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ai+energy

Fortifying American Energy Dominance in the Age of AI

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AI+Energy: Fortifying American Energy Dominance in the Age of AI

This report outlines a comprehensive strategy to ensure U.S. energy security and global leadership amidst the burgeoning demands of artificial intelligence (AI) and growing international competition.

Background

The United States currently holds a strong position as a net energy exporter.[1] However, maintaining this advantage requires a proactive and strategic approach to meet the unprecedented electricity demands of the AI revolution.[2] AI is poised to become a primary driver of economic growth and technological advancement, demanding a robust and reliable energy infrastructure. While the United States benefits from abundant fossil fuel resources that provide affordable energy in the near term, a long-term strategy must focus on developing and deploying next-generation energy technologies like advanced nuclear, fusion, and geothermal. These technologies offer the potential for virtually limitless and reliable power as they achieve economies of scale.[3]

China's aggressive pursuit of renewable energy technologies and dominance in critical mineral supply chains presents a direct challenge to U.S. leadership in the energy sector.[4] To maintain its competitive edge, the United States must overcome five key obstacles:

1. **Insufficient Supply:** Existing energy sources alone will likely prove inadequate to power the AI revolution and future economic growth.

[1] U.S. Energy Facts Explained, U.S. Energy Information Administration (last accessed 2024).

[2] AI is Poised to Drive 160% Increase in Data Center Power Demand, Goldman Sachs (2024).

[3] Jeff McMahon, 81% Of Renewables Offer Cheaper Energy Than Fossil Fuels, Report Says, Forbes (2024); Alison F. Takemura, Chart: Renewables are on Track to Keep Getting Cheaper, Canary Media (2023).

[4] Amy Hawkins, China Building Two-Thirds of World's Wind and Solar Projects, The Guardian (2024); David Fickling How the US Lost the Solar Power Race to China, Bloomberg (2024); Global Critical Minerals Outlook 2024, International Energy Agency (2024).

2. **Regulatory Hurdles:** Cumbersome regulations and permitting processes hinder the timely deployment of innovative energy technologies.
3. **Infrastructure Limitations:** The aging U.S. electric grid requires modernization and expansion to accommodate increased energy demands and integrate new energy sources effectively.
4. **Market Fragmentation:** A lack of cohesion within the U.S. energy sector limits collaboration and slows the pace of innovation.
5. **Global Competition:** Strategic competitors like China and Russia pose a significant challenge to U.S. energy dominance.

Recommendations

Building on the discussions at SCSP's AI+Energy Summit in September 2024, we offer a roadmap by which the United States can address some of these challenges and fortify its energy leadership.[5]

Immediate Actions (0-2 years)

1. Streamline Regulatory Processes

- **Accelerate Permitting:** The Department of Energy (DOE), the Environmental Protection Agency (EPA), the Federal Energy Regulatory Commission (FERC), and other relevant stakeholders should enforce strict timelines across the energy sector for environmental reviews and permitting decisions for energy infrastructure projects, particularly for advanced nuclear reactors and renewable energy projects. This includes leveraging existing legislation like the Fixing America's Surface Transportation Act[6] to expedite project approvals and implement the provisions of the Infrastructure Investment and Jobs Act (IIJA) to streamline National Environmental Policy Act (NEPA) reviews and establish clear timelines for project completion.[7]

[5] AI+Energy Summit, YouTube (2024); Memo to the President on AI & Energy, Special Competitive Studies Project (2024).

[6] Fixing America's Surface Transportation Act - Title 41, United States Environmental Protection Agency (last accessed 2024); Critical Minerals: Status, Challenges, and Policy Options for Recovery from Nontraditional Sources, U.S. Government Accountability Office (2024).

[7] Critical Minerals: Status, Challenges, and Policy Options for Recovery from Nontraditional Sources, U.S. Government Accountability Office (2024); IIJA Provisions to Accelerate Clean Infrastructure Permitting and Environmental Review, Bipartisan Policy Center (2022).

