



**Utilities Policy Advisory Committee (UPAC)**

**Wednesday, December 4, 2024**

**8:00 a.m. – 10:00 a.m.**

Blue River Board Room

121 S. Tejon Plaza of the Rockies or Microsoft Teams

[Click here to join the meeting](#)

<b>8:00 a.m.</b>	<b>1.</b>	<b>Call to Order</b>	
<b>8:05 a.m.</b>	<b>2.</b>	<b>Approval of November 6, 2024, UPAC Meeting Minutes</b>	Decision
<b>8:10 a.m.</b>	<b>3.</b>	<b>Bechtel and TerraPower</b>	Discussion
<b>9:00 a.m.</b>	<b>4.</b>	<b>Colorado Springs Utilities Key Account Manager for Local Military Installations</b>	Discussion
<b>9:45 a.m.</b>	<b>5.</b>	<b>Selection of UPAC Officers for 2025</b>	Decision
<b>9:50 a.m.</b>	<b>6.</b>	<b>Customer Comment</b> Citizens can provide comment in person, by joining the meeting from computer or by phone using the link above. If you would like to speak during the citizen comment period, please sign up to speak through <a href="mailto:BoardSubmissions@csu.org">BoardSubmissions@csu.org</a> prior to the meeting.	Discussion
<b>9:55 a.m.</b>	<b>7.</b>	<b>Committee Member General Discussion</b>	
<b>10:00 a.m.</b>	<b>8.</b>	<b>Adjournment</b>	

Next meeting: January 8, 2024

Note: UPAC Bylaws, Rule 6: Customer and Public Comment: (b) At the discretion of the Chair, or the majority of the Committee Members present, customers and members of the public will be allowed to comment or ask questions concerning items discussed at regular meetings or concerning matters discussed at special meetings. Comments or questions by individuals will be limited to five minutes each, and all customer or public comments will not exceed twenty minutes on any agenda item unless time is extended by the Chair or majority of the Committee Members present.





**Minutes**  
**Utilities Policy Advisory Committee (UPAC)**  
**Wednesday, Nov. 6, 2024**  
**Blue River Boardroom, 5<sup>th</sup> floor, 121 S. Tejon St., Colorado Springs, CO**  
**and Microsoft Teams Virtual Meeting**

**Committee members present in the Boardroom or via Microsoft Teams:**

Chair Larry Barrett, Scott Smith, Gary Burghart, Michael Borden, David Watson, Katherine Danner, Chris Meyer, Tom Carter and Albert Badeau

**Committee members excused:** None

**Staff members present in the Boardroom or via Microsoft Teams:** Travas Deal, Kaitlin Haslam, Bethany Schoemer, Amy Lewis, Tristan Gearhart, Al Wells, Christian Nelson, Marcela Espinoza, Heather Tocci, Fadil Lee, Leslie Smith, Gabe Caunt, Kathryn Rozwod, Steve Barry, Kerry Baugh, Matt Dudden, Tyrone Johnson and Jacqueline Nunez

**Utilities Board members present in the Boardroom or via Microsoft Teams:** None

**City of Colorado Springs staff present in the Boardroom or via Microsoft Teams:** David Beckett

**Residents present in the Boardroom or via Microsoft Teams:**

Mason Baker and Michael Squires

**1. Call to Order**

Chair Larry Barrett called the meeting to order at 8:01 a.m. and called the roll.

**2. Approval of Oct. 2, 2024, UPAC Meeting Minutes**

Committee Member Chris Meyer made a motion to approve the Oct. 2, 2024, meeting minutes and Committee Member Katherine Danner seconded the motion. The motion passed unanimously.

**3. Utah Associated Municipal Power Systems Presentation**

Mr. Mason Baker, Utah Associated Municipal Power Systems (UAMPS) Chief Executive Officer, presented experiences their agency has had in the nuclear generation space. UAMPS provides wholesale electric energy services, on a non-profit basis, to community-owned power systems throughout the Intermountain West. There are currently 50 members from Utah, Arizona, California, Idaho, New Mexico and Wyoming.

UAMPS terminated their Carbon Free Power Project due to construction risk concerns and the inability to reach 80% subscription target. The project

development started in 2012 with NuScale Power technology. This helped secure \$1.4 billion cost-sharing with the Department of Energy. UAMPS engaged with the Shoshone-Bannock tribes starting in 2014 for site considerations. Ultimately the construction cost deterred potential partners, and the interest rate increased 150 basis points, impacting power costs along with supply chain issues and labor availability.

Mr. Baker discussed their resource mix and energy transition needs which includes their current peak load of 1,350 megawatts. The resource mix includes 25% hydro, 15% coal, with an increase in natural gas. Their planning requirement increases to 115% of peak load for resource adequacy. UAMPS is currently studying 1,200 megawatts of new generation options.

#### **4. Customer Comment**

There were no customer comments.

#### **5. Committee Member General Discussion**

Colorado Springs Utilities CEO Travas Deal discussed the permitting process for the Nixon site. It is estimated that \$15 million would be the initial site permitting cost. This approach could open potential partners with an already-permitted site. Clear Springs Ranch was identified as a potential nuclear site with 1,000+ acres of existing transmission infrastructure.

The power plant transition strategy and timing were discussed. The committee identified a 15 year+ timeline for nuclear power implementation. The committee noted the importance of parallel planning for both short-term needs and long-term nuclear possibilities.

Mr. Barrett noted that his term serving as chair will conclude at the end of the year. He will be continuing as a committee member. Chair and vice chair elections are scheduled for the December meeting. Mr. Barrett will provide recommendations for the new leadership positions. In December, it is anticipated that we will have representatives from Bechtel, TerraPower, and a Springs Utilities military account representative. A presentation on ethics, open meetings, and the Colorado Open Records Act (CORA) will be scheduled for December 2024 or January 2025.

