



U.S. Department of Energy
Electricity Advisory Committee Meeting
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Meeting Summary

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Meeting Summary

This was the second day of the Electricity Advisory Committee's (EAC) February meeting. Michael Pesin, Department of Electricity (DOE) Office of Electricity (OE), began the day by discussing the Energy Storage Grand Challenge (ESGC). He reviewed the history of the ESGC and introduced the first panel session of the day consisting of Eric Hsieh, of DOE OE; Alejandro Moreno, of DOE's Office of Energy Efficiency and Renewable Energy (EERE); Valri Lightner, of DOE EERE; and Marcos Gonzales Harsha, from DOE's Office of Technology Transitions. Each panelist presented on their office's roles with respect to the ESGC. This panel was followed by a question-and-answer session. The day focused on the commercialization aspect of ongoing DOE projects. Mr. Hsieh provided an overview of the use cases being developed to shape the strategic direction of the R&D component of the ESGC. Mr. Hsieh led a discussion with the EAC on the content of those use cases. Mr. Moreno wrapped up the panel session by discussing the six elements of the Policy and Valuation track of the ESGC. EAC members provided rapid feedback on each element of the Policy and Valuation track. Ramteen Sioshansi, EAC Energy Storage Subcommittee Chair, provided an update about the Energy Storage Subcommittee's activities, work products, and priorities. John Adams, EAC Smart Grid Subcommittee Chair, provided an update about the Smart Grid Subcommittee's activities, work products, and priorities. There were no public comments and the meeting adjourned shortly after this.

Opening Remarks

Mike Heyeck started by clarifying the impending EAC leadership transition. He encouraged members to continue to participate in monthly calls and to be involved in at least one EAC subcommittee. Mr. Heyeck noted the change in structure and how the new format did not work exactly as planned yesterday. He let the members and presenters know there would be a time cap on discussions to allow more topics be addressed. He thought this format worked much better because it gave instant feedback, especially concerning DOE's "valley of death" difficulties and commercialization. The new format allows for more EAC members the opportunity to speak and, in turn, a wide array of sectors and perspectives can apply input (policy, regulator, consumer advocate).

Overview of the U.S. Department of Energy's Energy Storage Grand Challenge Structure

Mr. Pesin, Deputy Assistant Director of OE's Advanced Grid R&D division, began by outlining the Department of Energy Research and Energy Innovation Act. The act ensures there is strong coordination across the Department on energy storage investment. As a result, the Research Technology and Innovation Committee (RTIC) formed to fill this void. This group is co-chaired by OE (Mr. Pesin) and EERE (Alex Fitzsimmons). It includes nearly all technology offices and grew to include all applied sciences offices. The RTIC realized early in its existence that coordination is poor across all program offices for energy storage.

Mr. Pesin clarified what was meant by the term "energy storage." OE dealt specifically with bidirectional electrical energy storage, but the scope of the RTIC is broader causing more offices to get involved. The scope was then split into three focus areas: (1) bidirectional energy storage, (2) flexible generation and flexible loads, and (3) chemical and thermal loads.

The RTIC also oversees the Energy Storage Grand Challenge (ESGC). The vision of the challenge is that by 2030 the United States will be the world leader in energy storage utilization and exports. Mr. Pesin said the ESGC has five pillars:

1. Technology development
2. Technology transition
3. Policy and valuation
4. Domestic manufacturing and supply chain
5. Workforce development

A challenge they are facing is the ability to create a metric that will accurately compare these different technologies. Mr. Pesin said U.S. companies have a hard time securing capital investment for this technology. U.S. investors are not putting money into hardware development; instead they are focusing heavily on software. The RTIC is using the development of solar technology as an example of what to avoid (China leads the world in solar and the United States is left behind). The team aims to have the full developmental cycle take place within the United States. Mr. Pesin believes three factors tie into one another that are integral to successful adoption: technology development, supportive markets, and policy. He then gave the hierarchy of the committee.

Energy Storage Grand Challenge (ESGC)

The session began with each panelist briefly introducing themselves. Mr. Hsieh, Director of Grid Component Systems within OE's Advanced Grid Research and Development division, presented first. Mr. Hsieh provided an overview of the process for developing a 10-year R&D roadmap addressing energy storage and flexibility technologies. His presentation looked at this through four steps: vision, use cases, technologies, and pathways. The ESGC team is in the early stages of stakeholder outreach and a large-scale outreach initiative will occur in March. Mr. Hsieh and DOE will ask stakeholders what energy infrastructure goals they have and how they can be accelerated by better energy storage. The team will then divide the feedback into use cases and pair the vision into a specific technology based off the desired function. While doing this, they will focus on addressing the questions: What is a viable pathway to make this happen, and what DOE resources are needed for successful commercialization?

