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Veterans Advanced Energy Fellowship 2024 Policy Proposals

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The Veterans Advanced Energy Project is designed to drive US leadership in advanced energy by recruiting, equipping, and empowering military veterans who understand th importance of the evolving energy landscape to our future security and prosperity.

Advanced energy is defined by leading edge energy technologies including solar, wind, batteries, microgrids, advanced nuclear, electric vehicles, and end-user energy efficiency.

The Veterans Advanced Energy Project mission applies to veterans of the US armed services and national guard, reservists, active-duty service members, and their spouses. The Veterans Advanced Energy Project is housed within the Atlantic Council Global Energy Center, which promotes energy security by working alongside government, industry, civil society, and public stakeholders to devise pragmatic solutions to the geopolitical, sustainability, and economic challenges of the changing global energy landscape.

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Veterans Advanced Energy Fellowship *2024 Policy Proposals*

As part of the 2023-2024 Veterans Advanced Energy Fellowship, fellows prepared a policy memo on a topic related to national security, advanced energy, and/or military veterans with the guidance of an advisor from the Atlantic Council network. Each policy proposal diagnoses a problem and proposes a solution to a specific actor or actors. Fellows also consider the counterarguments of the policy prescription to strengthen the proposed pathway. Fellows were strongly encouraged to select a topic to which they have a professional or personal connection.

ABOUT VAEF

The Veterans Advanced Energy Fellowship seeks to create a cadre of future leaders within the advanced energy industry. A successful fellow will become a peer mentor, advocate, and spokesperson for other veterans, reservists, and military spouses, helping to solidify the advanced energy connection to national security and the mission-driven advancement of veterans' employment in advanced energy. As fellows rise within advanced energy organizations, they can more closely tie national security to energy security, as well as move the advanced energy economy forward.

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Allocation of DOE grant funding for critical minerals processing capacity

By Vik Bakshi

Recommendation

The US DOE Loan Program Office, in coordination with the DOE's Office of Clean Energy Demonstration (OCED) and Office of Fossil Energy and Carbon Management (FECM), should reallocate funding to execute a multi-billion dollar critical mineral hub program to substantially invest in refining and processing capacity of critical minerals in the United States. Allocation of funding to investment in critical mineral processing is a key step to reducing US dependence on foreign sources of critical minerals, namely China. Furthermore, allocation of funding to enable development of critical minerals processing capacity within the United States has numerous economic and social benefits, including job creation in economically depressed communities and advancement of emerging technologies.

Background

Both the Department of Energy and Department of Defense have identified critical minerals as a strategic priority for decades. In recent years, critical minerals—and the seventeen named rare earth elements, in particular—have gained prominence from a policy perspective due to their indispensable role in various vital defense applications including precision-guided missiles, lasers, military communication systems, radar systems, and electronic counter measures.[1] Beyond defense, rare earth elements such as dysprosium (Dy), neodymium (Nd), praseodymium (Pr), and terbium (Tb) are in demand in the clean energy space for permanent magnets required for electric vehicles and wind turbines.[2] Offices within the DOE and DOD have taken various policy measures in recent years to prioritize protecting these critical mineral supply chains and ensuring US ability to source the needed minerals without dependence on foreign sources, particularly China, yet the threat overwhelmingly remains.

Despite their strategic importance, supply chains for rare earth minerals are heavily concentrated in other parts of the world, particularly for processing. Deposits for critical minerals are scattered throughout the world based on various geologies; for instance, deposits for nickel (Ni) and cobalt (Co), both of which are critical for battery performance, are heavily concentrated in Indonesia and Congo respectively.[3] Regardless, China dominates global capacity for rare earths mineral processing, with estimates ranging from 85-90 percent of global market share.[4] Processing techniques for rare earth

[1] BRINK (2022). China is Moving Rapidly Up the Rare Earth Value Chain. https://www.brinknews.com/china-is-moving-rapidly-up-the-rare-earth-value-chain/

[2] BRINK (2022). China is Moving Rapidly Up the Rare Earth Value Chain. https://www.brinknews.com/china-is-moving-rapidly-up-the-rare-earth-value-chain/; The Oregon Group (2024). The West's pursuit of Rare Earths hits resistance from China. https://theoregongroup.com/investment-insights/the-wests-pursuit-of-rare-earths-hits-resistance-from-china/

[3] Oxford Institute for Energy Studies (2023). China's rare earths dominance and policy responses.

[4] The Oregon Group (2024). The West's pursuit of Rare Earths hits resistance from China. https://theoregongroup.com/investment-insights/the-wests-pursuit-of-rare-earths-hits-resistance-from-china/; Oxford Institute for Energy Studies (2023). China's rare earths dominance and policy responses.; Center for Strategic & International Studies (2024). What China's Ban on Rare Earths Processing Technology Exports Means. https://www.csis.org/analysis/what-chinas-ban-rare-earths-processing-technology-exports-means#:~:text=At%20present%20China%20produces%2060,given%20China%20a%20near%20monopoly.

minerals are uniquely designed for each type of deposit, yet overall consist of: crushing ores and separating rare earth oxides; chemical treatment to produce a leach solution; precipitation of rare earth oxides via dewatering; various follow-on techniques such as solvent extraction or ion exchange; and finally electrochemical separation.[5] China dominates in these extraction techniques, in no small part due to the hazardous nature of the byproducts produced through the process; by some estimates, one ton of rare earth metals produces 2,000 tons of solid waste. Furthermore, China recognized the value in rare earths as "protected and strategic minerals," investing heavily in the CAPEX intensive facilities in the 1990s and steadily introducing export bans over the last twenty years.[6] In August 2024, China introduced export restrictions on antimony (Sb), a critical (but not rare earth) mineral used in solar panels, armor-piercing rounds, and infrared sensors.

The US Infrastructure Investment and Jobs Act allocated a total budget of $407 million for research, development and demonstration of critical minerals refining; these efforts have largely led to the funding for demonstration and pilot facilities to enable the advancement of critical minerals technologies.[7] For instance, FECM selected several projects for a total of $30 million in grant funding to advance research into several projects that may help lower economic and environmental costs from chemical processing of rare earth minerals.[8] In contrast, to drastically scale development of the clean hydrogen ecosystem, OCED is administering the $7 billion Regional Clean Hydrogen Hubs Program (H2 Hubs) to establish a national clean hydrogen network through grant funding for a series of multi-industry, multi-stakeholder, massive hydrogen hubs.[9] This program, which ultimately selected seven proposed hubs for grant funding, received multi-stakeholder hub applications. Meanwhile, the DOE's LPO is providing loans to major projects at the scale to actually impact supply chains, including a $2.26 billion loan for a lithium processing plant and a $700 million loan for supply of lithium carbonate, both in Nevada.[10]

Proposal

The LPO has a mandate to issue $400 billion in clean energy loans, yet to date has made commitments in the range of $30 billion, with $6.5 billion in loans actually issued.[11] LPO can leverage the model of the OCED and allocate $10 billion or more in low-interest loans specifically for the creation of new, or repurposing of existing, facilities needed for mechanical and chemical processing of critical mineral ores into usable critical minerals, specifically for shared defense and clean energy applications. With a few exceptions, the DOE's prior loan and grant funds through their various offices have been focused on mature, established clean energy technologies, including photovoltaics, wind turbines, and lithium products for batteries. By shifting focus to the unmet need and strategic threat associated with supply chains for critical minerals, the LPO can facilitate the development of critical mineral processing facilities, targeted at specific needs.

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[5] Oxford Institute for Energy Studies (2023). China's rare earths dominance and policy responses.
[6] Ibid.
[7] International Energy Agency (2023). Infrastructure and Jobs act: Critical Minerals. https://www.iea.org/policies/14995-infrastructure-and-jobs-act-critical-minerals
[8] DOE Office of Fossil Energy and Carbon Management (2024). Advanced Processing of Critical Minerals and Materials for Industrial and Manufacturing Applications. https://www.energy.gov/fecm/funding-notice-bipartisan-infrastructure-law-advanced-processing-critical-minerals-and
[9] DOE Office of Clean Energy Demonstrations (2022). Regional Clean Hydrogen Hubs. https://www.energy.gov/oced/regional-clean-hydrogen-hubs-0
[10] DOE Loan Programs Office (2023). Critical Materials Projects. https://www.energy.gov/lpo/critical-materials-projects
[11] Wall Street Journal (2024). White House Races to Lend Billions in Climate Funds Before Election. https://www.wsj.com/politics/policy/white-house-races-to-lend-billions-in-climate-funds-before-election-9c5dce7a

Beyond the importance to both national security and energy independence, bolstering domestic supply chains of critical minerals can generate both environmental and economic benefits. From an environmental perspective, building upon FECM's R&D into newer processing techniques with lower environmental footprint, thus reducing US reliance on the environmentally fraught techniques of international supply chains, namely China. Beyond that, similar to the model employed by OCED with selection of hydrogen hubs, LPO can employ selection criteria that include job creation and economic justice for depressed communities. Particular emphasis should be paid to project locations relative to major ports where ores can be shipped; rail and highway infrastructure; and existing, non-operating manufacturing infrastructure that can be salvaged and repurposed to both re-create jobs while reducing overall project CAPEX required.

Conclusion

Investing in domestic processing and refining facilities for critical minerals is a strategic imperative for the United States. Although previous efforts have focused on innovation and research & development, the DOE should support the next wave of actually reshoring critical mineral production by leveraging the LPO to concentrate $10-20 billion in loans for actual critical mineral processing facilities located in economically depressed communities. Bolstering domestic refining capacity is aligned with strategic national security and sustainability imperatives. Moreover, investment in critical mineral processing facilities will drive economic growth and job creation in historically underrepresented and economically depressed communities, particularly those with access to critical, multi-modal transportation networks. Shifting DOE funding priorities to critical minerals processing will prevent exacerbating the risk associated with US reliance on Chinese-controlled critical mineral supply chains as the US scales up its investment in a sustainable future with net-zero aspirations.

Comprehensive Local Educational Agency Network of Resilient and Interconnected Dispatchable Energy Storage (CLEANRIDES)

By Michael Callender

Increasing adoption of bidirectional electric school buses is the nation's most rapid and cost-effective path to improving grid reliability and energy resilience. Nearly half-a-million yellow school buses serve most of the communities across the United States. Each electric bus model boasts a 200 kWh battery, enough mobile-dispatchable energy to run the average household for a week.

