GEH SMR Codes and Standards

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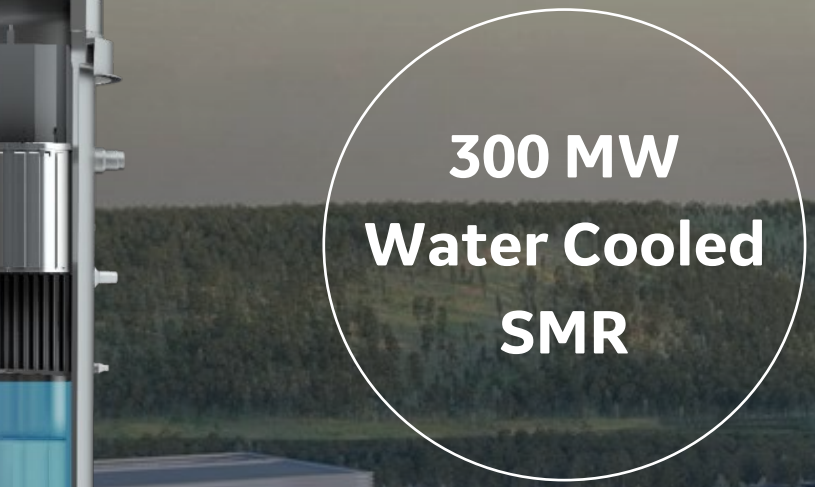
GE Hitachi Nuclear Energy

Identification of Codes & Standards Priorities for Advanced Reactor Designs

- GEH is active in advancing advanced Light Water Reactor (LWR) Small Module Reactor (SMR) technology
    - Priority LWR Codes and Standards are accelerated
- GEH is active in advancing Codes & Standards applicable to Sodium Fast Reactor (SFR) technology
    - Priority SFR Codes and Standards are accelerated
- Codes and Standards for technology that reflect risk and uncertainty

BWRX-300 small modular reactor

- 10th generation Boiling Water Reactor
- World class safety
- Leverages U.S. NRC licensed ESBWR
- Design-to-cost approach
- Significant capital cost reduction per MW
- Capable of load following
- Ideal for electricity generation and industrial applications, including hydrogen production
- Constructability integrated into design
- Initiated licensing in the U.S. and Canada
- Operational by 2028



Designed to Mitigate LOCA

Reduced Staff

Competitive LCOE

MOST
COMPETITIVE SMR

BWRX-300 Small Modular Reactor

Codes & Standards Priorities for Advanced LWR SMR Reactor Designs

❖ Containment Structure- ASME III Division 2, Containment

- Expand Div. 1 NE / Div. 2 CC to include steel-plate composite (SC) construction for containment structures
- AISC N690 allows SC walls for safety related structures other than containment

❖ ASCE Codes

- Provide clarity on analysis and design of deeply embedded structures
  - Seismic aspects added to ASCE 4, ASCE 43, and/or ANS 2.29
- Expand ACI 349 and AISC N690 to provide correlation of ductility limits for impact impulsive forces to inelastic energy absorption factors considered in seismic design

❖ ASME III, Div. 1 Components

- Advanced autogenous (no weld filler) weld processes
- EB, Laser, Friction, Diffusion Bonded -simplify shop/field fab & reduce inspect requirements

❖ ASME Section II, V and IX

- Changes in material specs (powdered metals, cermets), welding quals (new methods), acceptance of new welding methods (AM, EB welding, laser welding)

