Society of SAME American Military Engineers Omaha Post

WELCOME

VIRTUAL MEETING WILL BEGIN AT

11:30 AM Central

Society of American Military Engineers

Omaha Post

May 7th Meeting

Dedicated to National Security Since 1920

Omaha Post Meeting

Society of American Military Engineers

Omaha Post

May 7th, 2024 Meeting

Dedicated to National Security Since 1920

Society of SAME American Military Engineers Omaha Post

Meeting Agenda

- Pledge of Allegiance
- New Member/ Guest Introductions
- Invocation
- Lunch
- Announcements
- Membership Spotlight
- Presentation
- Q&A
- Split Kitty Drawing
- Closing Remarks

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Pledge of Allegiance

I pledge allegiance to the Flag of the United States of America, and to the Republic for which it stands, one Nation under God, indivisible, with liberty and justice for all.

Dedicated to National Security Since 1920

Introductions

Introductions

- Welcome SAME Student Chapter Members
- Welcome New SAME Members
- Introduction of Guests

Society of SAME American Military Engineers Omaha Post

Invocation

Please join us in the invocation before we dismiss for lunch

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Lunch

Dismiss by table

Announcements

- **Project Healing Waters**
  - ► May 18th at Halleck Park, Papillion, NE
  - ► Organization supports active military service personnel and veterans through therapeutic fly-fishing programs, including fly casting, fly tying, and rod building.
- **July - Monthly Omaha SAME Post Meeting**
  - ► July 9th at Field Club of Omaha
  - ► Topic: Environmental Remediation

Slide 8

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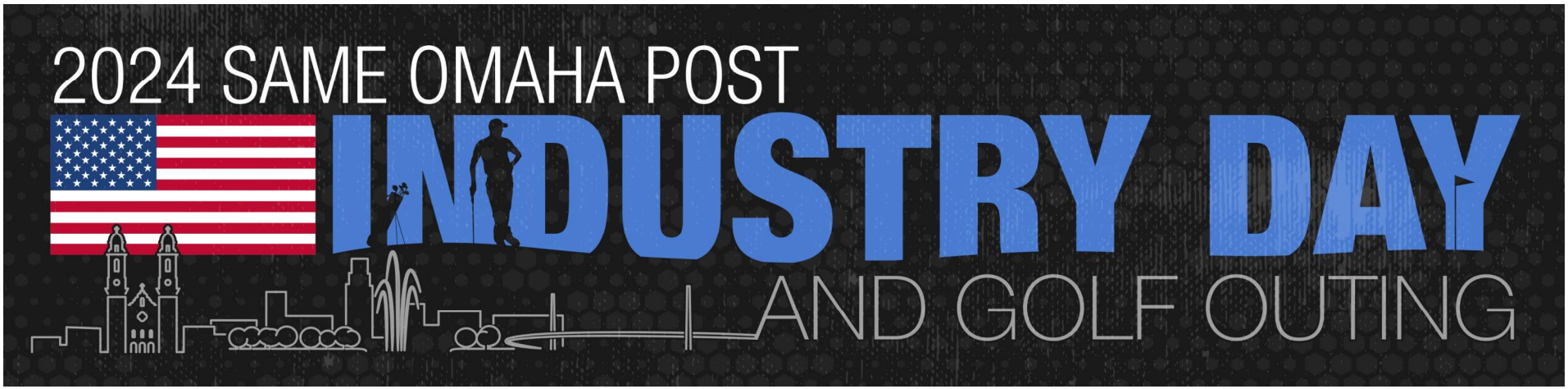
ch0 Thanks Jake. Was just going to add that.
chris.artz@tetratech.com, 2024-03-11T18:22:12.291

JB0 0 You bet!
Jake Batenhorst, 2024-03-11T18:23:32.223

Announcements

- **Omaha Industry Days**
  - ►May 29th-May 31st, 2024 at CHI Center



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Membership Spotlight

WOOLPERT

Dedicated to National Security Since 1920

WOOLPERT

CAPABILITIES OVERVIEW

SAME Omaha Post

7 May 2023

Woolpert is the Fastest-Growing Global AEG Firm

2500+
AEG Professionals

1000s
Completed Projects Nationally & Internationally

90%+
Client Referral Rating

60+
Office Locations

6
Continents of Coverage/Experience

WOOLPERT

Worldwide Project Locations

Woolpert is the Fastest-Growing Global AEG Firm

1911
Founded
Dayton, Ohio

9 companies acquired
in 4 years (3 international)

GREAT PLACE TO WORK®
7 straight years

HOT FIRM
ZWEIG GROUP
5 years in a row
2021 (#10)

ENR
Engineering News-Record
2021 ENR Top Global Design Firms (#115)
2022 ENR Top US Design Firms (#51)
Up 83 spots since 2014

Google Cloud Partner
Award-winning Google Cloud and Maps partner, just expanded to Europe

90%
client referral rating

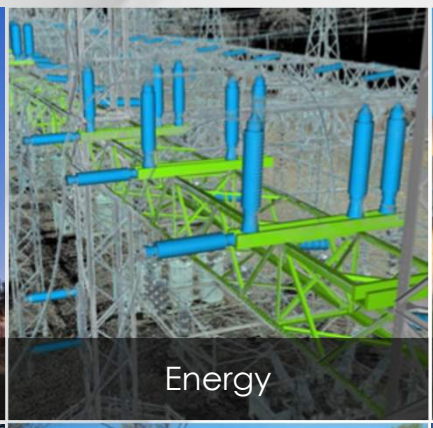
1000s
of national and international projects completed

Esri Gold partner	Planet partner	Trimble partner	Frequent ERDC partner	HBCU partner

