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The Small Modular Reactor

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Presentation to:
Southern States Energy Board (SSEB)

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1970-1980s U.S Nuclear Technology Dominance

- **France**
  - Framatome = France-America Atom, US Technology Transfer
- **Korea**
  - US Technology Transfer
- **China**
  - France (US) Technology Transfer
  - US Technology Transfer
- **Japan**
  - US Technology Transfer - 2x
- **Russia**
  - ???
- **Today**
  - New build: US, Middle East, India, China, Russia, Finland, France
  - Actively Considering: UK, Canada, Kazakhstan, South America, SEAsia, Africa, Middle East, Eastern Europe

Can the US Lead Again with Small Modular Reactors

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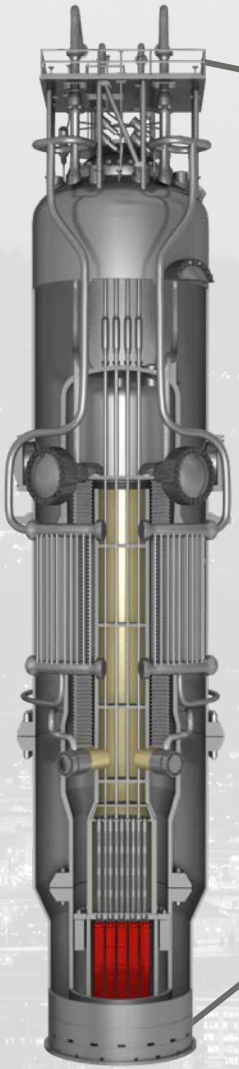
SMR Plant Site Overview



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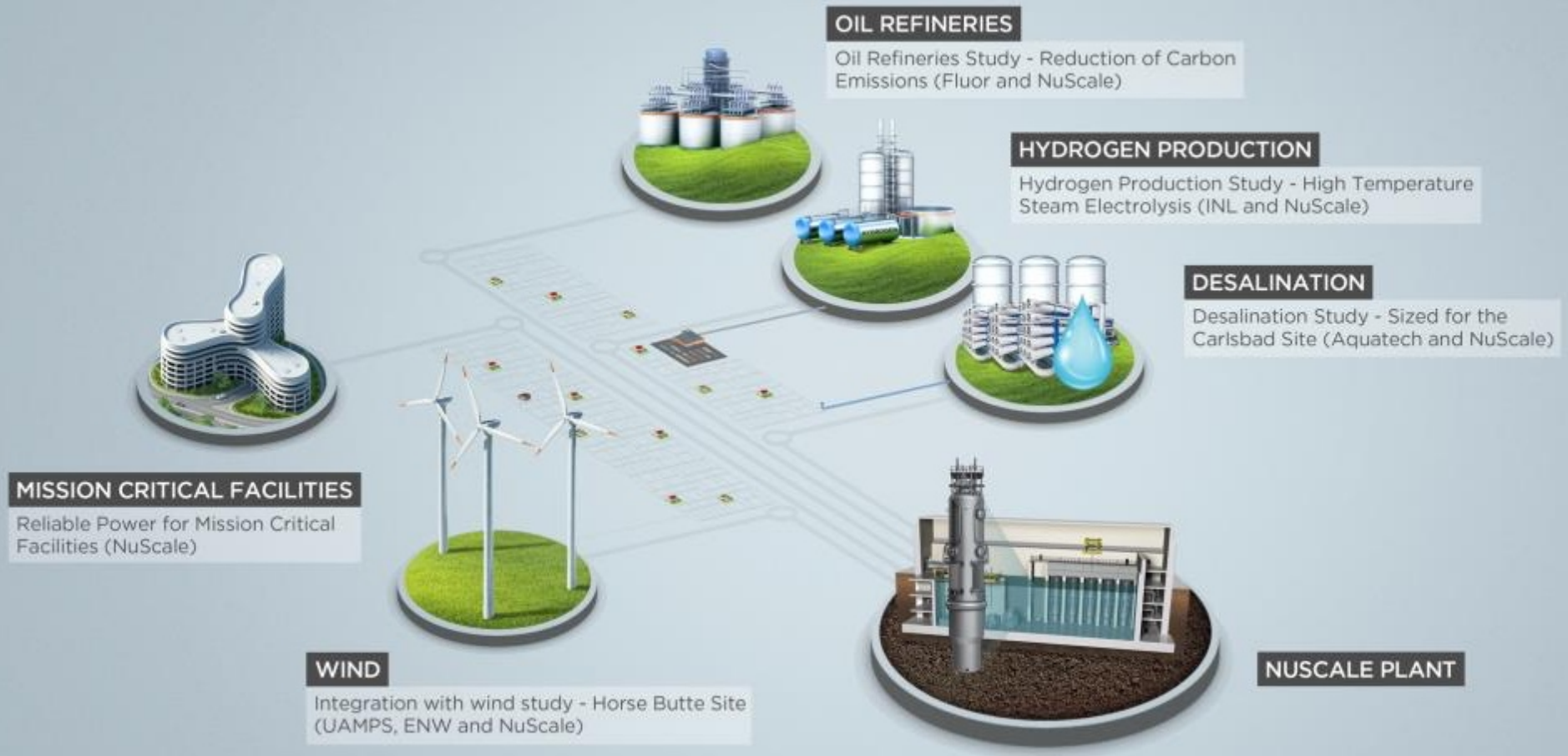
Beyond Electricity: Diverse Energy Platform