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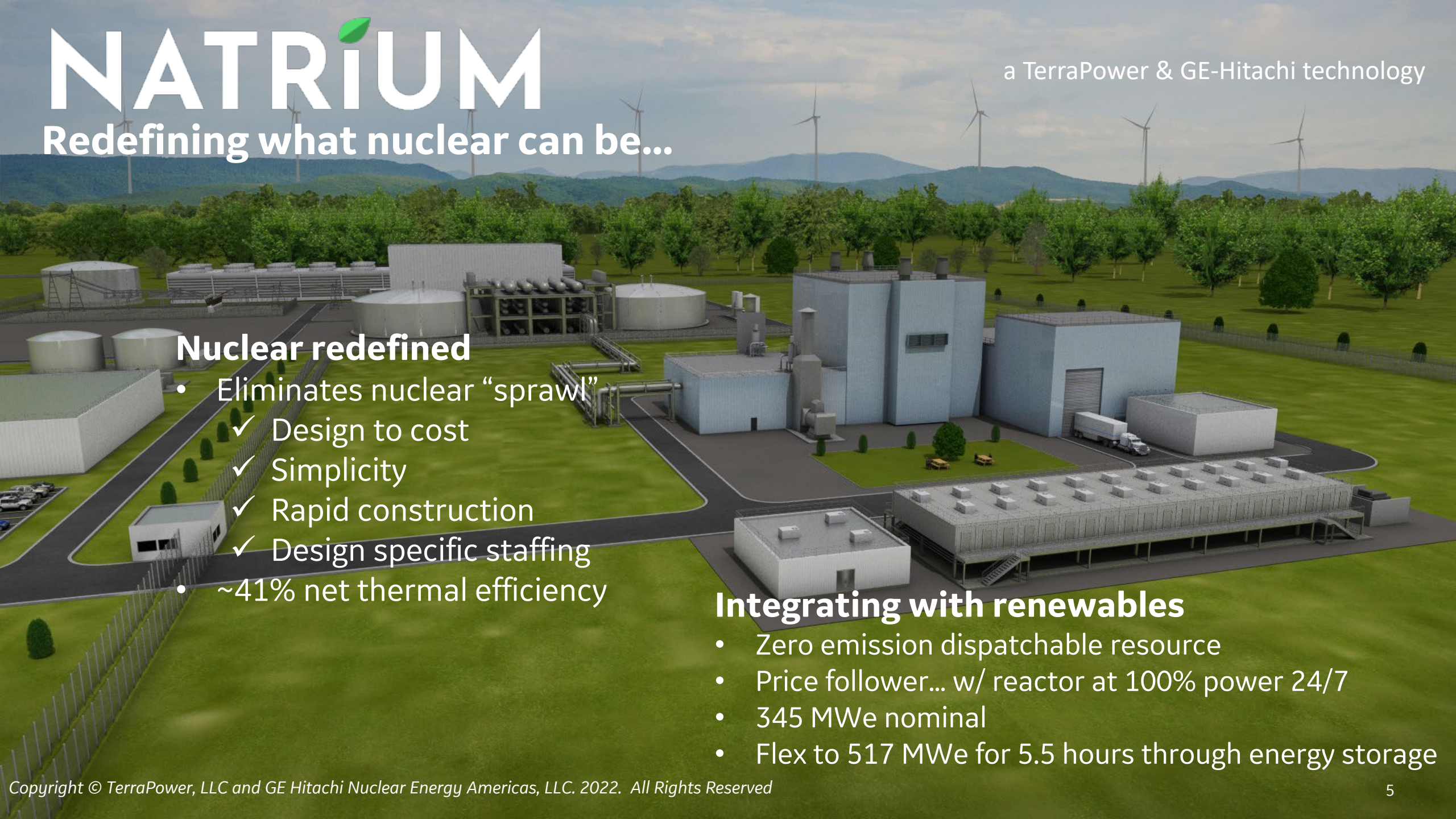
a TerraPower & GE-Hitachi technology

Redefining what nuclear can be…



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 517 MWe for 5.5 hours through energy storage

Codes & Standards Priorities for SFR Advanced Reactor Designs

(cont.)

- ANS 54.8, Liquid Metal Fire Protection in LMR Plants [W]
  - Requirements and guidelines associated with sodium fire protection
- ANSI/ANS-54.1 [R], Nuclear Safety Criteria and Design Process for SFR NPPs
  - Topics such as PRA Scope / Capability, Identification of LBEs, Selection Criteria
- ANSI/ANS-58.14, Safety /Pressure Integrity Classification Criteria For LWR
  - Basis to be used to develop a graded quality approach for non-LWR systems
- Requirements for Reliability and Integrity Management (RIM)
  - SFR design will benefit from advancing RIM by moving away from visual inspection of sodium wetted SSC to system based code requirements
  - Due to lack of corrosion under sodium VTM-3 (e.g. dimensional gauging) inspection value is low
  - Article VII-2, Supplement for Liquid Metal Reactor-Type Plants (In Course of Preparation – Completion Expected for Publication in the 2021 Edition)

Codes & Standards Priorities for SFR Advanced Reactor Designs

❖ Advance ASME III Division 5, High Temperature Reactors

- Extend the qualified lifetimes of Class A materials to support a 60- year design life
- Develop analysis methods to simplify the Division 5 design
- Develop loading and cyclic stress-strain curves for Division 5 materials
- Develop improved design methodology for creep-fatigue evaluation by analysis for BPV III-5 to take full advantage of modern analysis tools, such as elastic-plastic finite element analysis with creep strain capability

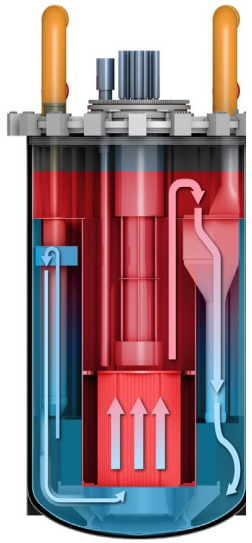
❖ ASME Section XI, High Temperature ISI

- ASME CC N-875, Alternative Inservice Inspection Requirements for Liquid Metal Reactor Passive Components, Section XI, Division 3, IMB-2500

❖ ASME QME-1, Qualification of Active Mechanical Components

- Address advanced reactor design components and HT applications to correspond to Section III, D1

GEH Input on Low Priority Codes and Standards



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1 **ANS 30.1. Integrating Risk and Performance Objectives into New Reactor Safety Designs**

GEH has direction under existing risk and performance evaluation methods including PRA and views development of ANS 30.1 as a low priority activity

GEH SFR offerings are utilizing the Licensing Modernization Process (LMP) as outlined in NEI 18-04

2 **ANS-30.2, Categorization and Classification of SSCs**

This standard provides a single technology neutral categorization and classification process for SSCs for advanced reactors that is, where possible, RIPB. This process will then be used to determine special treatment of SSCs to meet the safety basis

GEH has direction under existing SSC categorization and classification processes and views development of ANS 30.2 as a low priority activity

BWRX-300

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GEH LWR SMR offerings utilizing IAEA methods of assessment

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