



2024 FRONTIERS INITIATIVE IMPACTS REPORT







MESSAGE FROM DR. STEVEN AUMEIER AND AARON WESTON

The United States is at the forefront of a new frontier of global economic competition. How we adapt, engage and respond will have a marked impact on U.S. economic resilience and national security for decades.

This new frontier is precipitated by major competitive and geopolitical shifts brought about by intersecting challenges of climate change and the drive for lower emission economic activity, alongside growing great-power competition for resources, influence and economic control in key parts of the world.

In this environment, economies that can manufacture with less emissions are placed at a competitive advantage. This reshapes global economic leadership and is a competition the U.S. must lead and win.

Energy is a key input to this competitive equation. Those that can deploy low-emission, reliable energy in a form that meets the complex and diverse needs of industry will be ahead. Advanced nuclear energy – large and small reactors – can provide that crucial competitive edge for U.S. leadership.



Dr. Steven Aumeier (top) is a senior advisor for strategic programs at INL. Aaron Weston leads Nuclear Safeguards, Security and Nonproliferation Strategies at INL. Together, they established and lead the Frontiers Initiative.

To help advance this leadership position, Idaho National Laboratory (INL) organized the Frontiers Initiative to help first movers in advanced nuclear energy deployment leverage their early adoption of strategic advantage for economic development. As such, the initiative works with private-sector energy users, advanced reactor providers, businesses and innovators, state regulatory and policy officials, and universities to catalyze powerful partnerships and to help develop leadership-class capacity to deploy and lead in the new frontier of economic competition.

Under the umbrella of the Frontiers Initiative is the associated Frontiers Consortium of like-minded collaborators, who seek to advance low-emission economic activity, economic development and national security influence. Also, part of the Frontiers Initiative is our semi-annual Frontiers Project Meetings, in partnership with the Atlantic Council and our hosting states. This brings together national thought leaders and key stakeholders in our region.

In FY 2024, we have strengthened our partnerships with stakeholders in first-mover states – Idaho, Utah, Wyoming and Alaska – while adding engagements where increasing interest in advanced nuclear energy intersects industry needs, including in Louisiana, Montana, North Dakota and South Carolina.

This report outlines how our impact catalyzes partnerships and actions that result in global leadership, nuclear energy deployment and national security impact. Visit our website to learn more: <https://ema.inl.gov/frontiers/>.

FRONTIERS CONSORTIUM

The Frontiers Consortium (Frontiers) is private sector, market-focused and includes members from industry, academia, state and federal government and non-governmental organizations. Public and private entities in Alaska, Idaho, Utah, Montana, Wyoming and Louisiana have broadened their nuclear energy relationships with Idaho National Laboratory (INL) through this collaboration.

These first-mover states are actively pursuing an advanced nuclear energy economy. As such, Frontiers works with the following entities:

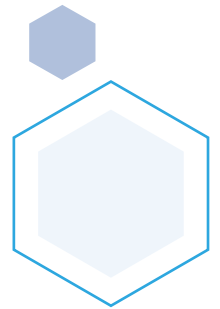
- Private companies to help create with business models that give them a competitive edge
- State governments to help inform policy
- Universities to help build capacity and the workforce needed to support nuclear deployment.

Members of the Consortium include INL, the Atlantic Council, Louisiana State University, University of Alaska, University of Utah Energy Futures, and several private sector developers.

Other collaborators include the U.S. Department of Defense and Montana Mining Association.

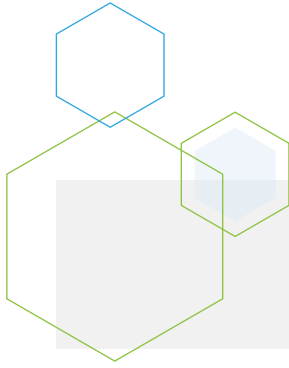


*Joshua Parker (BWXT) and Steven Aumeier (INL)
at Idaho State Capitol.*



ACTIVITIES AND ACCOMPLISHMENTS BY THE NUMBERS

The Frontiers Consortium has been a driver in generating interest in advanced nuclear deployment. Through this, we have advised a growing number of business and policy leaders. They seek guidance, advice, information and strategic council on advanced nuclear energy applications, energy-based economic development strategies and strategic partnerships. In 2024, Frontiers provided **17 “Nuclear 101” and “Nuclear energy perspectives”** presentations for leaders in **Alaska, Idaho, Utah, Wyoming, Louisiana, Tennessee and Montana**. In addition, Frontiers hosted **10 tours** with state leaders, academia, industry and military officials at INL. The impact of these engagements have strengthened private sector partnerships and built state government’s capabilities to leverage advanced nuclear energy for economic development.