Albeit exceptionally fragmented, the yellow bus is the largest mass transit system in the world, possessing over 100 GWh of mobile and dispatchable battery storage. While federal and state funding is accelerating the adoption of electric buses, the highly fragmented sources of supply (e.g, Original Equipment Manufacturers (OEM) and dealerships) and demand (e.g., Local Education Agencies (LEA)) are failing to invest in the value of bidirectional vehicle energy storage[12]. Common sense standards from both Congress and Statehouses are required to facilitate investments.

Although the National Highway Traffic Safety Administration (NHTSA) sets safety standards for the manufacture and sale of school buses, the use and operational aspects are primarily regulated by state laws. States determine how school children must be transported, and they may follow NHTSA's recommendations on various operational aspects, such as school bus routing and stop locations.

Federal Recommendations[13]

- Amend Federal Motor Vehicle Safety Standards (FMVSS) and NHTSA to require School Bus and Multifunction School Activity Bus (MFSAB) models to adhere to bidirectional technical and safety standards for critical distributed energy resources, including:
    - NIST SP 1108R3 - Smart Grid Interoperability Standards Framework
    - SAE J3072 - Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems
    - ISO/IEC 15118 - Road Vehicles - Vehicle to Grid Communication Interface
    - NERC CIP (Critical Infrastructure Protection) Standards
    - UL 9741: Standard for Electric Vehicle Power Export Equipment (EVPE)
    - UL 22022: Standard for DC Charging Equipment for Electric Vehicles

[12] NTD: fragmentation also drastically increases the number and type of specifications, thoroughly inflating prices and slowing adoption of EV buses. Debating whether to introduce this concept in the proposal or keep it focused on technical/security

[13] NTD: The existing federal bill proposed is simply asking for a roadmap and considerations from DOE, this policy proposes specific and actionable changes.

- Compel the General Services Administration (GSA) to exercise the federal government's commercial power to lower costs and procurement barriers for LEAs, including:
    - o Require bidirectional capabilities for School Bus, MFSAB, and applicable charging equipment for GSA Fleet purchasing.
    - o Amend 40 U.S.C § 602 and OGP 4800.2I to ensure eligibility of LEAs to utilize GSA sources and supply of services for the local procurement of electric School Buses and associated equipment or services.
- Amend the National Defense Authorization Act (NDAA) to compel the Department of Defense (DOD) to implement bidirectional electric School Buses and MFSAB capabilities on all US installations:
    - o 50 percent of yellow school buses serving DOD Education Activity (DODEA) must have capability to provide mobile and dispatchable backup power to the installation during grid-contested conditions.
    - o 20 percent of MFSAB vehicles must have capability to provide mobile and dispatchable backup power to the installation during grid-contested conditions.
    - o DOD installations must integrate capabilities into their operational and contingency plans.
- Amend Title 49 of the Code of Federal Regulations (CFR), Parts 383 and 384 to permit the Federal Motor Carrier Safety Administration (FMCSA) to issue a specific Commercial Driver License (CDL) category for School Bus operation with following minimum revisions:
    - o Knowledge test to include general safety and operational use of a bidirectional vehicle and charger.
    - o Skills test to include safely initiating charge and discharge procedures; removal of unnecessarily onerous physical requirements for the average school bus driver.
    - o Permit school bus CDL tests to be completed in multiple languages; testing may require a baseline proficiency of English for both verbal and visual safety measures[14].

Statehouse Recommendations

- Revise and/or create school bus regulations that pertain specifically to electric variants with the following minimum characteristics:
    - o Bidirectional capabilities and certifications recommended to NHSTA.
    - o Strike requirements only applicable to non-electric powertrains.
    - o Review specifications for components or requirements that unintentionally result in limited procurement choice or fraud, waste, and abuse.

[14] NTD: CDLs are built for big trucks on the interstate, a School Bus version would match the simplified requirements and improve a severely constrained labor pool.

- Revise LEA procurement regulations and requirements to avoid barriers to adoption:
    - Allow at least 12-year term contracts and useful life considerations.
    - Require all applicable solicitations to allow respondents to provide bidirectional solutions for consideration.
    - Require LEAs to compare all bids with options provided by GSA OGP 4800.2I or similar cooperative procurement.
- Eliminate regressive Sales and Use taxes on electric vehicles
    - Cap sales, use, and applicable motor vehicle excise taxes for bidirectional electric school buses at the equivalent tariff on a diesel bus.[15]

[15] NTD: school bus costs 2-3x a diesel comparison, so sales and excise tax are regressive and negatively affecting adoption.

Scaling up virtual power plants: Transforming the role of an energy consumer to meet surging electricity demand, decarbonization, and energy security goals

By Eric Davids

In the evolving landscape of energy management, two significant trends have emerged that hold promise for transforming the nation's power grids: the widespread consumer adoption of Distributed Energy Resources (DERs) and expanded Virtual Power Plant (VPP) capabilities. These developments present a critical opportunity for grid planners to address the multifaceted challenges of meeting increased load growth, maintaining reliability, and achieving ambitious decarbonization targets, all without overburdening ratepayers already grappling with significant inflationary pressures. Program administrators and regulators are tasked with the difficult challenge of transforming energy consumers into active participants, or "prosumers," in the energy grid. To scale these solutions, policymakers must take bold steps to set conditions for this transformation by leveling the playing field between demand-side solutions and physical infrastructure investments.

For the past decade, US grid planners have routinely forecasted a mere 0.5 percent annual load growth rate. In recent years, however, the nationwide forecast for electricity demand has been repeatedly adjusted upwards, with the 2023 Federal Energy Regulatory Commission (FERC) filings predicting 4.7 percent growth over the next five years.[16] Much of this near-term load growth is driven by investments in new manufacturing, industrial, and data center facilities. Federal agencies expect future energy demand growth to be compounded by the widespread adoption of electric vehicles (EVs) and electrified heating. The US Department of Energy (DOE) predicts energy demand will increase by 60 gigawatts (GW) by 2030, up from roughly 740 GW to 800 GW.[17] Wholesale auctions are also starting to send strong build signals to developers.[18]

US generation and grid developers are not prepared to build infrastructure quickly enough to meet this increased demand. Lead times for hard infrastructure components are too long, and despite recent progress, transmission backlogs and permitting delays remain the biggest bottleneck to the energy transition. The challenges are further exacerbated by China's dominance over the supply chains for many critical minerals and components essential to this energy system buildout.[19] Additionally, rate basing the necessary infrastructure upgrades to meet this demand growth will increase energy burdens on ratepayers, who are already coping with skyrocketing electricity prices that double overall inflation.[20]

Surging demand also poses a challenge to the Biden-Harris Administration's decarbonization agenda. Utilities are deferring planned retirements of fossil fuel generation resources to serve this incremental load, and analysts predict an accelerated commissioning of natural gas plants.[21] New clean-firm technologies, such as advanced geothermal and next-generation nuclear, are poised to play a much

[16] Grid Strategies. The Era of Flat Power Demand is Over. 2023.
[17] DOE. Pathways to Commercial Liftoff: Virtual Power Plants. 2023.
[18] Utility Dive. PJM Capacity Prices Hit Record Highs, Sending Build Signals to Generators. 2024.
[19] HeatMap. A Critical Mineral Trade War Is Brewing. 2024.
[20] UtilityDive. Electricity prices surged 14.3% in 2022, double overall inflation: US report. 2023.
[21] Financial Times. US slows plans to retire coal-fired plants as power demand from AI surges. 2024.

larger role in the US generation mix, but it is unlikely that significant capacity from these sources will come online before the end of the decade due to lengthy development timelines.

To overcome this challenge, utilities must strategically invest in demand-side solutions and grid-enhancing technologies (GETs) to increase the utilization and efficiency of the grid. Strategic investment should aim to reduce peak demand, which continues to increase and drive rate increases. Approximately 10 percent of infrastructure investments in the United States focus on serving demand for just 1 percent of hours of the year, revealing the inefficient nature of addressing demand with traditional infrastructure upgrades.[22] Demand-side solutions, which cost about 100 times less per project than physical infrastructure, can better address these costly hours. Currently, however, these solutions receive 100 times less investment than physical infrastructure, which is symptomatic of a policy shortfall.[23]

Virtual Power Plants (VPPs) have emerged as a scalable, customer-centric, demand-side solution to increase the utilization of existing and new grid assets and defer or negate the need for certain hard infrastructure investments. VPPs are grid-integrated aggregations of Distributed Energy Resources (DERs), including batteries, EVs, smart thermostats, and other connected devices. They provide a range of grid services, including shifting load from high to low-price times, responding to grid emergencies, shaping load profiles to match intermittent renewable generation, and generally reducing peak demand. There are 33 GW of VPPs across 1459 deployments as of July 2024.[24]

Recent studies have shown that VPPs can play a substantial role in a cost-effective transition to a low-carbon energy system. The DOE found that there is the potential to reach 80 to 160 GW of VPP capacity by 2030, representing 10 to 20 percent of system peak demand.[25] A 2023 Brattle Group study determined that the net cost to a utility of providing resource adequacy from a VPP is roughly 40 to 60 percent of the cost of alternative options.[26]

The key factors determining whether VPPs can achieve their full potential revolve around their capabilities and the extent of their adoption. First, can grid planners and operators depend on VPPs to deliver services traditionally provided by physical infrastructure? Second, will enough energy consumers agree to participate, thereby ceding some control over their grid-interactive devices, to enable VPPs to reach 10 to20 percent of system peak demand?

It is tempting to focus on the uncertainty surrounding VPPs' capabilities and use it to dismiss investing heavily in these solutions today. Utilities place a premium on reliability and safety, and it is a conceptual leap to believe that 100,000 smart thermostats enrolled in a load control program is a viable substitute for a 100 MW peaker plant. Yet, across the country, VPP demonstrations are doing exactly this.[27] Recent investments in Distributed Energy Resources Management Systems (DERMS) and advances in AI and machine learning, combined with the widespread deployment of advanced metering infrastructure (AMI) and better standardization of grid-interactive device protocols, will only expand and harden VPPs' potential to deliver a broader range of grid services over the coming years, effectively connecting the end consumer to the control room. To best leverage this emergent energy resource, policymakers should focus on adapting utility business models, operations, and regulatory frameworks to create a level

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[22] Advanced Energy United. Potential for Peak Demand Reduction in Indiana. 2018.
[23] WoodMac. Utility investment in grid modernization: H2: 2023. 2023.
[24] WoodMac. 2024 North America Virtual Power Plant Market Outlook. 2024.
[25] DOE. Pathways to Commercial Liftoff: Virtual Power Plants. 2023.
[26] Brattle. Real Reliability: The Value of Virtual Power. 2023.
[27] RMI. Virtual Power Plant Flipbook. 2024.

playing field between demand-side solutions and physical infrastructure investments. Policies and rules should **account for the short- and long-term benefits of VPPs**, **encourage integrated demand-side and distribution planning**, and **incentivize deployment of demand-side optimization on par with capital investments**.

