Securing the Grid:

Microgrids, Critical Minerals, and the Case for a Dual-Track U.S. Energy Strategy

Photo: Wendy Day/U.S. Air Force

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Executive Summary

Demand for electricity is expected to increase exponentially over the coming decades, driven primarily by the rapid scaling of data centers and AI infrastructure. Despite recent growth in nameplate capacity, effective generation capacity has remained largely flat, reflecting years of underinvestment and a regulatory environment ill-equipped to meet the pace of modern demand.[1] Strategic sites including military bases, airports, and data centers remain reliant on a civilian grid already pushed to its limits, presenting a single-point-of-failure vulnerability with direct implications for national security and economic competitiveness. President Trump's declaration of a National Energy Emergency formally recognized this reality.

The same infrastructure required to address domestic energy vulnerabilities including microgrids, energy storage, and small modular reactors depends on critical mineral supply chains almost entirely controlled by China. Through decades of strategic investment, China has secured vertical dominance across the critical minerals ecosystem, controlling 87% of rare earth processing[2] and maintaining leverage over the inputs essential to data centers, power plants, and defense systems alike. As Under Secretary of State Jacob Helberg observed, "if the 20th century ran on oil and steel, the 21st century runs on compute and the minerals that feed it."[3]

This memorandum proposes two mutually reinforcing initiatives: a domestic program to secure strategic sites through microgrids anchored by small modular nuclear reactors (SMRs), and an international effort to build on the momentum of Pax Silica and challenge China's mineral dominance through a coalition of likeminded states. Together, they address the supply and the security of the infrastructure upon which American power increasingly depends.

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[1] Cy McGeady, Joseph Majkut, Barath Harithas, and Karl Smith, "The Electricity Supply Bottleneck on U.S. AI Dominance," Center for Strategic and International Studies, March 3, 2025, https://www.csis.org/analysis/electricity-supply-bottleneck-us-ai-dominance.

[2] Meghan L. O'Sullivan and Jason Bordoff, *A Critical Minerals Policy for the United States: The Role of Congress in Scaling Domestic Supply and De-Risking Supply Chains* (Washington, DC: The Aspen Institute, Spring 2023), 18.

[3] U.S. Department of State, “Pax Silica,” accessed March 2026, https://www.state.gov/pax-silica.

Strategic Assessment of Energy Landscape

Demand for electricity is expected to increase exponentially over the forthcoming decades following years of stagnant growth in both the demand and supply of electricity in the U.S. Much of this demand surge emanates from the rapid scaling of data centers and the widespread implementation of power-intensive AI[4]. Addressing this critical issue will require updating and streamlining regulatory processes and major capital investment for new power plants, and exploring novel ways to produce electricity on an industrial level.

While some of the new demand will be met by slowing the decommissioning of coal and nuclear power plants, restarting recently closed plants, and through the construction of new renewable energy projects, the fundamental shift in the energy environment as a result of AI will demand a substantial increase in the effective capacity of the national generation mix[5]. The aging power grid and stagnant growth in the electricity sector reflects a strategic vulnerability for the U.S., which was recognized by President Trump's executive order (EO) titled: "Declaring a National Energy Emergency."[6] The scale of this vulnerability is considerable, considering the national grid operates across more than 3,000 utility companies and 55,000 substations.[7]

While the domestic power grid represents a bottleneck in scaling data centers and meeting growing demand domestically, building AI infrastructure is itself restrained by international bottlenecks. Currently, critical mineral supply chains, necessary for data centers, power plants, and energy storage systems, are almost entirely controlled by China. Massive investment in recent years through frameworks such as the Belt and Road Initiative[8] has resulted

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[4] McGeady et al., "Electricity Supply Bottleneck on U.S. AI Dominance."
[5] McGeady et al., "Electricity Supply Bottleneck on U.S. AI Dominance."
[6] Donald J. Trump, "Declaring a National Energy Emergency," The White House, January 20, 2025, https://www.whitehouse.gov/presidential-actions/2025/01/declaring-a-national-energy-emergency/.
[7] Paul Scheckleman, "Small Modular Nuclear Reactors: Securing American Military Energy in an Era of Vulnerability and Growing Demand," *MSU Defense and Strategic Studies Online* 1, no. 3 (Spring 2025): 93.
[8] O'Sullivan and Bordoff, *A Critical Minerals Policy for the United States*, 17.

in Chinese control over 87% of rare earth mineral processing,[9] as well as leverage over the entire vertical critical mineral supply chain.

