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a TerraPower & GE-Hitachi technology

Nuclear Power Challenges and Opportunities

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December 8, 2023

SUBJECT TO DOE COOPERATIVE AGREEMENT NO. DE-NE0009054

Outline

- Identify the Significant Advantages of Nuclear Power
- Identify the Challenges associated with Advanced Nuclear Reactors
- Provide a Brief Overview of the Natrium™ Demonstration Reactor to be built in Kemmerer, Wyoming
- Discuss how TerraPower is working to overcome the challenges identified.

Natrium™ TerraPower

Nuclear Power adds tremendous advantages to the Electricity and Process Heat Market

- Other than infrequent outages, electricity is available 24 hours per day.
- Nuclear energy is the most reliable carbon-free energy source in the USA
- Provides Energy Security
- Creates jobs, and former coal plant workers can be re-skilled to fill many of the nuclear power plant roles.
- For every 100 nuclear plant jobs, about 66 more are created in the local community
- Small Footprint
- Can support decarbonizing major industry by providing process heat
- Nuclear industry has a stellar safety record
- Advanced reactors are inherently safe – meaning that if there is an abnormal condition, they will shut down automatically without the need for external power or human intervention. The remaining heat in the reactor dissipates naturally by convection up the chimneys.

Challenges

- Design requirements are numerous.
- Supply chain has almost disappeared since very few nuclear plants are being built
  - ASME Section III and NQA-1 requirements need to be relearned
  - High Assay Low Enriched Uranium (HALEU) isn't currently available in the US except in very small quantities.
  - Many Advanced Nuclear Reactors run at high temperatures and few materials are qualified for use at these temperatures
- Regulatory Challenges
  - Published average time for approval of a Construction Permit Application or an Operating License is 36 months.
  - Rigorous analysis, testing and environmental review is required before submitting an application.
    - Seismic Structural Hazard Analysis Committee, Volcanic Hazard Analysis Committee
    - 3 years of meteorology data required
    - Soil structural analysis
- Financial Challenges
  - Income doesn't start until the plant is up and running and it could take up to 10 years to do all the work required to design, license, build and startup a nuclear reactor

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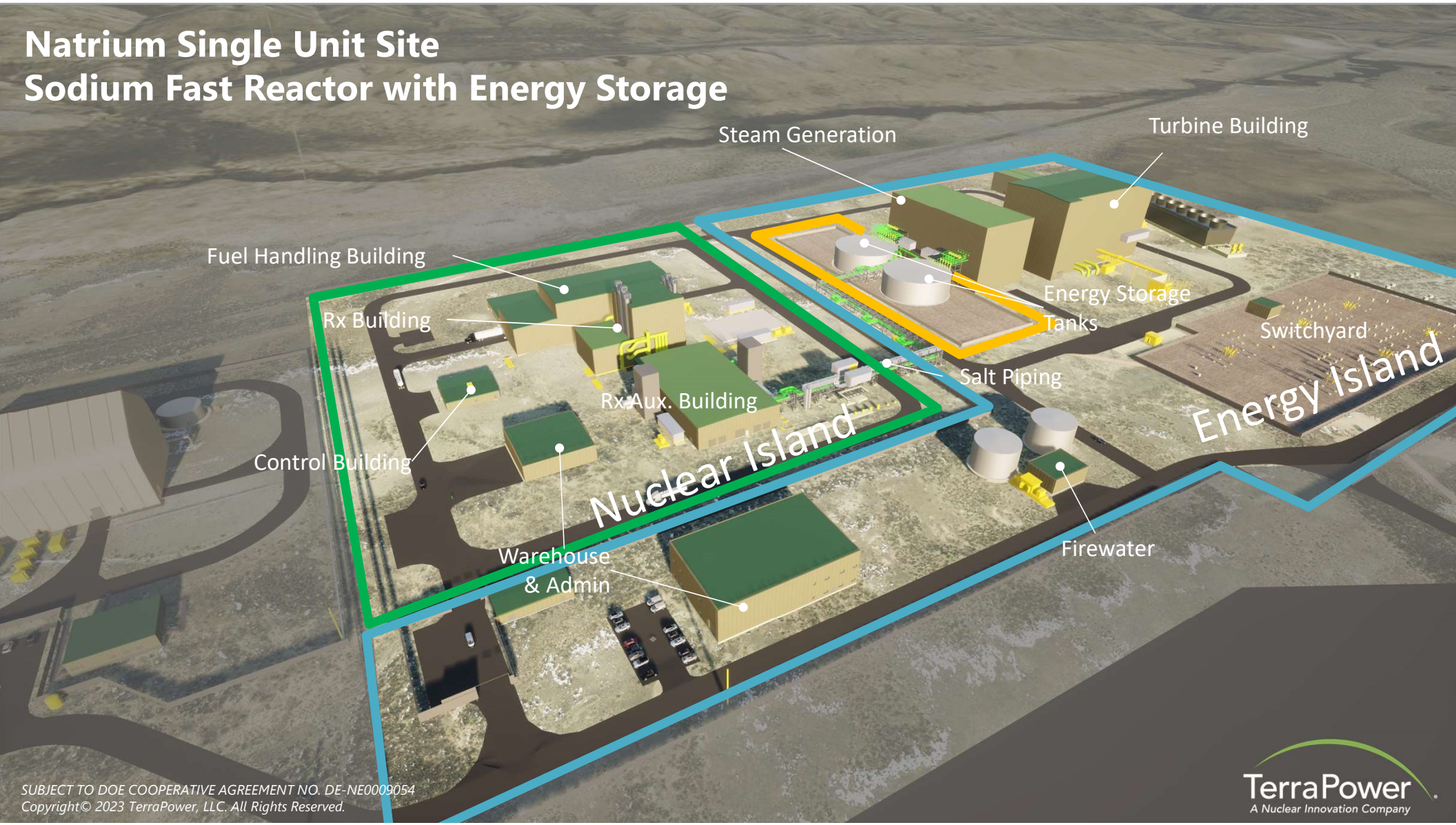
Challenges (Continued)

