U.S. Department of Energy

Electricity Advisory Committee Meeting

Hosted Virtually via WebEx

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Meeting Summary

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Meeting Summary

This was the third Electricity Advisory Committee (EAC) meeting of 2021, which was held virtually given the COVID-19 pandemic. On the first day of the meeting, Acting Assistant Secretary (AS) Patricia Hoffman of the U.S. Department of Energy's (DOE) Office of Electricity (OE) mainly discussed OE's re-organization and the looming Infrastructure Investment and Jobs Act. Paul Spitsen, Office of Energy Efficiency and Renewable Energy (EERE), discussed takeaways from EERE's Clean Energy Scenario Modeling. Eric Hsieh, OE, provided an overview of DOE and OE's ongoing energy storage activities.

Cheri Caddy, Cybersecurity, Energy Security, and Emergency Response (CESER), spoke about the cybersecurity portions of Executive Order 14017 and standing up an Energy Sector Industrial Base. Andre Pereira, OE, presented about the supply chain implications of large power transformers and high-voltage direct current lines. Ben Shrager, OE, presented about the supply chain implications of energy storage devices. The first day ended with panelists from Pacific Northwest National Laboratory, Cordova Electric Cooperative, Red Yucca Power Consulting, and DWR Associates presenting about black start considerations in the variable generation era.

All presentations and recordings from this meeting can be found at https://www.energy.gov/oe/october-20-21-2021-meeting-electricity-advisory-committee

Welcome, Introductions, and Developments Since the June 2021 Meeting

Christopher Lawrence, EAC Designated Federal Officer, introduced himself, thanked the former EAC members that had moved on, and welcomed the new committee members. Mr. Lawrence then officially called the meeting to order. The EAC members introduced themselves. Wanda Reder outlined the agenda across both days and then invited AS Hoffman to provide an update on OE programs and initiatives.

Update on Office of Electricity (OE) Programs and Initiatives

AS Hoffman expressed appreciation for the EAC and welcomed the new members. She then spoke about challenges facing the electricity sector. AS Hoffman provided updates about OE, emphasizing that its current priorities are addressing a Federal Energy Regulatory Commission's (FERC) Advanced Notice of Proposed Rulemaking (ANOPR) and transmission deployment. She also let the members know that Maria Robinson, a Massachusetts state representative, had been nominated to be OE's Assistant Secretary.

AS Hoffman discussed OE's re-organization. She mentioned division name changes with brief backgrounds and spoke about how some programs were moved to better align priorities. OE will continue to provide feedback to the Grid Modernization Laboratory Consortium (GMLC). OE will also further dive into artificial intelligence machine learning and its role within data analytics. AS Hoffman then spoke about DOE-wide initiatives, highlighting the Long-Duration Energy Storage and Hydrogen Earthshots. She discussed the Infrastructure Investment and Jobs Act at a high level because the appropriations were still being discussed. AS Hoffman is focusing on how to leverage provisions in the bill and the "no regrets" investments that need to be made. She interpreted the priorities as

electrification, transmission, system flexibility, and helping states with resilience investments. AS Hoffman said there will be a role for DOE to engage with the EAC regarding deployment.

AS Hoffman concluded the presentation by discussing DOE's response to FERC's ANOPR. This was a rare event where DOE issued department-level comments to a FERC ANOPR. She said that the ANOPR looks into getting multi-state and market regions online. DOE advocated for creating consistency across states to build high-voltage direct current (HVDC) interregional lines. FERC, states, and DOE need to take the lessons learned and improve on best practices to expedite the transmission development timeline.

Questions and Answers

Q1. Kimberly Denbow asked whether the labs can look at manual backup solutions as society becomes increasingly technology dependent. This was in the context that manual backup cannot be compromised like software.

AS Hoffman replied that redundancies have to be blended with new infrastructure. She spoke of the importance of balancing innovative technologies while also having manual monitorization and protections.

Q2. Lauren Azar asked how the subcommittee charges might change as the new administration continues to form.

AS Hoffman replied that the ongoing priority is to make sure that EAC input is actionable to DOE. The priorities are still getting straightened out. AS Hoffman highlighted the high-level themes of advancing the distribution system/overall grid architecture, transmission deployment, energy storage deployment, and the grid implications of electrification.

Q3. Jennifer Chen asked AS Hoffman to discuss large-scale grid planning and lessons learned under the American Recovery and Reinvestment Act. Ms. Chen also asked AS Hoffman to further discuss the tradeoffs of deploying different grid flexibility tools.

AS Hoffman agreed with Ms. Chen's comments about increasing interconnection analysis. AS Hoffman would like to see consistent modeling to help inform investments.