Pax Silica, a new multilateral initiative spearheaded by the U.S. Department of State,[10] aims to address the intersection of the two bottlenecks. The initiative seeks to build a coalition of likeminded countries to develop and secure critical supply chains, challenge the existing monopoly held by China, and enhance the ability for partners to build computing power and meet the associated power demands. Through Pax Silica, the entire energy ecosystem becomes a tool of statecraft, addressing the needs of both the U.S. and the coalition in general while circumventing China's leverage. China's 2010 rare earth embargo on Japan[11] serves as a prime example of the way China has used this leverage in the past, and justifies states' motivation to join the initiative.

<u>Domestic Policy Initiative</u>

The U.S. has an opportunity to simultaneously address two critical energy-related vulnerabilities facing the domestic grid: stagnant growth in effective capacity, and the reliance of critical sites on a vulnerable civilian grid. Despite recent growth in nameplate capacity, the effective capacity of the U.S. power grid has remained mostly flat, due primarily to the nameplate increases stemming from new projects with a relatively low capacity factor[12]. Solar and wind projects must continue to play a role in supplementing natural gas, hydro, nuclear, and storage, but cannot be equated with these sources when constructing policy to facilitate

[9] O'Sullivan and Bordoff, *A Critical Minerals Policy for the United States*, 18.
[10] U.S. Department of State, "Pax Silica."
[11] World Economic Forum, *Energy Transition and Geopolitics: Are Critical Minerals the New Oil?* White Paper (Geneva: World Economic Forum, April 2024), 7.
[12] McGeady et al., "Electricity Supply Bottleneck on U.S. AI Dominance."

production growth. Solar and wind projects have a capacity factor around 30%,[13] making firm baseload generation a prerequisite for any serious capacity strategy. Rather, these renewable sources should be framed as supplementary and ideally paired with energy storage systems to ensure adequate grid supply during periods of high demand. This oversight, coupled with a lack of investment in transmission infrastructure, has left interstate grids in a weak position to manage the expected rise in demand over the coming years.

Strategic sites, including airports, military bases, and data centers, remain generally reliant on a grid already pushed to the breaking point. Furthermore, the risk of a single point of failure, such as a substation, high voltage transmission line, or high-volume power plant, shutting down critical sites, is a strategic vulnerability. The recent power outage at DEN airport highlights this risk: as a critical transportation and cargo node with strategic importance in a potential conflict, the airport must prove more resilient than the single substation that connects it to the grid.[14] The deployment gap is significant, as the United States had only 692 operational microgrids with a combined capacity of approximately 4.4 gigawatts as of 2023,[15] a fraction of what would be required to secure critical sites nationwide. Furthermore, by combining on-site renewable generation, storage, and emergency diesel generation, the microgrid can support the wider grid during times of high demand or in the event of a failure.

This initiative is not without risk or cost. SMR technology is still being refined and deployment requires high up-front costs.[16] Public perception of nuclear energy is traditionally skeptical, hindering political approval for deployment on a local level, including at the DEN

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[13] Steven Curtis and Peter D. Rocha, "Microgrids for the 21st Century: The Case for a Defense Energy Architecture," *Joint Force Quarterly* 112 (February 2024): 25.
[14] Jon Murray, "DIA Power Outage Causes FAA Ground Stop, Flight Delays," *Denver Post*, March 18, 2026, https://www.denverpost.com/2026/03/18/dia-power-outage-faa-ground-stop/.
[15] Center for Climate and Energy Solutions, "Microgrids," C2ES, accessed March 2026, https://www.c2es.org/content/microgrids/.
[16] Curtis and Rocha, "Microgrids for the 21st Century," 26.

airport.[17] Cybersecurity of microgrids remains a priority as well, as isolating strategic sites from the public grid doesn't inherently secure them.[18]