Mr. Hsieh then walked through the technology pathways approach by giving a peek into the thought process of assigning the envisioned use case to a certain type of technology. He said the technology pathways are centered on finding ways to leverage DOE resources to accelerate the path from concept to commercialization, while keeping the value chain in the United States. Mr. Hsieh wrapped up his part with examples from fossil energy (thermal energy storage), vehicle technologies (lithium ion battery), and OE (electrochemical storage).

Mr. Gonzales Harsha, Principal Deputy Director within DOE's Office of Technology Transitions, presented next. He began by pushing the importance of forums like this, specifically for the EAC, because it provides a way to receive feedback from various sectors all at once. Mr. Gonzales Harsha emphasized that the ESGC is different from other DOE projects because it looks beyond R&D and technical roadmaps. The challenge also looks at market-pull factors and deployment tracks to commercialization.

The technology transition track is split into three sections: innovation, commercialization, and market information. Mr. Gonzales Harsha highlighted the InnovationXLab Summits as an effective forum to connect investors with businesses and, more importantly, to technology from labs. He described DOE's Lab Partnering Service, which is a Google-type platform where one can run a keyword search on a technology of interest. A list of experts across all the labs that work on the given technology will appear. DOE patents can also be searched and found using this system. He concluded the innovation segment by mentioning the Technology Commercialization Fund (TCF). The TCF is designed to increase the number of technologies developed at DOE's national labs that graduate to commercial development and achieve commercial impact.

Mr. Gonzales Harsha then discussed the commercialization aspect. He started by letting the members know there is a request for information coming out in April for industry responses. He emphasized the need to bridge the gap between a DOE technology that is ready for market and successful commercialization. Historically, this part has been U.S.-centric but, given ESGC's interagency effort, there is also an international development focus. The last part of his presentation touched on market information. The group is hoping to make ongoing and deployed projects available for both the government and general public projects for market analysis. This will include technical economic data from the labs. He wrapped up by giving context that the goal of the analysis is to provide deeper understanding of market dynamics for senior leadership both inside and outside of DOE.

Ms. Lightner, Acting Director of EERE's Advanced Manufacturing Office, presented next, focusing on the manufacturing and workforce tracks. Ms. Lightner began by addressing the issue of technology being developed in the United States but manufactured overseas. This brought up two central concerns about the manufacturing industry and potential for vast vulnerabilities in the supply chain. Ms. Lightner described a few focus areas, starting with identification of manufacturing challenges. Her team is seeking input from other program offices about opportunities and challenges to help address manufacturing needs through research and development. Ms. Lightner then outlined supply chain vulnerabilities of lithium battery manufacturing. Lithium is being used in a growing number of products, which is causing the supply chain to change fairly drastically. The battery manufacturers are trying to scale up with this product but are facing barriers. She provided insight on her thought process for assigning different classifications for manufacturing technology.

Her presentation shifted to discussing workforce development. Ms. Lightner said her group is focusing on understanding the skill gaps when looking at developing, manufacturing, and operating energy storage systems once deployed. Underlying this is to figure out what skills workers will need in the future that are not being considered now. Historically, DOE has focused on undergraduate and graduate programs while giving some attention to technician training. The new shift will center on recruiting STEM students. An internship program has been created to pair STEM students with a national lab to focus on energy storage for a summer. She said that a lab-embedded entrepreneur program within her office connects entrepreneurs with national labs for a two-year fellowship program that builds both technology and business skills. Ms. Lightner concluded her presentation by mentioning the upcoming ESGC stakeholder workshops. She pointed out the March 6 workshop in Seattle because it will focus on manufacturing.

Mr. Lawrence took a short pause before Mr. Moreno's presentation to poll who is scheduled to speak at the ESGC workshops. Mr. Morris, Mr. Koplin, and Dr. Sioshansi are scheduled to speak while several other EAC members have registered and are planning to attend.

