Advanced Nuclear In North Dakota

Prepared for the North Dakota Advanced Nuclear Committee

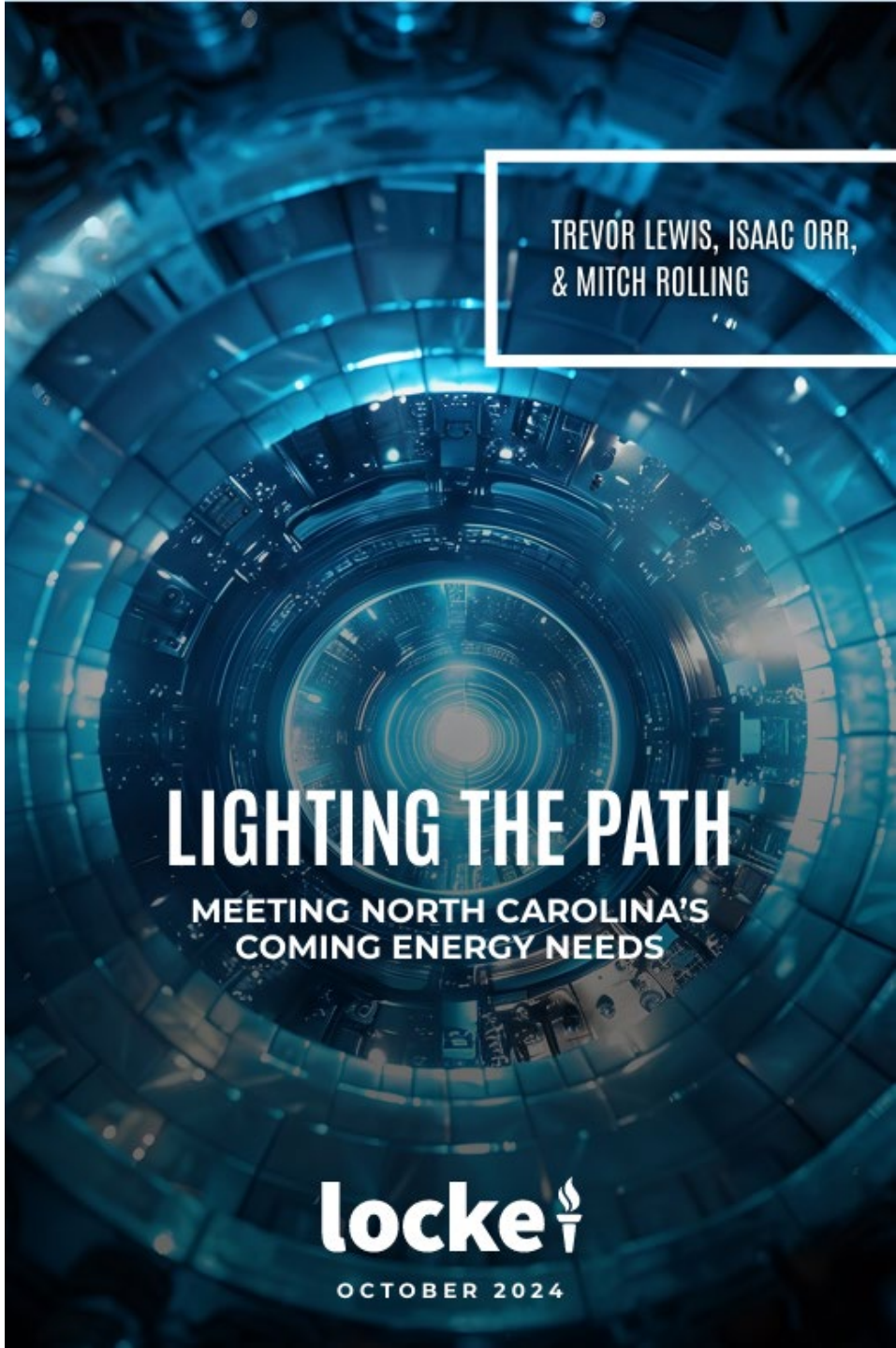
September 3, 2025

Prepared by Isaac Orr

Always On Energy Research

Why AOER is the Right Choice for this Project

1. We have completed similar projects in other states.
2. We have a proven track record of delivering for the state of North Dakota with high-quality energy modeling and research.
3. We have assembled the right team for the job to go above and beyond the original RFP to deliver an all-in-one package for North Dakotans with respect to the pros and cons of advanced nuclear in the state.



