



**U.S. Department of Energy
Electricity Advisory Committee Meeting
Hosted Virtually via Webex
March 10, 2022**

Meeting Summary

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Meeting Overview

The EAC's first meeting of 2022 on March 9 and 10 was held virtually via the video conferencing platform Webex. On the second day of the meeting Zach Tudor, Idaho National Laboratory, moderated a panel on the National Cyber-Informed Engineering Strategy that included panelists from the McCrary Institute for Cyber and Critical Infrastructure Security at Auburn University, the Cybersecurity Manufacturing Innovation Institute, and Dragos. The second panel, "DOE Executive Order 14017 Reports to the White House on the Energy Sector Industrial Base," was hosted by Paul Stockton, Paul N. Stockton LLC, and included panelists from the Department of Energy's (DOE) Office of Cybersecurity, Energy Security, and Emergency Response (CESER); DOE's Office of Policy; and Edison Electric Institute. The day continued with presentations on DOE's Energy Cyber Sense Program and cybersecurity current events. Joe Paladino, DOE Office of Electricity; Tom Bialek, Toumetis; Darlene Phillips, PJM; and David Kathan, Federal Energy Regulatory Commission (FERC) provided an update and comments on Section 8008 Voluntary Model Pathways development, which was followed by discussion. Finally, subcommittee chairs presented updates on subcommittee activities and planned projects. During the Grid Resilience for National Security Subcommittee update, the EAC unanimously approved the "Strengthening the Resilience of Defense Critical Electric Infrastructure" recommendations by voice vote.

All presentations, as well as recordings of the meeting, can be found at <https://www.energy.gov/oe/march-9-10-2022-meeting-electricity-advisory-committee>.

Opening Remarks

Matthew Aronoff, EAC Acting Designated Federal Officer, introduced himself and welcomed attendees. He covered several housekeeping items, took attendance, and officially called the meeting to order. EAC Chair Wanda Reder outlined the agenda and introduced Mr. Tudor, who made introductory remarks for the first panel.

Panel and Discussion: National Cyber-Informed Engineering Strategy

Moderator

- Zach Tudor, Associate Lab Director, Idaho National Laboratory

Panelists

- Frank Cilluffo, Director, McCrary Institute for Cyber & Critical Infrastructure Security at Auburn University
- Howard Grimes, CEO, Cybersecurity Manufacturing Innovation Institute
- Rob Lee, CEO, Dragos

Mr. Tudor said the National Cyber-Informed Engineering (CIE) Strategy followed from the National Defense Authorization Act for Fiscal Year 2020. DOE engaged stakeholders across industry, government, academia, and national laboratories to develop the strategy. Mr. Tudor said the clean energy future for the grid will require cutting-edge technologies. These technologies improve responsiveness and efficiency, but also create a large cyber attack surface. As a result, cybersecurity must be a foundational design feature for the grid and grid components. Mr. Tudor introduced the panelists and asked Howard Grimes to begin his presentation.

Dr. Grimes said DOE held a competition that led to the funding and launching of the Cybersecurity Manufacturing Innovation Institute (CyManII). There are 16 Manufacturing Innovation Institutes across the country, and CyManII is the first to focus exclusively on cybersecurity. Dr. Grimes said the next-generation grid architecture CyManII designs is informed by a national security perspective, and that its products are built with security integrated into the product from the ground up. Ideally, the products it designs will have virtually no attack surface.

Frank Cilluffo said the McCrary Institute for Cyber & Critical Infrastructure Security is focused on cybersecurity solutions for information technology and operational technology associated with critical infrastructure. Part of the institute's goal is to encourage all engineering disciplines to be cyber aware. He noted the need for a workforce with requisite cybersecurity skills.

Rob Lee said the reality is that less than 5% of the U.S. electric system is actively monitored for cybersecurity. He noted that extensive monitoring of operations and assets can quickly become overwhelming in terms of the expertise and personnel required. As a result, Dragos guides clients through a start-to-finish process hazard analysis that focuses on scenarios the client would like to avoid and engineering out as much of the risk associated with those scenarios as possible. Mr. Lee said CIE is a great way to reduce grid operators' attack surface. He encouraged thinking about resilience not as a general concept but in terms of being resilient "against what, and at what cost."

Dr. Grimes referenced CyManII's effort to train 1 million workers in cybersecurity, saying many of CyManII's member organizations are research universities with programs in cybersecurity, advanced manufacturing, and critical infrastructure. CyManII will also work with its national laboratory partners. Dr. Grimes added that CyManII is dedicated to upskilling and re-skilling the existing workforce, including in the manufacturing sector.