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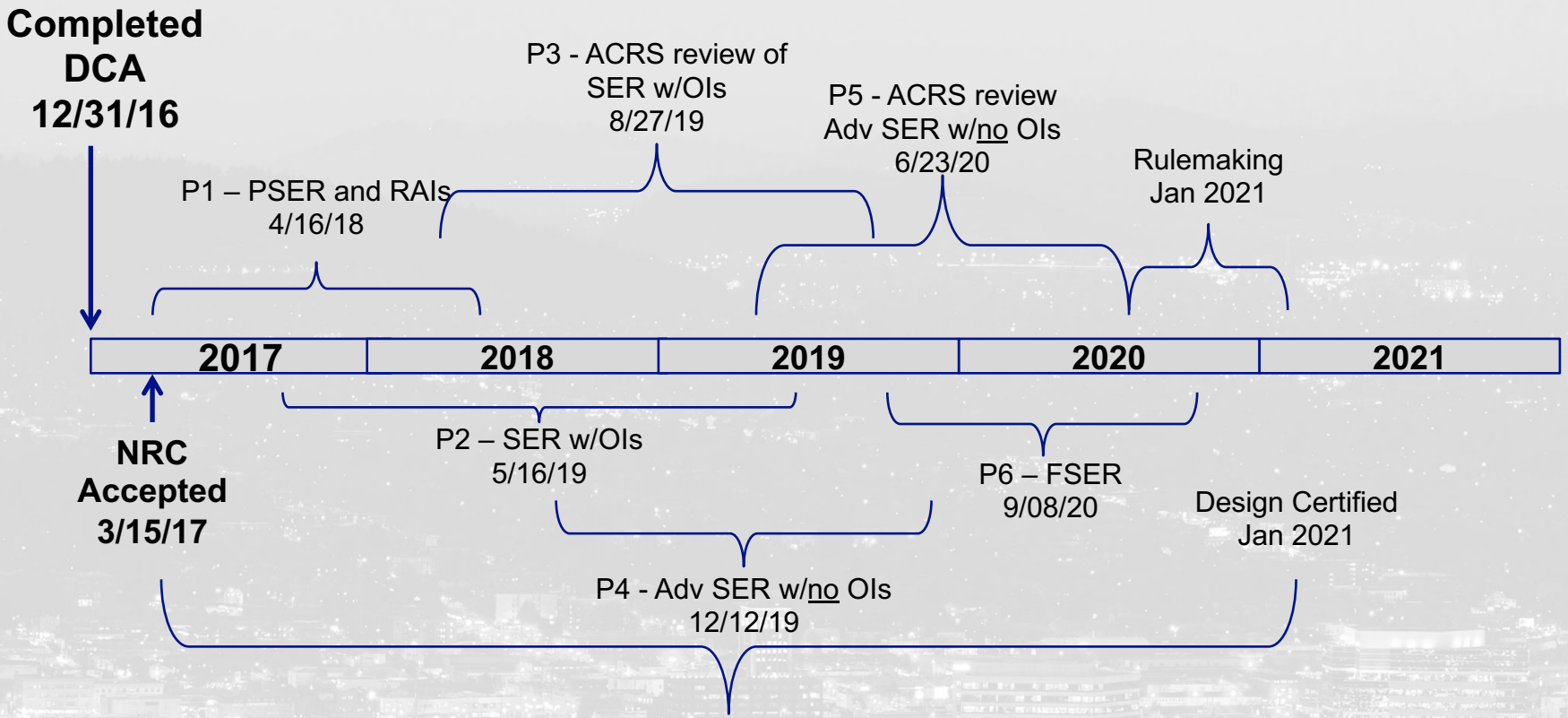
NRC Design Certification Review