Mr. Moreno, Director of EERE Water Power Technologies Office within DOE, capped off the presentations for this session with the policy evaluation track. He began by asking rhetorically if the EAC members believe policy, regulation, or planning decisions will have big impacts for the future of energy storage in the United States. This concept historically has not been recognized within DOE although the Department is filled with experts across all these areas that can be utilized. The ESGC is shifting the focus to incorporate all of these areas. Mr. Moreno emphasized the need to understand the different chemical makeups of storage, the value of services that different types of storage provide, and how to operate in a way that will maximize value streams while ensuring they are appropriately compensated. Mr. Moreno quickly addressed the question: What is DOE's role? In order for DOE to be effective, DOE must take a targeted, systematic, coordinated, and informed and objective approach. He noted DOE's unique position in the policy track because DOE does not set policy but offers decision-makers tools to make informed decisions.

His vision for getting information out is to provide analysis based on updated models, data about performance-based measures, and costs of energy storage technologies, as well as to integrate future projections. Building off this, an integral aspect will be to form strong bonds that create symbiotic relationships to better address their needs. Mr. Moreno then overviewed a few existing policy and valuation projects DOE is working on. He then showed a mock work structure chart to display the

complexities of the coordination and analytic processes. One of the positive outcomes from this new cross-agency collaboration effort is that different program offices are being connected with one another. The ultimate vision is to come out with a series of technical, analytical priorities that are based not on individual office mandates but on the needs of the grid and storage systems. Mr. Moreno wrapped up his presentation by alluding to the discussion, which will go more in-depth for specific scoped areas.

Questions and Answers

Q1. Kimberly Denbow started with a broad question to DOE in general: Why are they using the term “energy storage” when really what they are doing should be classified as “electricity storage”? She noted that natural gas and liquid fuels are also forms of energy storage.

Mr. Pesin said they got prompting from Congress to increase coordination of their energy storage efforts. DOE needed to address why they care about energy storage in the first place. The main reason is to improve and support electric grid flexibility and resilience. They had to draw the line somewhere to maintain that the U.S. is a leader on energy storage technologies. A major factor is figuring out what is exportable and can be commercialized. They also did not want to replicate research already being done by other offices; for example, the Office of Fossil Energy is working on gas storage.

Ms. Denbow reiterated that they are focusing on “electricity” storage and not doing themselves justice by calling it “energy” storage.

Mr. Pesin replied they got pushback on naming it, because “electricity” storage would not include technologies such as hydrogen, which they are also considering. Mr. Heyeck added that the electricity sector is making a substantial impact on reducing carbon emissions, while the transportation industry is lagging. The broader subject is capitalizing on the crossover benefits for other industries.

Q2. Darlene Phillips asked for clarification about the timeline for use cases. Ms. Phillips urged them to consider energy policy that is currently underway.

Mr. Hsieh clarified that between now and the end of March they are drafting a 10-year roadmap about how all tracks will be integrated into a DOE-wide effort. They will roll this out in April for formal public comment.

Q3. Wanda Reder asked where standards and certifications fit in.

Mr. Gonzales Harsha replied they were not included in the presentation but they are taking them into consideration.

Q4. Artie Kressner commended DOE for efforts incorporating the business case and structure of manufacturing, specifically within the United States. He noticed two missing areas: providing financial support to manufacturers and the time spent trying to secure funding. Mr. Kressner told DOE that there are investors out there eager to invest, but who might already have missed several opportunities for funding. Mr. Kressner also noted that DOE can provide a valuable vetting service to financiers.

Mr. Gonzales Harsha mentioned that the DOE Loan Programs Office can invest in projects like this. He acknowledged the need to get the finance sector involved, which will be addressed in their request for information. Mr. Gonzales Harsha noted that DOE is limited by statutory authorities.

Ms. Lightner added that the Loan Program was created to take technology risks because it focused on innovative projects. It was one of the first offices of its kind in the country.

Mr. Moreno added that a lot of the work in one way or another is geared to making financing easier.

Q5. Mr. Morris asked the panel to clarify bifurcation between states and PUCs because there is a lot of confusion about this at the state level. He noted that when discussing risk reduction, many utilities have mandates from the state executive branch giving them cover. He would like to know their overall thoughts about that bifurcation. He also asked if there should be bifurcation between technology and developers.

Mr. Moreno said not to read too much into bifurcation. He has had extensive conversations that reinforce the importance of getting state energy offices and PUCs together.