IDAHO

"WE GREATLY BENEFIT FROM OUR RELATIONSHIP WITH INL AND REGULARLY CALL UPON THEIR EXPERTS TO SPEAK AT OUR MEETINGS, EDUCATE OUR LEADERS AND WE WORK CLOSELY WITH THEM TO ADVANCE THE BENEFITS OF NUCLEAR POWER IN OUR STATE."

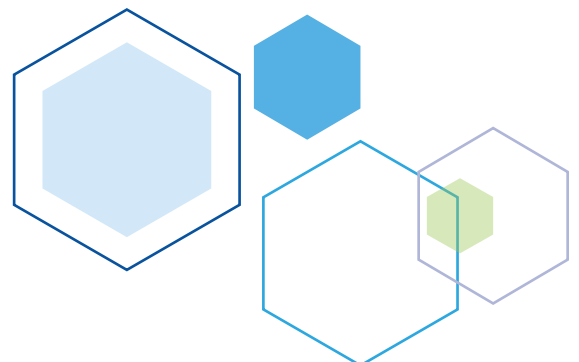
- WILL HART, EXECUTIVE DIRECTOR IDAHO CONSUMER-OWNED UTILITIES ASSOCIATION.

(ICUA REPRESENTS 21 RURAL ELECTRIC COOPERATIVES AND MUNICIPAL POWER COMPANIES SERVING OVER 140,000 MEMBER/ CUSTOMERS ACROSS THE STATE OF IDAHO.)

The [Idaho Office of Energy and Mineral Resources](#) reached out to INL's Frontiers to help develop an Advanced Nuclear Energy Strategic Framework. In doing so, it used its [Idaho Strategic Energy Alliance](#) (ISEA) to create a targeted task force to develop the framework. On May 8, 2024, Steven Aumeier provided a "Nuclear energy perspectives" presentation to ISEA to help identify a path forward. As a result, the task force is developing a framework to assist Idaho as it seeks to utilize advanced nuclear energy to drive economic opportunities.

Discussion between INL and ISEA prompted the [Idaho Consumer-Owned Utilities Association](#) (ICUA) to request a similar presentation. In late May 2024, Aumeier presented on "Advanced nuclear energy 101" to its board of directors.

The impact of these engagements is helping business leaders and policy makers establish the groundwork for the economic advancement of nuclear energy deployment.

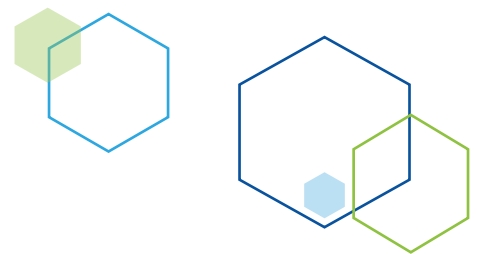


UTAH

In January 2024, Aumeier met with key Utah stakeholders to discuss how the state can leverage advanced nuclear energy technologies for economic development. That led to [University of Utah's Energy Futures Research Engine](#) joining the Frontiers Consortium.

In August of 2024, a Utah delegation toured INL, with Aumeier leading a discussion on nuclear energy policy. During the tour, members of the delegation expressed interest in INL's Frontiers Consortium hoping to capitalize on the laboratory's nuclear energy research to help build a workforce and lead Utah in capturing

economic competitiveness in low emissions manufacturing in the state. The impact has led Utah in setting the stage for developing an economic strategy that fully leverages advanced nuclear energy and gaining an understanding of the breadth of opportunities.



Dr. Steven Aumeier leading a discussion with Utah policymakers and university presidents about advanced nuclear energy strategic framework.