Discussion

Tom Bialek commented that DOE also needs to educate regulators and policy makers about cybersecurity. His experience at San Diego Gas & Electric showed him that they are oblivious to how expanding digitization also expands the attack surface.

Lynne Kiesling noted that the National Association of Regulatory Utility Commissioners offers materials for regulators on cybersecurity, including a cybersecurity manual published in 2019.¹

Clay Koplin referenced Cordova Electric Cooperative, a vertically integrated electric utility that he describes as a manufacturing plant that converts hydroelectric and diesel power into electricity. He asked if CIE curriculum developed by CyManII is suitable for the plant floor at his electric utility.

Dr. Grimes replied that it is. He noted that the curriculum will always be open source.

Questions and Answers

Q1. Lauren Azar asked if DOE could help develop human resources templates that are continually updated.

Mr. Tudor noted that Idaho National Laboratory has a workforce tool called the Cybersecurity Competency Health and Maturity Progression Model.

Q2. Ms. Reder asked for closing thoughts on how DOE can help reinforce CIE efforts, including the educational aspect.

Mr. Tudor said that when the Secretary of Energy signs the national strategy for cyber-informed engineering, educational outreach will be one of the main pillars.

Panel and Discussion: DOE Executive Order 14017 Reports to the White House on the Energy Sector Industrial Base

Moderator

Paul Stockton, President, Paul N. Stockton LLC

Panelists

- Scott Aaronson, Senior Vice President for Security and Preparedness, Edison Electric Institute (EEI)
- Cheri Caddy, Senior Advisor for Cybersecurity, Office of Cybersecurity, Energy Security, and Emergency Response, DOE
- Gina Coplon-Newfield, Chief of Staff, Office of Policy, DOE

¹ <https://www.naruc.org/cpi-1/critical-infrastructure-cybersecurity-and-resilience/cybersecurity/cybersecurity-manual/>

Dr. Stockton introduced the panelists and made introductory remarks. As directed by Executive Order 14017, in February 2022 DOE produced a report entitled *America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition*, along with 11 additional supply chain assessments. Dr. Stockton said that the reports are just the first step in a long journey to secure the country's critical supply chains. As DOE works to develop the Energy Sector Industrial Base (ESIB), Dr. Stockton encouraged DOE to draw lessons from the Department of Defense's (DoD) efforts to create a Defense Industrial Base (DIB). He said that the ESIB effort will fail if it does not account for the priorities of asset owners and operators, and it should bring in hardware and software producers as full partners in trying to establish a more secure industrial base. He went on to reference China as the U.S.'s pacing challenge and the fact that DOE will need to collaborate with DoD to take that into account when developing the ESIB.

Gina Coplon-Newfield said DOE's Office of Policy creates domestic policy on energy issues in collaboration with other federal agencies, the White House, and Congress. Ms. Coplon-Newfield noted that the *America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition* report laid out, for the first time ever, a comprehensive U.S. plan to build a strong energy sector. DOE has identified seven areas of action to address clean energy supply chain vulnerabilities: 1) increasing availability of critical materials, 2) expanding domestic manufacturing, 3) investing in and supporting reliable and responsible foreign supply chains, 4) increasing clean energy deployment, 5) advancing technologies to recycle and recover valuable materials, 6) enhancing knowledge and decision-making around supply chain policies and investments, and 7) attracting and supporting a skilled workforce. The report lays out 40 concrete actions DOE is already taking or will take. The report also presents 20 recommendations for congressional action.

Cheri Caddy said DOE is also focused on securing supply chains related to digital goods like firmware, software, virtual platforms, and data in general. The ESIB process involves bringing in many stakeholders to work together. DOE is working with the Department of Commerce and other federal agencies to gather necessary data. Another key element is developing more consistent and comprehensive guidelines for stakeholders across the energy industry that more appropriately address the interdependent risks within the industry.

Scott Aaronson offered his perspective on the role asset owners and operators play and the supply chain challenges they currently face. In reference to recent geopolitical events in Eastern Europe, he noted the importance of energy independence as a countervailing force against the use of energy as a tool of war. Mr. Aaronson thinks of supply issues in near, medium, and long-term categories. In the near term, there are acute global problems with energy independence and the use of energy as a weapon, and adequate supply will be needed to restore infrastructure damaged by storms or wildfires. In the medium term, players must not lose sight of the needs associated with the transition to clean energy. In the long term, all stakeholders need to be brought together to create a reliable, clean, secure, affordable grid.

