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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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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

For the past decade, US grid planners have routinely forecasted a mere 0.5 percent annual load growth rate. However, in recent years, the nationwide forecast for electricity demand has been repeatedly adjusted upwards, with the 2023 FERC filings predicting 4.7 percent growth over the next five years.[1] Much of this near-term load growth is driven by investments in new manufacturing, industrial, and data centers. In the future, it is expected to be compounded by the widespread adoption of electric vehicles (EVs) and electrified heating.

The US grid is not prepared to build enough infrastructure quickly enough to meet this increased demand. Lead times for hard infrastructure components are too long, and despite recent progress, transmission backlogs remain problematic. The risks are further exacerbated by China's central role in the supply chain for many components of this energy system buildout. Additionally, ratebasing the necessary infrastructure upgrades to meet this demand growth will significantly affect the energy burdens of ratepayers, who are already coping with inflationary pressures.

Surging demand also poses a challenge to the Joe Biden administration's decarbonization agenda. Utilities are already deferring planned retirements of fossil fuel generation resources to serve this load, and analysts predict an accelerated commissioning of new natural gas plants. New clean-firm technologies, such as advanced geothermal and next-generation nuclear, are poised to play a much larger role in the US generation mix, but it is unlikely that many new gigawatts from these sources will come online before the end of the decade due to construction timelines.

To overcome this mounting challenge, utilities must strategically invest in demand-side solutions and grid-enhancing technologies to increase the efficiency of the current generation resources and grid. For example, approximately 10 percent of infrastructure investments in the United States focus on serving demand during just 1 percent of the hours over the course of a year.[2] Demand-side solutions, which cost about one hundred times less per project than physical infrastructure, could be more fully deployed to address these costly hours. Currently, these solutions receive one hundred times less investment than physical infrastructure.[3]

Virtual power plants (VPPs) have emerged as one potential solution to increase the utilization of existing and new grid assets to meet load growth imperatives and support cost-effective system decarbonization. Importantly, vendors are already demonstrating the ability of VPPs to deliver important grid services at scale. VPPs are grid-integrated aggregations of distributed energy

[1] Grid Strategies. The Era of Flat Power Demand is Over. 2023.
[2] Advanced Energy United. Potential for Peak Demand Reduction in Indiana. 2018.
[3] WoodMac. Utility investment in grid modernization: H2: 2023. 2023

resources such as batteries, electric vehicles, smart thermostats, and other connected devices. They provide a range of grid services, including reducing peak demand, shifting load from high- to low-price times, responding to grid emergencies, and shaping load profiles to match intermittent renewable generation.

Recent studies have shown that VPPs can play a substantial role in a cost-effective transition to a low-carbon energy system. The Department of Energy (DOE) recently highlighted in its "Pathways to Commercial Liftoff: Virtual Power Plants" that there is currently 30 to 60 GW of VPP capacity, with the potential to add 80 to 160 GW by 2030, representing 10-20 percent of system peak demand.[4] 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.[5]

VPPs, in various forms, have been operating with commercially available technology for decades and are now poised for scaling. The two foundational questions for whether VPPs will contribute grid services at scale relate to capabilities and adoption. First, can grid planners and operators rely on VPPs to provide services historically provided by hard infrastructure, such as peaker plants or distribution substation upgrades? Second, will enough energy customers agree to participate, which requires ceding some control of their grid-interactive devices, for VPPs to develop into a meaningfully sized resource?

Of the two, it is tempting to focus on the former, and even use it as an excuse 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 can substitute for a 100 MW natural gas peaker plant. Yet, across the country, VPP demonstrations are doing exactly this, as highlighted in a recent report by RMI.[6] Significant recent investments in distributed energy resources management systems (DERMS), advances in artificial intelligence and machine learning, combined with the widespread deployment of advanced metering infrastructure (AMI) and better standardization of grid-interactive device protocols, will expand and harden this resource's potential to deliver a wider scope of grid services over the coming years.