Who We Serve


Aviation


Education

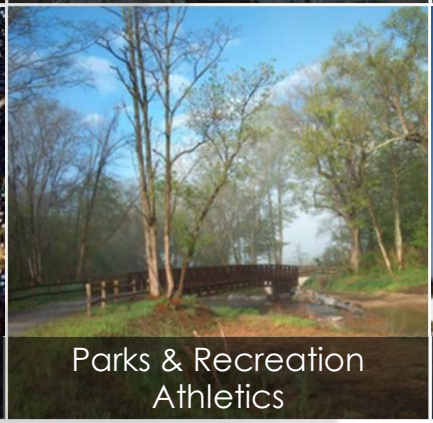

Energy

Facilities

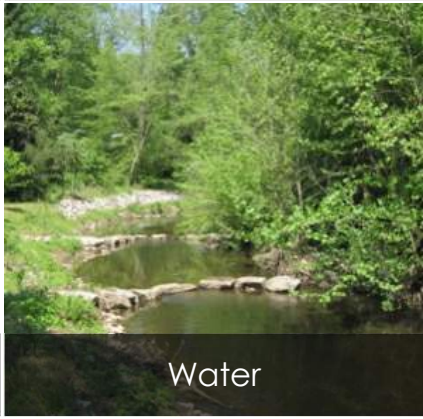

Government


IT Management Consulting


National Security


Parks & Recreation Athletics


Transportation


Water

Current DoD/Non-DoD Federal Agency Clients

U.S. Army Corps of Engineers

- Army Geospatial Center
- USACE Mobile
- USACE Galveston
- USACE Huntsville
- USACE Norfolk
- USACE Louisville
- USACE Kansas City
- USACE Fort Worth
- USACE Europe
- USACE Japan

U.S. Navy

- NAVFAC Mid-Atlantic

U.S. Air Force

- Air Force Installation and Mission Support Center (AFIMSC)
- Air Force Civil Engineer Center (AFCEC)
- Wright-Patterson Air Force Base, OH

Non-DoD Federal Agencies

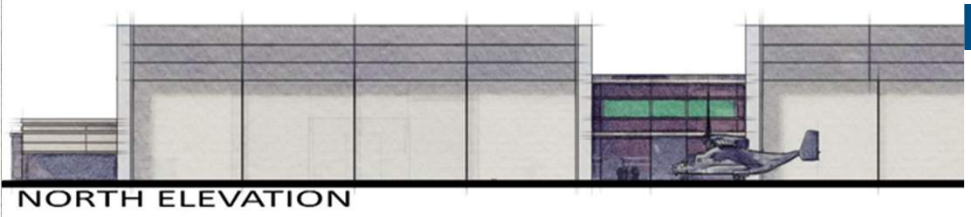
- U.S. Geological Survey (USGS)
- National Oceanic and Atmospheric Administration (NOAA)
- Federal Aviation Administration (FAA)
- Dept of Homeland Security/U.S. Coast Guard
- U.S. National Parks Service

Our Capabilities

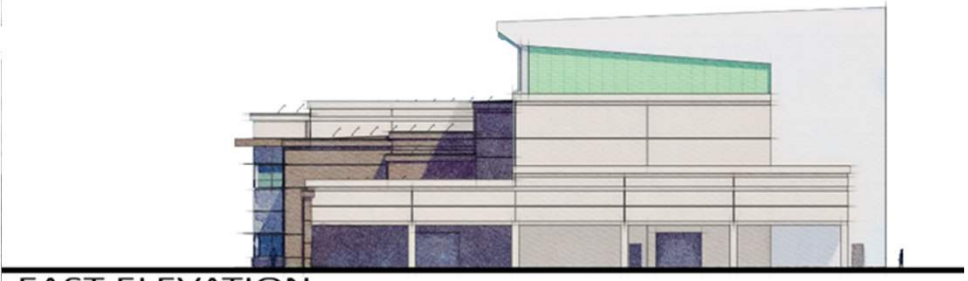
- We can support predesign to construction administration and everything in between.
- Because of our growth, we have acquired additional capabilities such as mission critical data center specialties and expansion into the Western U.S.
- Woolpert's work is executable, lasting, resilient, and meets all military standards/UFCs.
- We have 70+ years of proven planning and design experience across the DoD Community.
- We have 25+ years of specific AFSOC/USASOC/JSOC planning/programming/design experience.

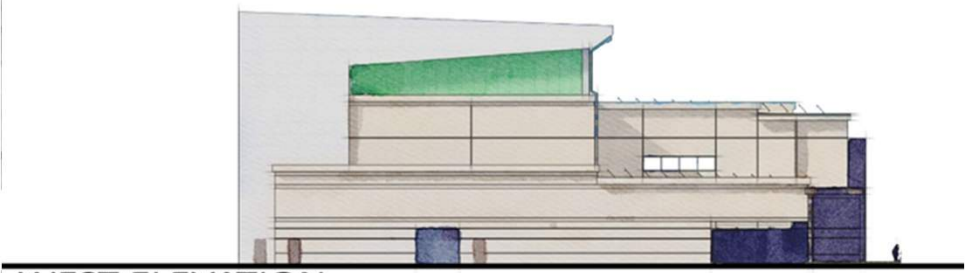
AE Services

- Full spectrum AE disciplines
- Master planning
  - Installation development plans
  - Encroachment plans
  - District and area development plans
  - Installation energy plans
  - Resilience planning


