacity
- Plus international membership
- We have a line of sight to our first 12 projects
- COD Timing between now and 2030
• Western Initiative for Nuclear (WIN) is a multi-western state collaboration to deploy a series of NuScale Power Projects

• Involved Program WIN participants: NuScale, UAMPS, Energy Northwest, ID, UT, OR, WA, WY, AZ, NM?, MT?
Utah Associated Municipal Power Systems (UAMPS) Carbon Free Power Project (CFPP) will be first deployment, sited somewhere in Idaho.

UAMPS consists of 46 members serving load in 8 western states.
UAMPS CFPP Details

- First commercial project: State of Idaho
  Potential locations may include the DOE’s Idaho National Laboratory (INL) Site.

- Project known as UAMPS Carbon-Free Power Project (CFPP)

- Commercial operation in 2023.

- A 12-module plant (~574 MWe)

- Will provide immediate advantages to the Western region:
  ‣ Provide clean, affordable energy and professional jobs
  ‣ Demonstrate the operations and benefits of this SMR technology
  ‣ Act as a catalyst for subsequent Program WIN facilities throughout the Western states
Idaho Summit/Supplier’s Day

The inaugural Intermountain Energy Summit featured speakers and panel discussions focused on the future of energy policy and production in North America—particularly Idaho, Utah, Montana, Wyoming, Alberta and Saskatchewan.

✦ ~350 Summit Attendees/participants:
  ✦ Secretary Moniz
  ✦ Assistant Secretary Lyons
  ✦ Governor Otter
  ✦ Lt Governor Little
  ✦ Senator’s Risch and Crapo
  ✦ Congressman Simpson
  ✦ Mayor Casper

✦ NuScale Supplier’s Day event held in conjunction with the Intermountain Energy Summit—provided organizations in the nuclear industry supply chain with the understanding they need to help prepare to meet NuScale’s manufacturing requirements for the NuScale Power Module.
  ✦ 134 attendees
  ✦ 90 companies
  ✦ 37 states and 3 countries
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COMING SOON TO AN ELECTRIC GRID NEAR YOU!

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