UTAH-FRONTIERS IN THE NEWS

A solution to Utah's air quality problem? Heavy industrial plants

University of Utah's part of energy initiative led by Idaho National Laboratory

<https://www.deseret.com/utah/2023/9/15/23875135/idaho-national-laboratory-nuclear-batteries-university-of-utah-research-technology-energy/>

Opinion: The U.S. could reshape the global economy for the next century. Will it seize the opportunity?

The Frontiers Consortium is an example of how states are leading the energy and economic transformation to secure our nation and enable their citizenry.

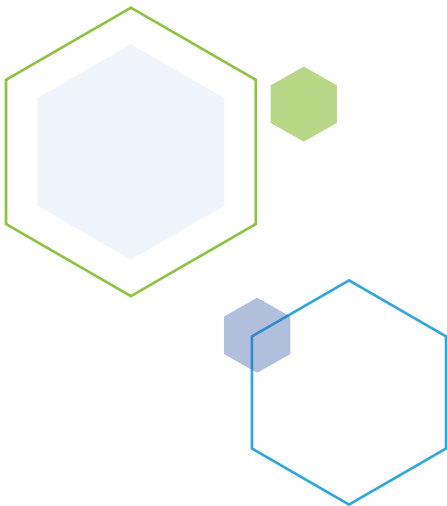
<https://www.deseret.com/opinion/2023/12/8/23992280/utah-nuclear-energy-frontiers-collaboration/>

Why did a group of Utah lawmakers visit this nuclear lab?

The Western energy grid is at a tipping point. Can Utah meet future demand?

<https://www.deseret.com/utah/2024/08/15/utah-lawmakers-idaho-nuclear-tour/>

Dr. Laura Nelson, regional engagement lead for Utah, leading a tour of INL's Transient Test Reactor.



LOUISIANA

In February 2024, the [Louisiana Public Service Commission](#) (LPSC) invited Frontiers to a public meeting to help identify economic opportunities associated with advanced nuclear energy. The LPSC asked Frontiers to help them develop an advanced nuclear energy strategic framework. Later, in June, a diverse set of executives from Louisiana's key chemical and oil and gas industries, manufacturers, regulators, military and universities gathered in New Orleans to prepare for the launch of the state's framework. The impact is significant as the Louisiana industry is a key economic engine of the U.S. and also one of the nation's largest greenhouse gas emitters. Frontiers is helping

the state develop a strategic vision to lower its carbon emissions.

Helping stakeholders build the capacity to deploy advanced nuclear energy is a key contribution of Frontiers. As Louisiana develops a strategy for advanced nuclear energy, Frontiers is building a partnership with Louisiana State University (LSU). On July 31, 2024, Frontiers hosted a tour of INL's research campus and discussed future collaborations. This led to LSU joining the consortium. "It was a very effective trip and really appreciate all the effort to provide a real systems overview of INL niche," **Dr. Robert Twilley**.



From Left to right: Joshua Parker (BWXT), Katie Austgen (NEI), Paul Kjellander and Steven Aumeier (INL Frontiers) and Marcio Paes-Barreto (Evercore Energy) at a LPSC hearing in February in Baton Rouge, LA.

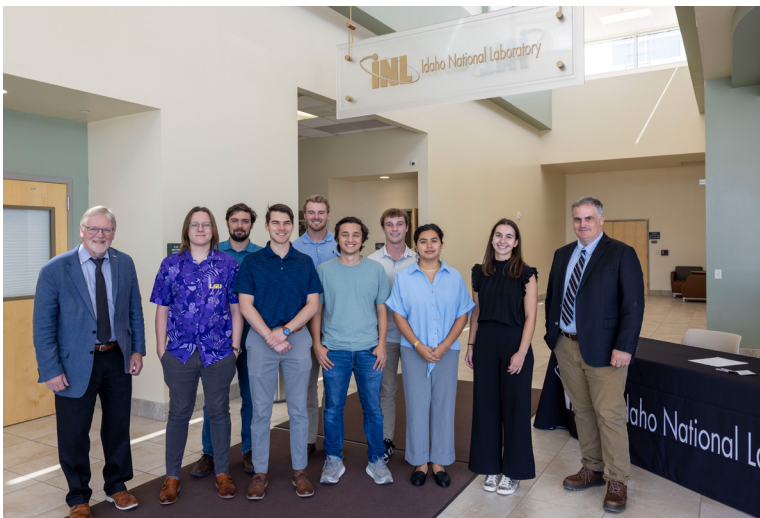
LOUISIANA-FRONTIERS IN THE NEWS

Louisiana looks to INL for a nuclear strategy.