The construction and implementation of microgrids is politically feasible, albeit vulnerable to partisan polarization given the relatively long timeline to operational deployment. That being said, recent legislation and executive action has sought to streamline this timeline. The ADVANCE Act of 2024, which passed with wide bipartisan support, modernized NRC regulation for SMRs[19]. Executive orders on nuclear energy during the current administration have built on this momentum as well.[20] Demand for edge-deployable SMRs and corresponding microgrid infrastructure is expected to rise in the defense sector as well. The Pentagon is currently engaged in several relevant projects including Project Pele and the Army Tactical Microgrid Standard (TMS),[21] and the U.S. Air Force is planning to install an SMR at Eielson Air Force Base for initial testing by 2027.[22] Moreover, despite cuts to renewable energy projects outlined in the Inflation Reduction Act (IRA), the One Big Beautiful Bill (OBBB) preserved nuclear-related credits, further emphasizing the bipartisan support for nuclear innovation.[23] The structure for federal financing is already in place: the OBBB preserved nuclear production tax

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[17] EPN Staff, "Denver Airport's Nuclear Ambitions Hit Political Roadblock," *Energy Platform News*, October 6, 2025, https://energy.policyplatform.news/energy/denver-airports-nuclear-ambitions-hit-political-roadblock.
[18] The White House, *President Trump's Cyber Strategy for America* (Washington, DC: The White House, March 2026), https://www.whitehouse.gov/wp-content/uploads/2026/03/president-trumps-cyber-strategy-for-america.pdf.
[19] *Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy Act of 2024*, Pub. L. 118-67, 118th Cong., 2nd sess. (July 9, 2024).
[20] Shuting Pomerleau, "Trump's Nuclear Executive Orders: Overview and Analysis," American Action Forum, June 3, 2025, https://www.americanactionforum.org/insight/trumps-nuclear-executive-orders-overview-and-analysis/.
[21] Scheckleman, "Small Modular Nuclear Reactors," 95–96.
[22] American Nuclear Society, "Air Force Issues Notice to Partner with Oklo on Microreactor Deployment in Alaska," *Nuclear Newswire*, June 16, 2025, https://www.ans.org/news/2025-06-16/article-7114/air-force-issues-notice-to-partner-with-oklo-on-microreactor-deployment-in-alaska/.
[23] Bipartisan Policy Center, "2025 Reconciliation Debate: Senate Energy Provisions," updated July 2025, https://bipartisanpolicy.org/explainer/2025-reconciliation-debate-one-big-beautiful-bill-act-energy-provisions/.

credits through 2031 and appropriated $125 million specifically for portable modular reactors for military use, providing a meaningful foundation for early deployment.[24]

Despite progress in regulatory reform, demand from the Pentagon, and widespread bipartisan support, SMR-based microgrids still face several hurdles before reaching initial operating capability. Nuclear-specific workforce gaps are a genuine constraint[25], evocative of similar constraints in other critical industries such as shipbuilding.[26] Regulatory approval for the various SMR designs currently in development will still take time even after reforms, and safety certification remains paramount for both practical and political reasons. As always, supply chain constraints, which will ideally be addressed through the Pax Silica initiative, further complicate matters. The production of several critical minerals, including zirconium, hafnium, and nickel-chromium alloys, relies heavily on China or Chinese-controlled facilities.[27] Near-term success should therefore be measured by regulatory milestones and pilot deployments rather than full operational capability. As such, the widespread deployment of SMR-based microgrids to critical sites around the country may require a decade of regulatory reforms, technological development, and coalition building with international partners. In the interim, there are measures that should be taken to maximize the efficiency of the grid as it stands, though none that simultaneously secure critical sites and build generating capacity with the same efficacy as the stated domestic initiative. Investing in large-scale transmission construction and renovation,

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[24] Bipartisan Policy Center, “2025 Reconciliation Debate.”

[25] U.S. Department of Energy, 21st Century Energy Workforce Advisory Board, *Recommendations of the 21st Century Energy Workforce Advisory Board* (Washington, DC: DOE, July 9, 2025), https://www.energy.gov/sites/default/files/2025-07/EWAB_Special_Report_Opportunities_for_American_Workers_in_Energy.pdf.

