Overview of NuScale Technology

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Deliberately Small for Safety and Affordability

**KEY: Scalable plant design based on robust 45 MWe module**

- Integral PWR design with natural circulation of primary coolant
- Steel containment vessel immersed in 4 million gallon pool
- Factory fabricated and truck transportable to site
- Staggered build-out to match demand growth and reduce cash outlay

540 MWe “12 Pack” Reference Plant

45 MWe Module
Passively Safe and Robust Modules

- **Natural Convection for Cooling**
  - Inherently safe natural circulation of water driven by gravity cools the nuclear fuel
  - No pumps required to continuously provide water for safety functions

- **Seismically Robust**
  - System is submerged in a pool of water below ground in an earthquake resistant building
  - Reactor pool attenuates ground motion and dissipates energy

- **Defense-in-Depth**
  - Multiple additional barriers to protect against the release of radiation to the environment

- Surface area to thermal power ratio **15 times larger** than typical PWR
- Water volume to thermal power ratio is **4 times larger resulting in better cooling**
- Reactor core has **only 5% of the fuel** of a large reactor

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NuScale nuclear power reactors are housed inside high strength (10x) steel containment vessels and submerged in 4 million gallons of water below ground level inside the Reactor Building.

The Reactor Building is designed to withstand earthquakes, floods, tornados, hurricane force winds, and aircraft impacts.

12-module, 540 MWe NuScale Plant

Any hydrogen released is trapped in containment vessel with little or no oxygen available to create a combustible mixture.

Reactor pool sufficiently large to provide all modules with 30-day supply of cooling water.
Decay Heat Removal From Containment

- Provides a means of removing core decay heat and limits containment pressure by:
  - Steam Condensation
  - Convective Heat Transfer
  - Heat Conduction
  - Sump Recirculation
- Reactor Vessel steam is vented through the reactor vent valves (flow limited)
- Steam condenses on containment
- Condensate collects in lower containment region
- Reactor Recirculation Valves open to provide recirculation path through the core
- Provides 30+ day cooling followed by indefinite period of air cooling.
Stable Long Term Cooling

Reactor and nuclear fuel cooled indefinitely without pumps or power

WATER COOLING

BOILING

AIR COOLING

No Pumps • No External Power • No External Water

Decay heat removed by steam generators and DHRS (3 Days)

Decay heat removed by containment (30 Days)

Transition to long-term air cooling (>30 Days)

TIME = POWER =

Decay Power (MWt)

1 sec 10 MWt
1 hour 2.2 MWt
1 day 1.1 MWt
3 days 0.8 MWt
30 days 0.4 MWt
Indefinite <0.4 MWt
Module Assembly Operations
Modularity Is Key to Scalability

Reference Plant: 12 modules @ 45 MWe each produces 540 MWe

Allows for staggered installation and refueling of modules

Cross-sectional View of Reactor Building
Incremental Build Out

- Initial Installation (270 MWe)
- Turbine Building and 6 Turbine Generators
- Cooling Towers
- Power Modules
- Installed: 6
NuScale Site layout
Innovation Requires Robust Testing Program

Fabricating and Testing Major Components
- Steam Generator
- Handling Equipment
- Control Rod Drive Mechanisms
- Passive Safety Systems

Separate Effect Tests
- Fuel Assembly Flow Testing
- Fuel Grid Structural Crush Testing
- Fuel Rod Critical Heat Flux Testing
- Containment High Pressure Condensation
- Steam Generator Heat Transfer Evaluation

Full System Safety Tests
- Valves
- Inspection Equipment
- Fuel Bundles
- Main Control Room