Total projected duration for NRC review and approval - 46 months

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Key Successes

6

- **Emergency Planning Zone**
  - NRC staff agrees with NuScale methodology that for the first time EVER allows EPZs as small as site boundary depending on design
  - NRC staff audit concluded NuScale design met conditions for site boundary
- **Electrical systems**
  - First design EVER approved without need for safety-related electrical power
- **Digital Instrumentation and Control Systems**
  - Field Programmable Gate Arrays that do not use software or micro-processors and are therefore not vulnerable to internet cyber-attacks

SMR Resiliency

FERC's Proposed Definition: The ability to withstand and reduce the magnitude and/or duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event.

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NuScale SMR Plant Resiliency

- Island Mode/Loss of Offsite Power
- Black-Start Capability
- First Responder Power
- Resilience to Natural Events
- Resilience to Aircraft Impact
- Cybersecurity
- Long-Term Power for Mission Critical Facilities
- High Altitude Electromagnetic Pulse (EMP) and Geomagnetic Storms

NuFuel HTP2 Testing

One-third scale NIST-1 Test Facility

NuScale Control Room Simulator

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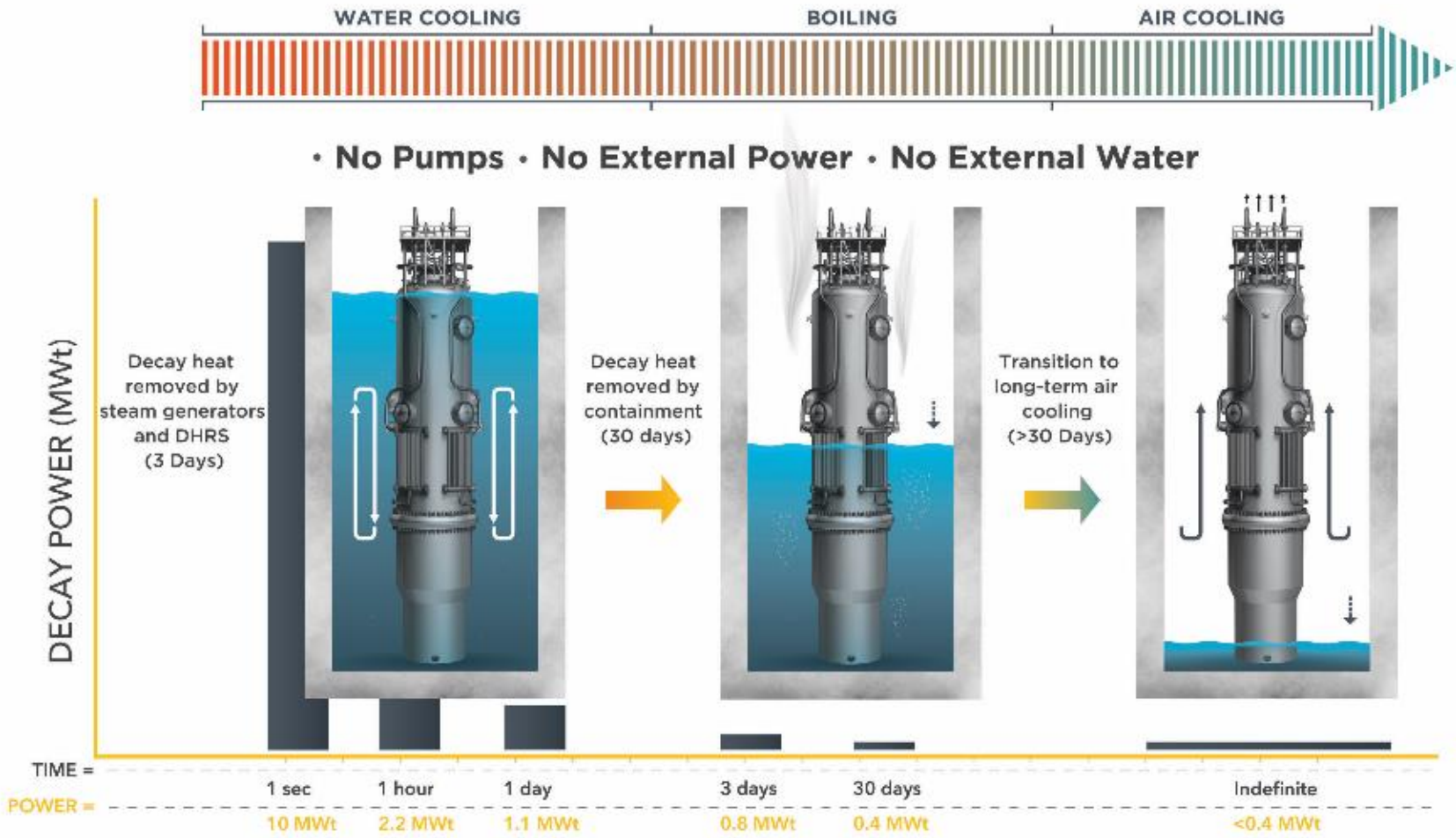
NuScale Safety Approach - Fukushima