Discussion

Questions and Answers

Q1. Dr. Stockton asked what the value of adding an ESIB is, in the context of existing industry and industry-government associations addressing supply chains and supply chain threats. He also asked what key objectives the ESIB should serve beyond what is already being done.

Ms. Coplton-Newfield said all relevant stakeholders need to be involved, and that includes DOE's role in developing the ESIB. Government can contribute necessary analysis to identify gaps and opportunities, and there are some challenges that government is uniquely suited to solve.

Ms. Caddy said policy has long centered on economic issues, but she is pleased to see more focus on national security issues. She has received feedback that the ESIB may create unnecessary redundancy and duplication of efforts, but she assured attendees that is not the case. She emphasized the holistic, structural framing of the ESIB.

Mr. Aaronson echoed Ms. Coplton-Newfield in saying that government has an important role to play. He emphasized that the energy ecosystem is growing, citing electric vehicles and distributed energy resources (DER), and said EEI's members are committed to integrating those new resources into a more secure energy infrastructure. He views the ESIB as a platform that will facilitate good conversations and partnerships which will lead to the development of cogent strategy.

Q2. Dr. Stockton referenced China as the pacing threat for the security of critical U.S. supply chains. He asked Ms. Coplton-Newfield what DOE should be focusing on in the near term and, in the long term, how the U.S. should deal with the challenge posed by China.

Ms. Coplton-Newfield cited several examples of China's influence over critical supply chains, including that the country controls approximately 80% of rare earth minerals production. She said the Bipartisan Infrastructure Law dedicates billions of dollars to help address those challenges.

Q3. Dr. Stockton referenced China's dominance in smart inverter production, asking Ms. Caddy to comment on that challenge.

Ms. Caddy said DOE and the current administration's collective strategy to address that and other challenges is long overdue. She emphasized the difference between price and cost, saying that the lowest-price option is not always the best option.

Q4. Dr. Stockton said Mr. Aaronson has been framing energy resilience as a national security issue for years. He asked Mr. Aaronson to comment on China's threat to U.S. critical supply chains.

Mr. Aaronson said in the near term, the U.S. needs to identify sources outside of China for critical materials and commodities. In the mid- and long-term, he expressed skepticism about onshoring of manufacturing but sees value and a future in reshoring manufacturing in this hemisphere.

Q5. Dr. Stockton noted that there are currently few details about how the ESIB will be established. He asked Ms. Coplon-Newfield how she envisions DOE establishing the ESIB and collaborating with industry.

Ms. Coplon-Newfield referenced the announcement that DOE will create a manufacturing and energy supply chain office. The office will engage with the private sector, other agencies, Congress, and the administration on its priorities, and to collect and analyze data related to the ESIB.

Q6. Dr. Stockton asked Ms. Caddy what lessons she will apply from her experience with the DIB when establishing and implementing the ESIB.

Ms. Caddy emphasized that a dedicated DOE office to implement the ESIB will be key. She said the benefit of the DIB is that it has been in effect for decades and has had time to apply lessons and evolve. She also stated it will be critical to communicate with partners and define roles and responsibilities for all stakeholders.

Q7. Dr. Stockton asked Mr. Aaronson how the electric utility industry should contribute to the ESIB.

Mr. Aaronson said it is critical to leverage the existing organizations. Further, he said it is important to bring in more stakeholders through new initiatives such as ESIB. He noted that the DIB is highly instructive, but the sole customer in that case is DoD. In the case of the ESIB, he said grid owners and operators play the role of DoD.

Presentation: Energy Cyber Sense Program

Ms. Caddy presented on DOE's Energy Cyber Sense Program. She explained that the Cyber Sense program is one of several DOE cyber discovery programs, which are intended to discover, mitigate, and engineer out cyber vulnerabilities in the digital components of critical supply chains in the energy sector. Key provisions of the program are: 1) establish a cybersecurity testing process for energy sector products and technologies, 2) solicit comments from the public, 3) conduct testing of products and technologies, 4) establish and maintain cybersecurity vulnerability reporting processes and a related database, 5) provide technical assistance, 6) biennially review products and technologies, 7) develop guidance for the procurement of products and technologies, and 8) consider incentives to encourage the use of program analysis in the design of energy sector products and technologies. The Cyber Testing for Resilient Industrial Control Systems (CyTRICS) initiative is one of DOE's major, and longest running, discovery programs. CyTRICS conducts cybersecurity vulnerability testing, forensics, and

subcomponent enumeration. The Energy Cyber Sense Program is CESER's agency performance goal of record for the 2022–23 reporting cycle.