NORTH ELEVATION


SOUTH ELEVATION


EAST ELEVATION


WEST ELEVATION

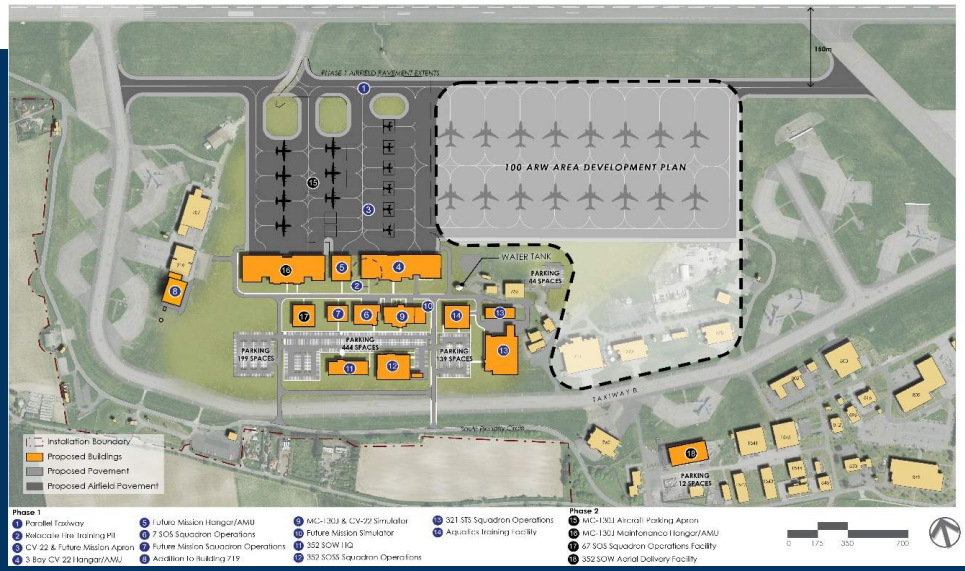
AE Services

- Pre-design/conceptual design
  - Requirements analysis and customer concept documentation
  - Facility and infrastructure condition assessments
  - Planning/programming charrette reports
  - DD Form 1391 development
  - Facility space utilization and optimization studies/plans
  - Traffic management studies
  - RFP development

AE Services

- Facility and infrastructure design
  - Design-bid-build and design-build
  - Design charrettes
  - Integrated design management
  - Sustainable design
  - Building information modeling/digital twins
- Aviation planning and design
- Construction administration

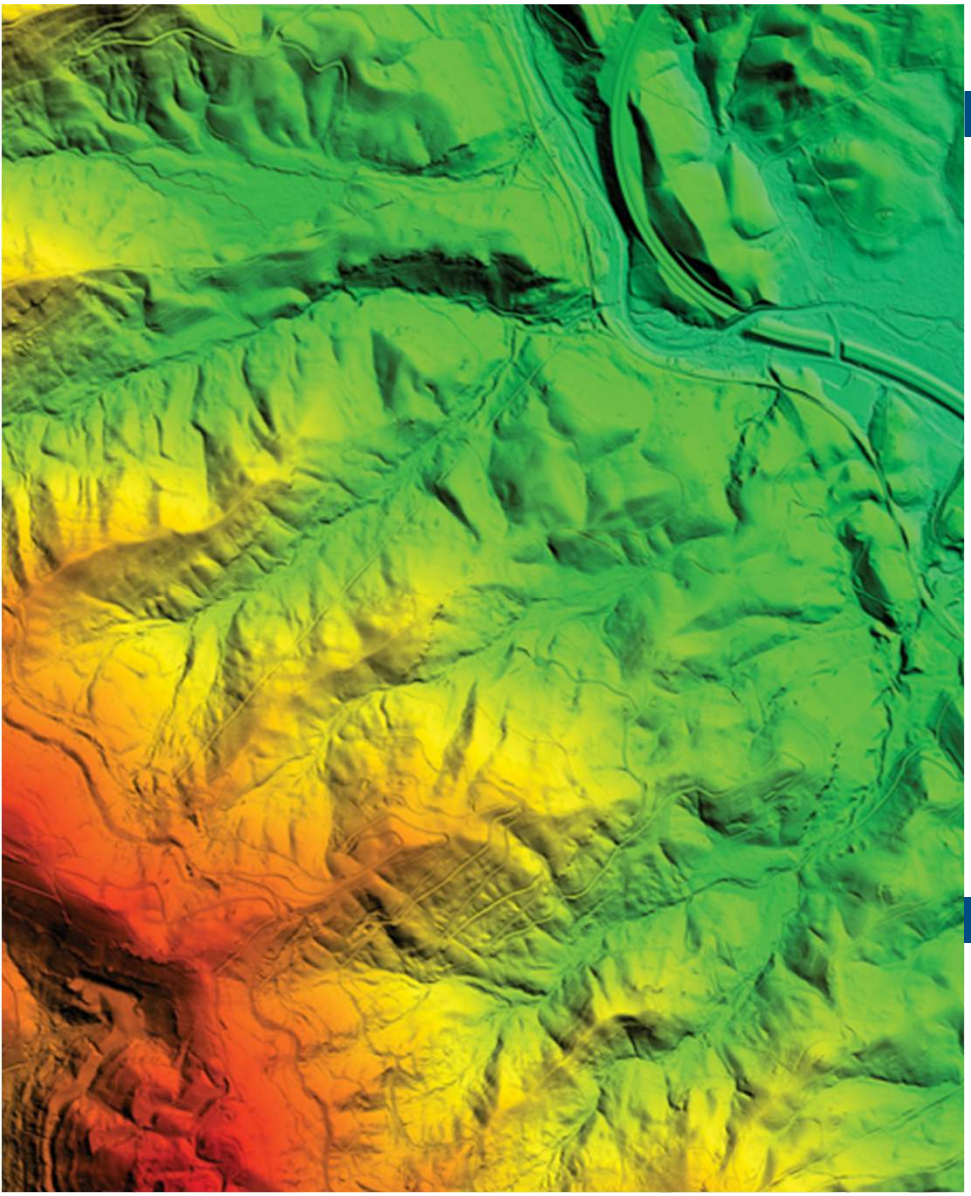
Experts in... Comprehensive Unit and Weapon Systems Beddown Planning



Experts in… Operations Centers/Command and Control Facilities Design

Experts in... Aviation and Mission Operations Facilities Planning and Design

Experts in… Secure Communications Facilities and Data Centers Design



Geospatial Services

- AF GeoBase Program and base-level/on-site support
- Survey and photogrammetry mapping
- Disaster recovery
- Scan-to-BIM/scan-to-asset
- Remote sensing/lidar/bathymetry
- Marine/shoreline capabilities
- Full-service aerial acquisition capability
- DoD/Intel capabilities