[26] U.S. Government Accountability Office, *Navy Shipbuilding: A Generational Imperative for Systemic Change*, GAO-25-108136 (Washington, DC: GAO, March 11, 2025), https://www.gao.gov/products/gao-25-108136.

[27] Kruthika A. Bala and Robert J. Johnston, “Nuclear and SMR Non-Fuel Critical Minerals Supply Chain: An Emerging Fourth Value Chain,” Payne Institute Commentary Series (Golden, CO: Payne Institute for Public Policy, March 10, 2026), https://payneinstitute.mines.edu/nuclear-and-smr-non-fuel-critical-minerals-supply-chain-an-emerging-fourth-value-chain/.

for example, could result in increased effective capacity and meet growing demand in the short term. Associated cost, risk, and political implications notwithstanding, this should be considered as a temporary stopgap.

Building both political and popular support for the construction of SMR-based microgrids at strategic sites should provide an unusual opportunity for bipartisan alignment, crucial for securing necessary funding. The administration should capitalize on ongoing public discourse and invite industry leaders to an Executive Order signing ceremony that focuses on microgrids specifically. At the same time, the administration should engage lawmakers across the aisle, albeit out of the public eye, and highlight alignments between the initiative and existing provisions in the IRA. Finally, the president should explicitly endorse ongoing Pentagon initiatives, including the Tactical Microgrid Standard (TMS), which will enhance the national security framing of the initiative.

International Policy Initiative

Challenging China's vertical dominance in critical mineral production is a prerequisite for the domestic initiative and a strategic priority in its own right. China has shown time and again that it is willing to leverage its control and restrict exports of critical materials, most notably through the rare earth embargo imposed on Japan in 2010 following a territorial dispute, the export controls placed on gallium, germanium, and graphite in 2023, and the sweeping export control expansion of 2025 that threatened to restrict global access to rare earth elements and related processing technologies.[28]

[28]World Economic Forum, *Are Critical Minerals the New Oil?*, 7; Crebo-Rediker and Khan, *Leapfrogging China's Critical Minerals Dominance*; Bordoff and O'Sullivan, "Return of the Energy Weapon," 56–71.

Before deploying resources, both capital and diplomatic, to pursue broad goals, the U.S. must identify which minerals are the most essential, where they can be found, the degree to which China controls all levels of production, and crucially, whether the U.S. may be able to bypass the need to use the materials at all. A 2026 report from the Council on Foreign Relations addresses this directly,[29] proposing several ways in which the U.S. can "leapfrog" some of the perceived leverage that China holds over supply chains. The report discusses recycling, alternative extraction and processing technologies, and innovative techniques that could enable the production of necessary infrastructure without the usage of critical minerals. Before the U.S. engages in mineral diplomacy or invests in costly projects to mine, process, and import critical minerals, adequate resources must be allocated to ensure that such projects are prioritized by absolute necessity. This sequencing is not merely strategic preference but practical necessity, as the average lead time for a mine to move from discovery to production exceeded 16 years between 2010 and 2019, meaning traditional mining diplomacy alone cannot address near-term vulnerabilities.[30]

Despite the best efforts of humanity, not every critical resource reliant on a supply chain controlled by China will be leapfrogged by innovation and recycling. Therefore, in tandem with the domestic initiative, the U.S. should leverage recent momentum to build a strong coalition of likeminded states to reduce reliance on China and construct alternative supply chains for critical minerals. The recent Critical Minerals Ministerial, held in Washington, DC in February 2026, laid the foundation for this effort.[31] Through FORGE, Pax Silica, and Project Vault, the U.S. is

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[29] Crebo-Rediker and Khan, *Leapfrogging China's Critical Minerals Dominance*.

[30] International Energy Agency, *The Role of Critical Minerals in Clean Energy Transitions* (Paris: IEA, May 2021), https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions; O'Sullivan and Bordoff, *A Critical Minerals Policy for the United States*, 13.