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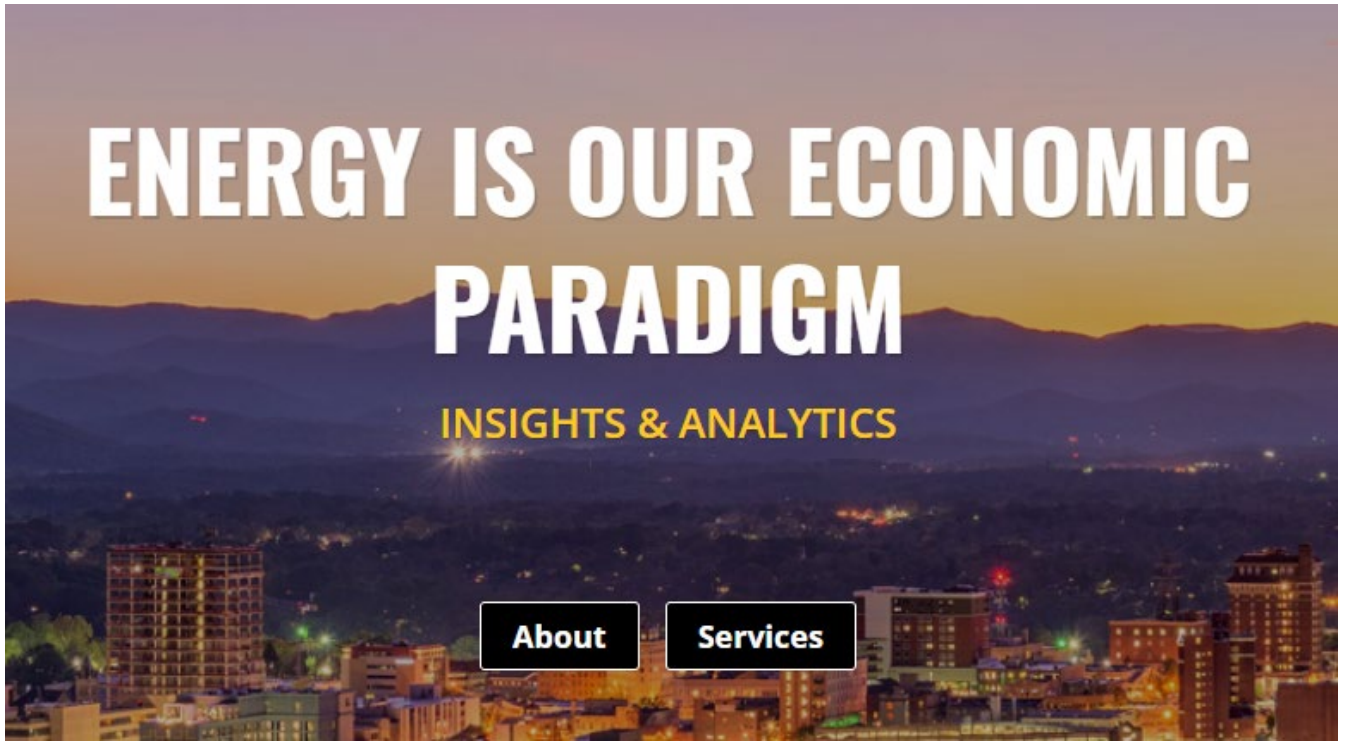
About Always On Energy Research

- Always On Energy Research (AOER) is a 501c3 organization dedicated to ensuring that every state in America has the affordable, reliable energy needed to power the nation and to fuel a robust, rapidly-growing economy now and into the future.
- Our modeling has been used to evaluate the economic and reliability impacts of EPA regulations and utility resource plans.
- Our proprietary “Always On” Levelized Cost of Energy (LCOE) model allows us to calculate the true cost to reliably meet demand and includes transmission, backup, and other factors that other firms generally leave out.



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Project Staff

Isaac Orr
Vice President of Research

David Stevenson
Director of Nuclear Development

Trevor Lewis
Research Fellow
And Ph.D. Candidate in Mineral and Energy Economics at the Colorado School of Mines

Mitch Rolling
Director of Research

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Isaac Orr

- I am a founder and Vice President of Research at Always On Energy Research, where I conduct energy modeling and write about energy and environmental issues, electricity policy, and natural resource development.
- My colleague Mitch Rolling and I have modeled the cost and reliability impacts of different energy portfolios and Environmental Protection Agency regulations in the Midcontinent Independent Systems Operator and Southwest Power Pool.
- We have also evaluated the cost and reliability implications of energy policies in more than twelve states.
- Lastly, I grew up on a dairy farm in Wisconsin and care deeply about issues impacting rural America.

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David Stevenson

- David is the Director of Nuclear Energy Development at Always On Energy Research.
- He served on President Trump's first-term EPA Transition Team.
- He successfully added used nuclear fuel amendments to the Advance Act, which passed with large bipartisan majorities in 2024. He has extensive experience working with utilities and public utility commissions on Integrated Resource Plans.
- He currently chairs a discussion team to end the used nuclear fuel problem with key members of the nuclear industry, and states that may host recycling and storage through federal legislation.
- He has written model legislation supporting nuclear power and storing used fuel for the Western Electricity Coordinating Council

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Industry Contacts

- **Used Nuclear Fuel (UNF) Processing and Recycling**
- Fuel Cycle Technologies, enrichment technology, fuel manufacturing, test irradiations, post irradiation examination, chemical separations, recycle and UNF management
- Orano, mining to dismantling, conversion, enrichment, recycling, logistics and engineering
- Exodys, onsite complete UNF recycling
- TLG Services, UNF storage
- Curio, UNF Recycling
- SHINE, Recycling UNF, fusion technology
- NAC International, UNF recycling

- **Manufacturers of nuclear power generation equipment;**
- Holtec, SMR generators
- Oklo, SMR generators
- General Atomics, advanced reactors
- **Nuclear power generators;**
- Southern Company
- Constellation Energy

Other organizations;
Nuclear Waste Strategy Coalition
Nuclear Energy Institute
Energy Communities Alliance
National Association of Regulatory Utility Commissions
Heritage Foundation
CATO Institute
Competitive Enterprise Institute
State Policy Network

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Trevor Lewis

- Trevor Lewis is a Research Fellow at Always On Energy Research and a Ph.D. candidate at the Colorado School of Mines' Mineral and Energy Economics program.
- Lewis's work examines the costs and benefits associated with regulations imposed on energy producers, and the distributional effects of tax policies and subsidies.
- His 2025 report, *Balancing the Scales,* prepared on behalf of Wyoming Liberty Group, examined how changes in taxation of fossil fuel, wind, and nuclear energy sources impacted state budget revenues.

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Mitch Rolling

- Mitch Rolling is a founder and Director of Research at Always On Energy Research, where he models energy proposals, analyzes the energy industry and electricity policy, and writes about energy and environmental issues.
- He developed AOER's proprietary "Always On" Levelized Cost of Energy (LCOE) model to accurately convey the true cost of wind and solar power.
- Mitch graduated from the University of Minnesota in 2018 with a bachelor's degree in history, and he earned an MS in Finance and Economics at West Texas A&M University in 2022.