Q6. Tom Bialek emphasized Ms. Lightner's presentation in the sense that most people do not appreciate scaling. The question becomes: What are companies actually doing? Often, the outcome leads to significant issues with compatibility. Dr. Bialek's other point is looking at policy and valuation through multi-use cases. He noted that there are many hypothetical uses, but they must operate in a reality and look at what is practical. This is often overlooked.

Ms. Lightner clarified that her work on scaling would include the entire energy storage system. She provided an example of wide gap power electronics they are already working on. Regarding scaling, her office is asking for feedback about what needs to be demonstrated because this is different for each technology.

Mr. Moreno added they are trying to give decision-makers the right tools and services to optimize the system and increase its value. He circled back to Ms. Denbow's earlier question by responding that storage technology needs to be evaluated from the services it can provide compared to non-storage energies.

Q7. Bob Cummings addressed the issue of scalability and brought up pumped storage. This is a known technology, with the new factors of variable pitched blades and speed drives. He strongly pushed getting advanced pump storage deployed at a large scale. Mr. Cummings urged them not to overlook the variability of the capabilities of the existing systems.

Mr. Moreno replied that this relates back to the finance question. The problem is the large capital investment and timeline to get it online (currently about 10 years). He added that a difficulty when comparing this to help with solar and wind to nuclear is that nuclear has a stable output, while solar and wind can be highly variable. His office is trying to predict the value stream to help get it online. Mr. Moreno added that all pumped storage going into Europe is variable speed. In France, they are stopping variable speed and will add batteries to pumps to make them fixed speed.

Q8. Tom Weaver asked if we have enough application and deployment of this in the United States to spur a manufacturing increase that is desired. Also, is there enough demand for all the systems we want to manufacture.

Ms. Lightner replied that they have mostly engaged with the battery community interested in opportunities for electric vehicles. She noted that there are supply chain vulnerabilities, which could become a problem with demand expected to grow. They received feedback that if there is demand, the

manufacturing will happen. They are happy to build capacity to meet demand. She is currently looking for feedback about how to keep manufacturing in the U.S. For example, are there policies that can be made?

Mr. Moreno added that demand will depend if the technology evolves in a way that it can be the most effective option for operators. It also comes down to making sure there is not a lack of resources to create the best path forward.

Mr. Gonzales Harsha said they are also looking at international exports and to get domestic manufacturing competitive with international facilities.

Q9. Drew Fellon built off Mr. Cummings' earlier comment by pushing thermal storage technology. There is already strong infrastructure, with buildings playing a large role and ready to be scalable quickly.

Mr. Heyeck clarified that when discussing energy storage the "storage" aspect is what is really being discussed, not the delivery or output.

Mr. Moreno added that they are not operating a battery program. It is a storage program that takes into account many types of technologies.

Chris Lawrence concluded the panel by referencing the EAC's June 2018 *Review of Emerging Energy Storage Technologies* report. Mr. Lawrence will forward that report to the group.

Moderated Discussion of Technology Development Track

Mr. Hsieh picked up from his presentation on the previous panel. He said they are trying to be more empathetic in this process. Their approach looks to be able to put the team in someone's shoes outside of the Department. He walked through an example process of getting an opportunity through Ms. Lightner's office to test a certain technology. The person would be paired with a National Laboratory to research their idea. Mr. Hsieh highlighted the different labs playing a specific role from when a given technology is in the early phase to ready for real-world mass integration.

He then dove into the presentation outlining the six types of end-use cases. Each of the use cases has a success statement and example. The success statement is treated as a benchmark for how they will know the technology is successfully deployed. Below is a list of the six use cases with a brief description:

1. Facilitating an Evolving Grid
 - Enabling the grid to meet new demands of variable renewable energy (VRE) and addresses stresses from weather, physical, or cyber threats.
2. Serving Remote Communities
 - Up to one billion people in the world do not have access to electricity. Mr. Hsieh highlighted island, coastal, and remote communities because they are not connected to bulk power systems. These areas usually have premium charges due to fuel logistics and maintenance.
3. Disaster Resilience and Recovery
 - This case specifically includes critical end users such as Department of Defense emergency services and is overall classified as "an extended loss of power to facilities in these sectors [that] can lead to unacceptable public health and safety risks."
4. Electrified Mobility
 - Entails onboard storage medium and fuel cells such as batteries or fuel cells in cars. Additionally, includes preparing the electricity system for the stresses that come from extreme fast charging.
5. Interdependent Network Infrastructure
 - Addresses the systems that the overall electric grid system depends on, such as natural gas, communication, water, etc.
6. Facility Flexibility, Efficiency, and Value Enhancement (split into two sections)
 - The first part addresses commercial and residential buildings.
 - The second section is for energy-intensive facilities and electric generation units.