The questions surrounding consumer participation poses a larger risk for whether VPPs could comprise a substantial portion of system peak demand. Despite very mature demand-side programs, only 23 percent of households participate in residential energy efficiency programs.[28] Furthermore, participation in demand response (DR) programs decreased by 10 percent in recent years, from 11.7 million consumers in 2020 to approximately 10.5 million consumers 2021.[29] Only slightly more consumers, 14.6 million, were enrolled in a time-varying rate as of 2021.[30] If VPPs are to realize the expectations set forth in industry forecasts, consumer adoption must increase dramatically. The Brattle Group estimates that a reasonable future participation rate for smart thermostat DR could be 30 to 40 percent of the eligible population, or approximately 20 percent of the total population, which is four times what it is today in relatively mature programs.[31]

Despite historic headwinds, the opportunity to expand program participation over the coming decade is ripe. Consumer trends, supported by incentives from the Inflation Reduction Act (IRA), foretell mass adoption of GETs between now and 2030. The number of smart thermostats in homes are expected to grow 2.4 times, rooftop solar will grow 2.1 times, behind-the-meter batteries will grow 12.5 times, and light-duty EVs will grow 7 times.[32] To capture this latent potential, policymakers should aim to **educate consumers on the benefits of participation**; **increase the use of automatic enrollment, point-of-sale incentives, and opt-out recruitment**; and **increase compensation and subsidies to include transmission and distribution infrastructure avoided costs and resiliency rather than just peak load shaving**. Furthermore, deliberate focus must be placed on **empowering marginalized households to participate**, otherwise they will likely be late adopters or left out completely.[33]

Without concerted policy efforts across the United States to realize the potential of VPPs, which DOE estimates could save up to $10 billion in annual grid costs, the cost of the energy transition may be prohibitive. Thankfully, the components of a supportive policy environment for VPPs are becoming clear, and various demonstrations show that this solution is poised for scaling.

[28] LBNL. Who is participating in residential energy efficiency programs? 2021.
[29] FERC. 2023 Assessment of Demand Response and Advanced Metering. 2024.
[30] Ibid.
[31] Brattle. Real Reliability: The Value of Virtual Power. 2023.
[32] Ibid.
[33] DNV / Alliance to Save Energy. Demand is the New Supply. 2023.

Building a US military sustainable aviation fuels program to address energy independence and emissions

By Megan Glancey

Summary

As the war between Russia and Ukraine rages on, energy resources like oil and natural gas have become political weapons. Despite the United States only accounting for 9 percent of Russian oil exports, the European reliance on Russian resources highlights the global risk of energy dependence on hostile economies.[34] Energy independence is often sold on the line of national security. The carbon footprint of the US military is enormous, largely accounted in their fuel use for defense aviation. A move toward energy independence will not be found in the domestication of fossil fuel resourcing, but instead a shift toward renewable energy sources. In one form, this can be accomplished through the steady growth of sustainable aviation fuels (SAF) in defense aviation.

The US military uses an enormous amount of oil relative to other institution in the world.[35] Their reliance on complex supply chains, cargo vehicles, shipping, and planes leads the Department of Defense (DOD) to consume more liquid fuels and emit more carbon emissions than one hundred countries combined.[36]

Ranked between Peru and Portugal, if the US military were considered its own country, they would be considered the 47th largest greenhouse gas emitter in the world.[37] In 2017, the DOD consumed more than 85 million barrels of fuel for operational energy costing nearly $8.2 billion.[38] The DOD defines operational energy as "energy required for training, moving, and sustaining military forces and weapons platforms for military operations" and includes "energy used by tactical power systems, generators, and weapons platforms."[39]

The largest portion of Pentagon fuel consumption comes from military jets, 70 million of the 100 million gallons of fuel the Defense Logistics Agency purchased in 2018 were for aviation use.[40] Despite this heavy fossil fuel consumption by defense aviation, the US military has embraced alternative energy technologies in the past. The US Navy pioneered the use of biofuels from advanced sources or algae during former Secretary of the Navy Ray Mabus's "Great Green Fleet" initiative during the Barack Obama

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[34] Houser, T. (2022, March 16). *US Policy Options to Reduce Russian Energy Dependence*. Rhodium Group. Retrieved April 25, 2022, from https://rhg.com/research/us-policy-russia-energy-dependence/

[35] *The US Military and Oil*. Union of Concerned Scientists. (2014, June 1). Retrieved April 25, 2022, from https://www.ucsusa.org/resources/us-military-and-oil

[36] Neimark, B., Belcher, O., & Bigger, P. (2019, June 28). *The US Military is a Bigger Polluter than More than 100 Countries Combined*. Quartz. Retrieved April 25, 2022, from https://qz.com/1655268/us-military-is-a-bigger-polluter-than-140-countries-combined/

[37] Neimark, B., Belcher, O., & Bigger, P. (2019, June 28). *The US Military is a Bigger Polluter than More than 100 Countries Combined*. Quartz. Retrieved April 25, 2022, from https://qz.com/1655268/us-military-is-a-bigger-polluter-than-140-countries-combined/

[38] Office of the Assistant Secretary of Defense for Sustainment. (2018). Operational Energy. Retrieved April 26, 2022, from https://www.acq.osd.mil/eie/OE/OE_index.html

[39] Office of the Assistant Secretary of Defense for Sustainment. (2018). Operational Energy. Retrieved April 26, 2022, from https://www.acq.osd.mil/eie/OE/OE_index.html

[40] Kehrt, S. (2022, January 18). *The U.S. military emits more carbon dioxide into the atmosphere than entire countries like Denmark or Portugal*. Inside Climate News. https://insideclimatenews.org/news/18012022/military-carbon-emissions/#:~:text=But%20by%20far%2C%20the%20most,million%20gallons%20were%20jet%20fuel.

administration.[41] Fueled by a blended mixture of algae and cooking oil, the USS Nimitz recovered its first aircraft carrier landing in 2012 with a C-2A Greyhound attached to its Carrier Air Wing.[42] In the same exercise, FA-18 Super Hornet jets in the air wing burned 40 percent less emissions than standard flight operations.[43] Later in 2016, Mabus worked with Tom Vilsack, secretary of agriculture, to launch a naval strike group headed by USS John C. Stennis aircraft carrier on a deployment fueled by a mixture of liquefied beef fat from Midwestern farms and petroleum.[44]

The military has the resources and ability to champion these innovations in SAFs but has recently chosen to fully omit these programs within their annual budget. As a continuation of what was successfully tested during the Obama administration, it is time to build a defense SAF program to scale.

The problem

In the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 (Public Law 117–263) (2023 NDAA) the DOD agreed to re-engage in renewed research and development regarding SAFs following the Obama administration. Section 324 outlined a requirement to identify logistical challenges, promote understanding of the technical characteristics, and select two distinct facilities to conduct a pilot program on the use of sustainable aviation fuel—one that would house an onsite refinery and partner with a major commercial airport that is actively increasing its use of SAF.[45] This was to be completed within one year of the act. Additionally, one year following the selection of the facilities, the secretary of defense had to develop an implementation plan of at least 10 percent SAF fuels in defense aviation by September 30, 2028, for use for a minimum of five years thereafter.

The 2023 NDAA set forth criteria for SAFs that they must be produced in the United States from domestic feedstock sources and constitute a “drop-in” fuel that meets all performance specifications for DOD aircraft. The pilot program could be waived by the defense secretary due to lack of biodiesel supply or national security contingency. The program also required that the assistant secretary of defense for energy, installations, and environment submit a final report to various appropriate congressional committees on their assessment of the cost, operational infrastructure, and logistical impact; plan to scale procurement; and recommendations on how to build out distribution at all military installations, leveraging proximity to major commercial airfields currently in SAF supply. The report was also to include details about impacts on transport weight, maintenance, aircraft performance, job creation, and supply chain, as well as on carbon emissions, air quality, and environmental justice factors in surrounding communities.

However, in the 2024 NDAA, all language relating to SAFs including the pilot program is wholly unrepresented. Additionally, in section 1053 on collaboration with partner countries to develop and maintain military-wide transformational strategies for operational energy, the previously held annual assessment of energy dependence measures and their related renewable energy or sustainable fuel solutions have been reduced to biennial assessments.[46]

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[41] Union of Concerned Scientists. (2014). *Us Military and Oil Use*. *YouTube*. Retrieved April 26, 2022, from https://www.youtube.com/watch?v=2kuN_Ga-ZIM&t=28s.

[42] Dumaine, Brian. “Can the Navy Really Go Green?” Fortune. Fortune, August 28, 2012. https://fortune.com/2012/08/28/can-the-navy-really-go-green/.

[43] Ibid.

[44] Klare, Michael T. *All Hell Breaking Loose: The Pentagon's Perspective on Climate Change*. PICADOR, 2020. 204.

[45] *National Defense Authorization Act for fiscal year 2024 ...* congress.gov. (2023, December 22). https://www.congress.gov/bill/118th-congress/house-bill/2670/text

[46] Ibid

Additionally, the 2024 NDAA introduced section 318 on the prohibition on required disclosure by DOD contractors of information relating to greenhouse gas emissions. This section creates a carte blanche approach to contracting companies with absolutely zero oversight as to their emissions impacts.