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Assured Power for Mission Critical Facilities

UTILITY MACROGRID

> 95% Capacity

NuScale 12-Module Plant

DEDICATED MICROGRID
100 MWe (net)
> 99.95% Availability

MISSION CRITICAL FACILITY

- Highly reliable power is required for Mission-Critical Facilities.
  - **Hospitals, Data Centers, Government Facilities, banking or retail systems, Security systems, telecommunications, air traffic control, Safety systems for conventional Nuclear Plants**
- Process failure can cause significant financial or reputational damage to the organization or may impact national security or safety
- Connection to a micro-grid, island mode capability, and the ability for 100% turbine bypass allows a NuScale plant to assure 100MWe net power at 99.95% reliability over a 60 year lifetime

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First Responder Power - A New Level of Plant Resiliency

- **Island Mode/Loss of Offsite Power** – a single module can power the entire plant in case of loss of the grid; no operator or computer actions, AC/DC power or additional water required to keep the reactors safe
- **First Responder Power** – on loss of the offsite grid, through variable (0% to 100%) steam bypass, all 12 modules can remain at power and be available to provide electricity to the grid as soon as the grid is restored
- **Resilience to Natural Events** – reactor modules and fuel pool located below grade in a Seismic Category 1 Building
  - Capable of withstanding a Fukushima type seismic event
  - Capable of withstanding hurricanes, tornados, and floods
- **Resilience to Air-Craft Impact** – reactor building is able to withstand aircraft impact as specified by the NRC aircraft impact rule
- **Cybersecurity** – module and plant protection systems are non-microprocessor based using field programmable gate arrays that do not use software and are therefore not vulnerable to internet cyber-attacks
- **High Altitude Electromagnetic Pulse (EMP)** – standard plant design has features that provide EMP hardening beyond current nuclear fleet

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Renewable Portfolio Standards

- Promote the deployment of clean energy resources.?.
- Do not include hydro or nuclear power
- Significant land requirements (proposed 200 MWe_{gross} wind farm needed 20,000 acres)
  - Eminent domain? Acres of farm land or forest removed?
- Hazardous waste
- US manufacturing? / Post construction jobs?
- 50% Doable – 80% Very Significant Challenges – 100% Impossible
- IL Zero Emissions Credits do not violate Federal Power Act