#### **6. Adjournment**

Committee Chair Larry Barrett adjourned the meeting at 10:30 a.m.

**Next meeting:** Dec. 4, 2024, at 8:00 a.m. in the Blue River Board Room

# TerraPower Introduction

December 2024

Christian Blessing  
Director of Strategic  
Development





# 2012

- TerraPower laboratory is established.
- TerraPower identifies molten salt reactors as a research technology.



# 2022-2024

- TerraPower works to finalize Natrium design.
- TerraPower secured a total of **\$830 million** in the largest private fundraise among advanced nuclear companies.

# 2006

Bill Gates and like-minded visionaries determine the private sector must act to develop clean energy resources to halt climate change and to raise global living standards.



# 2020-2021

- The DOE awards TerraPower **\$2 billion** to demonstrate the Natrium™ reactor and integrated energy system.
- TerraPower and PacifiCorp announce efforts to advance the Natrium™<sup>1</sup> reactor demonstration project near a retiring coal plant in Wyoming.



# TerraPower - Energy & Radiopharmaceuticals



- With over 15 years of innovation, TerraPower continues to grow and diversify its portfolio. Its multidisciplinary team has made progress on advanced reactor designs, reactor licensing, design software and isotope production
- The Sodium reactor program and TerraPower Isotopes (TPI) are now ready for commercial deployment, while the Molten Chloride Fast Reactor (MCFR) remains in the research and development stage.



## Carbon-Free Power for the Clean Energy Transition

- Natrium provides scalable, dispatchable power, supporting decarbonization efforts and stabilizing grids with high renewable penetration.
- The integrated energy storage capability allows Natrium to function as a peaker plant, supplying critical power when intermittent sources like solar and wind are unavailable.
- A key innovation is Natrium's novel architecture, which simplifies and separates major components, allowing the power block to be constructed and operated without nuclear-grade equipment.
- Natrium is particularly well-suited for converting retired coal plants into nuclear facilities, offering a pathway to repurpose existing infrastructure.

Ready for Commercial Deployment



## Transforming the Fight Against Cancer

- TerraPower Isotopes (TPI) is at the forefront of developing the next generation of medical isotopes, with a focus on revolutionizing oncology treatment.
- TPI is one of the few companies capable of delivering Actinium-225, a rare isotope with significant potential in cancer therapies.
- In January 2024, TerraPower delivered its first samples of Actinium-225 to customers, marking a groundbreaking step in expanding the availability of this critical isotope and moving closer to commercial sales.

Ready for Commercial Deployment

## Nuclear Technology R&D with MCFR Potential for Multiple Use Cases

- The Molten Chloride Fast Reactor (MCFR) has the potential to provide a low-cost, versatile solution for industrial process heating, chemical production, waste reduction, and maritime propulsion.
- MCFR's development program addresses a broad array of use cases across large end markets.
- TerraPower's strong partnerships, including a collaborative development effort with Southern Company, bring expertise and funding to the program.
- The project received the 2020 ARDP Risk Reduction Award, with an 80/20 cost-sharing arrangement between the U.S. Government and TerraPower.