Strategic Consulting

- Strategic asset management
- Business case and cost analysis

Contacts

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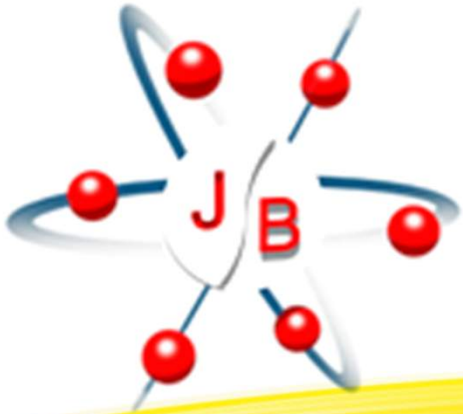
Advanced Nuclear Power

Jan Bostelman, PE, PMP
Chemical, Metallurgical, and Nuclear Engineer – Bostelman Engineering, LLC

THE STATE OF ADVANCED NUCLEAR POWER MAY 7, 2024 PRESENTATION TO SAME



Jan Bostelman, PE, PMP

SO WHAT'S BEING PROPOSED?

- Micro Reactors
- Modular Nuclear Plants
- Advanced Nuclear Plants
- Mobile Nuclear Plants (PELE Project DOD-SCO/DOE/NRC/NASA/Corp)

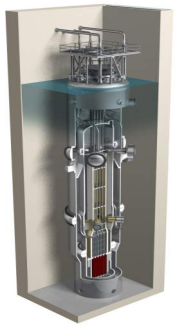
Types of Advanced Reactors

- Range of sizes and features to meet diverse market needs

Micro Reactors (< 20MW)

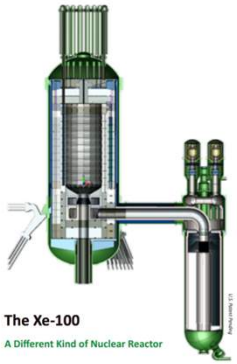
Oklo (shown)
Approximately a dozen in development

LWR SMRs <300MW



NuScale (shown)
GEH X-300
Holtec SMR-160

High Temp Gas Reactors



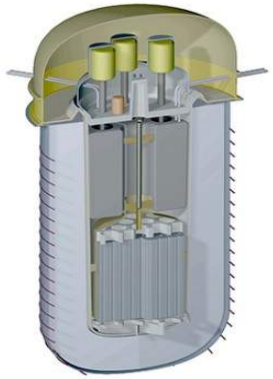
X-energy (shown)
Several in development

Liquid Metal Reactors

TerraPower Natrium (shown)
Several in development

Non-Water Cooled
Most <300MW, some as large as 1,000 MW

Molten Salt Reactors



Terrestrial (shown)
Several in development

Current State – Demonstrations by 2030 information from NEI

Developer	Technology	Utility	Location	Size
NuScale	Integral PWR	?		6 @ 77MW
• TerraPower & GE-Hitachi	Liquid Sodium	Pacific Corp.	Wyoming	345 - 500MW w/thermal storage
X-energy	High Temp. Gas	Energy Northwest/Dow Chemical	Washington/Texas	4 @ 80MW
TBD (GEH, X-energy, or Terrestrial)	SMR	OPG	Ontario, Canada	TBD
Oklo	Micro-reactor	Oklo	Idaho	1.5 MW
Ultra Safe Nuclear	Micro-reactor	Global First / OPG	Chalk River, Canada	5 MW
TBD (X-energy or BWXT)	Mobile Micro Reactor	Department of Defense	Idaho	TBD
TBD	Micro Reactor	Department of Defense	Alaska (Eliason AFB)	TBD
Kairos	Molten Salt (Flouride) High Temperature	Department of Energy/Kairos	Oak Ridge Tennessee	35 MWth 2023 start/2026 operating

OPPORTUNITIES FOR SMALL MODULAR REACTORS (SMRS)

May include several at a plant site

- Modular as components are typically built off site (modules)
- Innovative firm, non carbon emission dispatachable generation of electricity
- Load follow capability
- Several designs exist, one which was design certified by US NRC Executive Director August 31, 2020
- TerraPower submitted Construction Permit Application March 2024

NUSCALE 3 PLANT SIZE OPTIONS – SAME FEATURES, CAPABILITY AND PERFORMANCE

6-Module Plant

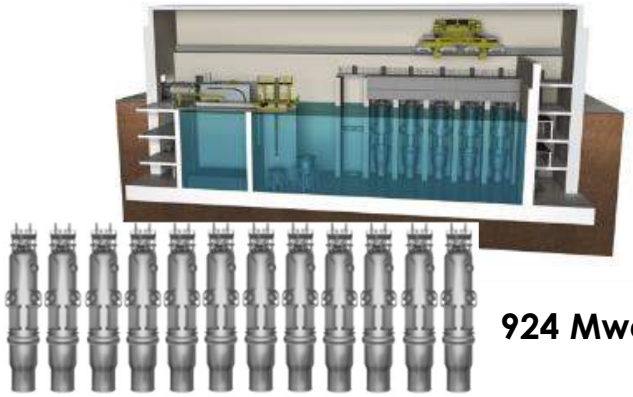
462 MWe (gross)

4-Module Plant

308 MWe (gross)

NuScale Power Module™
77 MWe (gross)