The second foundational question poses a larger risk for whether VPPs will ultimately comprise 10-20 percent of system peak demand. Despite very mature demand-side programs, only 20 percent of households participate in residential energy efficiency programs.[7] And participation in demand response programs actually decreased by 10 percent in recent years, from 11.7 million customers in 2020 to approximately 10.5 million customers 2021, which in total represents approximately 6 percent of households.[8] Only slightly more customers, 14.6 million, were enrolled in a time-varying rate as of 2021.[9] If VPPs are to realize the expectations set forth in industry forecasts such as the DOE's Liftoff Report, customer adoption must increase dramatically. The Brattle Group estimates that a reasonable future participation rate for smart thermostat DR could be 30-40 percent of the

[4] DOE. Pathways to Commercial Liftoff: Virtual Power Plants. 2023.
[5] Brattle. Real Reliability: The Value of Virtual Power. 2023.
[6] RMI. Virtual Power Plant Flipbook. 2024.
[7] LBNL. Who is participating in residential energy efficiency programs? 2021
[8] FERC. 2023 Assessment of Demand Response and Advanced Metering.
[9] ibid

eligible population, or approximately 20 percent of the total population, which is four times what it is today.[10]

There is a ripe opportunity to expand program participation over the coming decade. Consumer trends, supported by incentives from the Inflation Reduction Act (IRA), are showing signs of mass adoption of grid-interactive technologies between now and 2030. The number of homes with smart thermostats is expected to grow 2.4 times; the number of homes with rooftop solar will grow 2.1 times; the number of behind-the-meter batteries will grow 12.5 times; and the number of light-duty EVs will grow 7 times.[11] To capture this latent potential, program administrators and regulators must focus on strategically educating customers on the benefits of participation; increasing the use of automatic enrollment, point-of-sale incentives, and opt-out recruitment; and increasing compensation and subsidies to encompass 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.[12]

This convergence of increased VPP capabilities and widespread adoption, if realized, will result in a critical tool for grid planners as they seek to balance various priorities—meeting increased load growth, maintaining reliability, and achieving ambitious decarbonization targets. These solutions can increase energy affordability and empower citizens to directly take advantage of new value streams. Ultimately, they enhance our energy security by minimizing supply chain risks and increasing system resiliency. Over time, utility business models, operations, and regulatory frameworks will need to adapt to create a level playing field between demand-side solutions and physical infrastructure investments. Today, the urgent focus must be on figuring out how to fundamentally transform the role of an energy consumer into an active participant in the grid.

[10] Brattle. Real Reliability: The Value of Virtual Power. 2023.
[11] ibid
[12] 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.[13] 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.[14] 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.[15]

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.[16] In 2017, the DOD consumed more than 85 million barrels of fuel for operational energy costing nearly $8.2 billion.[17] 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."[18]

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.[19] Despite this heavy fossil fuel consumption by defense aviation, the US military has embraced

[13] 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/

[14] *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

[15] 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/

[16] 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/

[17] 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

[18] 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

[19] 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.

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 administration.[20] 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.[21] In the same exercise, FA-18 Super Hornet jets in the air wing burned 40 percent less emissions than standard flight operations.[22] 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.[23]

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.[24] 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.

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[20] 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.

[21] 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/.

[22] Ibid.

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

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

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.[25]

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.[26]

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.[27] 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.[28]

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.[29,30] 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.

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[25] Ibid

[26] *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

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

[28] Demirtas, M. U. (2019, May 16). *Greenhouse Gases, Regulated Emissions, and Energy use in Technologies Model*. GREET: The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model. https://www.anl.gov/topic/greet

[29] Environmental Protection Agency. (2023, July 12). *Renewable Fuel Standard Program*. EPA. https://www.epa.gov/renewable-fuel-standard-program

[30] California Air Resources Board. (2024, March 20). *Low Carbon Fuel Standard*. California Air Resources Board. https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about

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.

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.[31] 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.[32] 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

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

the bespoke generators. The high costs of these magnets and control systems are prohibitive to further advances in wind tech.

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.[33] 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.

[33] 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

This proposal aims to advance non-lithium battery chemistry standards for bankable energy storage, and to promote the integration of non-lithium battery chemistries as viable and reliable energy storage solutions in the United States. By establishing consistent standards, incentivizing research, and streamlining regulatory processes, this proposal seeks to accelerate the adoption of non-lithium battery technologies, fostering a diverse and resilient energy storage landscape.

Introduction

The energy storage sector is evolving rapidly, driven by the need to decarbonize the energy system and enhance grid reliability. While lithium-ion batteries dominate the market, non-lithium alternatives offer unique advantages such as resource diversification, improved safety, and enhanced sustainability. This proposal outlines strategies to level the playing field for non-lithium battery chemistry technologies, making them bankable and feasible solutions for energy storage needs.

