U.S. DEPARTMENT OF
ENERGY

Secretary of Energy Advisory Board

Recommendations on Artificial Intelligence for the U.S. Department of Energy

Presented to the Secretary of Energy on July 30, 2024

In view of the Executive Order (EO) of October 30, 2023, entitled "Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence", the Department of Energy has been asked to issue a public report within 180 days of the E.O. "describing the potential for Artificial Intelligence (AI) to improve planning, permitting, investment, and operations for electric grid infrastructure and to enable the provision of clean, affordable, reliable, resilient, and secure electric power to all Americans."

The Secretary of Energy has also requested SEAB to advise and provide guidance of how DOE should organize itself to execute on this EO. The purpose of this SEAB memorandum is to respond to that request.

This memo: (a) highlights the unique strengths of the DOE with respect to AI; (b) addresses what DOE can do in AI to create a secure future for the USA; (c) answers how the DOE could organize itself and what guardrails it should develop and implement to achieve this.

Background
The field of AI is undergoing a historical inflection point that will impact many aspects of society, the economy, privacy, and our national security. The recent developments resulted from the progress and confluence of three items: (a) low cost of information storage, (b) large amounts of data, and most recently, (c) significant improvements and cost reduction in compute power. However, just as with social media, AI comes with many risks and potential abuses. This demands some guardrails to be put in place, as highlighted by the recent Executive Order from the Office of the President. A recent report from the White House calls for the development of a public infrastructure for the public good.

Unique strengths of DOE with respect to AI
The Department of Energy has some unique features that make it a critical anchor for AI activities within the federal government.
1. Computing Facility: The DOE has the largest federal computing facility, part of which is accessible to the scientific community based on competitive proposals. Its computational power leverages the same computing devices and systems (e.g., GPUs) that are used in AI by the private sector, although the computational power of the private sector now exceeds that of the DOE national laboratories. So far, this has been used largely for physics-based computing, but it can easily be leveraged for data-driven computing as explained by the DOE report on AI.
2. Research Funding: The DOE is the largest funding source for research in the physical sciences, national security, and the environment, including on climate change. Furthermore, the DOE also has deep engagement with the research community in

academia and industry. Thus, the implications of DOE's AI efforts go beyond the national labs.

3. <u>National Labs as Regional Hubs</u>: Across its whole enterprise, the DOE manages 17 national laboratories (FFRDCs) that have some of the most talented scientists, engineers, and technical staff. Given their locations across the nation, the national labs create a network of regional hubs that could be adapted/made available for community-focused research and place-based initiatives.

4. <u>US Security and Competitiveness</u>: The DOE has been tasked by Congress to ensure US security and competitiveness. NNSA uses large-scale computing for nuclear, biological and cybersecurity where AI could play a vital role in our nation's security. The scientific frontiers in physical and biological sciences that DOE leads, such as quantum information, materials science and molecular design, can see major advances with the use of AI and are the bedrock of US competitiveness. Furthermore, the DOE is a key agency anchoring security of the US energy infrastructure, where AI could play a significant role.

5. <u>Engagement in energy project development on the ground</u>: With over $100 billion in funding toward competitive grants, and even more in loans, the DOE will play a significant role in energy project development in the coming decades. As such, the DOE can play an important role (in partnership with its private sector grantees) in pioneering the use of AI in project siting and permitting, as well as in "asset mapping" toward community and workforce engagement, and can continuously evaluate and improve this approach through future funding.

What can DOE do in AI to create a secure future for the USA?

Given the importance of DOE's unique role described above, DOE should consider creating an internal organization, such as **AI for US Competitiveness and Security**.

Such an organization should have a broad mandate that covers fundamental science to breakthrough energy technologies, to energy infrastructure and demonstration projects and to national security. In addition to playing a coordination role across the department, it could take on the ambitious goal of working across the DOE enterprise, academia and the private sector to develop AI algorithms and use that not only push the frontiers of energy and power efficient computing, but also prepare and manage the US energy infrastructure that can provide clean and affordable energy to power AI. Because it is hard to predict new areas where AI could be used, it should not be domain-specific but rather nimble and agile to leverage this technology to DOE's broad missions. Such an organization would also be a portal for DOE in its engagement with other federal agencies as well as with national labs, academia and industry.

History has shown that DOE organizations excel when a few attributes and conditions are met, namely:

A. Clear mission, values, goals and metrics of success
B. A talented team that has technical expertise and parity with the best in the external community, which is critical for dialogue, trust building, and ecosystem development
C. Sufficient resources to catalyze the ecosystem and stimulate broader activity with follow-on government, private-sector and philanthropic investments
D. A leader who is not only a domain expert, but also is skilled in building the team, engaging with and enabling the broader community, both inside and outside DOE, and being an efficient steward of DOE resources
E. Direct involvement, protection and stewardship from the Secretary, which also signals internally and externally the importance and value of the activity

It would be worth DOE considering creating such an organization, perhaps a small team, with these attributes. While the DOE national laboratories can be a source for talent, it is advisable that this DOE AI team bring in top expertise from academia, national labs and the private sector, with the goal of challenging the laboratory scientists and leveraging existing and planned infrastructure in realms beyond the traditional laboratory research.

It is also worth considering that the Secretary forms a small AI advisory group consisting of thought leaders from industry, academia and the broader community, which can provide guidance for the Secretary in her stewardship of this organization.

What guardrails should DOE develop and implement to achieve this mission of AI for US competitiveness and security?

In many national security research areas, the compute infrastructure in DOE as well as the data sets used in AI ought to be available to only those with clearance. However, aligned with the White House report, when dealing with the frontiers of science in non-critical areas such as climate predictions, the SEAB believes it is worth considering making part of the DOE computational facilities available for AI in the interest of public good, with the necessary guard rails, checks and balances. This would entail:

A. Making some of the compute power and storage available for AI initiatives in the public good that align with DOE's mission of science, energy and security, both to researchers in national laboratories and to the broader community beyond the purview of the national laboratories.
B. While procuring new computing infrastructure for such publicly-accessible AI, ensure that the infrastructure is tailored towards AI workloads so that the US remains globally competitive in AI.

C. Create and make available publicly accessible, open-source datasets that can be used for training AI algorithms, much like Datacommons.org.
D. Create and make available publicly accessible algorithms, much like Github
E. Ensure that the results of the AI work using DOE facilities meet standards created by the guardrails, as noted in the Executive Order, and that these are publicly available.

It is important that this DOE organization considers creating a set of values to execute on its plans to address its mission and goals. While the private sector creates value for the broader public, it is naturally also driven by financial returns and shareholder interests. Because DOE-supported AI would be created in the public interest without expectations of financial returns, its values ought to be different.   For example, DOE should consider whether an AI project would increase inequity, bias, lead to social unrest, or pose a risk to national security, and make the decision not to enable it, or proactively put guardrails in place to mitigate potential negative impacts on the public.