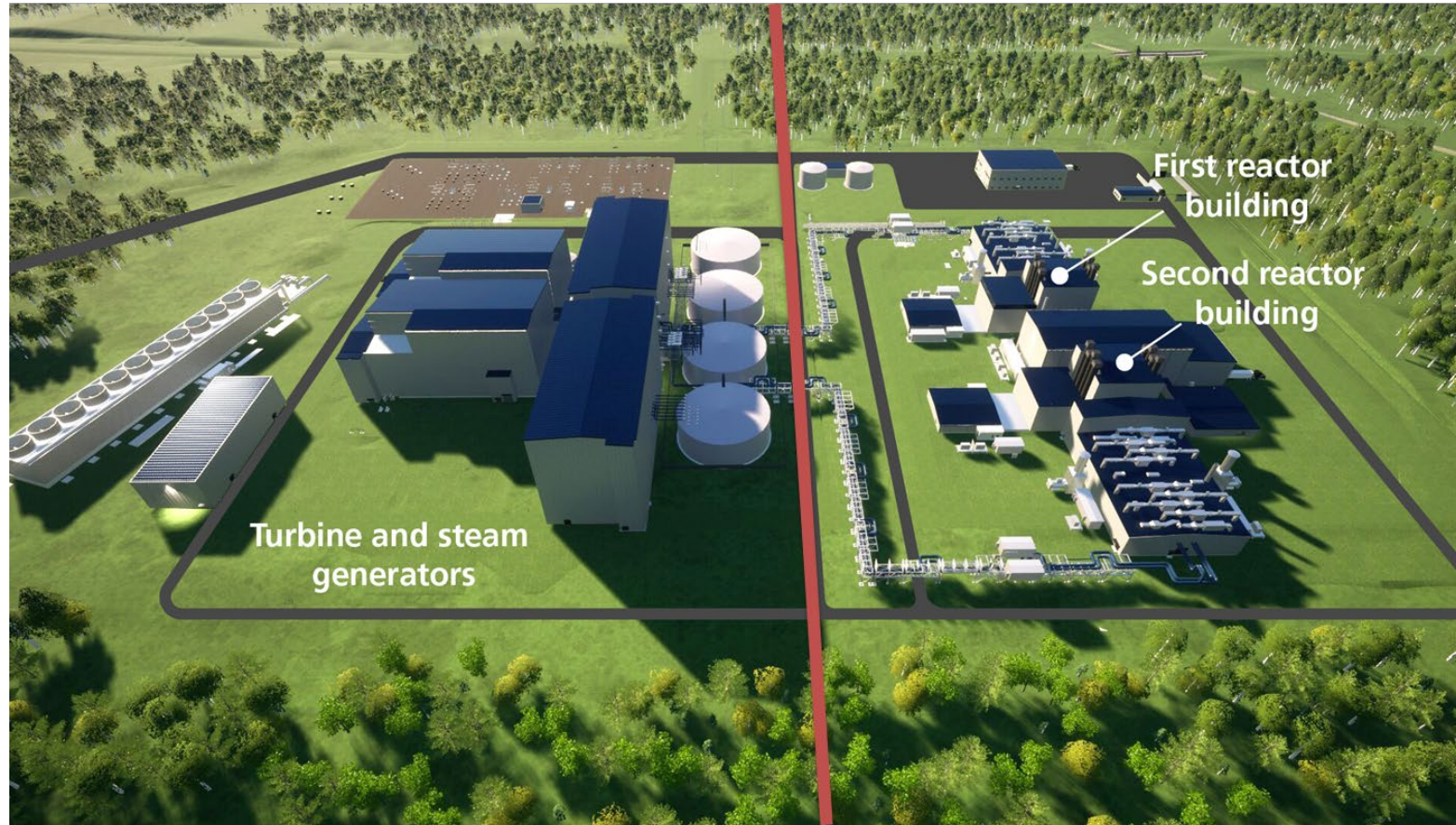
In R&D Stage



# Natrium Reactor Plant

## ENERGY ISLAND

- No Nuclear QA Work
- Operations support energy dispatch, demand following, arbitrage
- No immediate impact on reactor

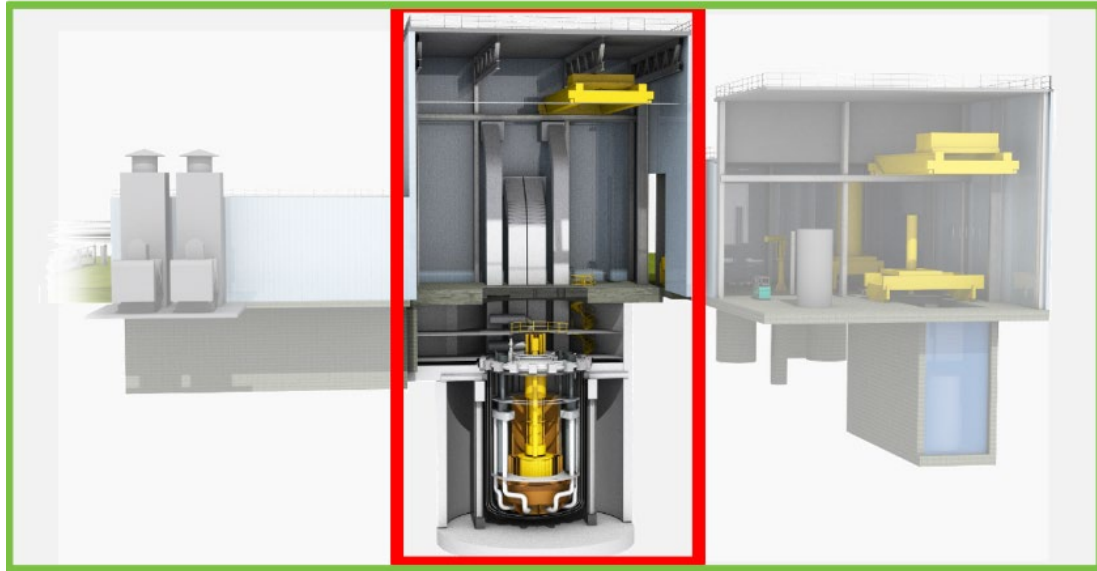


## NUCLEAR ISLAND

- Graded Nuclear QA Work
- Operations focused on constant reactor power
- No immediate impact from energy storage or turbine



# The Sodium Technology



## Advanced nuclear reactor

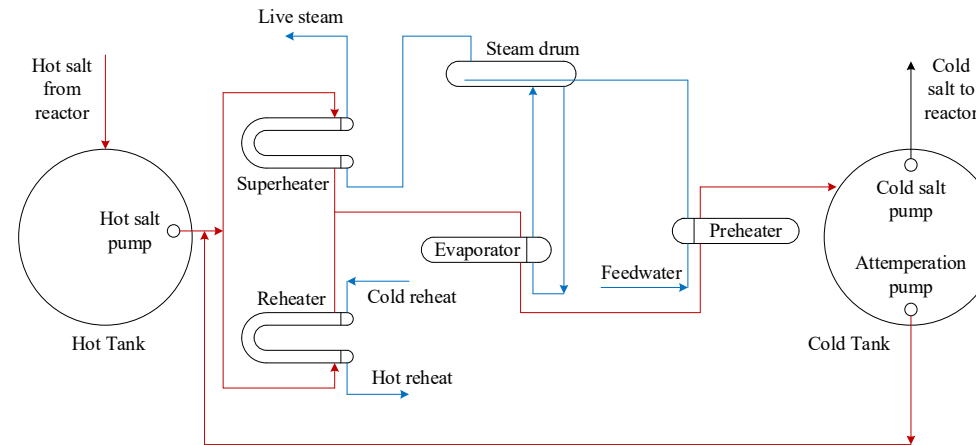
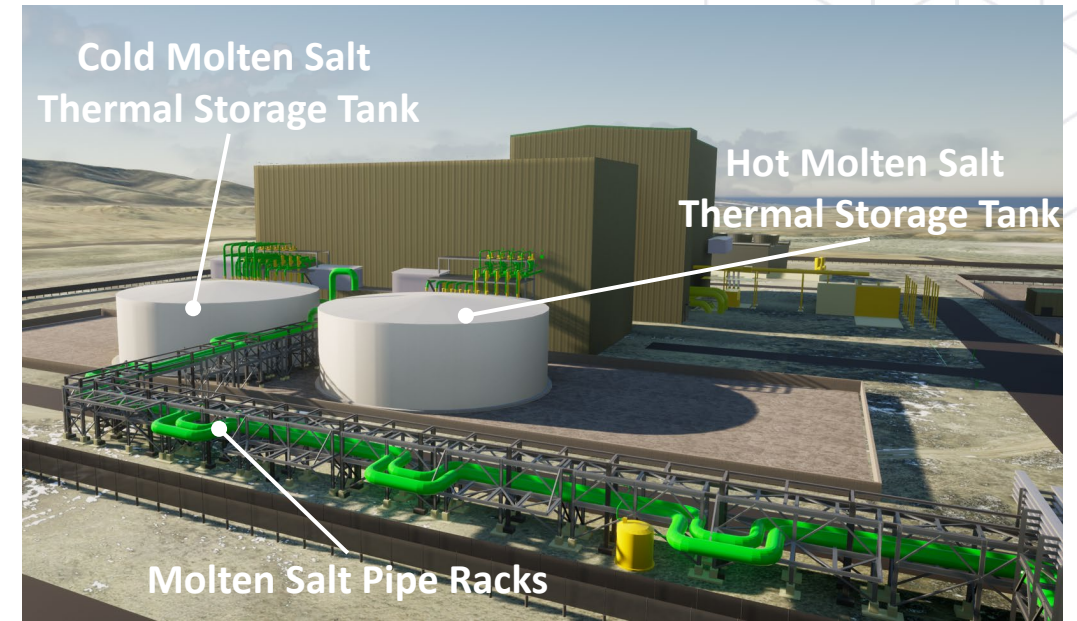
- Sodium-cooled fast reactor
- 345 MWe clean energy
- 4x more fuel efficient