- Water and Transmission
  - Although you don't need water for the advanced reactors as a moderator or as a primary coolant to transport heat generated by the reactor, water is still used to generate steam, similar to a coal plant
  - Dry cooling systems can be developed, but they take up a lot of land and have significant overhead capital cost and lower efficiency
- Unbalanced Risk
  - Although this is one of the key learnings from past mega-projects, the risk for new nuclear plants is extremely unbalanced, being taken currently by the developers exclusively, with the help of the US government.
- Long time to market – Nuclear plants take much longer to get to market than other power sources
- Used Fuel final disposition
  - The government has the responsibility to accept the used fuel but has not been successful at selecting a final repository in the US.

Natrium Single Unit Site
Sodium Fast Reactor with Energy Storage



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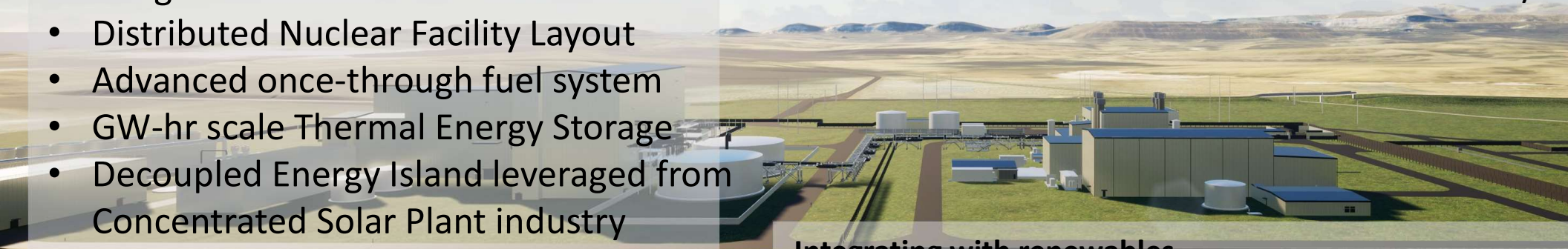
Redefining what nuclear can be…

What is the Natrium™ Reactor and IES?