The solution

The current draft of the 2025 NDAA includes amended language to the 2023 NDAA's section 324 relating to the SAF pilot program. As of this writing, section 313 on modifications to pilot program on the use of SAFs, clarifies the types of biofuel materials to be utilized and cites the most up-to-date emissions standards to be applied to the pilot program.[47]

These standards include the carbon offsetting and reduction scheme, which has been adopted by the International Civil Aviation Organization (ICAO) in their 2022 Environmental Report, which was developed by leaders within the FAA and European Commission.[48] Additionally, it incorporates the most up-to-date determinations from the greenhouse gases, regulated emissions, and energy use in technologies model from DOE developed by Argonne National Laboratory.[49]

I propose, in addition to these amendments, that the next iteration of the NDAA also reflect the need for the EPA's renewable fuel standards program and California's Air Resource Board's low carbon fuel standard (LCFS) to apply to SAFs specifically within the DOD.[50,51] So should thereto be an amendment to section 318 from the 2024 NDAA that would enforce reporting requirements for contracting companies to identify emissions impacts of their services and products to the secretary. Also, to section 1053 from the 2024 NDAA a return to annual foreign operational energy use assessments.

As to the section 324 SAF pilot program from the 2023 NDAA, the next FY NDAA should amend any timelines not adhered to from its inception as it relates to facilities identification and the 2028 emissions goals. Additionally, there should be a reinsertion of these standards, appropriations, and ultimately long-term scale of the operation and maintenance of SAFs beyond the proposed 10 percent blend to a 50 percent biodiesel fuel solution into defense aviation operations.

Finally, to promote a holistic and transparent energy transition in the interest of national security and reduction of foreign operational energy dependence, the various congressional committees so impacted should stand up annual emissions reporting requirements from the Department of Defense. The impacts of global warming and the climate crisis transcend environmental bearings and have both direct and indirect implications to the energy and national security of the United States. Reducing these impacts will require both mitigation and adaptation measures alike—to include emissions control from one of the world's major emitters: the US military.

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[47] *H. R. 8070 National Defense Authorization Act for Fiscal Year 2025*. congress.gov. (2024, June 14). https://www.congress.gov/118/bills/hr8070/BILLS-118hr8070eh.pdf

[48] ICAO Environmental Report 2022. (2022). https://www.icao.int/environmental-protection/Pages/envrep2022.aspx

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A carrot and a stick: An incentive and regulatory model to address cybersecurity risk to the energy transition in the US

By Katherine Hutton

Recommendation

In summer of 2024, the Cybersecurity and Infrastructure Security Agency (CISA) and the Federal Bureau of Investigation (FBI) warned of increased cyber threats to the renewable energy sector. This comes at a time when the renewable energy sector is poised for tremendous growth, as the world shifts energy strategies to incorporate more renewable energy to reduce carbon emissions and global rising temperatures. To support energy security and national security, policymakers and regulators should consider a regulatory model paired with incentives to raise the cybersecurity maturity of the industry to secure the energy transition.

Background

This is a decisive decade for reducing greenhouse gas emissions enough to limit the global temperature rise to 1.5°C or even 2°C. The impact of each fraction of a degree cannot be overstated and signs of change are already present with recurrent climate-induced natural disasters such as floods, fires, and droughts. Energy will play an essential role in keeping to the path of climate course correction with renewables being an essential energy source for the future (IRENA 2023). COP28 in December 2023 underscored the role of renewables in this effort when two hundred countries signed a pledge to triple renewable capacity and double energy efficiency by 2030, while working to transition away from fossil fuels. This balancing act requires cutting emissions by 43 percent by 2030 and aggressively accelerating renewables (IRENA 2024). Addressing this challenge is going to entail modernizing and expanding current infrastructure, adapting policy and regulation, and investing in technology (IEA 2021).

Shifting to renewables requires a strategy that considers economic, social, political, and technological shifts as well as cybersecurity risks because it involves more than just replacing one set of fuels for another. It is critical that countries do not inadvertently create new security risks as a new energy system evolves. Like many industries worldwide, the energy industry has transformed with the digital revolution and progressively relied on digital technologies to enable more efficient power production, management, and distribution. A renewables-dominated system that is electrically efficient must operate with flexibility and interconnectivity across borders to respond to changes in supply and demand. This interconnected and digital infrastructure increases the risk of cyber events that could trigger cascading disruptions that spread from the energy industry to other dependent sectors. Therefore, engineering more physical and digital resilience to cyber threats in the evolving energy system is an imperative for the energy transition.

Governments must play a key role in supporting the energy transition and addressing energy security by guiding policy and investment decisions at a national level because the new energy system will be more decentralized yet more digitally interconnected than the current system (Atlantic Council 2022). Policymakers and regulators have the tools to influence and ensure the necessary investments are made across the value chain to bolster operational resilience. For countries around the world, a resilient energy system is becoming a matter of national security as well as energy security. This paper assesses global approaches to address cyber risks and proposes a model for the United States to consider for securing the energy transition.

A global policy and regulatory analysis

The United States must accept the reality that cyber threats will impact the energy transition and our pursuit of energy security. The range of potential threats and the diversity of threat actors capable of impacting our energy system continue to grow as the world becomes more hyperconnected and cyber becomes a powerful tool for financial, economic, and political power and influence.

As governments and the market race to meet renewable energy growth targets and emission reduction goals, there is a global imbalance in addressing cyber risk to the energy transition as governments follow different strategies to raise cybersecurity maturity across industries. The following section provides an overview of approaches governments are taking worldwide to identify similarities and differences and to assess the most effective combination of policy approaches for the US market.

United States

The United States has a robust collection of cyber risk management tools, security frameworks, and technical guides to support organizations. In general, the United States has elected to stick with government-issued guidance for cybersecurity baselines that are voluntary for the private sector. One exception is the North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) standards, a set of mandatory security requirements designed to protect the Bulk Electric System (BES). NERC CIP was established in 1968 in response to the 1965 Northeast blackout. The standards started as voluntary compliance but became mandatory as part of the Energy Policy Act of 2005. In January 2024, NERC announced a three-year plan to set reliability standards for inverter-based resources (IBRs), which include wind, solar, and battery storage facilities (Howland, 2024). And in May 2024, the NERC Board of Trustees approved enhanced updates to the standards with the adoption of an additional requirement. NERC CIP compliance pressure was already trickling down to the renewable sector from BES customers, but the impending changes have more direct impact on the sector.

Efforts are also underway to clarify cybersecurity baselines that currently exist in many different forms from various government entities. In February of 2024, the National Association of Regulatory Utility Commissioners (NARUC) and the US Department of Energy (DOE) released a set of cybersecurity baselines to guide state public utility commissions, utilities, and distributed energy resource operators and aggregators in addressing cyber risk; the intent is to release another document in 2025 with implementation strategies (NARUC 2024). In June 2024, two US senators introduced the bipartisan *Streamlining Federal Cybersecurity Regulations Act* to harmonize overlapping and contradictory compliance cybersecurity requirements across the federal government (Homeland Security & Government Affairs 2024).

The pressure is building in the United States for the energy market to embrace cybersecurity risk seriously. In addition to using regulation to boost cybersecurity posture, the Federal Energy Regulatory Commission (FERC) took another step. It issued a final rule in the spring of 2024 to provide incentive-based rate treatment for utilities investing in advanced cybersecurity (T&D World 2024). This incentive is to reward voluntary efforts of utilities going beyond the regulation to invest in risk-based solutions tailored to their specific environments and to participate in cybersecurity threat information-sharing programs. The incentive allows public and non-public utilities to include their cybersecurity investment expenses in a rate base and earn a return on those expenses for up to five years (FERC 2024). This ruling balances regulation with incentive but does not extend to independent power producers or the broader renewable energy market.

While the US renewable energy market is experiencing significant growth driven by the energy transition due to supportive government policy and incentives and declining renewable technologies costs, security has been trailing as an afterthought to market growth until recently. The Joe Biden administration recently announced the launch of a whole-of-government effort led by the White House Offices of the National Cyber Director (ONCD) and Domestic Climate Policy (CPO) aimed at securing the energy transition through a variety of initiatives (The White House 2024). Through these initiatives, particular focus is placed on batteries and battery management systems, inverter controls and power conversion equipment, distributed control systems, building energy management systems, and electric vehicles and electric vehicle supply equipment—all of which are vital elements for driving down emissions and supporting the growth of renewable energy.

The US government is moving forward with more reform for the BES sector, continuing to develop voluntary guidance and support programs, and working to cultivate public-private partnerships to mitigate cyber risk. However, the leverage for participation and investment from the renewable energy industry depends on heroic intent.

European Union (EU)

The EU has taken a different approach than the United States, going straight to government regulation to push for a standard level of cybersecurity across broader industries. In 2024, the EU will experience sweeping change with the requirement for member states to incorporate the Network and Information Security (NIS) 2 Directive into national law, the enactment of the Cyber Resilience Act (CRA), and the publication of the first-ever EU Network Code on Cybersecurity for the electricity sector.

NIS2 is the next iteration of the NIS Directive adopted in 2016, which was the first EU-wide legislation on cybersecurity. The goal of NIS was to achieve a high standard level of cybersecurity throughout the EU, but it fell short of achieving this. There were significant gaps in member states' transposition of the directive into law, including unclear sanctions for non-compliance and a lack of enforcement mechanisms. Many companies elected for the bare minimum or included funds to pay non-compliance fines in their annual budgets (Damien 2024). Because cyber criminals and hacktivists started targeting more critical infrastructure across the EU, ransomware was hitting more small and medium enterprises, and geopolitical tensions were rising with cyber as a tool of influence, EU member states started discussions in 2020 to develop another iteration of NIS. NIS2 was designed with a more comprehensive scope, more stringent and harmonized requirements, a more transparent reporting and enforcement structure, and higher penalties for non-compliance, to include holding senior management liable for infringements. NIS2 came into force in January 2023, and member states have until October 2024 to transpose the directive into national law. This means member states will have laws that mandate sixty-seven types of entities, including their supply chains, to have cybersecurity measures appropriate to the identified cyber risks. All will be liable for reporting cyber incidents and must be prepared for broad inspections and security audits against compliance.

While NIS2 is focused on entities, the CRA places direct regulatory rules on products. Its goals are for products placed on the EU market to have fewer vulnerabilities and for manufacturers to hold more responsibility for product security. Product vendors that manufacture, distribute, and import products with digital elements must comply with a secure product development lifecycle process from design through maintenance and provide free security updates (Damien 2024). The legislation indicates that there will be market surveillance and penalties for non-compliance, with fines and sanctions higher than NIS2, including multiple fines for the same infringement and product distribution prohibited for non-action.