12-Module Plant

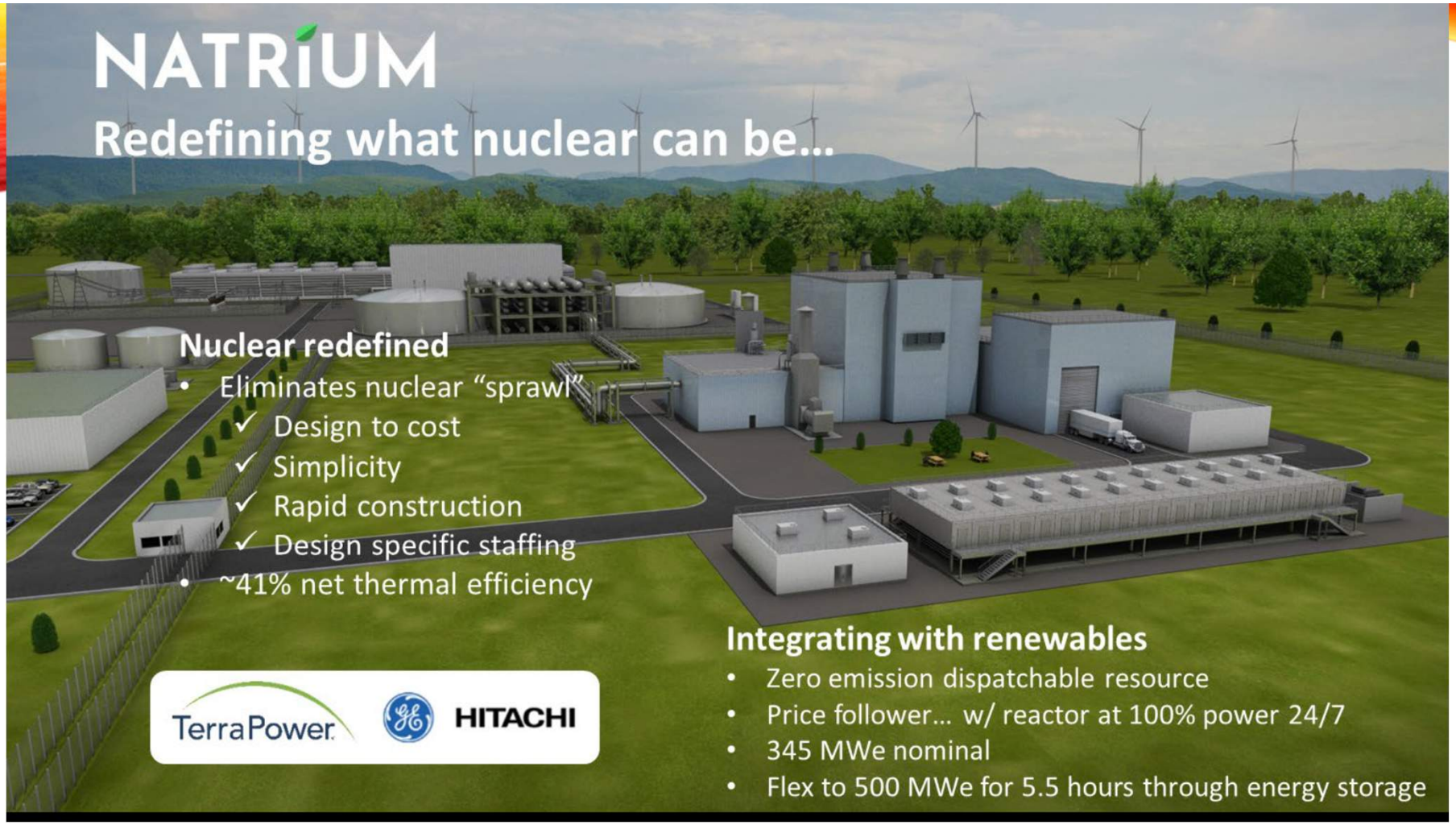


924 Mwe (gross)

- Flexibility in size and cost advantages, with the same operational flexibility and unparalleled safety case.
- Each module feeds one turbine generator train, eliminating single-shaft risk.
- Demonstrated resiliency for every configuration (e.g., “black-start”, “island mode”, seismically robust, cyber secure, etc.)

ADVANCED NUCLEAR

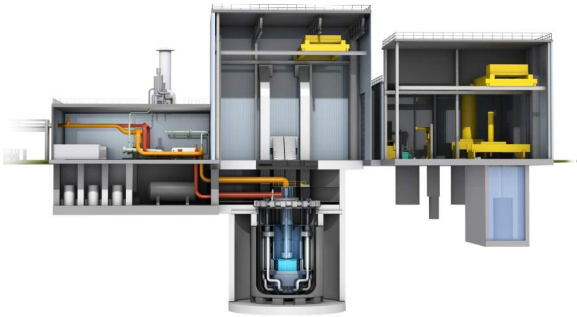
- Several Advanced Nuclear Options in Consideration
- Micro Reactors (1 to 10 MWe) for remote locations could support individual city, i.e. in Alaska, islands, Nebraska, Dakotas
  - Oklo has design for microreactor
  - DOD will build first microreactor at Eliason AFB, Alaska in two years
  - The size of a semi trailer, operate for 10 years non stop
- Large Scale Reactors (greater than 600 Mwe)
  - Demonstration TerraPower (molten salt, Bill Gates company, WY) operational 2029
  - Demonstration X-Energy (High Temperature Gas Reactor using fuel spheres, TX, WA) 2028
  - Westinghouse AP600 and AP1000 (conventional Light Water Reactor)
  - Framatome (conventional Light Water Reactor)
  - GE Hitachi (conventional Light Water Reactor) ABWR



TERRAPOWER GE HITACHI - NATRIUM

TERRAPOWER DEMONSTRATION AWARD

- DOE Funding Secured
- Sodium Cooled Reactor > 450 C
- Current Utility Partners Duke, Energy Northwest, PacifiCorp (Berkshire Hathaway)
- TerraPower/Hitachi being built Kemmerer, WY on Fossil Facility
- Overnight cost of $1Billion
- Based upon 690 MWe



XE-100: RELIABLE, DEPLOYABLE AND ECONOMIC

- 200MWt pebble-bed gas-cooled reactor
- 80 MWe units, 320 MWe 4-pack
- Grid-Scale w/ load-following capabilities
- No reliance on onsite or offsite power to perform any required safety functions
- Highly competitive First-of-a-Kind (FOAK) Levelized Cost of Electricity (LCOE) and significant Next-of-A-Kind (NOAK) cost improvements
- Timeline & Cost Controllable:
  Standardized, modular, manufacturable design minimizes on-site construction

INTRINSIC SAFETY: X-ENERGY FUEL

Pebble Fuel Element
(60mm)

TRISO Fuel particle
(≈1mm)

Physics, not mechanical systems, ensures 100% of safety.