Q4. Mike Heyeck voiced his support for DOE's ANOPR comments. He said that there seems to be interconnection issues in Texas and suggested that Texas join the rest of the U.S. eastern and western regional grids.

Q5. Jay Morrison asked how DOE can help with the vendor side of software and whether DOE can help ensure that secure equipment is being deployed.

AS Hoffman replied that there are some supply chain tests being done in the CESER office. She said that DOE has to create a culture that looks at quality assurance from an asset management point of view on the software side of products. AS Hoffman said that there is still work that needs to be done to better address these concerns.

Q6. Paul Stockton asked how the looming Energy Sector Industrial Base should be structured.

AS Hoffman suggested looking at critical components on the system and industrial manufacturing of the components. She suggested thinking about critical components and high-volume components.

Overview of DOE-Conducted Carbon-Free Energy Futures Analysis

Mr. Spitsen presented about EERE's Clean Energy Scenario Modeling. He outlined how scenarios are input into a model. Mr. Spitsen highlighted key findings across the studies. Some of the takeaway findings included (1) electrification of the transportation sector as the main driver for an increase in electricity demand; (2) electricity demand sources will require more electricity demand (e.g. production of green hydrogen); (3) the deployment of renewable energy generation and energy storage needs to be deployed at unprecedented, sustained levels; (4) expanded transmission is essential for accessing renewable energy resources and minimizing system cost; and (5) high levels of clean energy can be achieved at relatively low costs.

Questions and Answers

Q1. Lynne Kiesling asked about incorporating distributed energy resources (DERs) and adding a markets layer in decarbonization modeling at both the wholesale and retail levels.

Mr. Spitsen replied that there is a DOE GMLC model already looking into markets. He said that they are still in the early stages of incorporating DERs because there is high variability in societal adoption and the data available. His team can do this at scale for a single utility, but not at the regional or national level.

Q2. Rick Mroz asked a couple of questions. He first asked about the potential for advanced nuclear and advanced nuclear plus the co-location of hydrogen. Mr. Mroz asked how the models can be changed over time.

Mr. Spitsen replied that it depends on the nuclear assumption costs they use. He outlined what factors are used to determine costs. Regarding colocation, it cannot yet be modeled.

Q3. Tom Weaver asked how DERs are being integrated in transmission and distribution system modeling.

Mr. Spitsen replied that they have limited data sets and some of the referred scenarios are difficult to model. He noted that these models are still in the early stages.

Q4. Ramya Swaminathan asked how long-duration storage is incorporated in the models.

Mr. Spitsen said that long duration is currently limited, maxing out at 12 hours. They are currently using hydrogen to model long-duration storage. Mr. Spitsen's team is aiming to increase long-duration storage technologies in future models.

Q5. Ms. Chen asked whether their models have incorporated more off-ramps for transmission flyover states and whether the study plans on incorporating state energy policies. She also suggested incorporating cultural and environmental justice siting concerns.

Mr. Spitsen replied that state energy policies are incorporated. He said that they are not incorporating transmission off-ramps but hope to incorporate them in the future as transmission projects get further in their development process.

Q6. Tom Bialek commented that relying on levelized cost of energy models leads to an overreliance on intermittent generation resources, which require a large amount of backup resources in order to be relied upon as a firm resource. A better approach is to use an hour-by-hour analysis, also referred to as an 8760 model, that examines how to ensure firm resources are available when needed.

Q7. Ms. Denbow brought up the challenge of incorporating siting barriers.

Q8. Mario Hurtado asked whether inflection or break points have been identified when certain thresholds have been met. He also asked how the constraint of siting is incorporated.

Mr. Spitsen replied that inflection points are reached when the 90% renewable energy threshold is met. He said that energy costs increase dramatically at this point. To the second question, Mr. Spitsen replied that they have a geospatial layer that looks at buildings and roads in the United States, topology data, and other land use data.

Overview of DOE/OE Energy Storage Activities

Mr. Hsieh provided an update about how DOE is addressing energy storage research, development, and deployment. He outlined the goal of the Long-Duration Energy Storage Earthshot. Mr. Hsieh discussed the rapid operational validation initiative and displayed how DOE is allocating its funding to battery and energy storage technologies. He highlighted DOE funding opportunities announced during the first several months of this administration, citing more than $200 million in funding opportunities for energy storage. Mr. Hsieh pointed out a few specific funding opportunities based out of OE.