## Integrated energy storage system

- Molten salt energy tanks
- Allows ramp up to 500 MWe for 5+ hours
- Larger than any commercial battery available today

# Energy Island Thermal Storage



## Thermal Storage

- Number of tanks based on customer's energy need
- Steam generator trains based on size of turbines
- Turbine size based on customer's power

# Benefits of Energy Storage

- Dispatchable & CO2 free
- Step change in nuclear power flexibility
- Competitive with heavy duty combined cycle
- Unmatched GWe scale energy storage
- Nuclear island unaffected by turbine load following

	Ramp Rate ( $P_{nom}$ /min)	Turndown ( $P_{nom}$ minimum)
AP1000 <sup>1</sup>	0.4%	15%
NuScale <sup>2</sup>	0.8%	20%
Hard Coal <sup>3</sup>	6%	10-20%
<b>NATRIUM<sup>4</sup></b>	<b>10%</b>	<b>20%</b>
CCCT 1x1, GE 7F.05 <sup>5</sup>	10.4%	43%
CCCT 1x1, GE 7HA.03 <sup>5</sup>	11.7%	33%

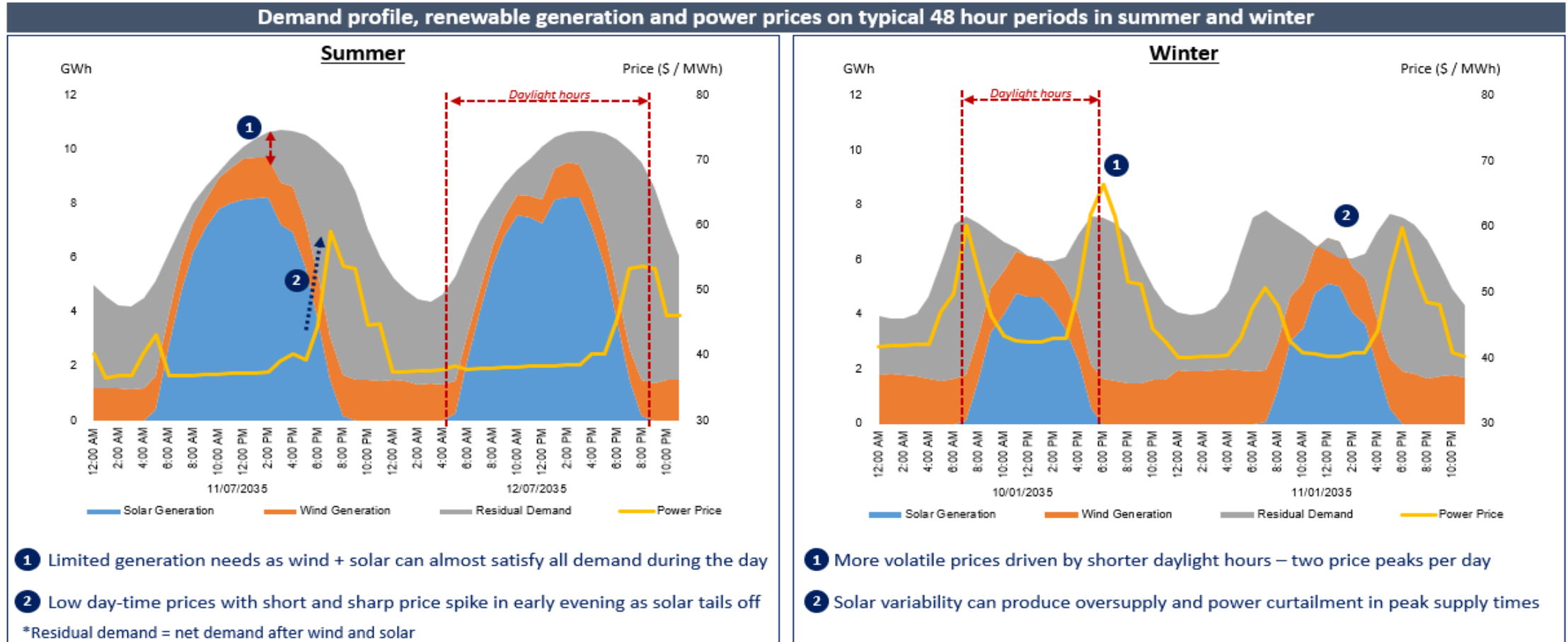
## Notes

1. Load following capability per AP1000 Design Control Document Tier 2 sections 3.9.1.1.1 r19 & 7.7.1.1 r16. 2%/min for  $<10\%P_{nom}$  is available for frequency response.
2. <https://www.nuscalepower.com/environment/renewables/solutions-to-the-duck-curve>
3. IRENA (2019), Innovation Landscape Brief: Flexibility In Conventional Power Plants
4. Further design expected to reveal higher ramp rate & lower turndown
5. GEA32930A (05/2020), GEA34163 (09/2019)