Clean Energy Standards

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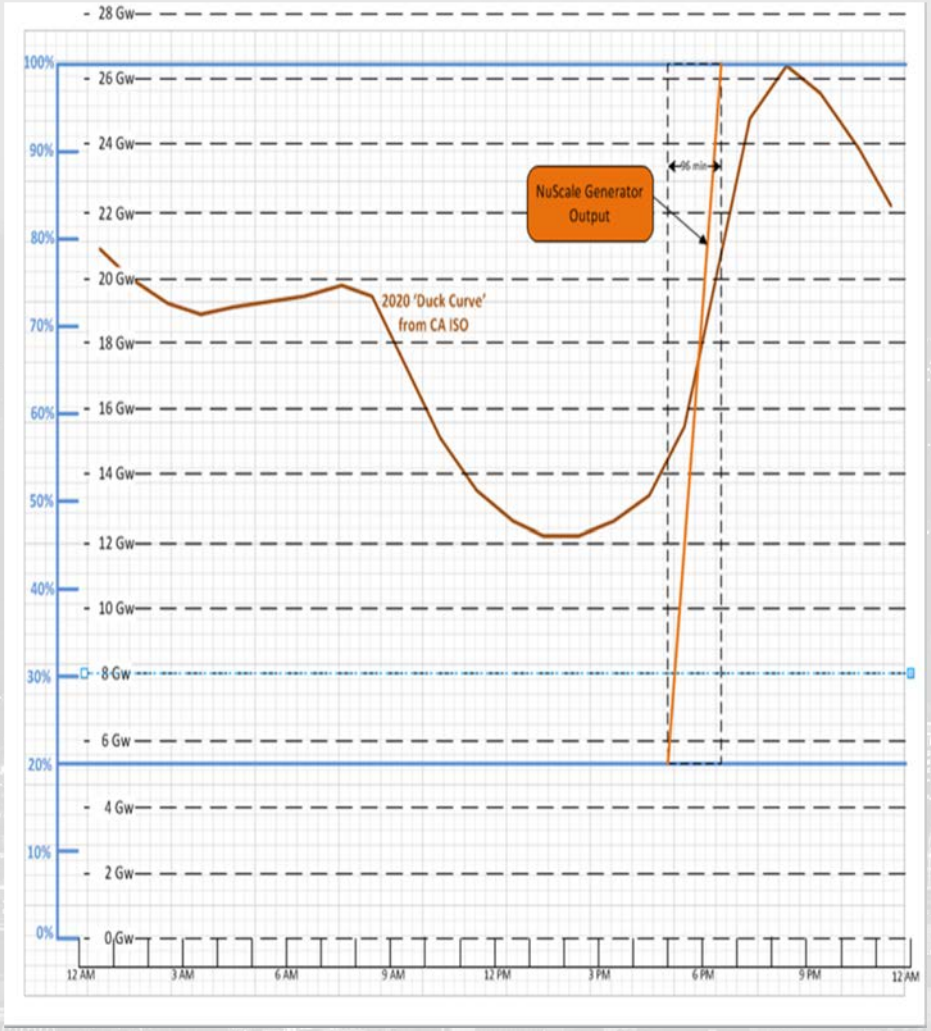
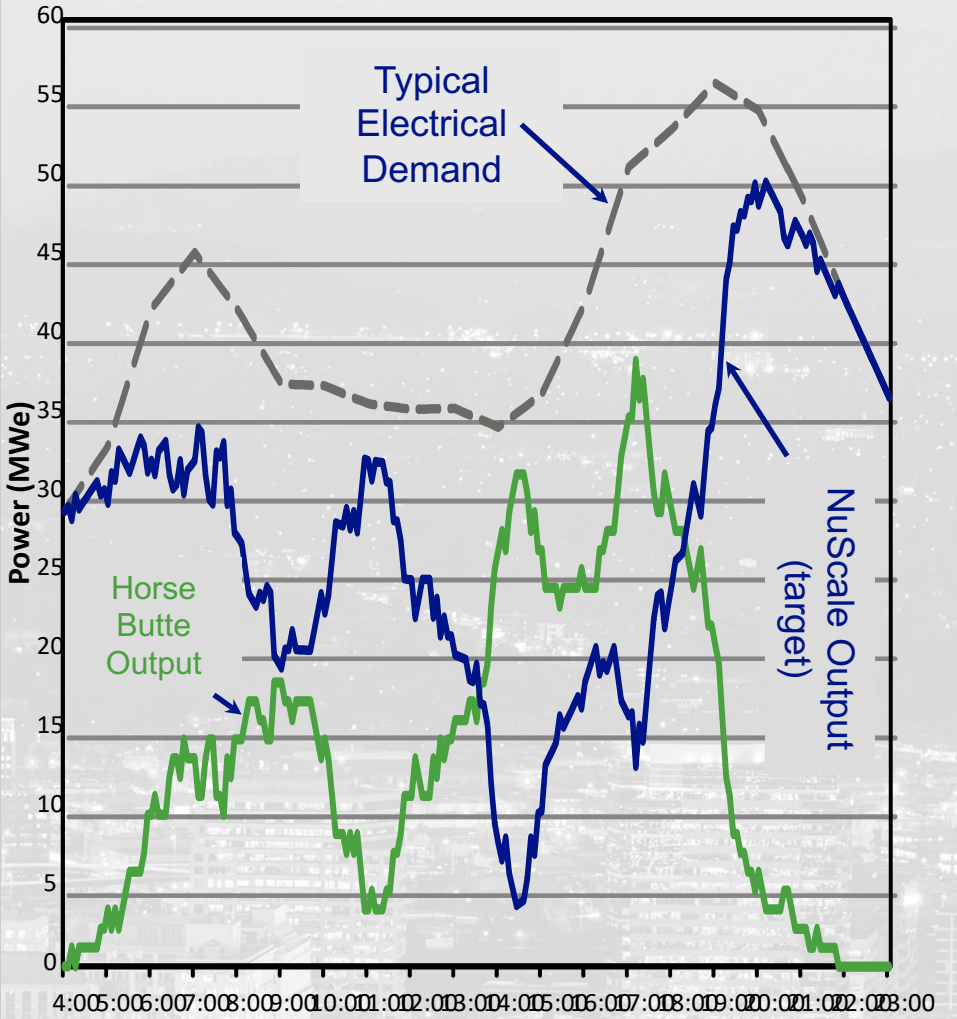
SMRs and Renewables can be friends