Presentation: Cybersecurity Current Events

Ms. Caddy noted that CESER has quite a few new cybersecurity projects underway. She said CESER will engage with the EAC and industry stakeholders to provide feedback on those programs. She explained the digital bill of materials (BOMs) initiative, which seeks to securely transfer hardware BOMs and software BOMs from manufactures to asset owners.

Dr. Stockton commended Acting Assistant Secretary Patricia Hoffman's remarks on the importance of remaining vigilant about cybersecurity in light of the heightened geopolitical tensions associated with Russia's invasion of Ukraine. He also referenced the accelerating transition to a low-carbon grid and highlighted the cybersecurity implications. Fossil fuel generation has significant benefits for grid reliability and resilience, and variable renewable generation sources cannot easily replicate those benefits. Technical solutions like advanced energy storage, power electronics, grid-forming inverters, and virtual inertia will play a valuable role, but also expand the grid's cyber attack surface. He emphasized the need to identify those vulnerabilities in advance and to build in mitigation measures when deploying those technologies.

Discussion

Bob Cummings commented that the Institute of Electrical and Electronics Engineers (IEEE) finalized a standard for utility-grade inverters attached to sub-transmission and transmission systems. He is working on efforts related to testing and compliance with the standard and emphasized the importance of determining what is and what is not necessary in terms of testing from a cybersecurity standpoint. He recommended that the EAC Grid Resilience for National Security subcommittee address the issue.

Ms. Frantzis noted that Advanced Energy Economy led a project several years ago on cybersecurity in a distributed energy future. She said it was not clear who determines what counts as critical infrastructure. She stated that to her knowledge, the North American Electric Reliability Corporation (NERC) has some requirements but does not have jurisdiction over DER. As DER devices like smart thermostats become more common, Ms. Frantzis noted that there is a lack of standards and regulations in place for grid edge devices.

Mr. Cummings said NERC's jurisdiction ends at the bulk power system (BPS). IEEE handles low-voltage and sub-transmission.

Rick Mroz noted that in addition to federal and national-level actors, state-level regulators and policymakers will also need to be involved.

Jay Morrison commented that there has been a lot of discussion over the past several years about expanding NERC standards to DER and grid edge devices. To do so would be a drastic increase

in NERC's jurisdiction and the regulatory burden on thousands of small utilities and retail customers. He noted that Ms. Frantzis raised the issue of standards for the producers of those devices and education and said those probably reflect a much more fruitful direction. He emphasized the need to build security into the devices.

Dr. Kiesling said there is a lot of low hanging fruit in terms of cybersecurity for grid edge devices. Her canonical example is requiring users to change a device's default password before they can use it on their network. That is not very burdensome on consumers and, as a regulatory burden on manufacturers, coding in that step requires minimal effort.

Mr. Morrison commented that he sees two main cybersecurity questions related to grid edge devices. One is, "Can they be used as a pathway to reach more critical devices or control systems on the BPS?" The other main question is, "Could a hacker controlling large numbers of grid edge devices have a material impact on the BPS?" He noted that protections like Dr. Kiesling described can address both issues. The question he has been asking for several years but cannot seem to get an answer to is, "How do we define the threshold where there is sufficient penetration of grid edge devices such that their operation or intentional mis-operation has a material impact on the BPS?" There is no point putting a large regulatory burden on grid edge devices or distribution systems in any area where that threshold has not yet been met. Southern California Edison is likely to see grid edge devices as a threat decades before small communities and rural areas in states with different regulatory policies than California will. He concluded by saying he would like to understand that threshold issue before any discussion goes too far toward recommending regulation.

Update and Discussion on Section 8008 Voluntary Model Pathways Development

Joe Paladino made introductory remarks and provided an overview of the 8008 steering committee's efforts to date. He then asked Dr. Bialek to present on the outcomes achieved by the steering committee. Dr. Bialek described the first scenario, a robust transmission system, developed by the steering committee. Dr. Bialek then turned to Darlene Phillips to present additional scenarios. Ms. Phillips described scenario two, a plug-and-play distribution system; scenario three, coordinating planning, operations, and market design; scenario four, incorporating flexibility into grid operations and design; scenario five, incorporating resilience into grid operations and design; and scenario six, accelerating adoption of advanced technological capabilities. Ms. Phillips outlined next steps and invited discussion.