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AOER: Delivering Wins for North Dakota Energy

- AOER's staff has years of experience writing and conducting energy modeling with the state of North Dakota.
- When Mitch and I worked at Center of the American Experiment, we helped save the Coal Creek Station by writing articles about how important this reliable and affordable plant is to the MISO grid and mobilizing co-op board members to support the sale of the plant to Rainbow Energy.

ENERGY & ENVIRONMENT

Written by **Isaac Orr** | August 3, 2021

American Experiment scores major victory on Coal Creek vote

Center of the American Experiment notched a major victory last week when 27 out of 28 rural electric co-ops served by Great River Energy voted to approve the sale and continued operation of the Coal Creek power plant.

The outcome of the vote was no doubt heavily influenced by the fact that nearly 900 co-op customers have now signed American Experiment's petition to encourage the sale of the plant. The sale of the plant is great news for the reliability and affordability of the electric grid.

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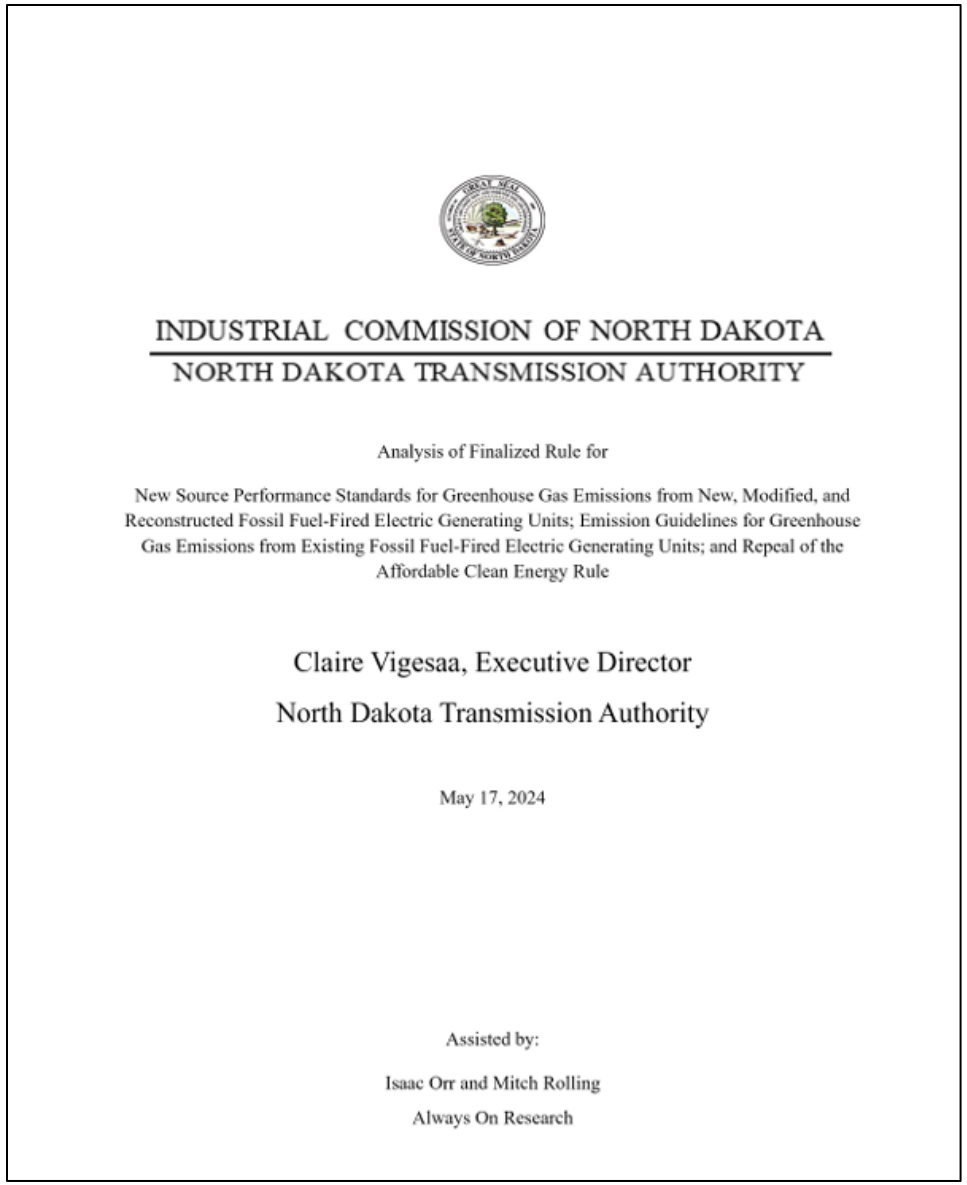
Fighting EPA Overreach For North Dakota

- AOER worked with the North Dakota Transmission Authority and the Attorney General's office on two studies to evaluate the economic and reliability impacts of the Biden Administration's greenhouse gas and MATS rules in the Midcontinent Independent System Operator region.
- We determined the Biden administration's rules would cause massive blackouts and cost ratepayers billions of dollars.
- This modeling was used by West Virginia in its lawsuit against the EPA and will likely be used to overturn the rules on court challenge pending current rulemakings by the Trump Administration.