In May 2024, the European Union published the EU Network Code on Cybersecurity for the electricity sector, which required a common cybersecurity standard for EU energy infrastructure and services. The new code was developed in partnership between the European Network of Transmission System Operators (ENTSO-E) and the European Distribution System Operators Entity (DSO Entity) to establish rules for cybersecurity risk assessment, minimum cybersecurity requirements, threat, vulnerability, and incident reporting requirements, and supply chain security recommendations (Directorate-General for Energy 2024). This publication was mandated under Electricity Regulation (EU) 2019/943, establishing a sector-specific cybersecurity regulation for cross-border electricity flows. This is a crucial regulation to support the energy transition which requires interconnected and cross-jurisdiction grid infrastructure.

Within one year, the EU is enacting a vision that all critical infrastructure owners, operators, service providers, *and* product vendors are addressing cyber risk. This legislative approach should lift the entire cybersecurity maturity of the energy market compared to the patchwork maturity improvements in the United States with a mix of voluntary guidelines and limited enforcement across the broader industry. The tactic, however, is one of using multiple sticks with fines and penalties for non-compliance versus an incentive for proactive action. This approach could create a negative market barrier to entry for small businesses and limit the importation of innovation.

United Kingdom (UK)

Regulation can be a powerful tool for enforcement if market pressure does not encourage change. However, developing regulation happens at a pace much slower than innovation and the growing threats in the digital landscape. To balance this, regulation can be outcome- and risk-based versus prescriptive. This is the method the UK's national utility regulator, the Office of Gas and Electricity Markets (Ofgem), adopted by mandating that operators of essential services implement cybersecurity measures appropriate and proportionate to the cyber risks in their environments. Ofgem references the National Cyber Security Centre (NCSC) Cyber Assessment Framework (CAF) as the tool to use to assess cyber resilience and set risk-based maturity targets (World Economic Forum 2020). NCSC developed the CAF to support regulation imposed by the Network and Information Systems (NIS) Regulations 2018, based on the EU NIS Directive of 2016. The CAF was tailored towards Critical National Infrastructure (CNI) and designed based on principles and outcomes versus a checklist of controls (National Cyber Security Center 2024). Ofgem set a deadline of the end of 2019 for operators to meet the basic level of cyber resilience outlined by CAF. Ofgem has the authority to impose fines and license consequences for non-compliant energy companies.

Similar to the EU's transition from NIS to NIS2, the UK government will soon introduce the Cyber Security and Resilience Bill to expand the existing cyber regulation (Ribeiro 2024). The government may include cost recovery mechanisms to regulators for the expanded scope and provide resources to small businesses.

While the UK is still more inclined to set regulations to strengthen cybersecurity defenses, its outcome- and risk-based approach differs from that of the United States. Having a cybersecurity strategy and program involves more than just following cybersecurity baselines and compliance checklists. A cybersecurity strategy is an individual plan to address risks specific to the system in question. The UK recognizes this, and the CAF provides a tool to help organizations understand and address their specific risks.

Australia
Australia created its framework for regulating critical infrastructure cybersecurity through the *Security of Critical Infrastructure Act 2018* (SOCI Act). The cybersecurity obligations of the SOCI Act are principle-based versus prescriptive, similar to the UK Network and Information Security (NIS) Regulation versus NERC CIP. Recent reforms to the SOCI Act include the *Security Legislation Amendment (Critical Infrastructure) Act 2021* (Cth) from December 2021 and the *Security Legislation Amendment (Critical Infrastructure Protection) Act 2022* (Cth) from April 2022, which expanded the scope and obligations to include maintaining a risk management program that complies with specified risk management program rules (Lander & Rogers 2023). Critical Infrastructure Risk Management Program Rules (CIRMP Rules) were released in 2023, and organizations have until August 2024 to comply. There are fines and penalties for non-compliance, but they are lower than those for the EU and UK (Lander & Rogers 2023).

Further legal changes are anticipated as Australia works to implement its Cyber Security Strategy 2023-2030, which sets the vision for Australia to be a world leader in cyber security by 2030 to protect Australians from global cyber threats (Australian Government 2023). With this strategy, Australia is setting the precedent for a whole-of-nation approach to cybersecurity and preparing to enact reforms that address entities and vendors, similar to the EU's NIS2 and CRA approach.

A unique aspect of Australia's approach to strengthening the cybersecurity posture of the energy industry is using proportionality to instigate ecosystem-wide resilience and peer influence to incentivize voluntary participation. Shortly after the SOCI Act's enactment in 2018, the Australian Energy Market Operator (AEMO), in collaboration with industry, developed the Australian Energy Sector Cyber Security Framework (AESCSF) to provide a tailored cybersecurity framework for the Australian energy sector. When the framework was released, AEMO invited market participants to self-assess their cyber posture and report back. Close to 85 percent of the National Electricity Market (NEM) and 75 percent of the Western Australia Wholesale Electricity Market (WEM) participated (IEA 2021). AEMO used the results to submit a confidential report to energy ministers to guide their strategy and reforms for supporting the energy sector's cybersecurity posture (AEMO 2024). Additionally, AEMO created a light-touch version of the screening for stakeholders that interact with the energy market to set proportional requirements based on the level of interaction (IEA 2021). This was done to avoid weak spots in the overall system by encouraging all stakeholders to implement relevant cybersecurity measures.

As the energy transition brings decentralization and new market entrants, policies and regulations should ensure cyber resilience measures are in place across the energy ecosystem, from utilities to independent power producers to product vendors. Policymakers and regulators should also work to foster peer-based participation to create a ripple effect of entities assessing cyber risk and implementing safeguards.

Policy proposal

Because governments construct laws, regulations, and standards from their countries' perspectives, comparing approaches can be challenging. However, there is a global trend toward more regulation of cybersecurity, which signifies that governments are realizing that the market alone cannot incentivize cybersecurity practices (World Economic Forum 2020). Regulation can help justify investment in a cybersecurity program. By obligating the renewable sector to uphold minimum cybersecurity baselines, policymakers and regulators can set the industry level across the board to mitigate weak spots.

In the EU, NIS2, CRA, and the Network Code on Cybersecurity forge a united front to enhance cybersecurity resilience in the energy sector. NIS2 brings stricter regulation across the industry, the CRA holds manufacturers responsible for secure products, and the Network Code on Cybersecurity enforces cybersecurity requirements specifically for EU energy infrastructure and services. The EU reforms hold senior management liable for security and have strict penalties for noncompliance. In the UK, Ofgem recognizes that a cybersecurity strategy is an individual plan to address risks specific to the system in question; therefore, regulation is based on principles and outcomes driven by risk assessment. Australia recognizes that the whole energy industry, from owner to product vendor to service provider, should uphold cybersecurity standards, and requirements might not be the same across the board. By having a light-touch version of frameworks and fostering peer-based participation alongside reforms, Australia has a holistic value chain approach.

To address the cyber risk introduced through the energy transition, US policymakers should institute regulations for the renewable energy sector so that the adoption rate of cybersecurity measures moves from reactive to proactive. This method worked for the financial industry with laws like Gramm-Leach Bliley, which included the safeguards rule (Makridis, Boustead, & Shackelford, 2024). Under the safeguards rule, the financial sector is liable for threats to information integrity and unauthorized access. When a customer gets fraudulent charges on their credit card, the bank pays for it and not the customer. Therefore, the financial industry has an incentive to invest in cybersecurity. Policymakers can look to the regulatory approaches in the EU, UK, and Australia and laws like Gramm-Leach Bliley to develop regulations that would define requirements and impose liability. The level of enforcement should be proportional to the organization's criticality within the broader ecosystem, and senior leaders should be held accountable for compliance.

Only having regulation, however, could result in an outcome like NIS, where the effort to comply becomes a box-ticking exercise versus properly addressing cyber risk. The balance can come through incentives. Policy and regulation intervention should set mandatory baseline requirements, and incentives should support a risk-informed strategy. Cyber risk is inherent in digital transformation and should be part of organizations' enterprise risk frameworks rather than just a technical issue. Risk management practices are vital to helping organizations prioritize effort and investment.

In 2013, President Barack Obama signed Executive Order 13636, "Improving Critical Infrastructure Cybersecurity," to increase the capabilities of the country's critical infrastructure entities to manage cyber risk. The administration recognized the importance of market-based incentives to promote change. It required the Department of Homeland Security (DHS) to complete an incentives study within one hundred and twenty days of the executive order (Department of Homeland Security Integrated Task Force 2013). The DHS study assessed the effectiveness, efficiency, and equity of several different types of incentives:

1. Grants
2. Rate-recovery for price-regulated industries
3. Bundled insurance requirements, liability protection, and legal benefits
4. Prioritizing certain classes of training and technical assistance
5. Procurement considerations
6. Streamlining information security regulations

The study concluded by recommending further study. In March 2024, further study arrived in a report published by the National Security Telecommunications Advisory Committee (NSTAC) that said financial incentives such as tax deductions and grants are needed to close a gap between minimum cybersecurity standards and what is required to address risk effectively for national security (Markon 2024).

US policymakers have several tax credit examples to use to develop a cybersecurity incentive scheme. The Leadership in Energy and Environment Design (LEED) tax credit was designed to reward companies for adopting environmentally sustainable practices and could be a model to mimic (Cunningham 2024). Other examples include the research and development tax credit that supports investment in innovation, the solar investment tax credit (ITC) that fosters investment in solar energy, and the Inflation Reduction Act (IRA) that has driven the growth of the renewable energy sector. A cybersecurity tax credit would reward companies for investing in measures to address risk. Companies that receive the cyber tax credit could receive recognition similarly to LEED-certified companies, and this could foster peer accountability. This value would extend beyond the United States for companies operating in more heavily regulated regions of the world to demonstrate a level of compliance.

To ensure the tax credit scheme is effective in inducing action, policymakers and regulators can look to the EU, UK, and Australia for best practices to audit cyber risk self-assessments and require companies to self-report based on specified control categories. Policymakers and regulators can also raise awareness for the value of entities in understanding and owning their cyber risk and continue to provide tools and guidance on best practices.

Conclusion

Policy intervention is essential for securing the energy transition, and policymakers should consider implementing an incentive and regulation model to address cybersecurity risks in the evolving renewable energy sector. Establishing effective cybersecurity policy and regulation is a balancing act, but policymakers can look to approaches that have worked in the United States for other industries and study what other countries are doing to bolster industry-wide cyber resilience.