<https://www.eastidahonews.com/2024/08/louisiana-looks-to-idaho-national-laboratory-for-a-nuclear-strategy/>



Far left: Robert Twilley, LSU Vice President of Research and John Flake (far right), LSU Associate Vice President of Research with LSU student interns at INL.



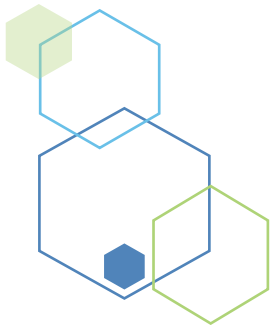
"FROM THE COMMENTS OF THOSE IN ATTENDANCE, I CAN ADVISE THAT THE MEETING WAS A RESOUNDING SUCCESS. WE ARE ANXIOUS TO EXECUTE THE (STRATEGIC) FRAMEWORK AND I BELIEVE THAT WITH YOUR ASSISTANCE, WE WILL MAKE LANCE (THE LOUISIANA ADVANCED NUCLEAR COMPETITIVE EDGE) A MODEL FOR HOW ADVANCED NUCLEAR ENERGY SYSTEMS WILL TRANSFORM OUR CRITICAL ENERGY INTENSE INDUSTRIES AND PROVIDE FOR OUR NATIONAL SECURITY AND ECONOMIC FUTURE." – **ERIC SKRMETTA, COMMISSIONER LPSC**



WYOMING

Frontiers continues to assist Wyoming's government and private sector aggressively build its nuclear-energy based businesses. Frontiers was instrumental in helping facilitate a relationship that led to a two-phase, two year [contract](#) between [BWXT](#) and the [Wyoming Energy Authority](#) to assess the viability of deploying small scale nuclear reactors in the state.

The ability of the Frontier's initiative to build trusted partnerships to advance nuclear energy applications has made a substantial impact at a national level, according to several international business executives.



YOU HAVE A PARTNER ON YOUR SIDE
THAT IS GOING TO MAKE SURE THAT
THE CRUSHING SIDE OF YOUR BUSINESS
IS UP, THE MACHINES ARE RUNNING,
AND GIVES YOU BEST TOTAL COST OF
OWNERSHIP.

MIKE WANDLER
President & CEO



Through this strategic engagement function, INL has made a substantial impact not just with national stakeholders but also with regional stakeholders who are focused on regional energy transition and economic development. The lead for a State of Wyoming industry group, the Wyoming Innovative Entrepreneurs, and the CEO of a major Wyoming industrial company stated the following:

"I am pleased to extend our heartfelt support and appreciation for the significant impact Frontiers has made on nuclear energy-driven economic development in Wyoming... this collaboration has not only enriched our understanding but has also played a pivotal role educating our team and broader Wyoming community about the safety and capabilities of nuclear energy. Your efforts have directly contributed to fostering a more informed and innovative entrepreneurial landscape within the state. Through Frontiers' initiatives, we have been able to engage with top-tier experts, facilitating crucial knowledge transfer and strategic discussions that are essential for the deployment of nuclear energy strategies in Wyoming." – Mike Wandler, CEO L&H Industrial, Inc.

At the request of the Wyoming House of Representatives Committee on Minerals, Business and Economic Development, Frontiers hosted a visit at INL on June 5, 2024. Aumeier and others provided an overview of nuclear energy and national security capabilities, along with INL's history.

The impact of this visit helped expand knowledge of how Wyoming stakeholders can engage with Frontiers to benefit from advanced nuclear deployment. In this visit, advanced fuel cycle opportunities were a key takeaway for the visitors.



Wyoming participants included Rep. Donald Burkhart, chairman, House Minerals, Business and Economic Development Committee, and Sen. Dan Dockstader, Reps. Scott Heiner, Jon Conrad, Martha Lawley; Nolan Rap, policy advisor, Office of Wyoming Governor; Ronald Gullberg, director of strategic partnerships at Wyoming Business Council; Curtis Biggs, executive director of Industry and Strategic Partnerships at University of Wyoming (UW); Ray Fertig, department head of mechanical engineering at UW; and Caleb Hill, co-director of UW's Nuclear Energy Research Center.