INDUSTRIAL COMMISSION OF NORTH DAKOTA

NORTH DAKOTA TRANSMISSION AUTHORITY

Analysis of Finalized Rule for

New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions from Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule

Claire Vigesaa, Executive Director

North Dakota Transmission Authority

May 17, 2024

Assisted by:

Isaac Orr and Mitch Rolling

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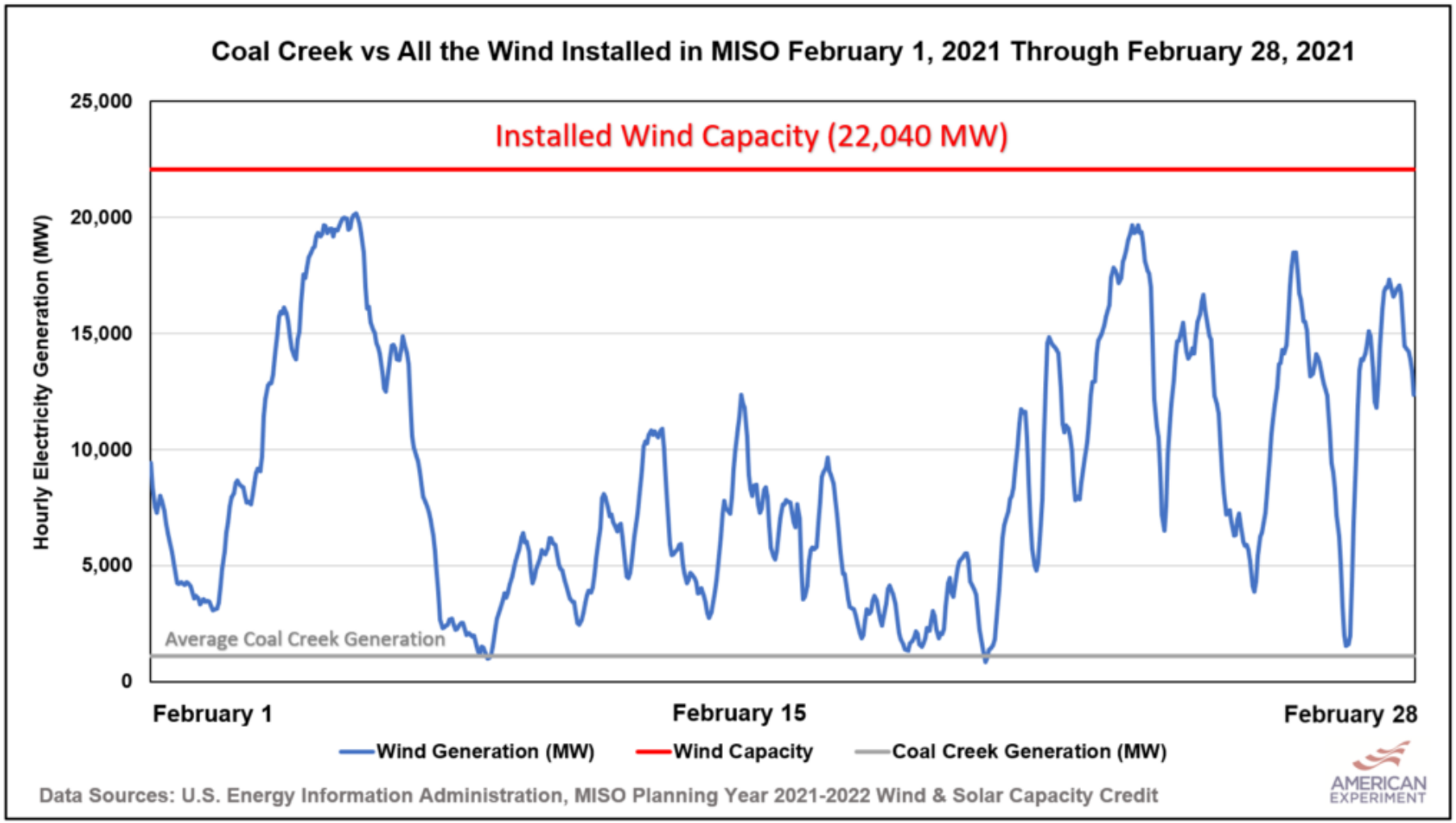
Coal Creek vs the MISO Wind Fleet



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Our Guiding Principle for this Project: What's in it for North Dakota?

- Before we evaluate *where* we should site advanced nuclear plants in North Dakota, AOER believes we need to answer these questions:
  - Who would build these plants?
  - Why would they build them?
  - How much would they cost?
  - How would they fit into North Dakota's existing energy industry?

The answers to these questions will help us evaluate whether the nuclear industry will benefit North Dakotans, and where reactors can be sited to maximize benefits and minimize costs.

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Who Might Build Advanced Reactors?

- Possible Candidates:
  - Minnesota utilities –Xcel Energy and Minnesota Power are the most likely candidates.
  - Tech companies seeking to build data centers.
  - Companies seeking to reindustrialize the USA.
  - U.S. military installations.

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Why Would They Want to Build Them?

- Minnesota utilities are seeking carbon-free, dispatchable power plants to replace retiring coal plants due to the state's carbon-free electricity mandates, and it is illegal to build new nuclear plants in Minnesota.
- Data centers are signing massive contracts to restart old reactors to take advantage of nuclear's high productivity and zero emissions.
- The Trump administration has made deploying advanced reactors at military bases a priority via executive order.
- Small nuclear reactors can be placed very close to demand centers to reduce transmission costs and bottlenecks.

2023-2024 Regular Session

State establishes standard of 100% carbon-free electricity by 2040

Minnesota's Renewable Energy Standard statute has been amended to include adding a carbon-free standard that utilities must meet beginning in 2030.

The law, effective Feb. 8, 2023, also streamlines the siting and routing process for solar energy generating systems and certain high-voltage transmission lines, and authorizes the Public Utilities Commission to require payment of the state's prevailing wage to workers constructing large wind and solar energy systems.

According to the law's definitions, "renewable" energy sources for electricity production are wind and solar, while "carbon-free" sources would also include hydroelectric, hydrogen and biomass.