[31] Gracelin Baskaran and Meredith Schwartz, "Critical Minerals Ministerial Introduces New International Cooperation Strategy," Center for Strategic and International Studies, February 13, 2026, https://www.csis.org/analysis/critical-minerals-ministerial-introduces-new-international-cooperation-strategy.

already making strides to securing supply chains and pursuing equitable working relationships with partner states.[32] This international initiative fits administration priorities by building mutually beneficial relationships between states with complementarily deployable resources.

In addition to pursuing innovative technologies and securing new supply chains through international partnerships, the U.S. must balance the risks that arise as a result of the initiatives. The initiative, therefore, must not be framed as explicitly antagonistic towards China, especially before alternative supply chains are secure. China has shown that they are willing to retaliate against threats through export controls, to which the U.S. and her partners remain highly vulnerable. Moreover, an alliance of this magnitude, spanning six continents and countless languages, cultures, and currencies, must be managed carefully to prevent fracturing. Mechanisms to manage burden-sharing disputes, divergent environmental or labor standards, and noncompliance must therefore be built into the structure of the alliance. Crucially, as the Aspen Institute emphasized in 2023, the U.S. must embrace partners and recognize that the ultimate goal is not American self-sufficiency, which is neither feasible nor desirable.[33]

Building the international coalition to secure critical supply chains will require support and consistency in Washington. The communications strategy should seek to exploit the unusual alignment of interests among national security hawks, sustainability advocates, and mining communities. While domestic mining projects are unpopular among climate activists, opportunities to replace coal mining with critical mineral extraction (where available) which in turn contribute to the construction of low-carbon-intensive energy sources independent of China-controlled supply chains, aligns hawks, activists, and miners on one comprehensive project.

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[32] U.S. Department of State, “2026 Critical Minerals Ministerial,” February 4, 2026, https://www.state.gov/releases/office-of-the-spokesperson/2026/02/2026-critical-minerals-ministerial/.
[33] O'Sullivan and Bordoff, *A Critical Minerals Policy for the United States*, 21.

Finally, drastic changes in the distribution of international aid through such reforms including the consolidation of USAID into the U.S. Department of State, presents an opportunity for the administration to endorse alternative aid strategies through the "Trade Not Aid" framework.[34] For example, rather than sending funds or materials to traditional aid recipients, efforts should be made to facilitate coalition investment in projects to extract, refine, or otherwise produce critical minerals and associated infrastructure. These projects, overseen by the coalition to ensure compliance and adequate safety and labor requirements, can serve as sustainable liquidity injections and preferred alternatives to China. While China has invested heavily in projects such as cobalt extraction in central Africa,[35] human rights concerns for laborers have been voiced across the international community. If done correctly, the U.S.-led coalition to secure supply chains can prove to resource-rich countries in need of foreign investment that working with the U.S. can benefit entire labor markets from the top to bottom, and serve as a mechanism to reduce human rights abuses across mineral extraction projects.

Integration and Prioritization

The interconnected nature of both the domestic and international initiatives can serve to strengthen the messaging for both: the international initiative enables the domestic initiative, while both simultaneously contribute to securing the U.S. economy, energy infrastructure, international partnerships, and resilience to strategic threats. Building out microgrid infrastructure across the U.S. at strategic sites, bases, and data centers will strengthen American resilience to threats and enable continued leadership in AI innovation. The construction of such infrastructure, however, is heavily reliant on supply chains almost entirely controlled by China.

[34] U.S. Department of State, "Department of State Launches Pax Silica Fund," March 2026, https://www.state.gov/releases/office-of-the-spokesperson/2026/03/department-of-state-launches-pax-silica-fund/.
[35] O'Sullivan and Bordoff, *A Critical Minerals Policy for the United States*, 17.

Crucially, the materials needed to build microgrids, SMRs, and energy storage rely on the same supply chains that the Pax Silica initiative is targeting. This reflects both existing risks in deploying infrastructure manufactured in China to strategic sites, and the necessity to establish alternative supply chains with likeminded nations. The international initiative should therefore be prioritized first, pursued immediately through executive action and existing diplomatic frameworks including FORGE, while the domestic initiative advances through its longer regulatory and procurement runway. The widespread deployment of SMR-based microgrids to critical sites around the country may require a decade of regulatory reforms, technological development, and coalition building with international partners. By design, the timelines align.

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