"IDAHO NATIONAL LABORATORY'S FRONTIERS INITIATIVE HAS BEEN A GAME CHANGER, ENABLING STATE AND LOCAL GOVERNMENTS TO CHART A PATH FORWARD TO CLEAN ENERGY SOLUTIONS. INL'S KNOW-HOW AND EXPERTISE CONSISTENTLY HELPS STATE POLICYMAKERS, REGULATORS, LEGISLATORS AND EXECUTIVES MAKE INFORMED DECISIONS ABOUT THEIR STATE'S ENERGY FUTURE. AND INL'S APPROACH TO BOTH COMMUNITY ENGAGEMENT AND EDUCATION...ALLOWS COMPANIES LIKE BWXT TO EASILY ENGAGE (LOCAL STAKEHOLDERS)." **JOSHUA PARKER, BWX ADVANCED TECHNOLOGIES**

University of Wyoming – UW expanded its nuclear energy research portfolio with support from Frontiers, academics and industry partners. In Fall of 2023, UW offered a class, “Fundamentals of nuclear energy,” which drew about 25 students from multiple disciplines, including engineering, land management and chemistry. Dr. Mary Lou Dunzik-Gougar, associate dean of Idaho State University’s College of Engineering, taught the course, supported by Frontiers, intended to give students an overall understanding of the basics of nuclear power. *“Many had no knowledge of nuclear,”* noted **Dunzik-Gougar**. *“In the end, they were thinking very practically about the role nuclear could play.”*

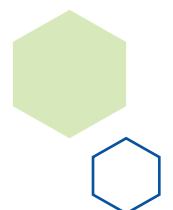
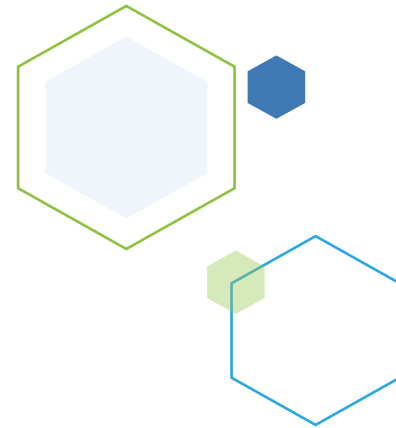
Frontiers to Frontiers – Frontiers hosted Charles Fegley, a retired captain in the U.S. Navy’s Civil Engineer Corps, who worked on the [Army Nuclear Power Program](#) from 1962 to 1972, including as the chief of operator training for the [SM-1](#) reactor. In 1961, the Navy shipped the [PM-3A](#) to the McMurdo Station Naval Air Facility in Antarctica. Engineers designed the PM-3A reactor to power the National Science Foundation’s Antarctic Research Program. All three PM reactors were modular so they could be shipped by airplane and assembled onsite.

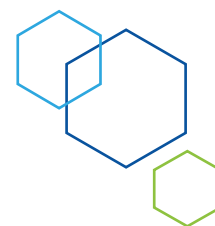
In an INL-produced documentary, Fegley recounts his experience working

on one of these historic microreactors. Just as tomorrow’s advanced microreactors answer the need for portable, reliable power in the face of climate change and increasing national security risks and competitive global economy, these reactors from the past answered the Cold War’s call and provided a realignment of global powers. Both generations of reactors served the nation at the frontier of a new age.



With the former EBR-II control room in the backdrop, Chuck Fegley (far left) talks with an INL film crew documenting the Frontiers of the past to the Frontiers of today.





WYOMING-FRONTIERS IN THE NEWS

Nuclear cogeneration gains momentum in Wyoming with new microreactor partnership

In April 2024, [L&H said the collaborative effort](#) – harnessed by a framework laid by INL's Frontier's initiative and the WEA's Matching Fund – will focus on the development and potential deployment of the BANR in cogeneration sets.

<https://www.powermag.com/nuclear-cogeneration-gains-momentum-in-wyoming-with-new-microreactor-partnership/>

Wyoming as a hub for new nuclear manufacturing and microreactor deployment?