U.S. Army Seeks Microreactor Nuclear Power Plant Solutions for Military Bases

The Army intends to deploy the prototype microreactor nuclear power plant at an installation in the continental U.S. by 2030. If successful, the technology could be used at bases around the globe.

Kathy Hitchens • June 20, 2024 • 3 min read

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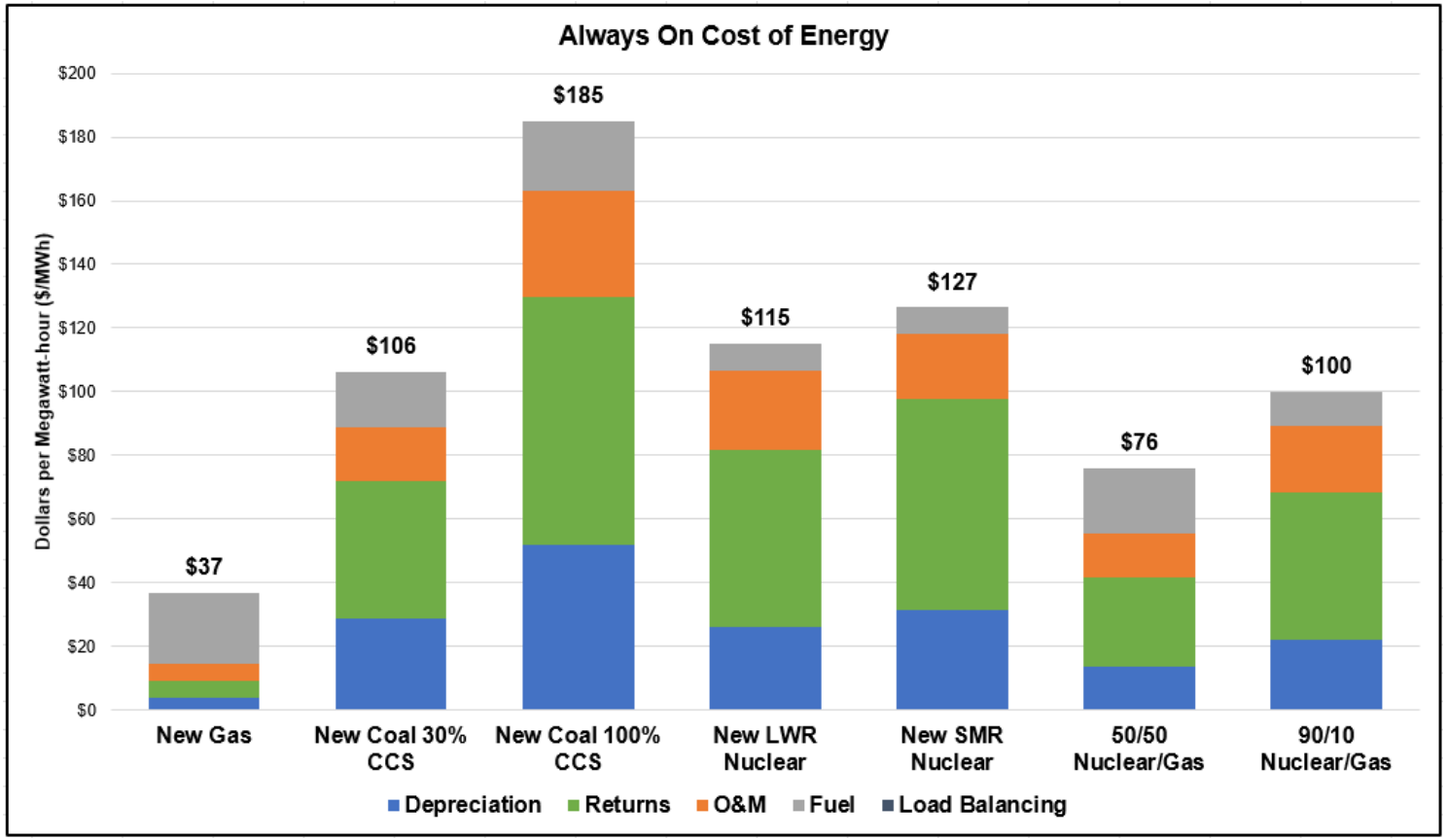
What Would it Cost?

- AOER is equipped to estimate the cost of a wide variety of nuclear and competing technologies to give North Dakota lawmakers a sense of the technology's feasibility in the state.
- AOER has modeled the cost of large and small reactors, with our current estimates at $115 to $127 per megawatt hour.
- This is substantially higher than new natural gas facilities.



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How Does Nuclear Fit?

- North Dakota's existing energy industry provides massive benefits to the state.
- How can North Dakota leverage nuclear power in addition to supporting the established energy industries in the state?
- North Dakota already exports half of the electricity it generates, so the biggest opportunity for nuclear will likely come from load growth.