- Integral Sodium Fast Reactor
- Distributed Nuclear Facility Layout
- Advanced once-through fuel system
- GW-hr scale Thermal Energy Storage
- Decoupled Energy Island leveraged from Concentrated Solar Plant industry

Nuclear redefined

- Eliminates nuclear "sprawl"
  - ✓ Design to cost
  - ✓ Simplicity
  - ✓ Rapid construction
  - ✓ Design specific staffing
- ~41% net thermal efficiency



Integrating with renewables

- Zero emission dispatchable resource
- Price follower… w/ reactor at 100% power 24/7
- 345 MWe nominal
- Flex to 500 MWe for 5.5 hours through energy storage

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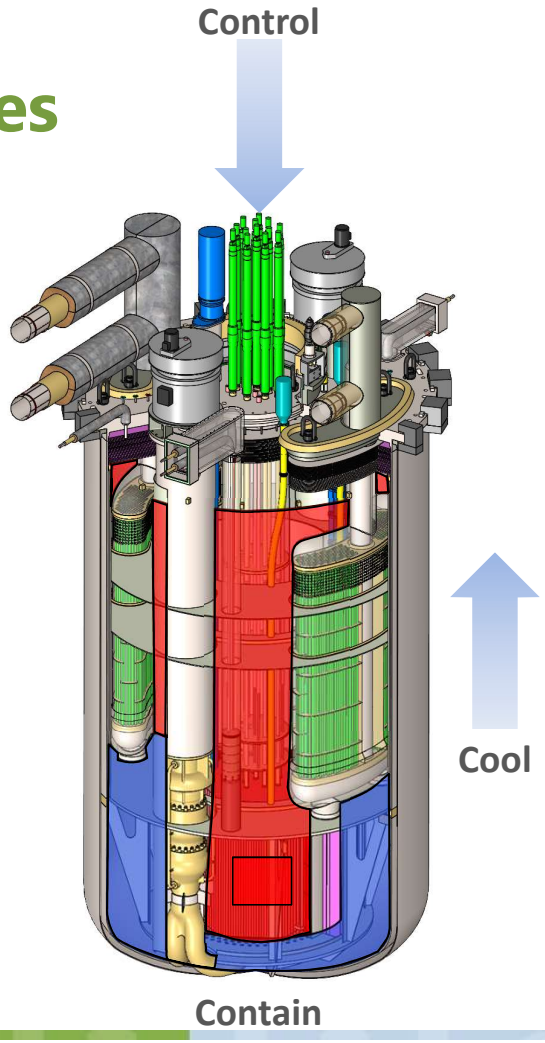
Natrium Safety Features

- Pool-type Metal Fuel SFR
  - Metallic fuel and sodium have high compatibility
  - No sodium-water reaction in steam generator
  - Large thermal inertia enables simplified response to abnormal events
- Simplified Response to Abnormal Events
  - Reliable reactor shutdown
  - Transition to coolant natural circulation
  - Indefinite passive emergency decay heat removal
  - Low pressure functional containment
  - No reliance on Energy Island for safety functions
- No Safety-Related Operator Actions or AC power
- Technology Based on U.S. SFR Experience
  - EBR-I, EBR-II, FFTF, TREAT
  - SFR inherent safety characteristics demonstrated through testing in EBR-II and FFTF



Control

- Motor-driven control rod runback and scram follow
- Gravity-driven control rod scram
- Inherently stable with increased power or temperature

Cool

- In-vessel primary sodium heat transport (limited penetrations)
- Intermediate air cooling natural draft flow
- Reactor air cooling natural draft flow – always on

Contain

- Low primary and secondary pressure
- Sodium affinity for radionuclides
- Multiple radionuclides retention boundaries