The U.S. DOE describes TRISO fuel as “the most robust nuclear fuel on Earth,” it retains waste and fission products within the fuel during ALL conditions **and cannot melt**, even during worst-case scenario accidents.

Why is this important?

- Because TRISO-X Fuel is the containment vessel we do not rely on traditional expensive, gigantic concrete & steel structures for the reactor, which must be built, maintained, and decommissioned.
- TRISO has been tested up to 1800ºC, proving that it cannot melt, even without active cooling.
- TRISO particles retain 99.999% of fission products.
- TRISO fuel has been demonstrated over 40+ years in prototype and full-scale reactors. **This is a proven safety approach.**
- The low reactor power density and self-regulating core design (i.e., if cooling stops, the core shuts down), ensures the reactor is always ‘walk-away safe.’

PELE PROJECT DOD MOBILE NUCLEAR REACTOR

- **BWXT 1 to 5 MWe**

- **X-Energy**
- DOD Exercises Option on Second Micro Nuclear Reactor Design September 2023
- Complimentary micro reactor design development
- The Xe-Mobile is a ground, sea and air transportable power generation system that can be delivered to the point of electricity need and quickly begin generating power; no construction or site preparation is required.
- Can operate at full power for more than 3 years
- Utilizes TRISO fuel, due to high maturity & a strong safety case
- Produces 2-7 MWe of electrical power

Whole of Government Approach

- **Interagency collaboration is crucial to the success achieved by SCO's Project Pele. This includes:**
  - Department of Energy (DOE) and Nuclear Regulatory Commission (NRC) are providing technical support, design/safety advice, and guidance on reducing current and future licensing risk
  - DOE is providing reactor safety oversight and authorization, and through an interagency agreement is providing an extension of Price-Anderson nuclear indemnification
  - NRC will approve the Pele reactor module transportation package for over-the-road transport
  - Army Corps of Engineers and DOE supported NEPA Environmental Impact Statement
  - NNSA is providing Pele with enriched uranium from its stockpile
  - NASA and DOE have developed, jointly with SCO, a commercial-scale TRISO facility

US Army Corps of Engineers

National Nuclear Security Administration

NASA

Pele Path Forward

- **Complete detailed design and associated testing**
  - Rigorous process to approve all technical specifications before ordering components.
  - Significant re-designs can be crippling to budget/schedule.
- **Enforce Quality Assurance through entire supply chain**
  - Finding suppliers who can meet all nuclear quality standards has been a challenge for other nuclear programs.
  - It cannot be assumed that subcontractors will deliver what they say they can deliver.
- **Complete Department of Energy authorization process**
  - Preliminary and Final Safety Analysis Report (P/FSAR) for reactor, as well as acceptance review for reactor fueling in TREAT.
  - Operational Readiness Review will be final step before turning on reactor.
- **Train operators**
  - Experienced reactor operators will be hired for initial operations.
  - Army Corps of Engineers and National Guard personnel will be trained to assemble, move, and operate the Pele reactor.

WHY NEW NUCLEAR-SMRS

- Planning, licensing and construction costs shorter and reduced
- Current projections 8 to 10 years total for first of kind SMRs
- Expect Nth of kind SMRs could be deployed 5 to 7 years
- Currently three US companies with SMR designs (i.e. competitive)
  - GE Hitachi 300 MWe (1 module)
  - Holtec 160 MWe (1 module)
  - NuScale 720 MWe (12 modules, ~60 to 77 MWe each)

WHY NEW NUCLEAR

- Environmentally Friendly (dry air cooling) no NOx, CO2, SOx
- Very Small Land Footprint 50 Acres per 1000 MWe compared to other sources
- Can be sited at existing nuclear sites, or previous sites, including old fossil sites, or on limited land area
- Low volatility in uranium prices, fuel is on site
- Can operate with one unit down
- Waste impact is known
- Federal PTC and incentives for nuclear technology ($18 to 25/MWhr)
- Below grade installation, hardened structures

	SMR	NGCC	Wind	Solar
Capacity Factor	**95% complete dispatchable 365/24/7**	55%	35% variable	25% variable
Plant Life years	**60 to 80**	40 to 50	20 to 25	20 to 25
Lifetime TWh	647	241	76	55
Land Required acres	50	343	85240	7900
Direct Land use	50	343	2000	7900
Indirect Land use	0	0	83000 to 140000	0
Land Utilization (acres per Lifetime TWh)	<0.1	1.4	1125	144