Executive Order (EO) 14017 Supply Chain Report: Cybersecurity and the Energy Sector Industrial Base

Ms. Caddy walked through the EO discussing what it encompasses. Her presentation focused on the cybersecurity aspects. Ms. Caddy spoke about the actions CESER is taking to create an Energy Sector Industrial Base similar to the Defense Sector Industrial Base. The cyber aspect of EO encompasses all digital elements in the energy sector supply chain. These include firmware, software, virtual platforms and services, and data. She spoke about several threats, risks, and vulnerabilities that CESER is looking to address. Ms. Caddy emphasized the vulnerabilities that data brings to organizations' security. CESER is currently defining the Energy Sector Industrial Base. They are looking at policy responses to supply chain vulnerabilities with the aim of addressing threats, risks, and vulnerabilities within the electric sector supply chain through policy actions. Ms. Caddy concluded by discussing the ongoing transition to cloud databases. Public policies are lagging behind technology innovation, leading to vulnerabilities.

Questions and Answers

Q1. Mr. Stockton asked how other sectors will be incorporated in the Energy Sector Industrial Base.

Ms. Caddy replied that DOE plans on incorporating other tangential sectors. She referenced best practices from the Defense Sector Industrial Base.

Q2. Mr. Mroz asked whether DOE is looking to create standards for grid hardware and, if so, how DOE is interacting with manufacturers. He also asked whether the Cybersecurity Maturity Model Certification will be applied to the energy sector.

Ms. Caddy referenced DOE's Securing Energy Infrastructure Executive Task Force. This task force engages manufacturers involved with the energy sector supply chain. Ms. Caddy is slated to provide an updated presentation about the task force to the EAC during its March 2022 meeting. To the second question, Ms. Caddy replied that there are several cyber verification methods and they are not ready to decide on one yet. She is monitoring best practices and takeaways from other industrial groups.

Q3. Don Parsons asked about the implementation of policies.

Ms. Caddy replied that DOE is taking an "all options on the table" approach to address vulnerabilities.

Q4. Dr. Bialek suggested that there be minimum cyber standards in order to sell products in a market. The lack of a minimum threshold creates increased vulnerabilities.

Q5. Sharon Allan commented about her experiences with the standards not living up to their intended purpose due to a lack of testing capabilities.

Ms. Caddy agreed with Ms. Allan's point. She discussed the hardships surrounding certifications and how DOE is trying to address long-term concerns.

Q6. Flora Flygt asked about quick actions and priority actions that should be taken.

Ms. Caddy replied that there is better security when software is most up to date. The electricity sector often uses outdated software and hardware. She emphasized grid security as more DERs and third parties come online.

EO 14017 Supply Chain Report: Large Power Transformers and Battery Storage

Mr. Pereira outlined OE's role in the broader supply chain report. OE is responsible for the Electric Grid (Large Power Transformers and High-Voltage Direct Current) and the Energy Storage/Batteries sections. Mr. Pereira identified several vulnerabilities in the Electric Grid section. The large power transformers' (LPTs) vulnerabilities included dependency on foreign suppliers, raw materials price volatility, LPT production time, and general business considerations. HVDC vulnerabilities included a limited number of suppliers, limited HVDC system build capacity, and scarce materials availability. Mr. Pereira walked through several U.S. policies related to the electric grid. He pointed out that many of them do not address the supply chain and tariffs have negative impacts on U.S. electric grid infrastructure and manufacturers. Mr. Pereira suggested several areas where the government can help the electric grid supply chain.

Mr. Shrager is leading the Energy Storage/Batteries section of the report. He highlighted the major supply chain vulnerabilities in energy storage. These included reliance on other countries; difficulty in siting, permitting, and environmental pushback; acceptance of energy storage technologies; and barriers to financing energy storage projects. Mr. Shrager suggested several actions that the government can take to further energy storage deployment.

Questions and Answers

Mr. Pereira and Mr. Shrager posed several questions for the EAC members to kick off a roundtable discussion.

Q1. Dr. Bialek echoed the economic concerns of large power transformers and HVDC lines. He said that another constant threat is moving jobs out of the United States for cheaper labor. Addressing energy storage, Dr. Bialek said that there is a significant need for public outreach and education. Most people do not think about where the raw materials are coming from and the impacts of mining.

Q2. Bob Cummings suggested creating standardized, portable LPTs. He commented that the HVDC issues are wrapped up in the broader lack of conversation regarding transmission development. Mr. Cummings emphasized the need for longer duration batteries.

Q3. Mr. Weaver asked about the limitations of mining raw materials in the United States.

Mr. Shrager replied that most materials are not found in the United States. He said an equally important issue is the location of refining facilities.

Q4. Dr. Kiesling suggested looking into how trade policies erect barriers to exchange and innovation. She also suggested looking into the opportunities that these barriers present, along with looking into modularity and interoperability.