<https://www.ans.org/news/article-5995/wyoming-as-a-hub-for-new-nuclear-manufacturing-and-microreactor-deployment/>

L&H Industrial and BWXT explore microreactor technology for industrial heat and power

"This effort is the result of the groundwork laid by INL's Frontiers Initiative and the Wyoming Energy Authority (WEA) Governor's Matching Fund project that is helping pave the way for new models of microreactor deployment."

<https://www.neimagazine.com/news/newslh-industrial-and-bwxt-to-explore-microreactor-technology-for-industrial-heat-and-power-11725689>

Gillette-based machinery company to build, lease tiny nuclear reactors in Wyoming

<https://cowboystatedaily.com/2024/04/24/l-h-partners-with-bwxt-to-build-and-lease-tiny-nuclear-reactors-in-wyoming/>

Wyoming firms win access to top nuclear labs to research advanced tech

"In recent years, INL has focused attention on building closer ties with Wyoming and other states on research and deployment of advanced nuclear technologies. The effort has come together around a push that the nuclear lab in Idaho Falls calls the Frontiers Initiative, designed to help the United States stay competitive with low-emission industrial activity through leading-edge technology.

Frontiers embraces a multi-state effort to jumpstart a nuclear component supply chain while GAIN opens the door to companies that want to research advanced technologies."

<https://cowboystatedaily.com/2024/03/22/wyoming-firms-win-access-to-top-nuclear-labs-to-research-advanced-tech/>

Wyoming part of aggressive effort to get cutting-edge nuclear plants online

<https://cowboystatedaily.com/2024/03/13/wyoming-part-of-aggressive-effort-to-get-cutting-edge-nuclear-plans-online/>

ALASKA

Frontiers partners in Alaska hosted the 2023 Frontiers Project meeting and subsequent 2024 Frontiers Executive Project meeting, in partnership with the [Atlantic Council](#). Through Frontiers Project meetings, the Atlantic Council convenes major stakeholders for thought leadership, visibility, business development, and influence. These stakeholders are diverse and are from industry, energy consumers and manufacturers, nuclear technology providers, local/state/regional/national/international policy leaders, regulators, military leadership, academic, finance and investment experts.

The October 2023 Frontiers Project meeting brought together a diverse audience of public and private sector stakeholders, business executives, military leaders, and state policy leaders to discuss the economic opportunities in advanced nuclear reactors. One panel discussion was about the economic and national security imperatives for leadership in low emissions industries moderated by Julia Nesheiwat, the Atlantic Council's vice president for policy and insights and former U.S. Homeland Security advisor.

L-R: Donna Kemp Spangler (INL), Paul Kjellander (Frontiers), John Revier and Jess Gehin (INL), Marcio Paes Baretto (Wyoming Energy Authority), Mike Wandler (L&H Industrial) and Christi Bell (University of Alaska Anchorage Business Enterprise Institute) at a meeting with the Governor's Office.





Christi Bell (University of Alaska, Business Enterprise Institute) moderates a panel discussion with Lieutenant Governor Nancy Dahlstrom, Michael Sfraga, chair and distinguished fellow, Wilson Center Polar Institute, and Jess Gehin, associate lab director INL.

Key highlights included the following:

- Senior-level oil and gas attendance, including representatives from Conoco-Phillips, National Oilwell Varco and Santos.
- Senior military officials from Alaska military installations met with select Frontiers speakers/ participants outside of the official event to discuss near-term deployment opportunities.
- Senior-level participation from multiple Alaska Native corporations demonstrated local support as well as nuclear's role in catalyzing inclusive economic development opportunities for indigenous communities and (Native) shareholders.
- Key Alaska companies continue to signal that Alaska's lack of clean, firm power is a competitive risk that endangers long-term competitiveness.
- INL and Frontiers members met with executive teams of major Alaska Native corporations (ANCs) and state officials ahead of the event. Multiple private sector nuclear developers held similar meetings, and there are clear signs of commercial traction developing with potential announcements in 2024 (all of these were follow-up meetings from prior visits).
- The post-event breakfast, featuring Jess Gehin and Mike Goff, created an opportunity for many key industry stakeholders to participate in a less public forum and to engage candidly without concern that their participation would attract attention or create distraction

The impact of the October 2023 meeting led to a follow-up meeting in September 2024 to help stakeholders better understand the opportunities for deploying small-sized nuclear reactors in Alaska. Frontiers leveraged collaborators in Wyoming to help facilitate discussions.