As a blanket statement, Mr. Hsieh reiterated DOE is technology-neutral in use cases. They just need the technology to meet functionality that would support the use case to be considered. He then outlined the plan for the coming weeks. This entails obtaining information to get a check on whether the cases make sense, specifically will they meet needs for 2030 and beyond. The second part of gaining feedback is how they can transfer these projects to commercialization and a successful pathway. His focal point is being able to leverage DOE resources, while cutting down costs of production.

Questions and Answers

Mr. Lawrence transitioned to the question-and-answer section by asking the members whether these use cases make sense. Specifically, are they relevant and will they be useful?

Q1. Mr. Heyeck asked about the short term—addressing grid flexibility, such as inertia and frequency response.

Mr. Hsieh said he will make sure that is explicitly addressed.

Q2. Mr. Cummings first emphasized Mr. Heyeck’s question about the importance of grid flexibility. One of the key issues is the valuation of services a device can bring. He added that that each device can do multiple jobs.

Mr. Hsieh responded they are conscious of the resources providing inertia responses today. He said if there is a plausible R&D pathway for a technology at a higher quality or lower cost they will pursue it.

Q3. Mr. Kressner suggested they look into health care and asked if there is a role in regard to batteries and inverters.

Mr. Hsieh said balancing is one-third or more of the total cost, so they are giving it a lot of attention. He said health care is dispersed across a few different use cases but specifically brought up in Disaster Resilience.

Q4. Lola Infante asked about the focus on facilities and lack of utility services and support. She also asked for clarification between the Disaster Resilience use case and Interdependent Network Structure.

Mr. Hsieh responded that the Interdependent Network Structure could be seen as a subclass of Disaster Resilience. His presentation highlighted Interdependent Network Structure because the operation of the power grid depends on these use facilities. Disaster Resilience does not necessarily focus on the facilities. Given the long-term path ahead, he said some of the use cases may wind up with similar requirements.

Q5. Dr. Bialek provided a series of comments. He began that storage is just another tool for these use cases. He focused on the Disaster Resilience case because there are different types of disasters that bring about different responses. Dr. Bialek suggested that the use cases act as a cost target because if there is a choice between a storage resource and a second feed to a facility, the cost difference will play a major role. Currently, the storage option costs significantly more, so large-scale operations will choose a second feed every time.

In response to Dr. Bialek’s comment on cost targets, Mr. Hsieh said the long-term roadmap is an advantage to DOE because utilities are forced to operate with short-term decisions in mind whereas ESGC looks at the bigger picture.

Q6. Mr. Morris spoke about the difficulties of HUD money being pushed out for hurricane and wildfire responses. His main point was that FEMA has done well identifying critical infrastructure pathways because the next round of funding will focus on town square hardening. These two paths combined will lead to real resiliency and a cut-down of cascading failures. He said building decarbonization is going to be a huge area for California. Grid storage in buildings will play a large role, but it will be the last step

after building efficiencies are implemented. He believes there is grand potential for AI technology to fill a void that will lead to even better planning and connection of buildings to the grid.

Mr. Hsieh agreed with Mr. Morris's point and added that using buildings for flexibility is the reason they can be used for storage.

Chuck Kosak added his perspective on the HUD funding. It is OE's intent to leverage the HUD funding and it is a unique situation to get housing people to recognize the importance of tying in the national security aspect. OE is also looking into FEMA BRIC to help leverage the energy lifeline. From a national security perspective, even if an adversary does not focus on a DCEI site, they can still execute demonstration attacks by targeting a small city or operational information. Mr. Kosak outlined a cascading effect of taking down non-DCEI sites at a mass scale. He said the United States needs to be prepared on all levels, emphasizing mitigation and response.

Q7. Rick Mroz asked if they are looking into end-of-life complications and challenges, such as deployment or long-term relative costs associated with deployment.

Mr. Hsieh replied that this is mainly being looked at in manufacturing. His team needs to consider where they can source materials from and close the loop when getting to the point of enumerating a technology portfolio.