- **Digitize and Simplify:** DOE, FERC, and other relevant agencies should transition permitting processes to digital platforms to improve efficiency and transparency.[8] All relevant agencies should simplify application procedures and reduce bureaucratic burdens for energy projects.[9]

- **Promote Regulatory Certainty:** FERC, the Nuclear Regulatory Commission (NRC), and the DOE, in coordination with Congress, should establish clear and consistent regulatory frameworks for emerging energy technologies to encourage long-term investment. All relevant agencies should provide clear guidance on permitting requirements and timelines to reduce uncertainty for project developers.[10]

2. Enhance Grid Security and Resilience

- **Cybersecurity Enhancements:** The DOE, the Department of Homeland Security (DHS), the North American Electric Reliability Corporation (NERC), FERC, and the Electricity Information Sharing and Analysis Center (E-ISAC), should implement comprehensive and advanced cybersecurity measures, such as real-time threat monitoring, to protect the entire energy system—from generation to distribution—from cyberattacks.[11] The DOE, DHS, FERC, NERC, and E-ISAC should enhance information sharing and coordination across the energy sector to improve threat response and recovery.[12]

- **Physical Security Measures:** The DOE, DHS, FERC, NERC, E-ISAC, utilities, and state and local governments should strengthen physical security at critical energy infrastructure sites, including power plants, substations, and transmission lines, to

[8] Natalie Alms, Energy Department Wants to Use AI to Speed Up Permitting, Nextgov 2024); Karyn Hede, Faster, More Informed Environmental Permitting with AI-Guided Support, Pacific Northwest National Laboratory (2024).

[9] John Jacobs, et al., Licensing and Permitting Reforms to Accelerate Nuclear Energy Deployment, Bipartisan Policy Center (2024); Xan Fishman, et al., Finding the Goldilocks Zone for Permitting Reform, Bipartisan Policy Center at 61 (2024).

[10] U.S. Department of the Treasury, IRS Propose New Rules to Drive Clean Energy Investments, U.S. Department of the Treasury (2023); Eric Schmidt, We Need Energy for AI, and AI for Energy, Project Syndicate (2024); Kenneth Sercy & Johan Cavert, Siting, Leasing, and Permitting of Clean Energy Infrastructure in the United States, Niskanen Center (2024); National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project (2024).

[11] Glen Anderson, et al., Report Modernizing the Electric Grid: State Role and Policy Options, National Conference of State Legislatures (2021); National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 33 (2024).

[12] Grid Security, American Public Power Association (2024); 2024 Report on the Cybersecurity Posture of the United States, The White House (2024); National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 33 (2024).

prevent disruptions and sabotage.[13] All relevant stakeholders across the energy system should improve surveillance and access control measures to deter physical attacks and unauthorized access.[14]

- **Grid Modernization:** The DOE and FERC should invest in grid modernization technologies, such as advanced sensors, AI-powered grid management systems, and microgrids, to improve grid efficiency, reliability, and resilience.[15] Utilities and state and local governments should utilize distributed energy resources (DERs) like battery storage to enhance grid flexibility and responsiveness.[16]

3. Foster Public-Private Partnerships

- **Incentivize Private Investment:** The DOE, in coordination with Congress, should offer tax credits, loan guarantees, and other financial incentives to encourage private sector investment in energy innovation and infrastructure development.[17] The DOE should explore innovative financing mechanisms and public-private partnerships to leverage private capital and de-risk investments for new energy projects.[18]

- **Facilitate Collaboration:** The DOE should establish platforms[19] and initiatives to foster collaboration between national laboratories, universities, and private companies to accelerate the development and deployment of new energy

[13] Glen Anderson, et al., Modernizing the Electric Grid: State Role and Policy Options, National Conference of State Legislatures (2021); National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 33 (2024).

[14] Ben Joelson, How US Grid Operators Can Defend Against the Unprecedented Surge in Power System Attacks, Utility Drive (2023); National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 33 (2024).

[15] Kyle Baranko, et al., Fast, Scalable, Clean, and Cheap Enough, Offgrid (2024); Srishti Slaria, et al., Expanding the Possibilities: When and Where Can Grid-Enhancing Technologies, Distributed Energy Resources, and Microgrids Support the Grid of the Future?, Resources for the Future (2023); Innovative Grid Deployment - Pathways to Commercial Liftoff, U.S. Department of Energy (last accessed 2024); National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 30-33; fn 144 &145 (2024).