# Energy Storage & Ramping Balance a Renewables-Based Grid

Significant price volatility from solar daily / seasonal variability - WECC Region





# Load Following/Integrated Energy (Thermal) Storage

## Basic Operation

**Charging:** Low Price  $\dot{W}_T < \eta_T \dot{Q}_{Rx}$

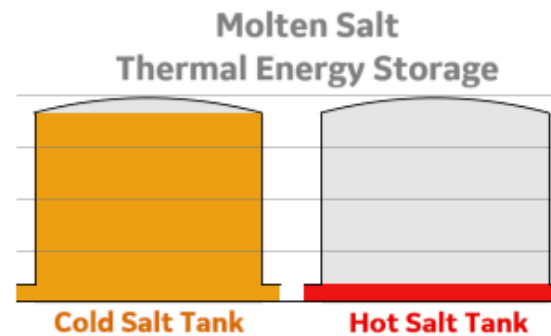
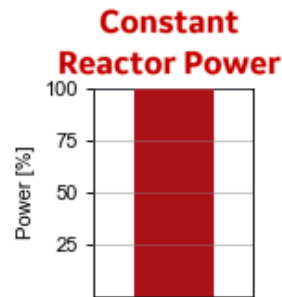
- Hot salt tank level increases
- Cold salt tank level decreases

**Discharging:** High Price  $\dot{W}_T > \eta_T \dot{Q}_{Rx}$

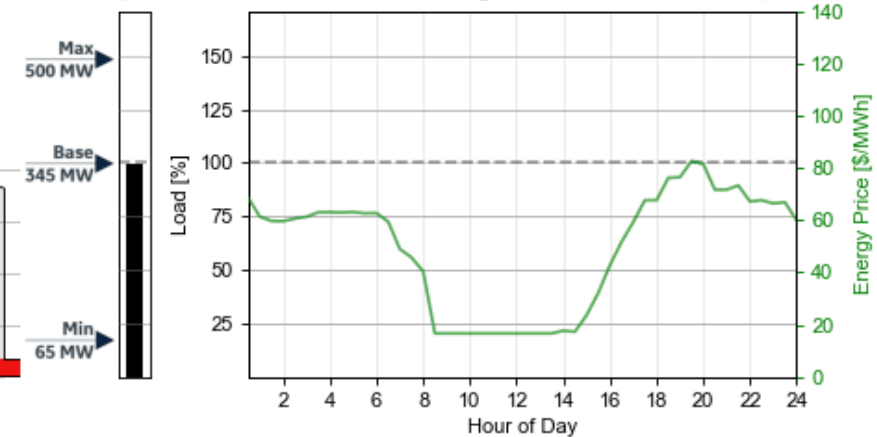
- Hot tank salt level decreases
- Cold tank salt level increases

**Even:**  $\dot{W}_T = \eta_T \dot{Q}_{Rx}$

- Steady hot tank salt level
- Steady cold tank salt level



Optimized Load-Following With Boosted Capacity



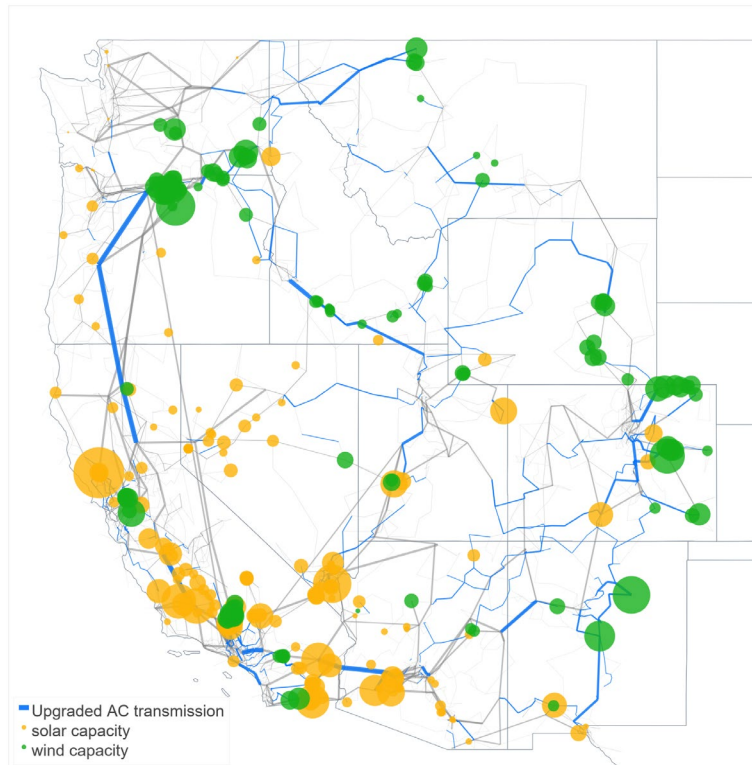
## Low price - sell less, high price – sell more

- Store when renewables are producing power (lower prices) and discharge when they are not (higher prices)
- The Sodium design is different from LWRs because the outlet temperature is high enough to support storage.
- Reactor output is steady ... minimize cycling of reactor
- Price following above and below 100% reactor power