Q8. Paul Hudson commented that in areas with scale-level deployment, there is an undercurrent implied of the customer and the question of who is really purchasing the tech is not fully considered. He asked if they consider this question when moving these technologies to the deployment phase. Mr. Hudson added that there are example sets from the last few years. He suggested looking at these best practices as a path to scale.

Mr. Hsieh replied that they are still in the early conversational phase and would be interested in having a deeper discussion offline.

Q9. Bryan Olnick mentioned different options from the utility side to address resilience, such as adding new capacity. He would often face the dilemma that the only options for utilities are permanent, whereas they would like more temporary solutions (weeks or months). Mr. Olnick gave a shout-out that battery storage is particularly useful because it can be mobilized. Overall, he suggested the mobility factor as a key characteristic.

Mr. Hsieh said some functional use requirements may find themselves in another use case and improve that value.

Q10. Dr. Infante noted the ambition of the ESGC. She asked a couple of questions: Given the scenario that they have enough money to do everything, how will they prioritize? Also, where can the EAC play a role?

Mr. Hsieh replied that a difference is coming at this from a private company versus federal government perspective. He said that others would likely make some of the decisions.

Mr. Kosak added that the Department of Homeland Security is beginning to work on this with the National Critical Functions publication. He would like to see true prioritization and at least figure out what needs to be done.

Q11. Mr. Kressner asked if they have been considering threats to technology for their prioritization and what alternatives there might be. Building off Mr. Olnick’s question, he asked about the capabilities of incumbent technology in terms of the grid delivering services in a more cost-effective manner.

Mr. Hsieh said incumbent technologies are front and center given they are already being deployed. For threats, including them in this discussion involved discussions from other parts of DOE.

Q12. Mr. Heyeck wrapped up the session with the saying, “We do not know what we know until we know it.” The six use cases may yield something quite different than intended. He advised Mr. Hsieh to focus on the most important topics (national security) and hope tributaries of this seep to the six use cases.

Moderated Discussion of Policy and Valuation Track

Mr. Moreno kicked off this discussion by returning to an earlier question about whether there will be enough demand to drive manufacturing. He clarified that the ESGC is not trying to promote storage as the solution to all problems. They want to make sure storage is a characteristic that can be embodied within many technologies and will also be able to bring down prices. Given the broad scope, this will allow them to see where storage can be most effectively utilized. The ESGC ensures the best option for a certain technology can be used for those applications and the decision-making process does not hinder this. The goal of this session is for EAC members to give input to DOE about questions they are not able to answer and that affect their business and the ability to use storage. Mr. Moreno is seeking the data, models, tools, and analysis they think can be most helpful to answer these questions more effectively. He noted there will be ample opportunity for follow-up, and he is happy to set something up.

Mr. Moreno began with the Resilience slide. He gave context to a few pieces of the slide before opening the floor to EAC members to comment and ask questions.

Resilience

Questions and Answers

Q1. Mr. Mroz said he would like to see a consistent set of metrics across DOE.

Q2. Mr. Koplin said one area DOE can help is to identify the state of technology, specifically for remote locations.

Q3. Mr. Morris brought up scalability and noted he is seeing a lot of this in California. Money is being pushed out when looking at development and deployment. He gave the example that developers are shifting away from looking at how to do 10 specific fire stations. They are now addressing 80% of the critical functions a fire station entails and are able to do that 80% of functions across a grand scale of fire stations.

Q4. Mr. Weaver said one struggle across the board is there is no dollar amount associated with reliability or resiliency. This makes it hard from a business case because they rely upon finances.

Q5. Ms. Phillips asked for clarification about what DOE means when saying, “Energy storage can provide resilience.” Clarifying this phrase will help others see the value in certain technologies. After Mr. Moreno replied, Ms. Phillips added that PJM has a hard time differentiating between reliability and resilience.

Mr. Moreno followed up about the difference between resilience as a forecastable event versus an event out of the blue; the characteristics are quite different. Mr. Moreno responded to Ms. Phillips’ second comment and said, at the baseline, the ESGC is looking to address low-probability, high-impact events.

Q6. Mr. Olnick built off Ms. Phillips’ comments saying resilience is usually a longer term event. Currently, the technology (battery storage) addresses the short-term needs for resilience. A utility looks at a potential application in the scope of the long-term planning perspective. He suggested using caution when listening to how members discuss resilience because they often talk in terms of different timelines within the same conversation.