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Gearless wind turbines: A strategic solution to America’s clean energy future

By Jake Jablonski

Recommendation

As demand for renewable energy surges around the world, supply chains are being stretched to their limits, threatening the United States’ ability to diversify its energy matrix and sustain its existing wind energy assets. A strategic shift toward gearless wind turbines will address impending supply chain shortfalls, improve competitiveness of US manufacturing, increase wind turbine efficiency and reliability, reduce long-term maintenance costs, lower electricity bills, and strengthen American energy security. To advance gearless wind turbine technology, the US must adopt a comprehensive approach that includes accelerating research and development (R&D), incentivizing domestic manufacturing, and encouraging strategic partnerships.

Background

New renewables projects are developing so rapidly that existing manufacturers are struggling to keep up with the demand: the international wind sector alone is expected to add a whopping 680 GW of new capacity by 2027. As such, the Global Wind Energy Council’s 2023 report warns of wind turbine supply bottlenecks as soon as 2026.[52] The report also estimates that 60 percent of wind turbines and parts are manufactured in China. In some cases, China even produces 100 percent of certain components, such as nacelles for offshore wind turbines. Given the increasing geopolitical tensions between the United States and China, the security of that supply chain is uncertain. In order to meet the urgency of the climate change crisis and continue driving toward energy transition goals, US domestic manufacturing is a must.

Contributing significantly to the impending supply shortfall are gearboxes. Gearboxes are a critical component of a wind turbine used to ramp up the rotational speed of the rotor to the input required for an electrical generator. Gearboxes are only produced by a few dominant players in the market, but manufacturers are not on track to keep up with projected demand. New gearboxes are not only required for new wind developments, but also they replace failing components in existing wind farms to keep them running. Even with this ballooning demand, there are no clear solutions on the horizon as there are substantial barriers to entry for aspiring manufacturers of wind turbine components, and especially gearboxes, due to their high complexity.

Over the short history of the wind industry, many have attempted to find alternatives to geared turbines, but according to a European Academy of Wind Energy report, only about 25 percent of existing utility-scale turbines are gearless.[53] These existing gearless wind turbines require generators made mostly with expensive and scarce rare earth magnets. Additionally, the novel designs of these direct-drive wind turbines require complex control systems designed to operate the bespoke generators. The high costs of these magnets and control systems are prohibitive to further advances in wind tech.

[52] https://gwec.net/wp-content/uploads/2023/03/GWR-2023_interactive.pdf
[53] https://wes.copernicus.org/articles/1/1/2016/wes-1-1-2016.pdf

However, these gearless turbines have proven to possess valuable long-term potential. Gearless wind turbines are not only technically feasible, but are preferred over traditional turbines with gearboxes as they are more reliable and require less maintenance. Furthermore, gearless turbines become more attractive at larger scales, as larger gearboxes increase exponentially in complexity and cost in order to achieve higher power ratings. Experts argue that wind turbines with gearboxes are reaching maximum efficiency within technically possible design limits, while gearless turbines still have ample room for improvement.[54] The United States can and should do more to advance gearless wind development as it is an opportunity for the country to make a high-potential technology commercially and technically viable.

Proposal

- Accelerate R&D funding into direct-drive wind turbine materials, generators, and advanced control systems.
- Incentivize domestic manufacturing of wind turbine major components to sustain the America's existing and future wind farms.
- Direct the National Renewable Energy Laboratory to develop R&D partnerships focused on technology for next-generation wind turbine generators.

Conclusion

The United States is finally taking action at a massive scale to make electricity production cleaner and more diversified, subsequently strengthening the country's energy security. However, the ongoing clean energy revolution is producing new challenges for America as we compete for precious resources and plan for long-term sustainment of the power generation matrix of the future. In order to ensure the United States' continued leadership in clean energy and reduce dependence on an already-strained supply chain, the country must do more to invest in future technologies such as gearless wind turbines.

[54] https://www.sciencedirect.com/science/article/pii/S0040162519313691

Advancing non-lithium battery chemistry standards for bankable energy storage in the United States

By Rolando Mattar

Executive Summary

The transition to renewable energy sources necessitates robust energy storage solutions. Non-lithium battery technologies offer promising alternatives, but their adoption faces challenges related to safety, performance, and standardization. This policy proposal aims to advance non-lithium battery chemistry standards to accelerate the deployment of bankable energy storage systems.

Introduction

The rapid growth of solar and wind energy installations underscores the need for reliable energy storage. While lithium-ion batteries dominate the market, their limitations—such as resource scarcity, safety concerns, and capacity degradation—highlight the urgency to explore alternative chemistries. Let's delve into specific examples:

- **Resource Scarcity:** Lithium-ion batteries rely heavily on lithium, which is not abundant globally. Non-lithium alternatives, such as sodium-ion batteries, utilize more widely available materials like sodium, reducing supply chain risks.
- **Safety Concerns:** Lithium-ion batteries are prone to thermal runaway and fires. Solid-state batteries, with their stable electrolytes, offer enhanced safety. For instance, Toyota's solid-state battery research aims to eliminate fire risks.
- **Capacity Degradation:** Non-lithium chemistries, like flow batteries, exhibit minimal capacity fade over thousands of cycles. The vanadium redox flow battery, used in large-scale applications, maintains consistent performance.

Additional examples of non-lithium battery chemistry and technology:

- **Sodium-Ion Batteries:** These batteries use sodium, which is more abundant and cheaper than lithium. Companies like Natron Energy are developing sodium-ion batteries for industrial applications.
- **Zinc-Air Batteries:** These batteries use zinc and oxygen from the air, offering high energy density and safety. They are being explored for grid storage and electric vehicles.
- **Magnesium-Ion Batteries:** Magnesium is more abundant than lithium and offers higher volumetric capacity. Research is ongoing to improve their performance and commercial viability.
- **Aluminum-Ion Batteries:** These batteries use aluminum, which is abundant and inexpensive. They have the potential for high charge and discharge rates, making them suitable for grid storage.

Objectives

1. **Standardization:** Establish comprehensive standards for non-lithium battery chemistries, addressing safety, performance, and interoperability.
    - Example: Collaborate with the International Electrotechnical Commission (IEC) to define safety testing protocols for solid-state batteries.
2. **Research and Development (R&D):** Invest in R&D to improve non-lithium battery technologies.
    - Example: Fund university-led projects to enhance the energy density of sodium-ion batteries through novel cathode materials.
3. **Market Incentives:** Create financial incentives for manufacturers and utilities to adopt non-lithium solutions.
    - Example: Offer tax credits to companies that invest in non-lithium battery production facilities.
4. **Education and Outreach:** Educate stakeholders about the benefits and risks of non-lithium batteries.
    - Example: Organize workshops for utility operators on integrating flow batteries into grid systems.

Key strategies

1. **Safety Standards:**
    - Develop safety protocols specific to non-lithium chemistries.
        - Example: Mandate thermal stability tests for flow batteries to prevent overheating during operation.
        - Example: Implement fire safety standards for zinc-air batteries to ensure safe operation in residential areas.
2. **Performance Metrics:**
    - Define performance metrics beyond energy density.
        - Example: Evaluate the round-trip efficiency of solid-state batteries under varying temperature conditions.
        - Example: Assess the cycle life of magnesium-ion batteries in high-demand applications.
3. **Interoperability:**
    - Facilitate communication between non-lithium battery systems and grid infrastructure.
        - Example: Standardize communication protocols for flow battery management systems.
    - Example: Develop interoperability standards for sodium-ion batteries to integrate with existing grid management systems.
4. **Research Funding:**
    - Allocate federal grants and private investment for non-lithium battery research.
        - Example: Support startups working on zinc-ion battery technology.
    - Example: Fund research into aluminum-ion batteries for rapid charging applications.

Innovative ideas and emerging technologies

1. **Cleaner Manufacturing Techniques:**
    - Explore water-free processes for cathode material production.
    - Optimize resource usage during manufacturing.
2. **Restructuring Lithium-Ion Batteries:**
    - Investigate precise pore structures and gradient designs within electrodes.
    - Consider freestanding electrode designs for improved energy density.
3. **Alternatives to Lithium-Ion Batteries:**
    - Promote water-based zinc batteries as a safer and more environmentally friendly option.
    - Monitor advancements in anode-free sodium solid-state batteries.
        - Example: Develop scalable production methods for magnesium-ion batteries to reduce costs.
        - Example: Implement aluminum-ion batteries in fast-charging stations for electric vehicles.

Fact Analysis

1. **Domestic Content and the Inflation Reduction Act (IRA):**
    - The IRA provides a domestic content bonus credit for clean energy projects that use domestically produced components. Non-lithium battery chemistries, such as sodium-ion and zinc-air batteries, can be manufactured using materials that are more readily available in the United States. This aligns with the IRA's goals to boost domestic manufacturing and reduce reliance on foreign supply chains.
    - Example: Sodium-ion batteries can be produced using sodium, which is abundant in the United States, thereby meeting the domestic content requirements and qualifying for additional tax credits.
2. **National Security and Infrastructure Protection:**
    - Non-lithium battery technologies enhance national security by diversifying the energy storage supply chain and reducing dependence on foreign lithium sources. This diversification mitigates risks associated with geopolitical tensions and supply chain disruptions.
    - Example: Zinc-air batteries, which use zinc—a material abundantly available in the United States—can be integrated into critical infrastructure, reducing vulnerability to supply chain disruptions.
    - Non-lithium batteries also address cybersecurity and intellectual property (IP) protection concerns. By fostering domestic production and innovation, the United States can better safeguard its technological advancements and critical infrastructure from cyber threats and IP theft.
    - Example: Solid-state batteries, developed and manufactured domestically, can be integrated with advanced cybersecurity measures to protect against cyber threats targeting energy storage systems.

Certifications and implementation

1. **UL 9540A Testing:**
   - Required for all new battery systems (Underwriters Laboratories, n.d.).
     - Example: Include specific testing protocols for zinc-air and sodium-ion batteries to ensure compliance with safety standards.
2. **DOB Bulletin 2019-007:**
   - Establishes standards, requirements, and procedures for outdoor stationary storage battery systems (New York City Department of Buildings, 2019).
     - Example: Expand the bulletin to include guidelines for aluminum-ion and magnesium-ion batteries.
3. **NFPA Codes:**
   - Compliance with NFPA 1, NFPA 69, and NFPA 855 is essential (National Fire Protection Association, n.d.).
     - Example: Update NFPA codes to incorporate safety measures for emerging non-lithium battery technologies.