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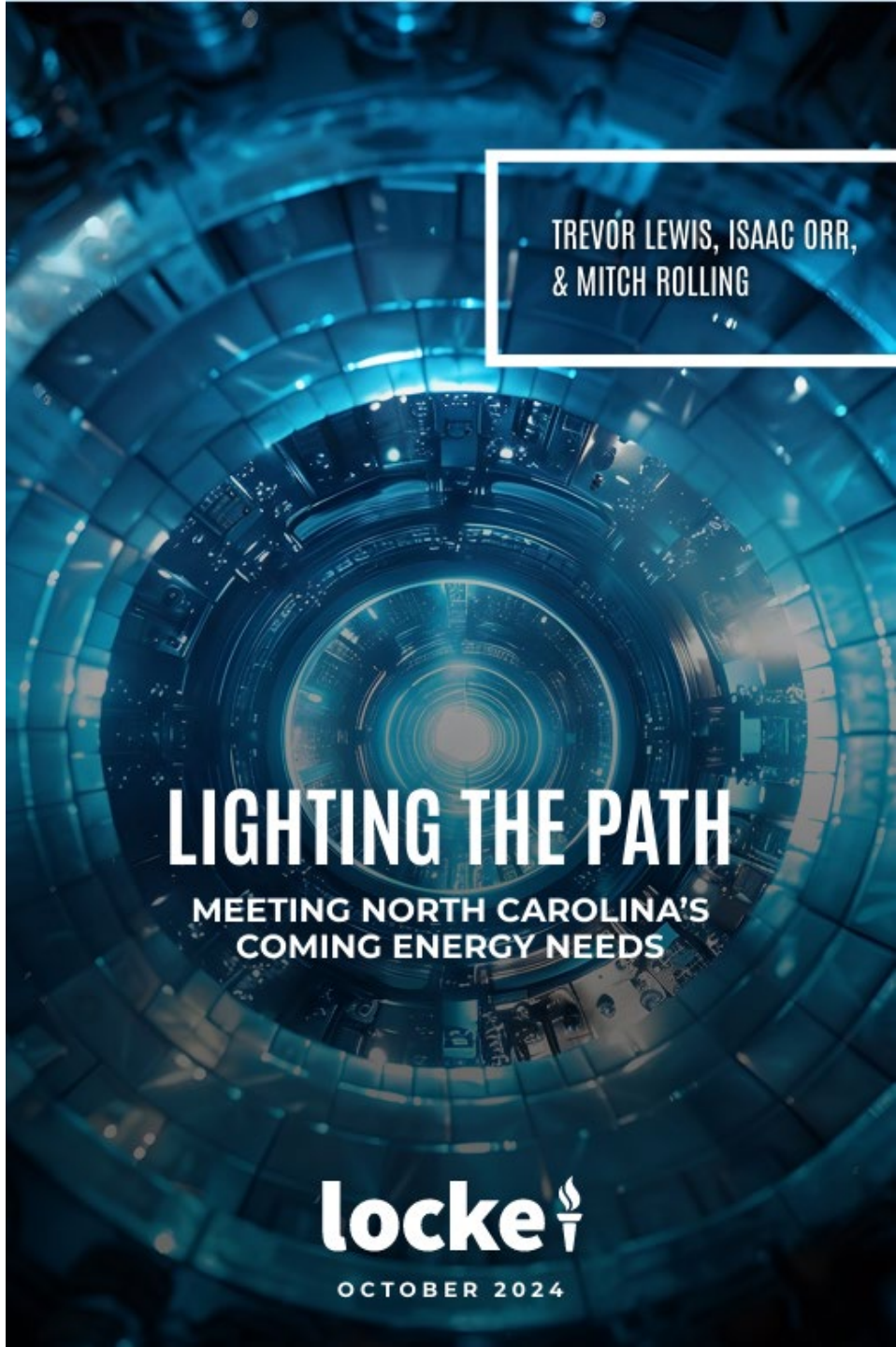
Lighting the Path

- In 2024, AOER prepared a 162-page report for the John Locke Foundation in North Carolina entitled “Lighting the Path,” examining alternative energy futures for the Tarheel State.
- We evaluated:
- North Carolina’s existing infrastructure.
- Economic drivers of electricity demand.
- Modeled the capacity needs to meet the demand under two scenarios, a Renewable scenario and a Nuclear scenario.
- Examined possible brownfield and greenfield sites for new nuclear facilities based on factors such as proximity to load and transmission availability.
- Evaluated the land use needed to meet the same demand with various energy portfolios.
- Calculated the cost of electricity and its impact on electricity prices for families and businesses.



Economic Drivers of Demand Growth

- Data centers and the reshoring of manufacturing are expected to drive the vast majority of additional electricity demand in the MISO region.
- AOER will evaluate the potential for load growth by utilizing public reports and statements from MISO and N.D. utilities, such as MDU, OTP, Xcel, about their projections for datacenter demand.

North Dakota coal mine to become processing site for Minnesota nickel

Project contingent on approval from regulatory agencies

BY: **JEFF BEACH** - MAY 28, 2025 4:55 PM

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Electric Grid Connectivity

- Evaluate the amount of new nuclear capacity, including small modular and micro reactors, that may be needed based on the load factors of the potential demand drivers to meet rising demand while maintaining reliability.
- Examine existing transmission lines and identify potential needed upgrades based on the amount of advanced nuclear in the state.

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Siting Locations and Environmental Analysis

- AOER's analysis will use siting recommendations from the Nuclear Regulatory Commission to determine sites that are safe and suitable for new reactors, i.e., flood zones, and other potential hazards.
- We will examine brownfield sites and areas near existing infrastructure. Greenfield sites will be evaluated for their ability to interconnect to the grid.
- Potential environmental impacts, such as temperature changes in rivers due to discharge, will be listed for the committee's benefit.

