



U.S. DEPARTMENT OF
ENERGY

Secretary of Energy Advisory Board

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Observations and Recommendations
September 2021 – January 2025



Between September 2021 and January 2025, members of Secretary Jennifer M. Granholm's Secretary of Energy Advisory Board (SEAB) included:

Arun Majumdar, SEAB Chair, September 2021-January 2025

Madelyn Creedon, SEAB Vice-Chair, September 2021-January 2025

Trenton Allen, Member, September 2021-January 2025

Priscilla Almodóvar, Member, September 2021-September 2022

Norman Bay, Member, September 2021-January 2025

Roxanne Brown, Member, September 2021-January 2025

John Dabiri, Member, September 2021-January 2025

Noah Deich, Member, September 2021-April 2022

Kerry Duggan, Member, September 2021-January 2025

Bryan Garcia, Member, September 2021-January 2025

Phil Giudice, Member, September 2021-January 2025

Shirley Ann Jackson, September 2021-January 2025

Paula Gold-Williams, September 2021-January 2025

Denise Gray, Member, September 2021-January 2025

Kate Gordon, Member, January 2023-January 2025

Brad Markell, Member, January 2023-September 2023

Maria Pope, Member, September 2021-January 2025

Adrianna Quintero, Member, September 2021-January 2025

Suzanne Singer, Member, January 2023-January 2025

Michael Skelly, Member, September 2021-September 2023

Christopher Smith, Member, January 2023-January 2025



Introduction

The Secretary of Energy Advisory Board (SEAB) advises the U.S. Department of Energy (DOE) on various strategic initiatives aimed at enhancing the nation’s energy infrastructure and innovation ecosystem. Over the past four years, SEAB focused on several key areas, including modernizing the U.S. electricity grid, advancing AI innovation and infrastructure, fostering entrepreneurship within the DOE’s National Labs, and improving Tribal and community engagement and investment across DOE’s portfolio. The passage of significant legislative measures such as the Inflation Reduction Act (IRA), the Infrastructure Investment and Jobs Act (IIJA) (also known as the Bipartisan Infrastructure Law (BIL)), and the CHIPS and Science Act have provided the DOE with an unprecedented foundation and meaningful funding to implement these initiatives. SEAB responded by forming specialized working groups to develop actionable recommendations that align with the DOE’s mission to promote clean energy, grid resilience, energy security, and technological innovation—all in ways that truly support America’s diverse regions and communities. This report synthesizes the SEAB’s findings and recommendations, offering a roadmap for the DOE to achieve its strategic goals and ensure a clean, reliable, and resilient energy future for the United States.

Artificial Intelligence

SEAB produced three reports on the DOE’s emerging challenges and priorities related to Artificial Intelligence.

Artificial Intelligence and the U.S. Department of Energy (2024)

In response to the Executive Order of October 30, 2023, which calls for enhancing the use of AI in the electric grid infrastructure, the DOE was tasked with issuing a public report on AI’s potential to enable “clean, affordable, reliable, resilient, and secure electric power to all Americans.” The Secretary of Energy also sought guidance from SEAB on adjusting the DOE’s organization to meet this directive.

The SEAB report outlines the DOE’s strengths in AI, including its vast computing resources, substantial research funding, and National Laboratories serving as regional hubs. The DOE’s role is pivotal in advancing AI for energy infrastructure and national security. To achieve this, SEAB recommended that:

- DOE create an internal organization, “AI for US Competitiveness and Security,” to lead these efforts. This body should be agile, covering a broad range of areas from fundamental science to energy technologies and infrastructure.
- DOE establish guardrails to ensure AI applications are secure and beneficial. This includes making computing resources and datasets available for public good, creating open-source algorithms, and setting standards to align with the Executive Order. The DOE’s AI efforts should focus on public interest without financial motivations, addressing potential risks such as inequity and bias.



Powering AI and Data Center Infrastructure (2024)

Data center power needs are surging due to the growth of AI technologies and large language models (LLMs), which require significant energy. Hyperscale facilities, ranging from 300 to 1000MW, are placing strains on local grids to supply power at a rapid pace. The DOE is key in addressing these challenges through its focus on energy efficiency, clean energy, grid-enhancing technologies, and AI-related energy research.