Conclusion

Advancing non-lithium battery chemistry standards is essential for a sustainable energy future. By fostering collaboration, investing in research, and prioritizing safety, the United States can lead the global transition toward bankable energy storage.

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American energy transition crisis: Getting buy-in from rural America

By Samantha Sawmiller

Problem

Climate change has put significant pressure on world leaders, business leaders, and American citizens alike to change how society produces and consumes energy. In 2022, the United States enacted an unprecedented law, the Inflation Reduction Act (IRA), that unlocked billions of dollars to support government, nonprofit, and private business efforts to deploy clean energy, onshore critical manufacturing supply chains, and ensure the benefits of these investments flow to those communities most in need. However, organized opposition within local project communities is creating significant challenges to achieving the IRA's promise.

Since the IRA passed, local governments and states have imposed restrictions and outright bans on wind, solar, and transmission projects, many of which are located in rural parts of the country (Weise et al., 2024). According to a recent poll from TigerComm and Embold Research, rural Americans are skeptical of clean energy developers and the idea that clean energy even works (Bare, 2023). This skepticism and opposition puts political pressure on local government leaders to support restrictions on clean energy projects.

Many of the sites that possess the best renewable energy resources are in rural communities that often view energy projects as opposed to their agricultural character or political values, leaving developers with formidable challenges when trying to build local government support. Berkeley Lab recently surveyed wind and solar developers across the United States and found: 1) local opposition to energy projects is delaying and/or blocking construction, and 2) developers expect that opposition to grow and are spending more time and money mitigating concerns raised by opponents (Nilson et al., 2024).

If rural Americans refuse to take part in the energy transition, the United States will struggle to play its part in mitigating the worst impacts of global climate change. The US energy transition depends, in part, on the ability to identify and mobilize trusted strategic messengers in local discussions, especially in rural communities. Notably absent from the dialogue today are military veterans, national security experts, and representatives of the US Defense Community who can speak credibly to the economic, environmental, and security value of the clean energy transition.

Solution

When rural Americans were asked who they trust most in their communities, polling pointed to one group of Americans above all others: military veterans (Bare, 2023).
Veterans are credible messengers in the minds of many rural Americans, and recent research suggests they could most effectively help change hearts and minds and build local support for renewable energy projects. By encouraging veterans to talk about energy security and the importance of transitioning to a more diverse energy portfolio, project developers, policymakers, state and federal governments, and utilities could engage more easily in a constructive dialogue with rural communities. Many rural communities appear to resist clean energy due to a perception that such projects reflect political values that stand at odds with their own. Veterans could help bridge this ideological divide.

Veterans already play a critical role in the renewable energy industry. An annual Clean Jobs Report released by Environmental Entrepreneurs and Evergreen Climate Innovations shows military veterans consistently make up 11 percent of the clean energy workforce, whereas in all other industries, the veteran workforce is 5 percent (Clean Jobs Midwest, n.d.). While working in the energy industry inherently helps advance clean energy policies and projects, there is an opportunity for veterans to have an even greater impact. Veterans should receive training on outreach and stakeholder engagement, including how to speak with rural communities about their military service, the national security implications of our energy choices, and the importance of the energy transition. Outreach will entail proactively talking with local elected officials, engaging in permitting hearings, and reaching out to opponents and other important stakeholders. Several cases demonstrate the potential of this message to open dialogue with rural communities and promote win-win outcomes.

It is essential to incorporate military veterans in the drive to educate the public, especially rural communities, on the security implications of the energy transition. Such an approach could improve prospects for clean energy in rural communities where new restrictions are making it difficult, if not impossible, to build clean energy projects.

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Clean energy industry workforce data for accession and retention

By Eric Shangle

Recommendation

Identify a means to collect, aggregate, analyze, and disseminate clean energy industry workforce demographic data. These data should serve as the baseline for demographic information and compensation providing targeted information for better accession and retention opportunities within the industry.

Background

There is a current working shortage in the United States, and current statutory and regulatory definitions do not adequately capture and consolidate workforce data in the clean energy industry.[55] This is a rapidly growing sector, significantly contributing to job creation and economic growth.[56] However, it is unclear if the clean energy workforce comprises workers who are representative of the American workforce at all levels. Industry accession and retention programs are stymied by a lack of independent workforce data. These data are essential to identify areas of opportunity for new accession sources and establish equitable compensation practices. Specifically, this can uncover opportunities for better industry accession sources including bringing more veterans into the industry beyond in-field operations. These data also can lead to more equitable company-level compensation and benefits programs promoting increased industry retention at all levels.

The Issues

This recommendation proposes: (1) changes to current regulatory definitions to better reflect the realities of the clean energy industry and (2) facilitation of more accurate data collection, analysis, and dissemination to address three current issues.

1. <u>Baseline clean energy workforce data</u>
   Current employment data for the clean energy industry is either blended with other energy industry data or not available. These data are required to purposefully and intentionally make industry and company-level workforce decisions. There is a lack of data for the following key categories:
   a) Veterans employed in clean energy by job classification
   b) Diverse groups (gender, race, ethnicity) in clean energy by job classification
   c) Employment data (job and compensation information) in clean energy by job classification

   Current definitions may not encompass all roles within the clean energy industry. For instance, jobs related to energy efficiency in buildings, stationary battery energy storage, solar photovoltaics (PV), and land-based wind are often overlooked. Broadening the definition to

[55] U.S. Chamber of Commerce: Understanding America's Labor Shortage
https://www.uschamber.com/workforce/understanding-americas-labor-shortage
[56] DOE Report Finds Clean Energy Jobs Grew in Every State in 2022
https://www.energy.gov/articles/doe-report-finds-clean-energy-jobs-grew-every-state-2022

include these roles will provide a more accurate picture of employment in the clean energy sector.
Currently, the Department of Energy (DOE) publishes an annual US Energy & Employment Jobs Report (USEER).[57] This report is based on surveys of tens of thousands of US energy sector employers and is a comprehensive summary of national and state-level energy jobs, reporting by industry, technology, and region with data on unionization rates, demographics, and employer perspectives on growth and hiring. Energy jobs that are covered in this report are comprehensive but blended in ways that do not give clean energy industry workforce data to make fully informed decisions for strategic employment.

2. Workforce definitions and job titles in emerging clean energy technologies
The clean energy industry is continually evolving, with new technologies emerging regularly. Current workforce definitions should be updated to recognize these new technologies and the jobs they create. As these technologies emerge, new job titles are created associated with those technologies. Current data collection sources do not account for the fast-paced nature of the clean energy industry with these emerging technologies and roles.
3. Unique characteristics of clean energy jobs
Clean energy jobs often involve skills and qualifications that differ from traditional energy jobs. Recognizing these unique characteristics in statutory and regulatory definitions can help address hiring challenges and skills gaps in the industry.

Proposal

The clean energy industry should identify and fund an independent organization that will be responsible for collecting, aggregating, analyzing, and disseminating clean energy industry workforce demographic data. This organization should be supported by and work closely with the leading trade organizations unifying the clean energy industry. These data can be utilized provide the following:

- Statutory workforce definitions. Definitions should be established identifying the unique job attributes unique to the clean energy industry. These can help inform USEER data collection to represent the clean energy industry accurately.
- Consolidated workforce employment data. These data should be used to identify accession opportunities in the clean energy industry beyond craft jobs. For example, there are no current data identifying veteran employment in clean energy by job type and level. This type of information can inform opportunities for better targeted accession opportunities and retention programs for veterans. This same methodology can be applied to other demographics.
- Consolidated compensation data. This information will assist companies in making informed decisions about equitable compensation and retention programs.

These data can also serve energy companies looking to create opportunities to access new talent from diverse communities and backgrounds. The DOE is currently awarding money through their Inclusive Energy Prize to increase diversity in the energy sector.[58] This is “designed to help foster an equitable and just clean energy transition by directly empowering underserved communities,” said Alejandro Moreno, acting assistant secretary for energy efficiency and renewable energy.[59] Ensuring that these organizations

[57] DOE US Energy & Employment Jobs Report (USEER) https://www.energy.gov/policy/us-energy-employment-jobs-report-useer
[58] DOE Inclusive Innovation Energy Prize https://americanmadechallenges.org/challenges/inclusiveenergyinnovation
[59] DOE Announces Inclusive Energy Innovation Prize Winners https://www.energy.gov/eere/articles/doe-announces-inclusive-energy-innovation-prize-winners#:~:text=%E2%80%9CThe%20Inclusive%20Energy%20Innovation%20Prize,Energy%20Efficiency%20and%20Renewable%20Energy.

have more complete industry data can enable them to ensure their work is providing the greatest positive impact in the industry.

Conclusion

There are three main areas of responsibility to move this initiative forward: DOE, clean energy trade organizations, and clean energy companies. The DOE should work to ensure that clean energy data are collected in a manner that enables data to be useful to them along with the clean energy industry companies. Trade organizations should work to fund an independent organization responsible for workforce data collection and dissemination. Clean energy companies should comply with data requests as members of the trade organizations. These data are essential to the clean energy transformation that is already happening. Ensuring that this transformation has the tools to make an effective change is paramount to the United States’ energy future.

The benefits of state-level electric transmission authorities

By Christina Tamayo

States should consider establishing an electric transmission authority to nimbly meet rising electricity demand. For the electric transmission authorities that do exist, they should consider a joint transmission needs study and other incentives to developers. Cooperative, regional collaboration at the state-to-state level is a nimble, expedient way for stakeholders to align while keeping federal intervention at an optimum level.

This paper will refer to the concept of a state-level electric or energy transmission authority as an "X-Electric Transmission Authority" or X-ETA. Two states provide an example of an X-ETA, Colorado and New Mexico, CETA and RETA, respectively. Understanding the opportunities captured and developed by CETA and RETA, and the context of load growth in the United States could further inspire legislators to create X-ETAs, thus attracting infrastructure development and securing America's energy future through grid reliability and resilience. This paper proposes a specific action for state legislators plus specific action for CETA and RETA.

Proposals

1. State legislatures should consider creating X-ETAs and establishing their objectives to incentivize transmission development, which can help each state's unique energy outlay.
2. CETA and RETA should conduct a joint transmission needs study. Studies play an important role in encouraging and inviting development of energy projects to a state or region.