COMPARISONS PER 1000 MWE

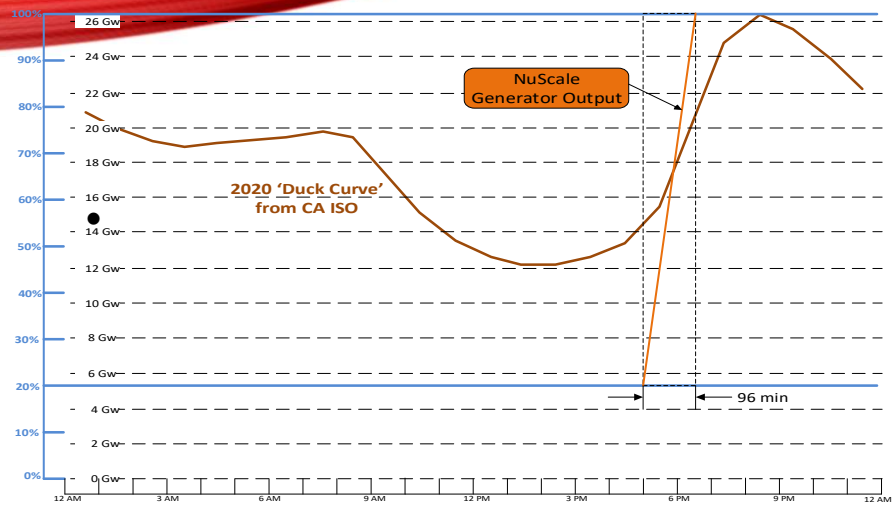
SMR ECONOMIC ENGINES

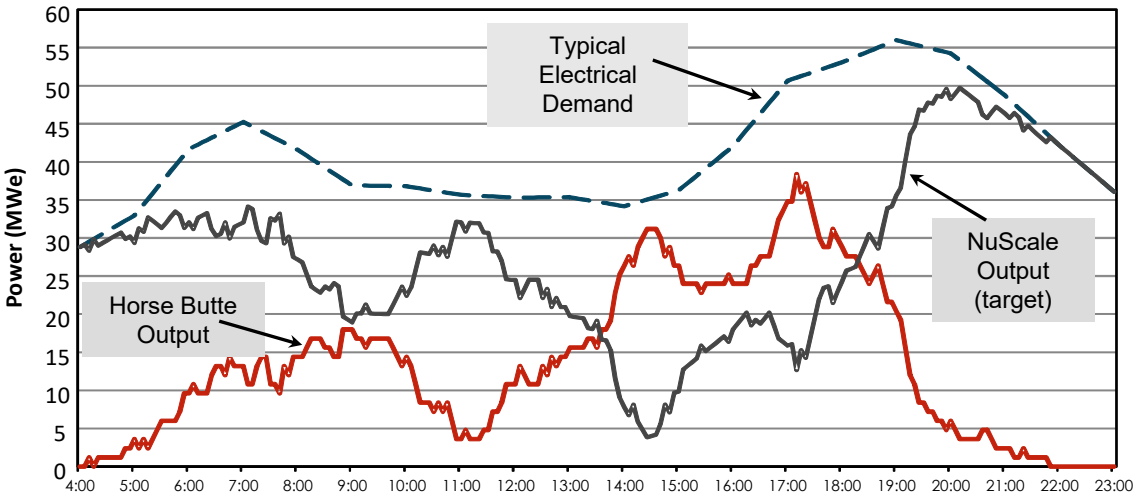
- A 600 MWe SMR would employ 900 manufacturing/construction jobs 4 years
- 300 permanent positions for 60 or more years at site
- For every 100 permanent positions an additional 66 jobs created in local community
- Nuclear pays 20 to 25 percent more on average than other energy jobs
- $500 million in direct and indirect economic output annually
- $20 million annually for ratepayers as part of energy portfolio
- Nuclear power plants are the economic engines for rural areas where they are located as established by 2018 Oxford Economics study

INTEGRATED RESOURCE PLANNING

- SMRs can be located at retired Fossil Fuel Sites
- Carbon Free Generation
- Fuel Diversity leads to lower electricity costs, i.e. not requiring excessive capacity margin or energy storage systems
- Flexible Dispatchable Generation can operate up to 2 years without shutting down (95% or more capacity factors)
- Can produce thermal energy in form of heat and clean steam for other industrial processes (i.e. ethanol or other related steam intense)
- Operate independent of grid, withstand severe natural phenomena, physical and cyber threats

INTEGRATING RENEWABLES: LOAD FOLLOW STRATEGIES FROM NUSCALE





NuScale plant is designed to work with renewables, including being able to ramp up power quickly enough to meet high evening demand when solar ramps down.

NuScale design meets or exceeds EPRI Utility Requirements Document (URD), Rev. 13, load following and other ancillary service requirements.

Method	Up Power	Down Power
Turbine Bypass	20% to 100% (27 min) 3%/min	100% to 20% (8 min) 10%/min
Reactor Power Change	20% to 100% (96 min) 50%/hr	100% to 20% (≤ 24 min) 200%/hr
Module Dispatch	HSD to 100% (13 hrs) Refueling	100% to HSD (30 min) 200%/hr

- Rapid load variation response
- Hourly demand response
- Extended period response

RESILIENT NUCLEAR SUPPORTING ECONOMIC DEVELOPMENT FOR NE

- Hydrogen Hubs – LB 1099 DOE Funding, Monolith*
- Direct Steam Production for Ethanol Facilities
- Ethanol Facilities with Carbon Sequestration Compressors (9MW each)
- Data Centers (Omaha, Kearney)
- BitCoin Mining
- Smelting
- Traditional Mining (Niobium Mine Southeast Nebraska)
- Supporting Nebraska Uranium Mining Northwest area
- Supporting Remote Rural/Military Communities
- *note Nebraska was not chosen for Hydrogen Hub by DOE, but it is still being pursued in this state

Yeah But……

Are SMRs Really Cost Competitive?