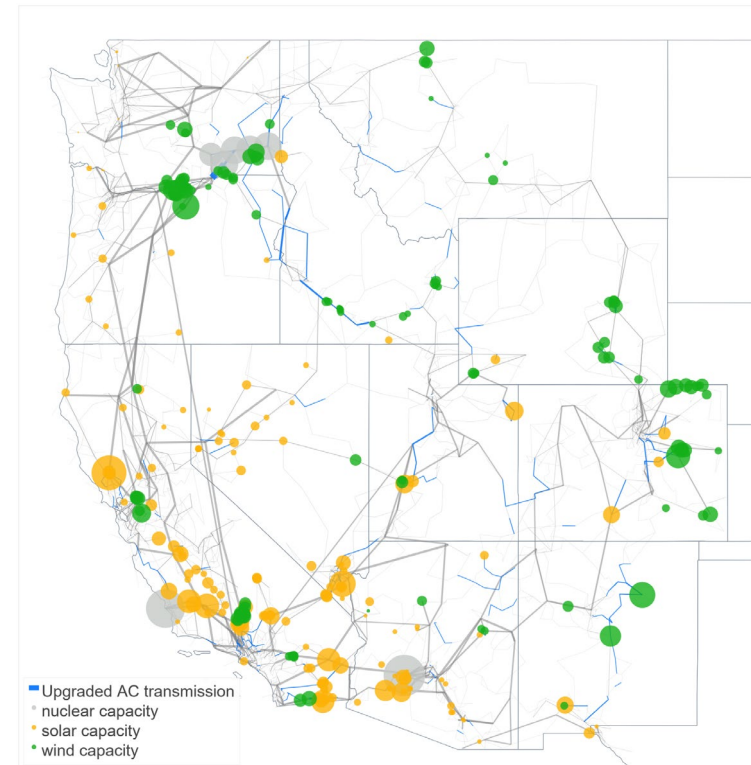
$$\text{Full Power Turbine Hours} = \frac{(\rho V_{\text{working}})_{\text{hot}} (C_{\text{hot}} T_{\text{hot}} - C_{\text{cold}} T_{\text{cold}})}{\frac{\dot{Q}_T}{\eta_T} - \dot{Q}_{Rx}}$$

# Total System Cost Reduction with Energy Storage

Breakthrough Energy Grid Model (<https://science.breakthroughenergy.org/>) of generation and transmission for the Western Interconnect with 90% carbon free energy

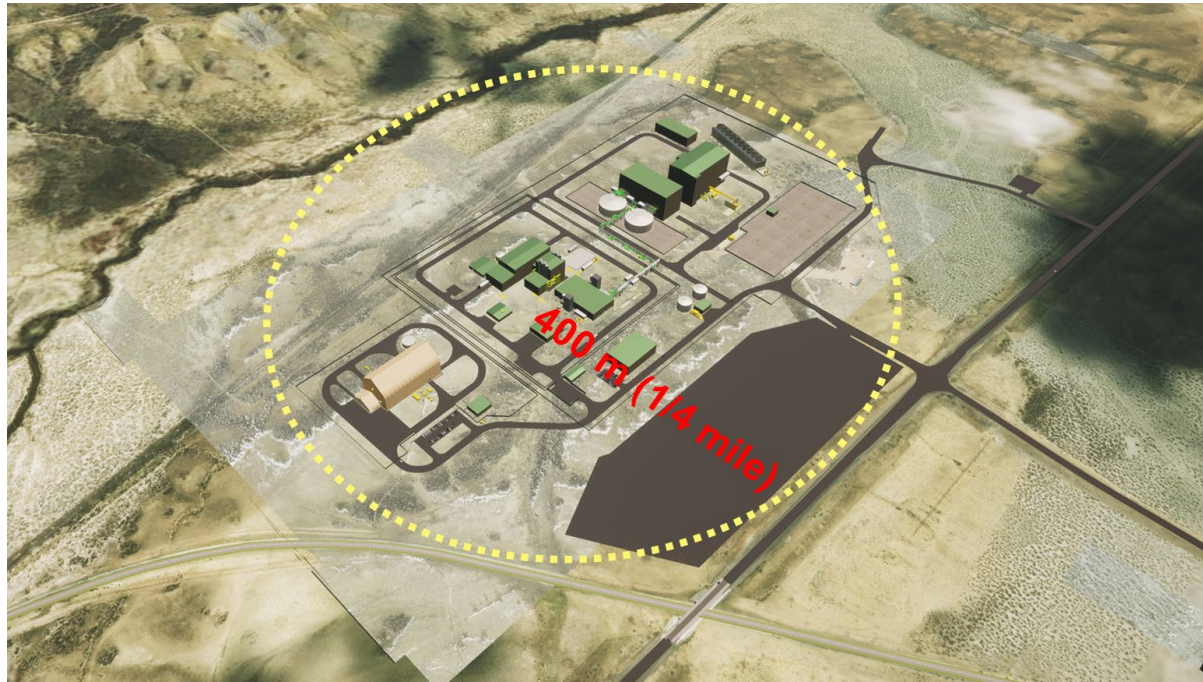


**New renewables only: over 12,000 GW-miles of new transmission capacity needed in lowest-cost scenario**



**Renewables + flexible nuclear:  
83% reduction in new transmission capacity**

# Sodium Cost Advantage

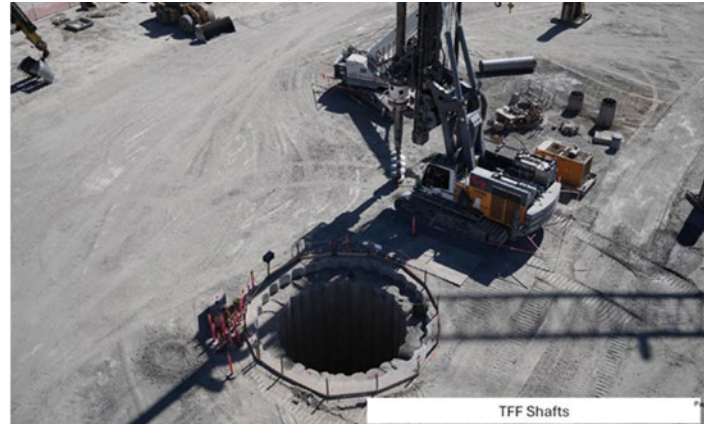


400m Environmental Protection Zone

- Sodium maintains its key advantages relative to other designs:
  - Reduced nuclear quantities and construction labor
  - Shorter construction duration
  - Added value from energy storage
  - Smaller Emergency Planning Zone (EPZ)
- Total cost of energy for the current Sodium design is lower than competitors
- We are realizing cost reductions on the base Sodium design and will continue to do so
- We are also pursuing technologies that can reduce costs on future commercial units