Q5. Ms. Swaminathan emphasized looking into several types of energy storage technologies because different materials and technologies can be better suited for different uses.

Q6. Andrew Barbeau commented that a lack of markets to facilitate deployment is a major gap hindering further growth. He has observed battery storage start-ups struggle with getting approval for their inverter-converter systems, which hinders these companies' success.

Q7. Ms. Azar asked about the performance of modular transformers and substations.

Mr. Pereira replied that OE is starting demonstration projects that test modular transformers.

Q8. Mr. Weaver asked about the possibility of rebuilding transformers using recycled pieces.

Mr. Pereira replied that OE is not currently pursing research about this topic. He said that this a potential solution that might be looked at in the future.

Q9. Lisa Frantzis asked whether DOE has considered coordinating with utilities to pool resources for transformer investment.

Mr. Pereira replied that OE is not currently pursuing this topic. He said that this a potential solution which might be looked at in the future.

Panel and Discussion: Black Start in the Variable Generation Era

Mr. Stockton provided introductory background comments that gave context to the panel. He discussed the importance of black start capabilities and the challenges that black start generation will face in the future with regard to high-penetration DER deployment.

Jeff Dagle spoke about the role that transmission plays for black start capabilities. He walked through restoration strategies and priorities for black start. Mr. Dagle highlighted the increased importance of critical load centers and cascading implications if one of these sites goes offline. He sees energy storage playing a big role for black start capabilities as battery technology develops. Mr. Dagle outlined several opportunities and challenges facing black start in the "future grid." He highlighted emerging threats and pushed for grid hardening. Some of the recommendations from a Pacific Northwest National Laboratory study addressing this topic include increasing resiliency, improving system modeling, performing more extensive studies, and increasing cross-sector coordination.

Dave Roop emphasized the need for firm, dispatchable gas generation for black start in the foreseeable future. He spoke about the impact of renewables coming online, specifically for when "next start" generation goes offline. Mr. Roop reiterated the need for firm generation and grid hardening.

Mr. Cummings provided context for the different considerations that make up black start. He discussed factors that need to be considered for restoration. Mr. Cummings concluded by walking through "cranking paths" considerations to meet the priorities for black start.

Clay Koplin's presentation was in the context of black start for microgrids. He highlighted part of Cordova Electric Cooperative's system that has been upgraded to handle black start events and dissected how Cordova's battery energy storage system is used as a black start asset. Mr. Koplin emphasized investment in planning analysis as an upfront cost to save money down the line.

Questions and Answers

Q1. Dr. Bialek said that loss of inertia, a decrease in protections, and planning for black start are increasing concerns as there is a higher penetration of renewables on the grid.

Mr. Cummings replied that DERs deployed on the grid have to meet standards thresholds. He added that the distributed energy resource management system has to become smarter about knowing when to charge vs. dispatch.

Mr. Dagle responded that he sees three levels of impact from DERs: (1) minimize harms, (2) ride through, and (3) rely on DERs for black start. Technology is able to do the first two, but the third is still being developed. He does not believe that DERs are part of utilities' black start plans.

Mr. Roop agreed that DERs are not part of black start plans. He said a vulnerability is that DERs are transmitting the data being collected to the asset controller/homeowner, leading to a lack of awareness regarding fixing issues.

Q3. Mr. Mroz emphasized that black start has to be better incorporated into planning with DER deployment. He asked about cost recovery mechanisms for black start assets.

Mr. Roop spoke about the benefits of having deployable black start units at the regional level. He said that ancillary services need to be better accounted for.

Q4. Ms. Flygt commented about the need for transmission and distribution systems to incorporate DERs. She asked how many utilities have these capabilities.

Mr. Dagle said that advanced distribution management system controls are integral and that DOE is working on furthering the deployment of those controls.

Mr. Cummings and Dr. Bialek discussed the challenges arising from the increased variability in generation associated with higher DER penetration.

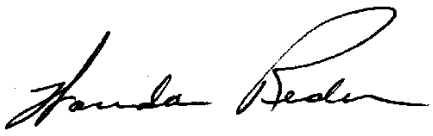
Mr. Koplin spoke about a different Alaskan co-op's power grid. He highlighted how this co-op is able to extend their battery life by having a fly wheel.

Wrap-Up and Adjourn Day 1

Ms. Reder provided comments to close the first day, mentioning that the journey of our electric grid is just as important as the final point.

Mr. Lawrence adjourned the meeting for the day.

Respectfully Submitted and Certified as Accurate,



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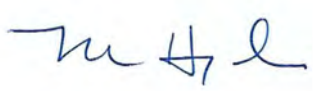
2/4/2022
Date



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