[16] Electricity Grids and Secure Energy Transitions, International Energy Agency (2023); National Transmission Needs Study, U.S. Department of Energy (2023); Srishti Slaria, et al., Expanding the Possibilities: When and Where Can Grid-Enhancing Technologies, Distributed Energy Resources, and Microgrids Support the Grid of the Future?, Resources for the Future (2023).

[17] To Boost Energy Innovation, Pull Technologies Into the Market, Issues in Science and Technology (2024); Nadia Schadlow, Reindustrialization: A Strategy for American Sovereignty and Security, First Breakfast (2024).

[18] FOAK Guide, Sightline Climate (2024); David M. Hart, To Boost Energy Innovation, Pull Technologies Into the Market, Issues in Science and Technology (2024).

[19] Fueling Innovation: Insights into Federal AI R&D Investment, Special Competitive Studies Project (2024); Frontiers in Artificial Intelligence for Science, Security and Technology (FASST), U.S. Department of Energy (last accessed 2024).

technologies. The DOE and industry associations should support the creation of industry consortia and research partnerships to address common challenges and share best practices.

Medium-Term Actions (2-5 years)

1. Invest in Breakthrough Energy Technologies

- **Increase R&D Funding:** The Federal Government should substantially increase federal funding for research and development to solve key scientific barriers to realizing advanced nuclear reactors, fusion energy, geothermal energy, long-duration energy storage, and other promising energy technologies.[20] The DOE should prioritize funding for high-risk, high-reward research with the potential to transform the energy sector.

- **Support Commercialization:** The DOE should provide financial and technical support to facilitate the commercialization and deployment of these technologies, including demonstration projects and first-of-a-kind deployments.[21] The DOE and the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs should support early-stage companies and entrepreneurs developing breakthrough energy technologies.[22]

2. Secure Critical Mineral Supply Chains

- **Domestic Production:** The Department of the Interior (DOI), the Bureau of Land Management (BLM),[23] and the U.S. Geological Survey (USGS) should incentivize domestic exploration, mining, and processing of critical minerals to reduce

[20] Fueling Innovation: Insights into Federal AI R&D Investment, Special Competitive Studies Project (2024); Funding for the Future: The Case for Federal R&D Spending, Special Competitive Studies Project (2024); National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project (2024).

[21] FOAK Guide, Sightline Climate (2024); David M. Hart, To Boost Energy Innovation, Pull Technologies Into the Market, Issues in Science and Technology (2024); National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 29-30(2024).

[22] Small Business Innovation Research and Small Business Technology Transfer, U.S. Department of Energy (last accessed 2024); Review of the SBIR and STTR Programs at the Department of Energy, The National Academies Press (2020).

[23] Adam Vann, Energy Production on Federal Lands: Leasing and Authorization, Congressional Research Service (2024).

reliance on foreign sources.[24] The DOI and the EPA should streamline permitting processes for mining projects.[25]

- **International Partnerships:** The Department of State and the U.S. Agency for International Development (USAID) should strengthen alliances with countries rich in critical minerals to diversify supply chains and reduce dependence on China.[26] The U.S. Trade Representative (USTR) should negotiate trade agreements and partnerships to secure access to critical minerals and promote responsible sourcing practices.[27]

- **Recycling and Recovery:** The DOE and the EPA should invest in technologies for recycling and recovering critical minerals from existing products and waste streams.[28] The EPA and Congress should continue to develop policies and incentives, such as recovery standards and benchmarks, in addition to tax credits, grants, and depreciation incentives to spur both national, state, and local partnerships focused on materials recycling and recovery.[29]

Long-Term Actions (5+ years)

1. Build a Resilient and Reliable Energy System

- **Diversify Energy Sources:** The DOE, FERC, utilities, and state and local governments should promote a diverse energy mix that includes fossil fuels – oil

[24] Gracelin Baskaran, Seven Recommendations for the New Administration and Congress: Building U.S. Critical Minerals Security, Center for Strategic and International Studies (2024); Daniel F. Runde & Austin Hardman, Elevating the Role of Critical Minerals for Development and Security, Center for Strategic and International Studies (2023).

[25] Gracelin Baskaran, Seven Recommendations for the New Administration and Congress: Building U.S. Critical Minerals Security, Center for Strategic and International Studies (2024); Daniel F. Runde & Austin Hardman, Elevating the Role of Critical Minerals for Development and Security, Center for Strategic and International Studies (2023).