At the September 16, 2024, Frontiers Executive Briefing participants – which included, state government officials, legislators, utility executives and energy officials – gained an understanding of how advanced nuclear energy could bring economic benefits in Alaska-based business and applications. Frontiers’ partners shared economic analyses done in Alaska settings and trona mining in Wyoming to spark discussions of how Alaska can capture this new frontier of economic competition.

The impact from this discussion set the stage for Alaska taking actions to pursue steps in partnering with entrepreneurs and government to develop a strategic framework for advanced nuclear energy driven economic development tailored to the state’s unique energy challenges.



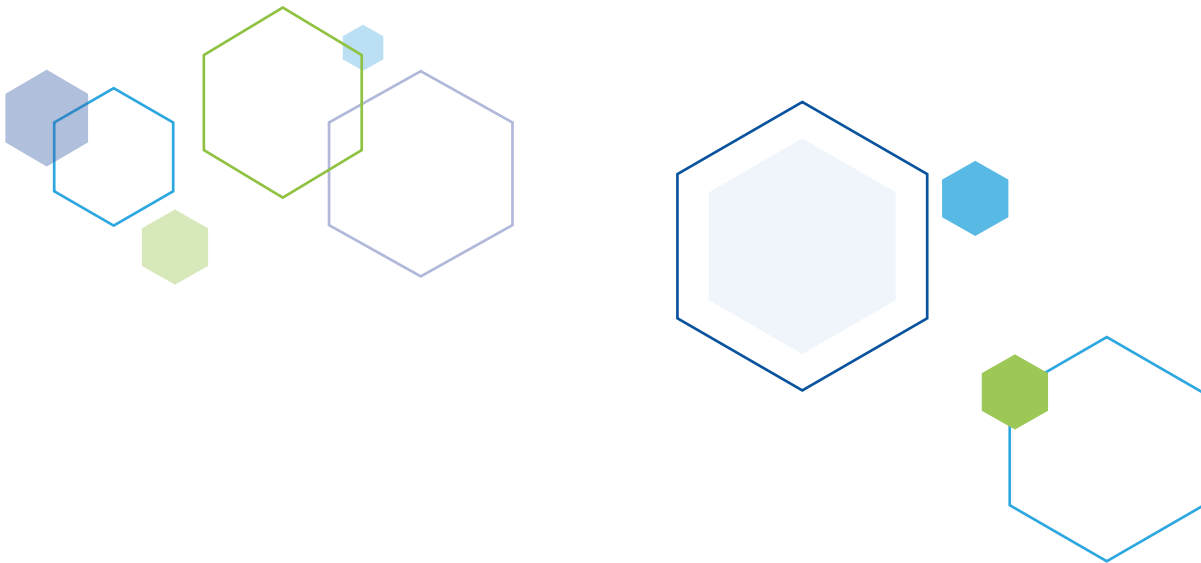
Jennifer Gordon, director of the Atlantic Council's Nuclear Energy Policy Initiative, experiences a virtual reality of a microreactor in an urban setting.

"FRONTIERS HAS BEEN A TRUSTED PARTNER, PROVIDING ACCESS TO A STRONG NETWORK AND HELPING SHAPE A BOLD VISION FOR ALASKA: RELIABLE, AFFORDABLE AND RESILIENT ENERGY IS THE KEY TO UNLOCKING ALASKA'S FULL ECONOMIC POTENTIAL. BY ADDRESSING THE CHALLENGES OF HIGH ENERGY COSTS AND LIMITED AVAILABILITY, WE CAN REVERSE OUTMIGRATION, REVITALIZE THE WORKFORCE, DIVERSIFY ENERGY SOURCES AND CREATE NEW MANUFACTURING AND ARCTIC TRANSPORTATION OPPORTUNITIES. THIS IS THE TRANSFORMATIVE SOLUTION FOR ACHIEVING ALASKA'S RESILIENCE AND LONG-TERM PROSPERITY."

– CHRISTI BELL, ASSOCIATE VICE CHANCELLOR AND EXECUTIVE DIRECTOR, BUSINESS ENTERPRISE INSTITUTE, UNIVERSITY OF ALASKA



Steven Aumeier led discussion at the Frontiers Executive Briefing in Anchorage, Alaska, on September 16, 2024.