The SEAB proposed solutions through three tracks:

- 1. Energy Efficiency and Power Dynamics:** Recommendations include establishing a data-center-scale DOE AI testbed and exploring AI training to demonstrate and publicize capabilities in collaboration with the National Labs and private partners. This testbed would allow researchers from the National Labs, academia, and industry to collaborate in the development and assessment of algorithms for energy-efficient AI training and inference, advancing the nation's AI capabilities and building on the success of comparable public-private efforts that have accelerated advances in high-performance computing.
- 2. Operational Flexibility:** Recommendations include fostering dialogue among energy utilities, data center developers, and key stakeholders to manage power supply bottlenecks and sustain AI into the future. SEAB recommends that the Secretary should work with other government agencies and the private sector to develop a standard taxonomy and framework for defining and orchestrating grid services for large energy users that are adaptable to local and regional circumstances and priorities.
- 3. Generation, Storage, and Grid Technologies:** Immediate recommendations focus on assessing cost, performance, reliability, availability, and supply chain issues facing generation, storage, and grid technologies to support regional data center expansion. This needs to be done while consistently serving existing area customers. Long-term strategies involve accelerating private investment in emerging technologies by supporting legislation that de-risks private investment in new technologies. SEAB recommends providing technical support to data center owners interested in making long-term financial commitments to next-of-a-kind technologies in nuclear, geothermal, long-duration energy storage, green hydrogen fuel cells, carbon capture, and others to be developed in the future.

The SEAB engaged a diverse set of stakeholders, including hyperscalers, data center developers, technology providers, and electric companies to develop actionable recommendations. These efforts aim to balance the growing energy needs of data centers with sustainability and grid reliability.



Harnessing AI to Accelerate Clean Energy Deployment (2024)

SEAB was asked to determine how AI can streamline and expedite permitting and other regulatory processes for clean energy deployment. SEAB found the use of AI in the energy industry is still early stage and saw how critical it is that AI tools be developed carefully so as to build trust in them and that the use of AI tools not create new risks. AI tools will assist and augment, not replace, the exercise of a subject matter expert's technical judgment.

SEAB recommended:

- Fostering increased data transparency and standardized data platforms.
- Engaging the National Labs and using DOE's status as a convener.
- Encouraging DOE funding and developing AI pilot projects.
- Encouraging public-private collaborative R&D initiatives.
- Launch public engagement campaigns.
- Focus on human-centered AI.

Grid Modernization

SEAB provided three broad recommendations for modernizing the U.S. electricity grid provided by the increase in funding from IRA and BIL.

Grid Modernization under IRA and BIL (2022)

In June 2022, SEAB provided detailed recommendations for modernizing the U.S. electricity grid under the IRA and the BIL. Key areas of focus include the Transmission Facilitation Program (TFP), which allows the DOE to finance and enter capacity contracts for new or upgraded transmission lines, and deploying technologies to enhance grid flexibility, such as smart grid functions and advanced transmission technologies. SEAB recommended:

- Prioritizing early successes with "shovel ready" projects and supporting regional and interregional transmission to integrate renewables.
- Structuring the DOE's participation in transmission projects as matching grants rather than outright ownership.
- Highlighting the need for collaboration among regional transmission organizations (RTOs) to enhance reliability and resiliency, particularly in light of past challenges like Winter Storm Uri in 2021.

By following these recommendations and regularly evaluating progress, the DOE can drive significant advancements in the U.S. transmission system, ensuring long-term benefits for the nation's energy infrastructure.

Grid Modernization – Interregional Transmission and Distribution (2023)

In January 2023, SEAB recommended prioritizing DOE funding towards enhancing interregional transmission and distribution solutions to boost grid resiliency and flexibility. This approach complements ongoing Federal Energy Regulatory Commission (FERC) efforts and addresses



common outage issues at the distribution level by investing in distributed resources, hardware, and data analytics. SEAB recommended:

- Highlighting the importance of the development of regional electricity markets, demand-side management, long-term energy storage, and diverse generation mixes to improve reliability and efficiency of renewable energy delivery.
- Stochastic modeling in grid simulations to prepare for extreme climate events and urged consistent methodologies across regional transmission organizations.
- Supporting advanced battery technology research and green hydrogen development to ensure energy storage reliability. The goal is to enhance grid stability, particularly during extreme conditions, and maximize the benefits of interregional projects, thereby improving national energy security and economic efficiency.