[26] Fact Sheet: Critical Minerals, U.S. Agency for International Development (2024); Gracelin Baskaran, Seven Recommendations for the New Administration and Congress: Building U.S. Critical Minerals Security, Center for Strategic and International Studies (2024).

[27] A Critical Minerals Policy for the United States: The Role of Congress in Scaling Domestic Supply and De-Risking Supply Chains, The Aspen Institute (2023); A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals, U.S. Department of Commerce (2020).

[28] National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 26 (2024); USGS Provides $2 Million to States to Identify Critical Mineral Potential in Mine Waste, U.S. Geological Survey (2023); Sustainable Materials Production, Phoenix Tailings (last accessed 2024); Recovery of Rare Earth Elements and Critical Materials from Coal and Coal Byproducts, U.S. Department of Energy (2022).

[29] Biden-Harris Administration Announces $4 Billion in Tax Credits to Build Clean Energy Supply Chain, Drive Investments, and Lower Costs in Energy Communities, U.S. Department of Energy (2024).

and natural gas – and renewable energy sources – such as advanced nuclear and geothermal – to ensure long-term energy security and reduce reliance on any single source.[30] The DOE, in coordination with the White House, should develop an integrated energy strategy for the nation that optimizes the use of different energy sources based on availability, cost, and reliability.

- **Expand Transmission:** The DOE and FERC should exercise their existing authority to construct high-voltage direct current (HVDC) transmission lines across the interconnection seams to increase energy transmission.[31] This includes leveraging FERC's ability to expedite the permitting process for projects in the national interest and DOE's power to provide capital for transmission build-out.[32]

2. Lead in Global Energy Governance

- **International Cooperation:** The Department of State, the DOE, and USAID should actively engage in international forums and partnerships to promote energy technologies, security, and development. The DOE should collaborate on research and development with other countries to accelerate the global energy transition.[33]

- **Export U.S. Energy Technology:** The Department of Commerce and the Export-Import Bank of the United States (EXIM) should support the strategic export of U.S. energy technologies, including small modular reactors (SMRs), to strengthen global partnerships and promote American leadership in energy.[34] The Department of State and USAID should provide financing and technical assistance to help other countries adopt energy technologies and build resilient energy systems.[35]

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[30] National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 10 (2024).

[31] National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 30-33 (2024); OpenAI's Infrastructure Blueprint for the U.S., OpenAI (2024).

[32] The U.S. government has taken steps to build more transmission lines across the nation, funding the development of three transmission lines that cross multiple states: Nevada to Utah, Arizona to New Mexico, and New Hampshire to Vermont. See Biden-Harris Administration Announces $1.3 Billion to Build Out Nation's Electric Transmission and Releases New Study Identifying Critical Grid Needs, U.S. Department of Energy (2023); National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 30-33 (2024).

[33] National Action Plan for United States Leadership in Next-Generation Energy, Special Competitive Studies Project at 23 (2024).

[34] The United States Announces Key Measures to Jump Start Deployments of Advanced Nuclear Energy Systems and to Secure Nuclear Fuel Supply Chains, Accelerating the Contribution of Nuclear Energy to Net Zero Goals, U.S. Department of State (2023); U.S. EXIM Small Modular Reactor Financing Toolkit, Export-Import Bank of the United States (last accessed 2024).

[35] Expanding Opportunities for U.S. Energy Companies Abroad, U.S. Agency for International Development (2024).

Conclusion

The AI revolution presents both an unprecedented opportunity and a significant challenge for U.S. energy security and global leadership. Meeting the energy demands of this transformative era requires bold, strategic action to modernize infrastructure, streamline regulations, and invest in next-generation energy technologies. By leveraging the nation's unique position as a net energy exporter and proactively addressing vulnerabilities, the United States can ensure a resilient, diversified, and sustainable energy system. The recommended steps—ranging from immediate regulatory reforms to long-term investments in advanced energy solutions—offer a comprehensive roadmap to maintaining American energy dominance. With decisive leadership and a collaborative approach, the U.S. can not only power the AI revolution but also define the global energy future, safeguarding its economic and technological preeminence in an increasingly competitive world.