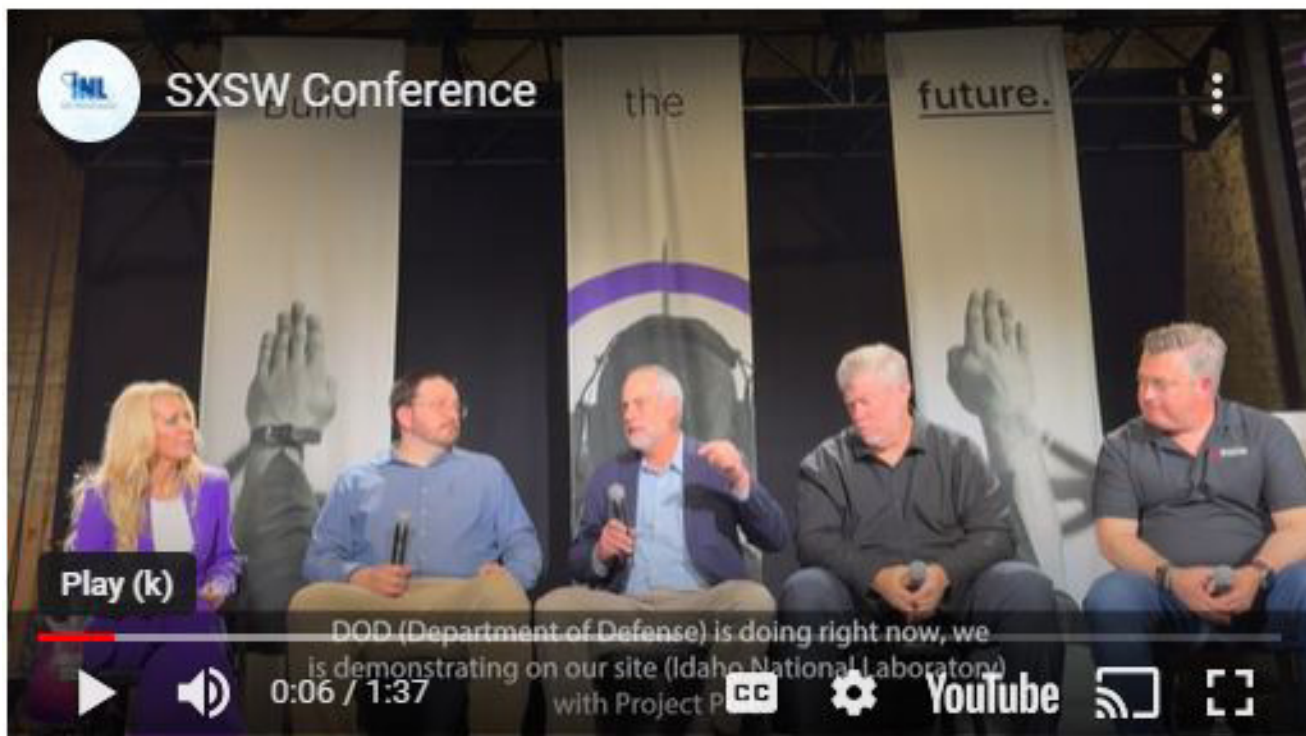


NATIONAL SECURITY

Frontiers' impact has also gained attention with the U.S. Department of Defense, with representatives from the [Defense Innovation Unit](#), [Army Special Operations Command](#) and [Southern Command](#) now engaging Frontiers as an asset in strategic relationship development and outreach, communicating how advanced nuclear energy can be used as an international strategic partnership tool. These topics are central to the Frontiers Initiative mission and purpose.

South by Southwest – The Department of Defense invited Aumeier to participate in an expert lineup at the South by Southwest conference from March 8–16, 2024.

Critical Resource Minerals Summit – The [National Security Innovation Network](#) invited Aumeier to participate in a panel discussion at its Critical Resources Summit on April 10, 2024, in Washington, D.C. He joined experts in intelligence, foreign relations, critical minerals and arts to talk about American leadership in this new frontier of economic competition; key to all of which is energy innovation.



Steven Aumeier joined an expert lineup led by the U.S. Department of Defense at the SXSW 2024 Conference in Austin, Texas.