Levelized Cost of Energy (LCOE) Comparison

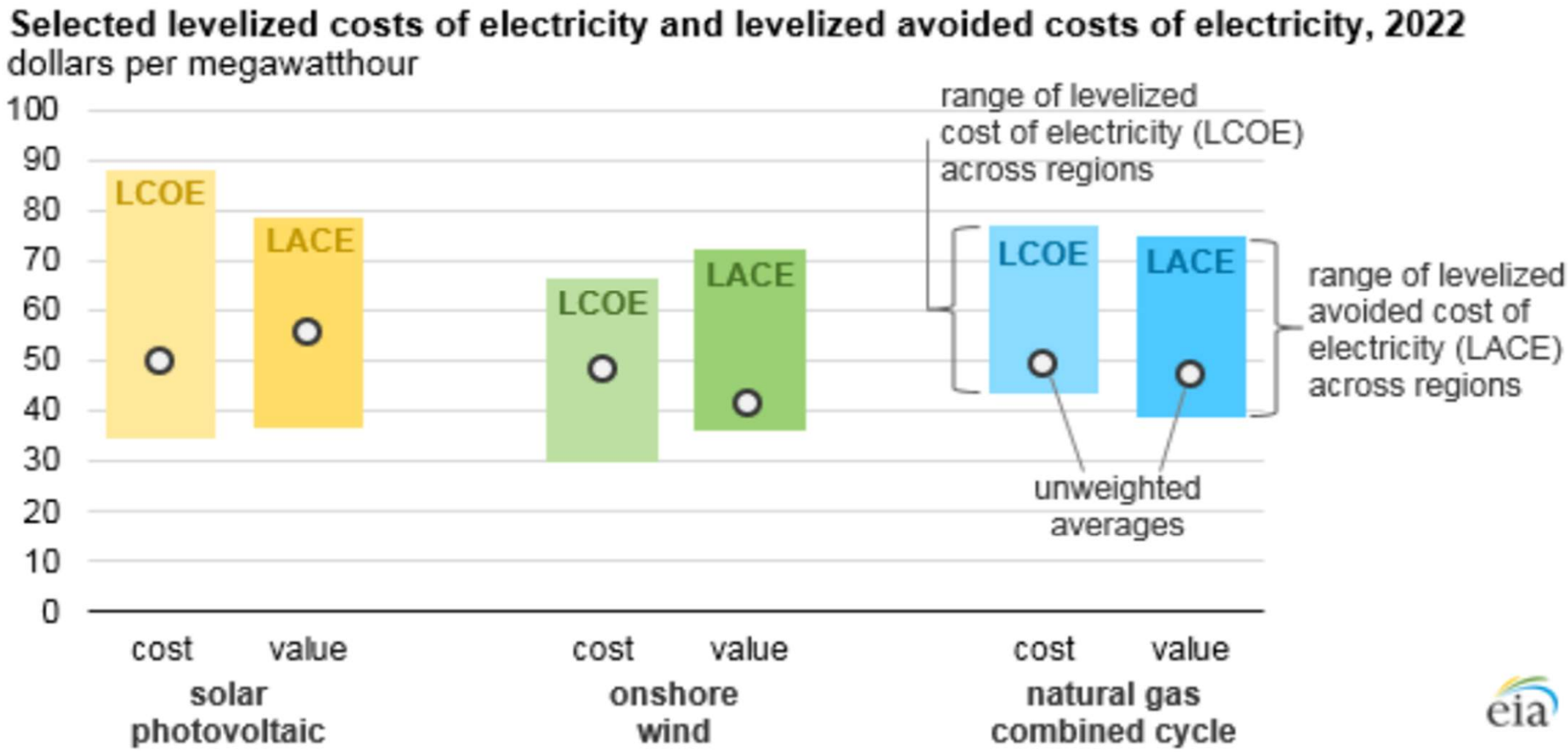
$44-75/MWh Gas Plant

UAMPS Review of Nu-Scale Estimate
$55-$58/MWh

+$20/MWh or $40/$CO_2$ton Cost of Carbon or CCUS
$64-$95/MWh

scottmadden | Sources: Breakthrough Institute, Nu-Scale, Lazard

EIA uses two simplified metrics to show future power plants' relative economics



Source: U.S. Energy Information Administration, *Levelized Cost and Levelized Avoided Cost of New Generation Resources in*

ADVANCED NUCLEAR COALITION

- A non-profit organization to provide for ongoing education and advocacy in Nebraska and beyond.

- The primary purpose of ANC is to provide education, advocacy, and engagement regarding advanced nuclear technologies.

- ANC develops and offers programming and resources to educate the public, policy makers and electric industry personnel about the advancements in nuclear energy generation, nuclear safety, fuel and waste management and the role nuclear generation plays in reducing carbon in the environment.

- Thank you for your Time!
- References:

- Nuclear Energy Essential Carbon Free Energy for a Low Carbon economy, NEI
- Nuclear Energy in a Low Carbon Energy Future, Challenges and Opportunities
- E3 Pacific Northwest Zero Emitting Resources Study
- Natrium, TerraPower-GE Hitachi, November courtesy of Mr. Christian Blessing of TerraPower
- SMR Start, Opportunities for Small Modular Reactors in Electric Utility Resource Planning
- Nuclear Costs in Context, NEI
- Graphs GenerationAtomics.org
- NEI Marc Nichol Presentation NANF
- NuScale Presentation NANF
- X-Energy Presetation NANF

QUESTIONS?

- Jan Bostelman, PE, PMP
- Chemical, Metallurgical and Nuclear Engineer
- Bostelman Engineering, LLC Small Woman Owned Business
- 40+ Years Experience Commercial Nuclear in US and Overseas
- Expert Panel DOE Yucca Mountain Project for High Level Radioactive Waste Storage
- 14 Years Direct Employment Supervisor of Reactor Performance OPPD
- 30 Years Consulting for Nuclear Industry areas of Fuel Storage, Power Uprates, License Renewal, Licensing, Radiological, Safety Analyses
- NRC Research Panel for Containment Materials
- Nebraska Board of Engineers and Architects
- Vice Chair Central Zone (17 States) for National Council of Examiners for Engineers and Surveyors
- NCEES Exam for Professional Engineers Committee (oversight of 50,000 exams per year)
- Current Adjunct Instructor SECC Energy Generation Program, Nuclear
- Current Industry Trainer for Radiological Software
- Current Electric Power Research Institute Project for Power Recovery & Radiological
- Previous UNL Adjunct Instructor Mechanical Engineering/Metallurgy Program
- Currently working on Advanced Nuclear Project Thermal Hydraulics and Safety Conseq.

Meeting Close

- Split Kitty Drawing

- PDHs available from the Omaha Post Website
  - https://www.same.org/omaha/resources/