David Kathan offered his perspective on the steering committee work and noted that his views do not represent those of his employer, FERC. He referenced the transmission scenario, noting that FERC has focused on transmission infrastructure and planning and more efficient uses of existing infrastructure. He overviewed several recent actions taken by FERC on transmission issues. For the second scenario, a plug-and-play distribution system, he noted that the distribution system will need fundamental changes as it modernizes. Dr. Kathan suggested one

area for improvement, saying the steering committee would benefit from better recognizing and incorporating the role of the regulator, particularly at the state and local level, in improving grid modernization plans and associated cost recovery.

Discussion

Tom Weaver said the steering committee's efforts connect with DOE's Building a Better Grid Initiative, and he commended DOE's work overall. He added that it will be key to get the right stakeholders together to agree on the actions recommended by the steering committee. Otherwise, it is unlikely that those stakeholders will buy in.

Mr. Cummings said that grid modernization efforts should not be siloed but need to be considered as an overall system.

Mr. Mroz noted that there is no one centralized place to find grid modernization plans, saying there will be a need for a great deal of collaboration.

Andrew Barbeau noted the importance of acknowledging that planning for grid modernization is a human process.

Flora Flygt said it will be critical to prioritize issues.

Ms. Azar said that in most areas of the country there is a fundamental failure to engage in forward-looking transmission planning. Over the next 20 years, a shocking amount of new generation and transmission will be required. She recommended adding minimum time horizons for transmission planning in any recommendations the steering committee or DOE produce. She added that regulators do not have a good handle on transmission benefit metrics, which means they cannot appropriately value transmission. She suggested fleshing out those benefit metrics in any recommendations the steering committee or DOE produce. She went on to say that DOE should clearly define and act on its authorities in relation to building out the grid.

Jennifer Chen commended Ms. Azar's comments and noted a Midcontinent Independent System Operator analysis that looks at co-optimizing renewables siting with transmission buildout. She said DOE could also provide co-optimization analysis. She suggested that DOE could create a nationwide transmission plan and solicit bids from transmission developers. She proposed a study that examines which transmission rights-of-way could be strategically expanded to help achieve emissions reduction goals.

Ms. Phillips suggested adding the need for education and outreach as an additional cross-cutting issue identified by the steering committee. In terms of Ms. Flygt's comment about prioritization, Ms. Phillips referenced the EAC recommendations entitled "State and Federal Coordination on Jurisdictional Boundary Issues," which prioritize 1) the need for integrated planning and 2) the need to appropriately integrate DER. In response to Ms. Azar's comment, Ms. Phillips asked who does that 20-year planning.

Mr. Mroz referenced scenario five and commented on the need to define resilience and set resilience metrics. He referenced the emerging potential of advanced nuclear and co-location of hydrogen, saying he wasn't sure in which scenario the siting of those generation resources would fit.

Mr. Barbeau said the steering committee did discuss those issues, but the discussion focused on the uncertainty around when those resources would become available rather than siting and locational considerations.

Ms. Phillips said those resources were considered as inputs, rather than something they were planning for.

Ms. Flygt said long-range scenario planning has been done, there just has to be a consensus and a will to carry it out. She suggested that risk analysis should be added to the planning objectives—for example, taking into account the risk of not having enough transmission versus the risk of not having enough.

Ms. Reder said the “how” element of planning needs to be added to the conversations about “what” and “who.” She encouraged considering new planning paradigms. She said that the points being made about transmission can also be made on the distribution side. She said the educational aspect at the state level is a must. She also encouraged clearly defining the roles and responsibilities.

Dr. Kiesling said she prefers bottom-up planning. She also said that the National Institute of Standards and Technology was intended to be the credible, trustworthy focal point around which stakeholders would coalesce when making policy about smart grid. She suggested that DOE could be thought of similarly.

Ms. Azar said decentralized planning has been taking place in the U.S. since FERC Order 1000. For interregional planning, it has been uncommon for stakeholders to contribute to the planning assumptions. She wishes that more centralized planning were happening, but it is not.

Dr. Kiesling said she sees more potential for long-term success when there is a focal point to coalesce around, compared to a situation where people feel they are having something imposed on them.

Michelle Manary said she appreciated all comments about where DOE can add value.

Subcommittee Updates

Grid Resilience for National Security Subcommittee

Dr. Stockton, Subcommittee Chair, introduced the “Strengthening the Resilience of Defense Critical Electric Infrastructure” recommendations developed by the subcommittee. He

overviewed the origin of the work product, the analytic approach, key findings, and implementation measures.