X-ETA structure

Objective

Incentivize transmission development by offering developer incentives in the form of tax incentives, land acquisition assistance, accelerated regulatory approval processes, and project or construction financing. Land acquisition may include eminent domain under well-defined circumstances, if compatible with the legislative and stakeholder environment. Some states may desire their X-ETA to capitalize on a more robust relationship with the Department of Energy, Federal Energy Regulatory Commission, or other federal government agency, while other states may want to minimize federal action by creating or supporting state-level policy. For both sides of the spectrum, X-ETA can provide a purposeful platform.

Composition and reporting

An X-ETA could comprise a chosen or elected Public Utility Commission (PUC) board that represents energy researchers and leaders from across the state. Terms for board members could be considered based on any underlying legislation that establishes the X-ETA. Pay, if any, should be transparent and publicly available as it is crucial to the trust demanded of a state constituency. Consider whether X-ETA should report directly to a public utility commissioner or to a state energy office, which is typically an office of the governor. The latter option separates an X-ETA from public utility commission staff and official affairs but may offer political benefits due to the separation.

Capabilities
Offering unique, government assistance to developers with challenges like construction financing (e.g., bonds), land acquisition challenges, and proposing tax incentives to the legislature with feedback from county tax stakeholders. CETA offers some ideas on X-ETA abilities to encourage and unlock transmission development, which include sponsoring a state transmission needs study, offering eminent domain authority under specific circumstances, and a bonding authority. With an X-ETA, interregional studies with neighboring states can be better organized than with a broad RTO structure, which tends to address the more technical, rather than business or regulatory incentives to transmission development, and often may not include the whole of a state.

Staffing
There should be at least two to three permanent staff to handle board matters, records, and logistics like billing or bids. Large studies, Requests for Proposals (RFPs), and analytics should be outsourced to a third-party firm, chosen through a transparent bidding process. Keeping overhead lean is key to efficient use of limited government funding resources.

Key relationships
Include a reporting requirement to the state public utility commission or governor's state energy office. Transparent records of X-ETAs activities are key to demonstrating how a new state institution is serving its constituency. Foster relationships with transmission developers to learn about what regulatory incentives drive developers toward one state over another.

X-ETA benefits

Regardless of each state's position on support for different types of energy generation, an X-ETA can contribute to a state's energy business development outlay. When proposed in legislature, X-ETA objectives should be clearly outlined and worked through the state lawmaking, and thus, stakeholder consultation process. Well-designed benefits come from well-thought out and defined problems to be solved.

X-ETAs can offer incentivized partnerships to developers while succinctly and clearly outlining and supporting business cases for transmission infrastructure, its supply chains and labor considerations. CETA offers a version of private-public partnership levels. Although CETA's partnership structures are relatively young, time will tell how and if these state-level partnerships accelerate transmission development.

X-ETA members can offer quick, informed decisions and analysis to provide data to decision-makers at the state utility commission or governor level. There is a question familiar to many veterans of whether a "90 percent solution today" is better than "100 percent solution tomorrow." Too often, studies on a topic contribute to an "analysis paralysis" or the equivalent of a "policy punt," which can delay implementing a solution and iterating on that solution, to the detriment of a constituency. Transmission most recently fell into this issue at the federal level with a NERC Interregional Transfer Capability study directed in 2023 with filing in December 2024. This legislative compromise further put off actual implementation of a regional transfer capability to another Congress.[60] Getting bogged down in study administration can be avoided by imbedding analytic responsibilities to a nimble, X-ETA organization, rather than leaving studies to be run by the federal government.

[60] Interregional Transfer Capability Study (ITCS), https://www.nerc.com/pa/RAPA/Pages/ITCS.aspx

States in the West stand the most to gain from an X-ETA framework, as they lack cohesive RTO coverage, like MISO or PJM. A unified state voice for transmission de-risks project development for businesses on a regulatory level. This paper recognizes that an X-ETA construct is best for the Lower 48 states whose geographical and jurisdictional borders may naturally prohibit collaboration. An X-ETA approach should make state-to-state collaboration easier and incentivized.

Rising electricity demand and transmission value

The forecast for electricity demand in the United States is increasing after many years of stability. The cause for rising demand is contextual to each region, though generally driven by growth in data centers and industrial facilities, which are mainly battery and automotive, and some hydrogen facilities. Federal legislation encouraging domestic content (e.g., Build America, Buy America) also encourages industrial growth and thus, the need to deliver power to upgrade facility capacity or build new facilities.[61] Further straining the grid are more frequent and extreme weather events, posing a resiliency issue.

Transmission provides more connections between nodes. This optimization helps generation of any type to be used at its maximum efficiency, with beneficial market connections.
The often-cited Berkeley study on Locational Marginal Prices also sets a backdrop on the value of interregional transmission through nodal pricing models.[62] Updated yearly, this study quantifies the value of transmission, especially interregional links and values during extreme weather conditions such as drought and winter storms.

CETA and RETA: An optimistic window

Most recently in August 2024, CETA completed its Transmission Capacity Expansion Study for Colorado.[63] Energy Strategies, plus sub-contractors, was selected in an RFP process to conduct the study over nine months. Presenting their results to the Colorado PUC, it was through stakeholder emphasis that the study identified interstate transmission upgrades that were not in the study's original scope. The adaptiveness within the study was possible because of the sponsorship of CETA and its overarching strategic priorities.[64] The need to study and opportunity to implement interstate transmission is real and demonstrated by CETA's most recent study process and report to the Colorado PUC.

CETA and RETA are aligned in their interests with a state-level renewable energy portfolio.[65] As neighboring states, they have a natural incentive to work together to benefit from non-coincident renewable resources to build out a reliable and resilient grid supported by renewable energy generation. Since both Colorado and New Mexico have entities empowered to study and incentivize transmission development, it is feasible that both authorities could work or study interstate grid concepts together. Furthermore, in an optimistic future, CETA and RETA could form a state-to-state partnership with a

[61] John D. Wilson and Zach Zimmerman, Grid Strategies, The Era of Flat Power Demand is Over, published December 2023.
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developer to attract the billions of dollars in development needed to address interregional and interstate transmission across their respective X-ETA jurisdictions.

Both Colorado and New Mexico created electric transmission authorities, inspired by demand for renewable energy. This need not be the exclusive case for other states. Siloing transmission from other energy infrastructure is about capturing opportunity, fueling economic growth through welcoming the right projects for each state’s context. X-ETAs represent an ability to capture the opportunity of transmission growth that is needed to address growing electricity demand, funneling the economic, reliability, and resiliency benefits that come from connecting with neighbors.

An energy clearinghouse within the Department of Energy

By Evan Weaver

Recommendation

The US Department of Energy (DOE) should establish a clearinghouse platform that retains and holds authority over complex issues that affect decarbonization and renewable energy growth. This is well defined within the mission of the department and would assert the department's leadership and authority in the energy transition, supporting prosperity and national security. This entity would resemble the Federal Energy Regularity Commission but with a comparably strict focus on furthering decarbonization and renewable energy growth.

Background

Across the energy landscape in the United States, many markets, policies, and other initiatives intersect in compelling ways concerning the strengthening and decarbonizing of the grid and promoting renewable energy growth. Individual markets, state agencies, and commercial efforts are generally promoting ambitious goal setting and are making strides toward decarbonization. However, organizations formally leading this seem to be on different paths. There are many complex entities with various roles. At a glance, consider the DOE, state energy agencies, regional independent system operators, and large, politically powerful organizations such as the Tennessee Valley Authority and the DOE's national laboratories. In the private sector, there are leading public utilities and developers of generation and transmission resources and other private commercial interests. These groups often would benefit from a single source of information and authority over complex challenges or conflicts. There is a leadership void in the decarbonization effort that the DOE should be filling more directly than it currently is. There should be a defined body that promotes decarbonization and renewable energy growth.

If you consider the 2021 Department of Commerce circumvention inquiries and its effects, it is apparent that energy-related matters should remain within the purview of the DOE. When Commerce announced the inquiries, the effects were almost entirely felt within the energy sector, and it greatly impacted energy project planning in a far more significant way than it impacted US domestic production of solar panels, labor issues, or trade. Without debating the merits or findings of the inquiries, it was inconsistent with goals set by the administration renewable energy production goals.

The DOE's mission is: "... to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions."[66] The department has not and currently does not meet this mission to the extent it is capable of in terms of driving decarbonization to seek prosperity and deliver national security realizations to Americans. There are certainly existing options for refining the role of the department such as increasing efforts to support American-made products and services and labor in the new energy economy. There is also room for

[66] *Mission*, United States Department of Energy, https://www.energy.gov/mission#:~:text=The%20mission%20of%20the%20Energy,transformative%20science%20and%20technology%20solutions.

discussion around the role of the department with state energy agencies to support state-level energy leadership in states' prospective goals and unique energy situations. Both of these popular topics exist in various forms but also are shaped and affected by political positions, implications as to the role of government, and other social actions. More directly, with practical action, the department and, separately, the Federal Energy Regulatory Commission do manage many energy challenges and conflicts, but there is not a separate body that retains and holds authority over complex issues that affect decarbonization and renewable energy growth.

Proposal

The establishment of a clearinghouse body and authority on matters related to trade, labor, and other complex energy matters would allow greater clarity and direction on expressed goals of decarbonization and the energy transition. It would also work to de-politicize decarbonization and reactive policy changes that challenge the mission of the department. The logic stands that if any matter at hand ultimately affects energy goals such as decarbonization and those related to long-term national security, then matters related to inquiries and decisions should be led by the DOE in a specialized body, not with a department examining factors with effects far larger than they are considering. This specialized body would function similarly to FERC but solely on matters related to renewable energy and advanced energy. For example, EV charging infrastructure matters and proposals would be contained here as the end goal of this is not a transportation matter but an energy matter. This body would also retain the ability to incentivize renewable energy deployment in ways that the Inflation Reduction Act does not; with a more targeted and specialized focus when a need case or proposal may arise.

Conclusion

The structural change recommended here, of a new body, would promote the Department of Energy into a truly active leadership role in the US energy future. The market is moving strongly toward decarbonization—political and social trends are as well—and, as such, the government authority in space must be among the top leaders in the US effort to decarbonize and secure our grid. In casual comparisons to the defense industry, one of the only other industries so dependent on both the market and government leadership, anyone can see that the Department of Defense leads in the space and is quickly supported and guided by the market in terms of needed resources. Based on the mission of the DOE and the current outlook for a once-in-several-generations energy transition, the department must change and adapt to fulfill its role within the transition.

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