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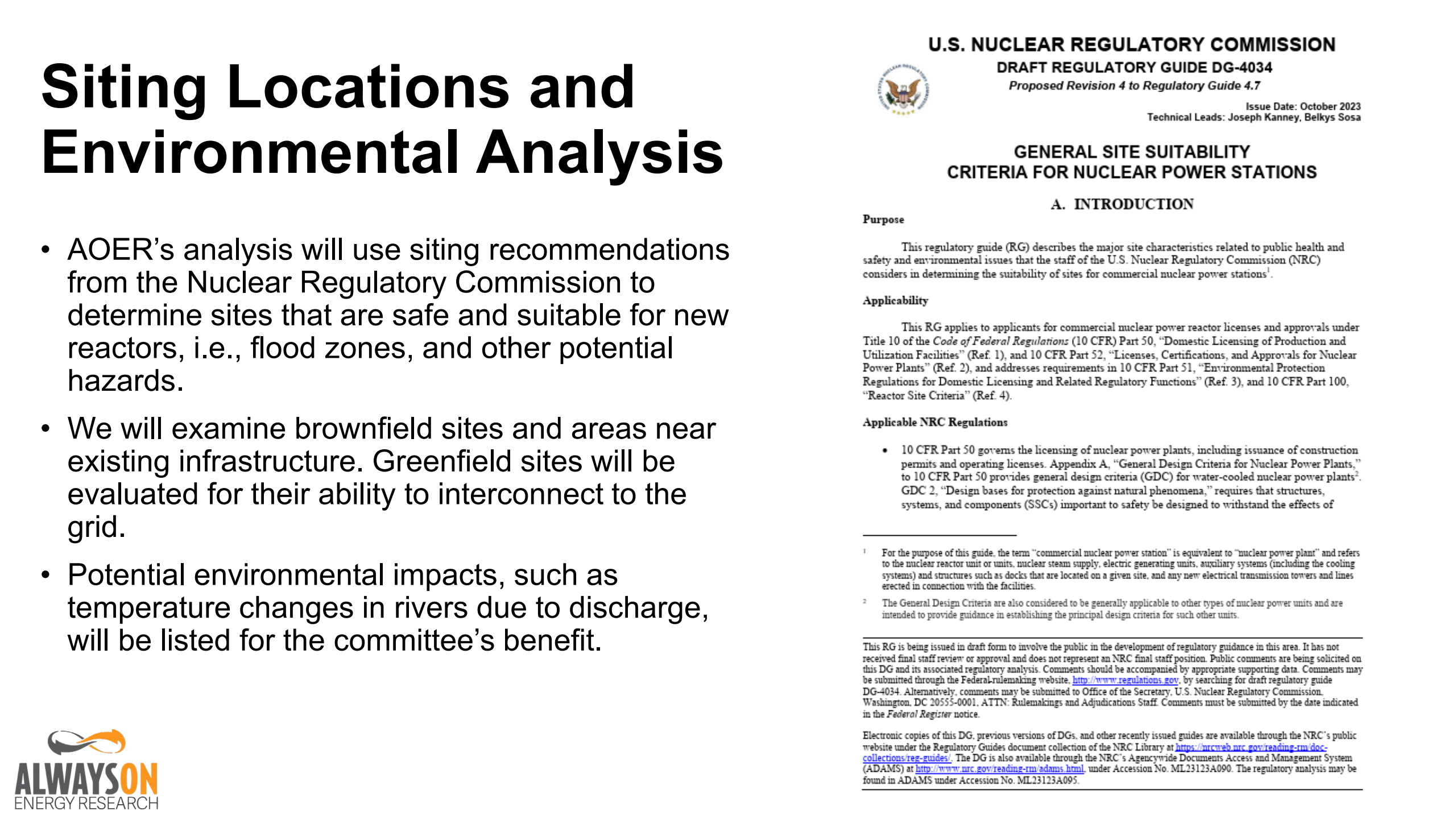

U.S. NUCLEAR REGULATORY COMMISSION

DRAFT REGULATORY GUIDE DG-4034

Proposed Revision 4 to Regulatory Guide 4.7

Issue Date: October 2023
Technical Leads: Joseph Kanney, Belkys Sosa

GENERAL SITE SUITABILITY CRITERIA FOR NUCLEAR POWER STATIONS

A. INTRODUCTION

Purpose

This regulatory guide (RG) describes the major site characteristics related to public health and safety and environmental issues that the staff of the U.S. Nuclear Regulatory Commission (NRC) considers in determining the suitability of sites for commercial nuclear power stations[1].

Applicability

This RG applies to applicants for commercial nuclear power reactor licenses and approvals under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities" (Ref. 1), and 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" (Ref. 2), and addresses requirements in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" (Ref. 3), and 10 CFR Part 100, "Reactor Site Criteria" (Ref. 4).

Applicable NRC Regulations

- 10 CFR Part 50 governs the licensing of nuclear power plants, including issuance of construction permits and operating licenses. Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 provides general design criteria (GDC) for water-cooled nuclear power plants[2]. GDC 2, "Design bases for protection against natural phenomena," requires that structures, systems, and components (SSCs) important to safety be designed to withstand the effects of

[1] For the purpose of this guide, the term "commercial nuclear power station" is equivalent to "nuclear power plant" and refers to the nuclear reactor unit or units, nuclear steam supply, electric generating units, auxiliary systems (including the cooling systems) and structures such as docks that are located on a given site, and any new electrical transmission towers and lines erected in connection with the facilities.

[2] The General Design Criteria are also considered to be generally applicable to other types of nuclear power units and are intended to provide guidance in establishing the principal design criteria for such other units.

This RG is being issued in draft form to involve the public in the development of regulatory guidance in this area. It has not received final staff review or approval and does not represent an NRC final staff position. Public comments are being solicited on this DG and its associated regulatory analysis. Comments should be accompanied by appropriate supporting data. Comments may be submitted through the Federal-rulemaking website, http://www.regulations.gov, by searching for draft regulatory guide DG-4034. Alternatively, comments may be submitted to Office of the Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, ATTN: Rulemakings and Adjudications Staff. Comments must be submitted by the date indicated in the *Federal Register* notice.

Electronic copies of this DG, previous versions of DGs, and other recently issued guides are available through the NRC's public website under the Regulatory Guides document collection of the NRC Library at https://nrcweb.nrc.gov/reading-rm/doc-collections/reg-guides/. The DG is also available through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-rm/adams.html, under Accession No. ML23123A090. The regulatory analysis may be found in ADAMS under Accession No. ML23123A095.