Michael Heyeck moved to vote on the work product, and Drew Fellon seconded the motion. The EAC unanimously approved the work product by voice vote.

Energy Storage Subcommittee

Lola Infante, Subcommittee Chair, provided an update on potential and planned subcommittee projects and work products: recommendations related to the panel on facilitating the integration and commercialization of energy storage, providing input and guidance to DOE on the Bipartisan Infrastructure Law, and the 2022 Biennial Energy Storage Review.

Smart Grid Subcommittee

Dr. Bialek, Subcommittee Chair, overviewed the subcommittee's previous and planned projects and work products. Prior to the 8008 Voluntary Model Pathways effort, the subcommittee had been discussing advanced grid requirements for DER integration. During its next session, the subcommittee will determine how to move forward with the effort. Other upcoming efforts are potential work products related to transmission planning for renewables integration, integration of electric vehicles into the grid, and resiliency.

Public Comments

Keryn Newman provided the following written comment:

I do not see anyone on the EAC that is representing the interests of the communities and landowners who will be affected by new transmission and electric infrastructure. During yesterday's webinar, I noted that several speakers expressed concern that new transmission could not be built in a timely fashion due to siting and permitting issues. Community and landowner opposition is perhaps the largest impediment to getting new infrastructure built in a timely fashion. I urge DOE and/or this committee to consider that burial of new transmission on existing rail or road rights of way may be an appropriate path forward. Building new transmission that does not take new land, or visit lasting visual impacts upon host communities, does not foment community and landowner opposition. Without opposition, siting and permitting can happen much faster. It's the sensible solution.

Martha Peine provided the following written comment:

Communities and landowners affected by new transmission and electric infrastructure are not represented on the EAC. It may be that when the committee was formed, no one considered affected communities and landowners would have the expertise required to help guide the DOE's involvement in transmission planning. However, many do become true experts on issues of necessity and environmental impacts when their way of life is

threatened. Their opposition is then successful because the evidence is on their side. I believe the burial of new transmission on existing rights of way would meet with less resistance provided it is necessary. The IIA [Infrastructure Investment and Jobs Act] provision that allows, and the committee's consideration of, making the DOE an anchor tenant on merchant projects does raise a red flag as to necessity. Are these merchant projects roads to nowhere built to deliver electricity that no one wants? This could end up being a bill taxpayers get stuck with for up to 40 years in exchange for nothing. Again, the burial of new transmission on existing rights of way will meet with less resistance provided it is truly necessary. Siting and permitting could then happen much faster.

Mary Doughty Mauch provided the following written comment:

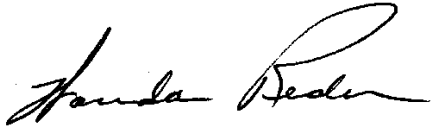
I would like to address the following comment Tom Bialek made in the chat comments of today's session. Tom wrote: "Also need to ensure that the program engages and educates the NIMBY/BANANA/CAVE stakeholders." Does this disparaging of concerned and educated taxpayer/ratepayer stakeholders reflect this committee's attitude? Who is really responsible for creating "equity" in this "deploy, deploy, deploy" energy transition? Respecting, including, and listening to the voices of educated citizen stakeholders might actually yield far better results than disrespecting and marginalizing them. After all, they're most likely the ones living in the "remote" industrial wind/solar plants and being forced to "host" private, speculative transmission lines and have researched and observed some of the TRUE costs to "remote" communities, non-renewable prime farmland, and the "remote" wildlife and environment. Equity must be at the forefront of energy transition across all domains.

Concluding Remarks

Ms. Reder thanked everyone for their contributions and provided closing comments. Mr. Aronoff adjourned the meeting.

Signature Page

Respectfully Submitted and Certified as Accurate,



Wanda Reder
Grid-X Partners, LLC
Chair
DOE Electricity Advisory Committee

4/27/2022

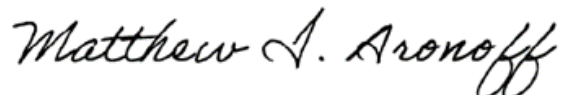
Date



Michael Heyeck
The Grid Group, LLC
Vice-Chair
DOE Electricity Advisory Committee

4/27/2022

Date



Matthew Aronoff
Office of Electricity
Acting Designated Federal Officer
DOE Electricity Advisory Committee

4/27/2022

Date