Grid Modernization – Resilience, Reliability and Capacity (2024)

In April 2024, SEAB provided several new recommendations for the DOE to advancing grid development. These recommendations build on the progress achieved through the IRA. Key recommendations included:

- Acting urgently to expand regional and interregional transmission capacities to meet the 2035 carbon-free grid goals, with a focus on complex, capital-intensive projects like offshore wind infrastructure.
- Supporting innovation in grid-enhancing technologies, optimizing the Power Marketing Administrations' capabilities
- Creating a DOE Office of Electric Reliability to handle planning and analysis.
- Supporting the National Interest Electric Transmission Corridor (NIETC) process, providing technical assistance to FERC, strengthening supply chains for critical grid components, and advocating for increased federal funding for transmission development.

These steps are essential for ensuring the grid's resilience, reliability, and capacity to integrate renewable energy sources efficiently.

National Laboratory Entrepreneurship (2024)

SEAB provided recommendations to leverage DOE's culture of innovation and entrepreneurship at the National Laboratories.

SEAB examined entrepreneurship ecosystems within the DOE's National Laboratories, focusing on the Lab-Embedded Entrepreneurship Program (LEEP) and other DOE initiatives. The report highlights the success of LEEP, which has supported 176 fellows, created 154 businesses, and generated over 2,244 jobs. SEAB identified some challenges, including inconsistent awareness of LEEP, varied operational modes, and difficulties with the Cooperative Research and Development Agreements (CRADAs) process. The recommendations focus on:

- Enhancing the organization and improving communication across the National Labs;



- Increasing funding support, fostering external partnerships, and improving metrics for success;
- Recognizing the need for structured recruitment and mentoring, particularly for entrepreneurs from underserved and underrepresented communities, and called for better alignment of DOE leadership to promote entrepreneurship;
- Formalizing collaboration across the Labs;
- Increasing venture and bridge funding access;
- Developing clear metrics for scaling and achieving DOE clean energy goals; and
- Aligning financial incentives for Lab scientists with entrepreneurial objectives and creating a venture fund to commercialize National Lab research, inspired by successful models like The Engine (MIT) and In-Q-Tel.

Tribal and Community Engagement and Investment (2024)

SEAB provided recommendations to support the DOE in its goal of ensuring the benefits of historic federal clean energy investments provide tangible benefits to Tribes, workers, and communities across the U.S.

The DOE is committed to ensuring that the benefits of the nation's energy transition reach all communities, particularly those historically underserved and those that may be left behind by shifts in policy and technology. Engaging directly with communities where projects are being funded by the DOE serves to promote project viability, decreasing permitting and siting timelines and reducing litigation risk for these critical energy projects.

SEAB formed a working group to focus on three tracks:

1. Expanding opportunities and access within and across DOE programs: Recommendations include creating regional support hubs in the short term, and eventually building out DOE regional offices; establishing clear guidelines for expanding Tribal and community engagement opportunities across DOE; enhancing technical assistance to Tribes and underserved communities, including historic fossil energy communities; improving interagency data collection to track resources; and using AI for equity and climate data analysis.
2. Implementation of Community Benefit Plans (CBPs): Recommendations include encouraging early and meaningful engagement from developers; investing in contract negotiators to ensure better agreement design and accountability before, during and after a project is implemented; improving the monitoring of project outcomes using AI; enhancing capacity building for community leaders through training and resources; promoting knowledge sharing; and focusing on the enforceability of agreements.



3. Tribal consultation and engagement: Recommendations include establishing consistent and early consultation practices across DOE, creating a permanent office for Tribal consultation, using AI to enhance Tribal engagement and analyze feedback, building long-term partnerships with Tribal Nations, enhancing transparency and accountability, and creating pathways for integrating Tribal knowledge.