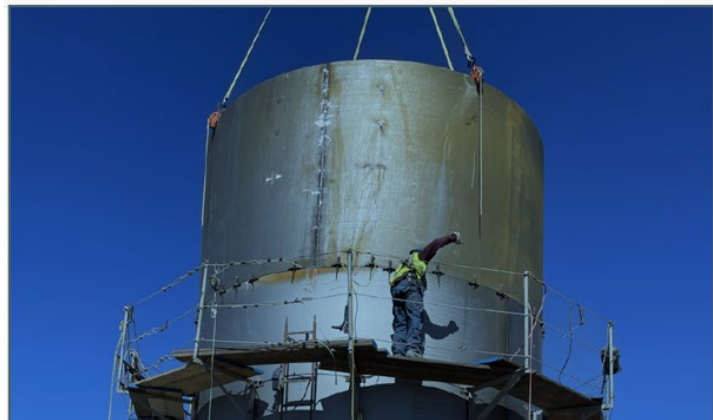


# Sodium in Wyoming



- Developing the first Sodium plant near a retiring coal plant in Wyoming with utility PacifiCorp

- Announced final site choice in Kemmerer, Wyoming, November 2021



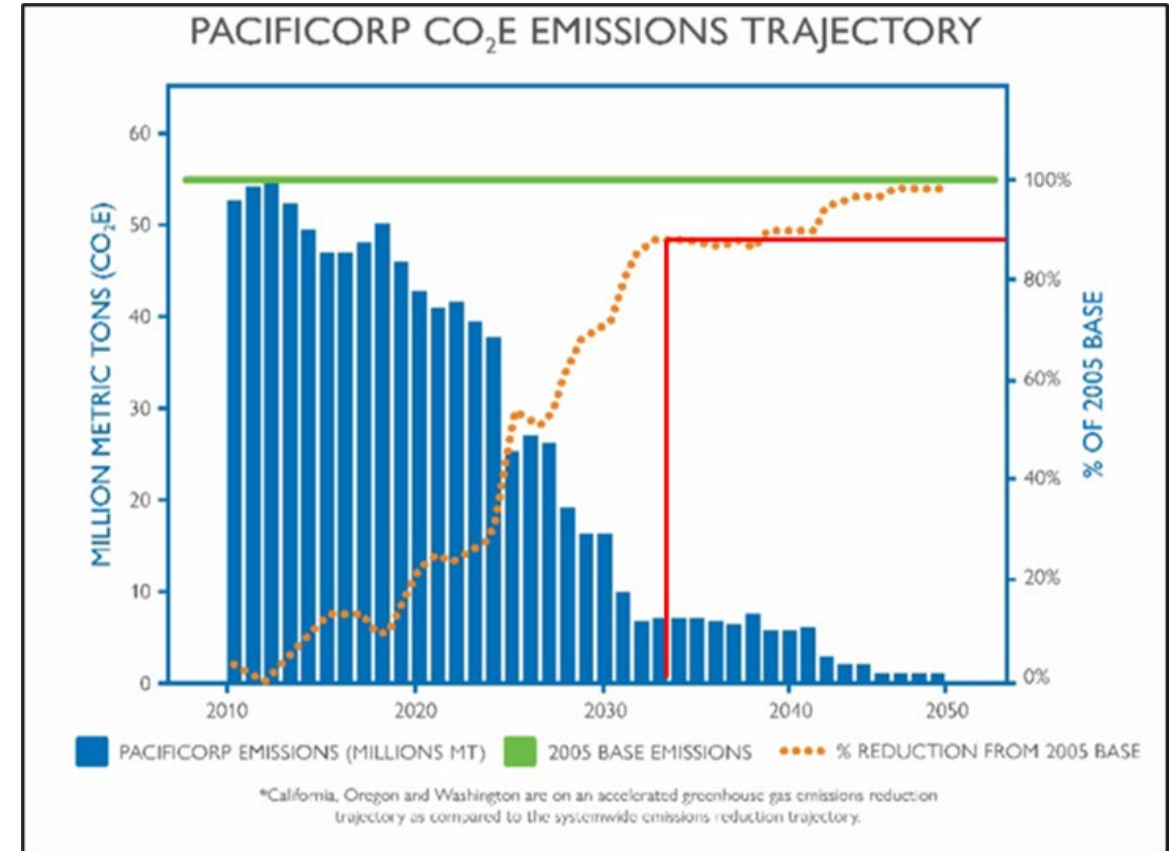
- 1,600 construction jobs at peak; 200-250 full time jobs when the plant is operational

- Non-nuclear construction began in June 2024 and plant operational is planned ca. 2030



# Sodium Reactor's Strategic Advantage

- Sodium reactor delivers
  - Low Cost
  - Clean Electricity
  - Dispatchable Power
  - Clean Heat
  - Resilience – changing markets
- Sodium reactor's target market
  - 80% decarbonization
  - Diminishing returns
- Scarcity
  - Strong market need
  - Challenging production