Economic Impacts

- AOER will use economic modeling programs to estimate job growth, wages, and direct, indirect, and induced employment from the construction of advanced nuclear facilities.
- Trevor Lewis has extensive knowledge of modeling the economic impacts of energy projects and energy tax revenues and can create quality estimates and recommendations for tax policy.

Land Use and Environmental Considerations

- Nuclear plants require far less land than wind or solar facilities and generate far more power.
- Nuclear plants also last up to 80 years while wind facilities last 20 years and solar facilities are commonly warrantied to 25 years.
- Most SMR's do not require much cooling water from rivers, rather they recycle cooling water.
- AOER will examine the decommissioning process and the long-term environmental impacts of hosting a nuclear site.

Land Use of Energy Technologies	
Technology	**Acres/MW**
Solar	**7-8**
Wind	**70-106**
Batteries	**0.02**
Light Water Reactor Nuclear	**1.58**
Nuclear SMR	**0.8**
Natural Gas	**2**
Coal	**0.5-1**

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Gauging Public Support

- We understand some parts of the state are experiencing fatigue with energy project proposals.
- AOER's team has experience conducting polling and constructing survey questions to gauge public opinion on energy issues in areas throughout the country.
- This experience can help us identify the areas of the state that are the most receptive to advanced nuclear projects.

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Regulatory Review and Policy Recommendations

- AOER will evaluate the Century code and determine if there are potential provisions that impede nuclear energy.
  - We will likely also consult with a local regulatory attorney to ensure our findings are accurate and up to date.
- AOER will also include a list of policy recommendations that the state of North Dakota can adopt to ensure the responsible development of nuclear power in the state moving forward.
  - Recommendations regarding bonding/financial guarantees for decommissioning.
  - Waste storage safety.

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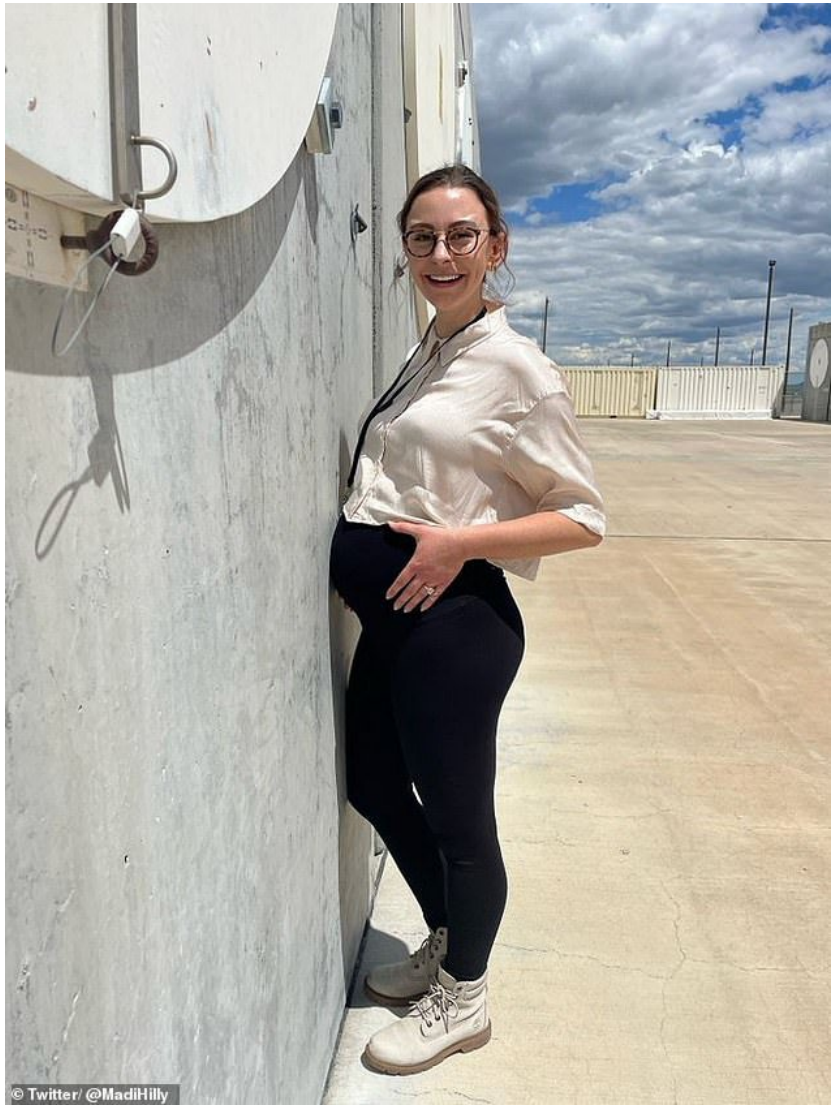
Waste Storage and Recycling

- Nuclear waste is a manageable challenge.
- The current inventory of used fuel in the country is approximately 95,000 metric tons, comprising about 95 percent reusable uranium recoverable in certain fuel cycles.
- A state developing interim and long-term storage could see meaningful economic gains--from potential payments out of the nearly $50 billion Nuclear Waste Fund, and co-locating recycling, reprocessing, and nuclear power plants.
- Storing waste on-site at the power plant is a safe and effective way to store it.



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Conclusion

- Evaluating the question of *why* advanced nuclear may be a fit for North Dakota will help us evaluate *where* it should go.
- AOER believes we are in a strong position to deliver a high return on investment for the people of North Dakota based on our educational, policy, and past work experience in the state.
- This project will require coordination with nuclear power plant manufacturers. David Stevenson has developed relationships with several such manufacturers

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Questions, Comments, Scathing Rebuttal?

- Contact information:
- lsaac@aoenergy.org
- 715-513-0440
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