Objectives

- Encourage research, development, and commercialization of non-lithium battery technologies as competitive and bankable energy storage solutions.
- Establish standardized testing, performance evaluation, and certification protocols to ensure the safety, reliability, and bankability of non-lithium battery chemistries.
- Create a supportive regulatory environment and provide financial incentives to accelerate the deployment of non-lithium energy storage technologies.

Key strategies

a) *Research and development (R&D) incentives.* To promote non-lithium battery technology development, the federal government should allocate substantial funding to research initiatives. Grants and tax incentives would encourage private sector investments in R&D and manufacturing facilities, fostering innovation and technological advancements.

b) *Standardized Testing and Certification.* Collaboration between industry stakeholders and research institutions is crucial for establishing comprehensive testing standards. The creation of an independent certification body would ensure that non-lithium energy storage technologies meet safety, performance, and environmental criteria, making them more attractive to investors and financiers.

c) *Regulatory Support and Streamlined Permitting.* Developing streamlined permitting processes tailored to non-lithium energy storage projects would reduce regulatory obstacles. Clear guidelines

and regulations must be established for deployment, operation, and decommissioning, enabling project developers to navigate the regulatory landscape with greater ease.

d) *Market Access and Grid Integration*. Utilities should be incentivized to integrate non-lithium battery systems into the grid by offering favorable terms for grid services and capacity support. Standardized interconnection procedures will ensure seamless integration, allowing non-lithium technologies to contribute effectively to grid stability.

e) *Public Awareness and Education*. Public awareness campaigns play a vital role in educating stakeholders about the benefits of non-lithium battery technologies. These initiatives should include information about the advantages of non-lithium options and their potential contribution to a sustainable energy future.

f) *Implementation and Collaboration*. To ensure successful implementation, a national task force comprising federal agencies, state governments, research institutions, utilities, battery manufacturers, and environmental organizations should be established. Regular workshops, forums, and working groups will facilitate collaboration and address challenges, leading to effective policy execution.

Conclusion

This policy proposal presents a comprehensive approach to promoting non-lithium battery technologies as feasible and bankable energy storage solutions in the United States. By leveraging research incentives, standardized testing, supportive regulations, and public awareness campaigns, this policy aims to unlock the potential of non-lithium battery chemistry, contributing to a resilient, sustainable, and diversified energy storage landscape.

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.[34] This is a rapidly growing sector, significantly contributing to job creation and economic growth.[35] 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. Baseline clean energy workforce data
   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,

[34] U.S. Chamber of Commerce: Understanding America's Labor Shortage https://www.uschamber.com/workforce/understanding-americas-labor-shortage
[35] 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

solar photovoltaics (PV), and land-based wind are often overlooked. Broadening the definition to 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).[36] 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.[37] This is “designed to help foster an equitable and just clean energy transition by directly empowering underserved communities,” said

[36]DOE US Energy & Employment Jobs Report (USEER) https://www.energy.gov/policy/us-energy-employment-jobs-report-useer
[37] DOE Inclusive Innovation Energy Prize https://americanmadechallenges.org/challenges/inclusiveenergyinnovation

Alejandro Moreno, acting assistant secretary for energy efficiency and renewable energy.[38] Ensuring that these organizations 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.

[38] 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.

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.[39] Getting bogged down in study administration can be avoided by imbedding analytic

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

responsibilities to a nimble, X-ETA organization, rather than leaving studies to be run by the federal government.

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.[40] 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.[41] 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.[42] 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.[43] 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.[44] As neighboring states, they have a natural incentive to work together to benefit from non-coincident

[40] John D. Wilson and Zach Zimmerman, Grid Strategies, The Era of Flat Power Demand is Over, published December 2023.
[41] Millsetin, Wiser, et al, Empirical Estimates of Transmission Value using Locational Marginal Prices, Lawrence Berkley National Laboratory, August 2022.
[42] Transmission Capacity Expansion Study for Colorado,
https://www.cotransmissionauthority.com/transmission-study
[43] CETA Strategic Plan, adopted February 2024. Accessed online:
https://static1.squarespace.com/static/6390da3a799a023d4be2c27e/t/65ca5bc8b240dd4d4e9b2404/1707760585306/Reso+Adopting+Strategic+Plan+and+Plan+Attached.pdf
[44] RETA Act, 2007 with 2019 amendment. https://nmreta.com/wp-content/uploads/2022/11/RETA_Act.pdf

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 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."[45] 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

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

such as increasing efforts to support American-made products and services and labor in the new energy economy. There is also room for 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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