# Mitigating Megaproject Challenges

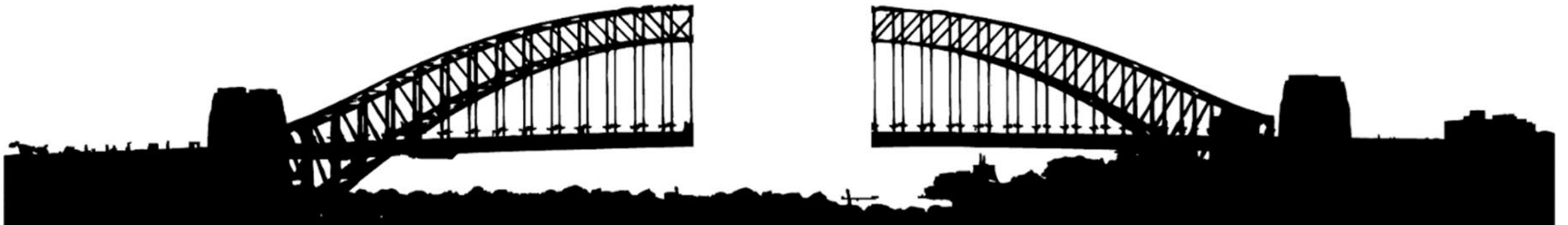


## Nuclear Vendor – Challenges

- Incomplete Design & License
- Inexperienced Supply Chain & Workforce
- Inequitable Contract Structure

## Client Requires Certainty

- Cost
- Schedule
- Plant Performance



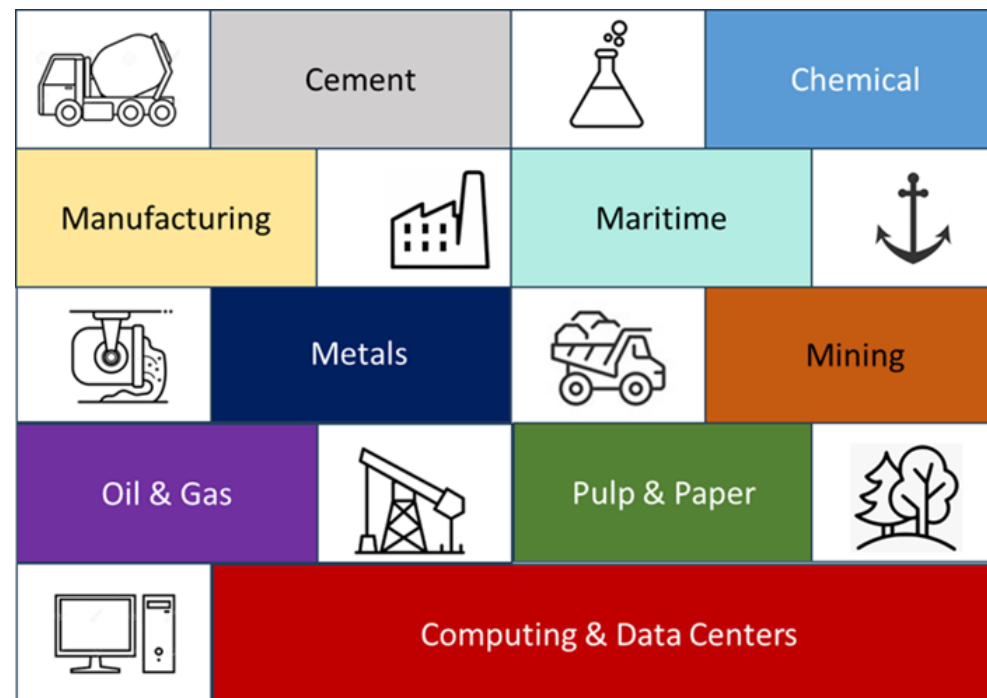
# Natrium Reactor Development Roadmap

- First-of-a-kind (FOAK)
  - Demonstration Reactor Kemmerer, Wyoming, completed circa 2030.
  - Mature Design & License
- Next-of-a-kind (NxOAK)
  - Mature the Natrium Reactor technology beyond FOAK.
  - Supply Chain and Workforce Mature & Expanding
- N<sup>th</sup>-of-a-kind (NOAK)
  - Standardized design
  - Experienced supply chain and workforce,
  - Fair contract structure



# Targeted Clients

- Attractive Industries
  - Large Energy Consumers
  - Converting to Clean Energy
  - Perceive utilities as slow moving
- Commodity Producers
  - Energy cost sensitive
  - Require Mature Technology
  - Disruption to Organization
- Ranking the Commodity Producers
  - Best - Company can influence or control global price
  - Good - primary form of energy is heat
  - Poor - primary form of energy is electricity







# THANK YOU

To learn more, visit [www.terrapower.com](http://www.terrapower.com)

# **Nuclear Energy & Military Installations**

**Steve Carr**  
**Principal Account Manager**

# UPAC Officer Selection for 2025



# UPAC Officer Eligibility and Selection



According to UPAC Bylaws, the Committee shall elect the Chair and Vice-Chair for the next calendar year at the Committee's December meeting.



The Chair shall be elected by a majority vote of the Committee members following nomination(s) by a member or members of the Committee, which nomination(s) must be seconded. The Vice-Chair shall be elected in the same manner as the Chair. If a nominee fails to get elected, nominations shall be reopened.



The Chair and Vice-Chair shall have a voice and shall vote in the selection of the officers of the Committee.



Committee members shall not serve more than two consecutive years as Chair and not more than two consecutive years as Vice-Chair.



# UPAC Officer Eligibility

## UPAC Chair

Michael Borden

Gary Burghart

Kate Danner

Scott Smith

David Watson

Chris Meyer

## UPAC Vice Chair

Michael Borden

Gary Burghart

Kate Danner

Scott Smith

David Watson

Chris Meyer

Larry Barrett