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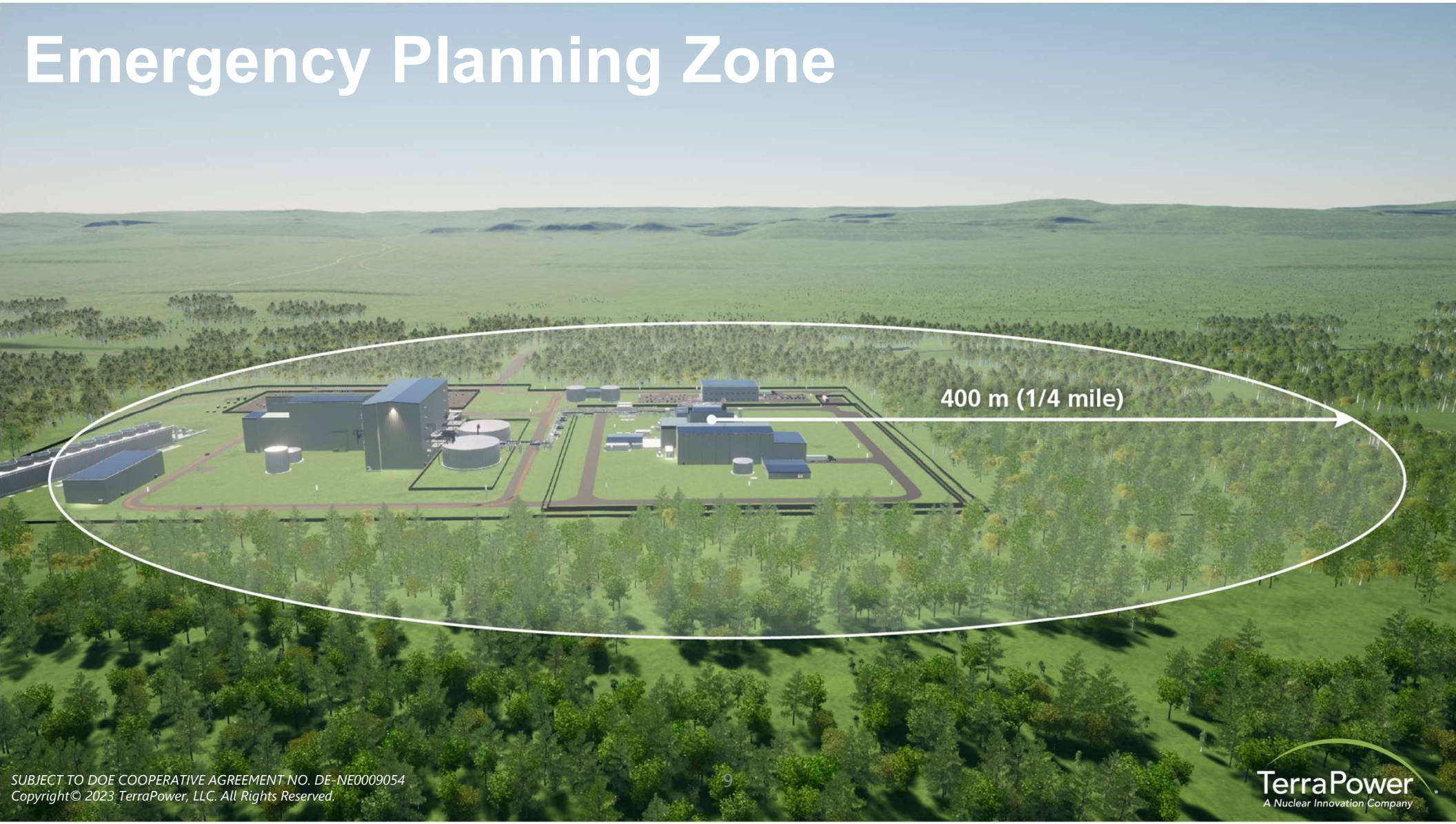
Emergency Planning Zone