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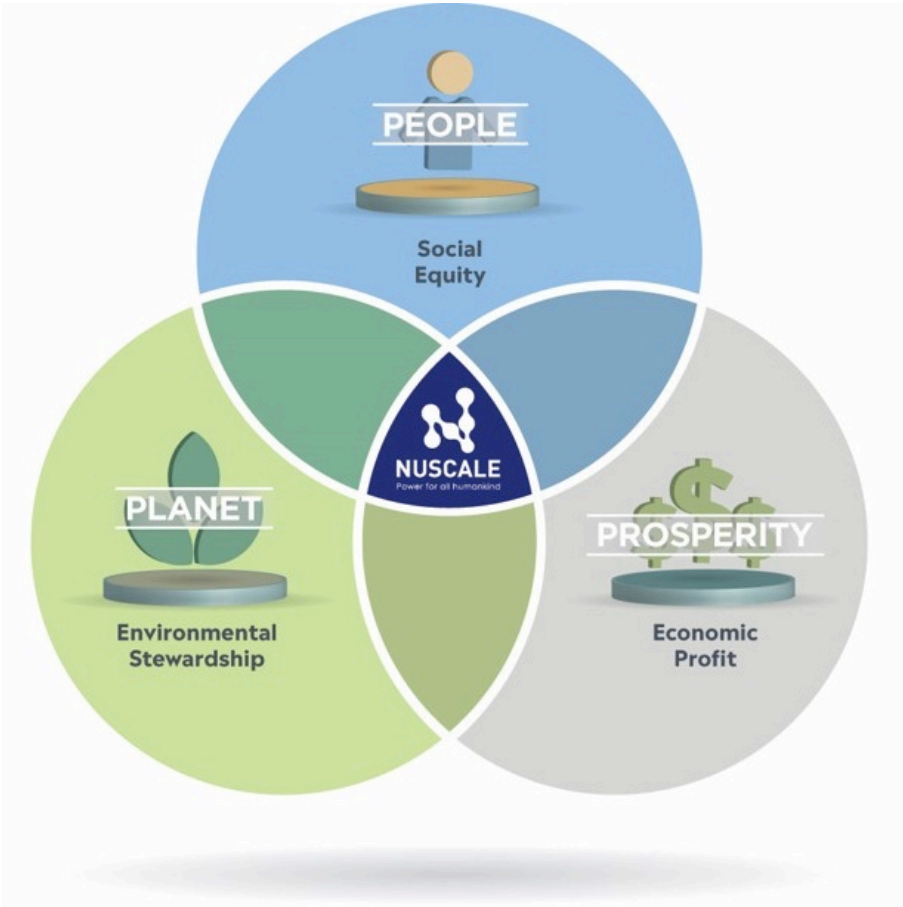
Nuclear Power's Commitment



US Small Modular Reactor technology can provide scalable power for the production of electricity, integrate with renewable generation, provide process heat, and clean water. Improve the standard of living. Provide jobs and low cost electricity to promote economic growth in the US and around the world.

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QUESTIONS ?