Hot Topics and Other Discussions

SEAB also held a series of “Hot Topics” meetings with the Secretary and other discussions for some members and outside experts to provide informal thoughts on areas of interest of the Department.

- **Presentations at Oak Ridge on Large Scale Battery Storage (2022)**
SEAB members and other national experts on grid-scale battery storage discussed the logistics and future of energy storage. Long-duration energy storage accelerates the path towards 100% clean electricity and can enable equitable and efficient decarbonization. SEAB members discussed the urgent need for innovation in this area and suggested that federal R&D policy should focus on long-duration storage technologies that support affordable, reliable future electricity systems.
- **Virtual Power Plants (2023)**
Virtual Power Plants (VPPs) are distributed energy resources (DERs), such as rooftop solar, energy storage systems, electric vehicles, and smart HVAC/appliances that are aggregated and controlled at a large “utility” scale to affordably decarbonize the grid, balance load, improve reliability & resilience, and provider other grid services. Full utilization of VPPs and DERs will require more sophisticated grid capabilities which will add costs and require that the services provided by DER aggregators are reliable. DOE plays a critical role in enabling VPP deployment. SEAB discussed DOE’s ability to:
 - Enable transportation, building, and energy networks to deliver services through an integrated grid;
 - Enable markets to value services delivered;
 - Enable participation of innovation and technology partnerships by aligning incentives to value delivery;
 - Enable bottom-up grid architecture to layer communications and software to support local reliability and regional access;
 - Enable customer enrollment flexibility to encourage participation of all communities, resources, and devices.



- **Strategies to Accelerate Clean Energy Investments in Tribal Communities (2023)**
SEAB members discussed technical assistance and capacity building for Tribes, many of which would like to own and profit from institutional and commercial-scale renewable energy generating facilities, rather than leasing their land to outside firms. SEAB members and outside experts discussed:
 - Using an external liaison trained by DOE to help Tribes navigate existing systems, resources, and relationships to support Tribal involvement in clean energy investments
 - Using National Laboratories, which are inherently place-based, to support the Tribal communities they are sited in, often working through Tribal partnerships and youth internships.
 - Strategies to overcome barriers that complicate tribal efforts to be owners of renewable energy projects, such as enabling Tribes to use tax incentives for battery storage and microgrids, and promoting existing technical resources, the DOE Tribal Energy Loan Program and the Office of Indian Energy's grant for transitioning Tribal colleges and universities to clean energy.
- **Workforce Capacity Building in Power Engineering (2023)**
Increased electrification, grid complexity and clean energy deployment have led to increased engineering needs of utilities, developers, and Real Time Operating Systems (RTOS). At the same time, the system is experiencing a lack of power system engineers due to anticipated retirements, location challenges, and lack of pay incentives. SEAB members and other experts discussed:
 - Constructively address the nation's labor resource gap that derail a wide range of energy gaps, utilizing HB1 visas to hire talent from other countries;
 - Incentivizing retirees to return to the utilities industry, as well as serve as advisors and mentors;
 - Asking community colleges to help fill workforce needs and provide coursework for non-engineer employees to become engineers;
 - Raising awareness of career opportunities in power systems engineering.

Conclusion

The comprehensive recommendations put forth by the SEAB provide a framework for the DOE to navigate the challenges and opportunities in the evolving energy landscape. By focusing on key areas such as grid modernization; AI and data center infrastructure; lab-based entrepreneurship; and community engagement and investment, SEAB has outlined a path for the DOE to leverage its authority and resources effectively.

The recommendations emphasize the urgency for enhancing regional and interregional transmission capacities, integrating renewable energy sources, and fostering innovation through targeted funding and partnerships. They also highlight the importance of continued engagement between federal agencies, private sector stakeholders, and regional entities to ensure the



successful implementation of these initiatives. As the DOE moves forward, regular evaluation and adaptation will be essential to achieving long-term success and securing the nation's energy future. SEAB's guidance supports the DOE's mission to maintain a resilient, efficient, and sustainable energy system that meets the needs of all Americans.