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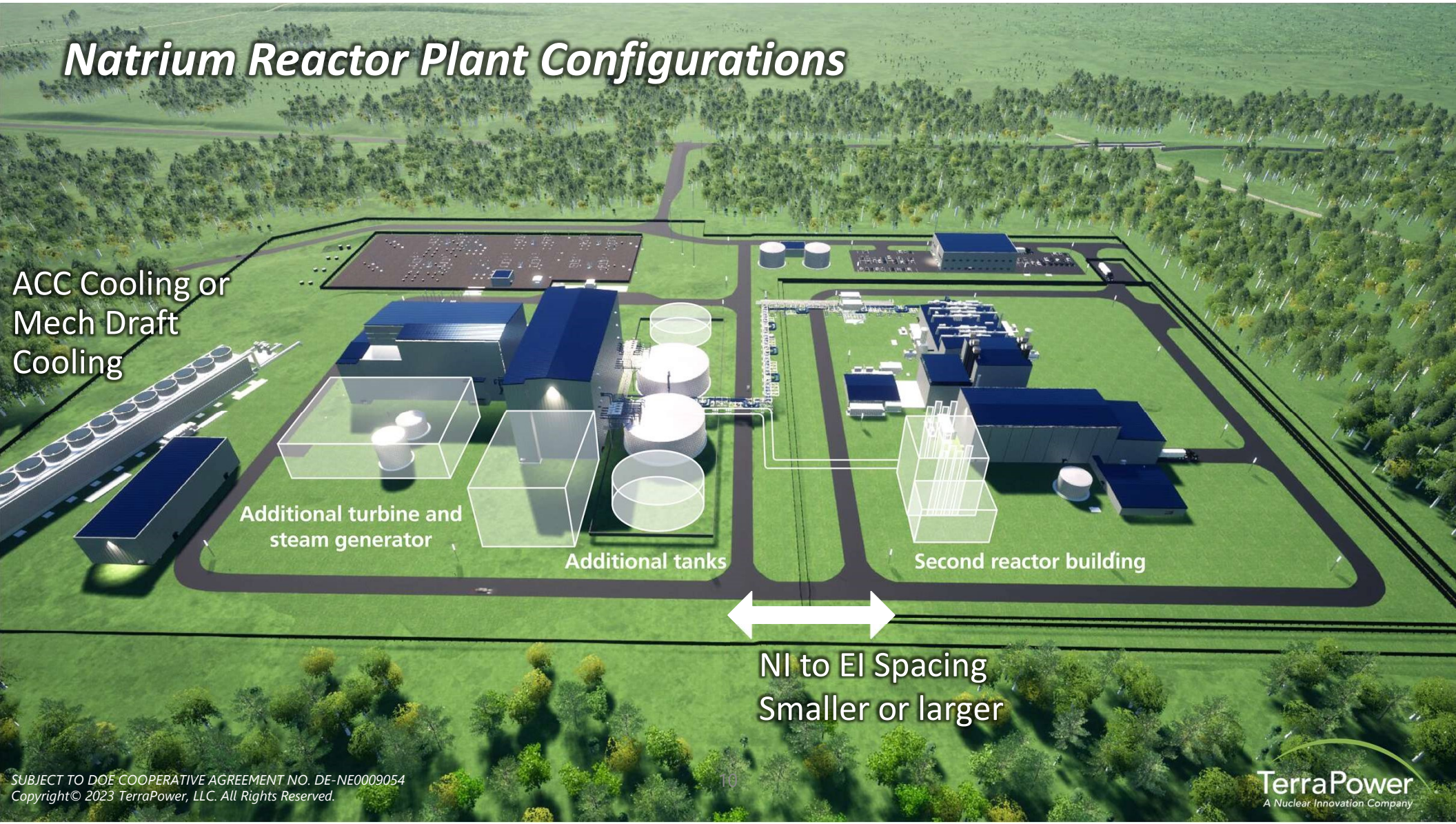
Natrium Reactor Plant Configurations



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Natrium Team Response to Challenges

- Design Requirements
  - Close engagement with regulator
  - Simplify when possible
  - Segregation of Energy Island and Nuclear Island
  - Minimize the amount of safety related equipment when possible
- Supply Chain
  - Contracts in place or in process for major nuclear island equipment
  - Supporting DOE efforts on HALEU contracts and doing early development work on HALEU deconversion
  - Fuel Fabrication facility being built at GNF in Wilmington, NC
  - Long lead equipment for Energy Island planned for Summer, 2024.
- Regulatory Issues
  - Intensive pre-application interaction – over 60 technical meetings, Topical Reports and White Papers written and reviewed on challenging issues. Application Submittal date March 2024 which supports our need date
  - Working very effectively with NRC, and NRC is using audits in preference to Requests for Additional Information which shows promise for shortened licensing review time.
- Financial Challenges
  - Investors with Long Term Strategy
  - DOE 50-50 cost share for first commercial unit

Natrium Team Response to Challenges

- Water and Transmission
  - Without water the project will not be successful. We selected Kemmerer because there was access to transmission lines and sufficient water.
  - We are working with PacifiCorp to obtain a fair and equitable contract for water needed at the plant, but it is challenging
  - With the decision to convert the coal plants to gas, we no longer can rely on the transmission lines and may need to build additional transmission capability because the gas plants and the nuclear plant are expected to operate concurrently. This results in extensive unplanned expenditures on the project but can be recovered eventually in electricity rates.
- Unbalanced Risk
  - Cost sharing with DOE
  - Reduce some risk through subcontracting
  - Risk is still very unbalanced.
- Long time to market
  - Efficient licensing process and interaction
  - 36-month nuclear construction schedule
  - Extensive planning
- Used Fuel final disposition
  - Designing on site storage for use as needed
  - DOE states that all used fuel at nuclear plants should be able to be stored for 100 years on site.
  - Working with DOE on used fuel contract
  - Minimizing quantity of used fuel by developing advanced fuels that can stay in the reactor longer

QUESTIONS?