Mr. Moreno replied that they include both long- and short-term because weaknesses will appear in some technologies that claim themselves as “an answer to resilience.”

Q7. Ms. Reder referred to an earlier comment about metrics by saying resiliency itself is craving for models. She reiterated the need for “resilience” to be better defined in the first place. There has to be a heavy push migrating the metrics into tools and the decision-making process once they are on line. Ms. Reder envisions integration coming through an assessment of what is used and needed, and identifying gaps.

Q8. Chris Ayers provided his perspective on questions from the consumer advocacy side. He urged the need for a consistent definition, because it is hard to put a value on something that is undefined. His second point was that consumer advocates and regulators must determine cost-effective solutions to whatever the problem is. He said that these are the questions regulators ask when resilience is brought up, as a way to begin the conversation.

Q9. Mr. Heyeck said low probability, high impact means the technology is sitting around. He suggested thinking about mobility of the technology or an everyday use that can also have a backup use of resilience.

Mr. Moreno wrapped up this session with the takeaway that more rigor needs to be brought to conversation of resilience. This includes crafting a definition and identifying associated system attributes, technology characteristics that assist system attributes, and how to value these characteristics for specific attributes and the system as a whole.

Q10. Mladen Kezunovic emphasized that the definition floated at a high level does not account for everything being talked about. When looking at outages, less than 9% are associated with “low probability, high impact” and over 90% are from everyday life. He concluded by saying ESGC has to keep these everyday events accounted for.

Long-Term Planning

Mr. Moreno used Dr. Kezunovic’s question to pivot to the next topic, long-term planning. He clarified that low-probability, high-impact events must be discussed differently because they present unique challenges. Designing for the long term is all about reliability. A focal point of this is understanding how storage fits in. The models currently deployed do a poor job representing storage and utilities have openly acknowledged this. The ESGC is trying to identify how technologies (storage, gas, hydro, etc.) will be used in the future system. He then listed a few different scenarios to show how much variability there will be, along with the complexities of looking into the future.

Q1. Flora Flygt said when getting planners to think about storage there need to be scenarios. The two types of planning are reliability and economic. From the reliability side, she said planners will only look at peak load 20 years out and do not utilize scenarios. But for economic planning, scenarios are utilized. Ms. Flygt views resilience as a reliability issue. The resilience tools being used are far from looking at scenarios for trying to plan ahead. She emphasized the importance of understanding the end goal.

Mr. Moreno followed up by saying that the pillar used to be titled “Long-Term Planning and Scenario Analysis” and that scenarios still play a huge part. Many reliability issues are driven by the insufficiency

of looking at the peak for reliability planning, specifically the speed of change between the peak and profile.

Q2. Ms. Phillips said when considering various aspects of energy storage for long-term planning operation markets, they must make sure there is a clear ending across all the use cases. This begins at the interconnection process because that will dictate other technology later in the grid.

Mr. Moreno said this was quite helpful and it is not something he knows much about. He added if members know about how restrictions in the interconnection agreements affect future uses, he would appreciate following up with them.

Q3. Sheri Givens said they are thinking about storage as a non-wired alternative. She used the example of Nantucket Island because its load is five times larger in the summer when people migrate there. On the hydrogen side, they are looking at what their system can handle and how they can utilize it as storage with more renewables coming online. Ms. Givens said hydrogen is missing in the analysis being done to scale occurring in Asia and the EU. She recommended education of regulators, consumer advocates, and overall communities to understand potential benefits.

Q4. Ms. Reder said there is a desire to define how the grid might evolve. For example, there may be microgrids to interact with one another and under this scenario both distribution and storage would play a different role. Ms. Reder urged DOE to define different scenarios for how the distribution will evolve.

Mr. Moreno said a few people at PNNL are looking at this. He said the grid would look quite different if storage was integrated from the beginning. Mr. Moreno mentioned areas in Africa where they are looking at grid development, which would truly be starting from scratch.

Q5. Dr. Bialek asked about the role of third parties for storage. Involvement of third parties would impact availability along with the overall concept of how storage is used. He also commented on the evolving customer space and the need to address how customers will use storage. His experience is that the assumptions today will be quite different once customers start buying, because the customer will have ownership and act differently.

Mr. Moreno replied that having insight into customer groups is where DOE can improve and has the least amount of connections. He would appreciate feedback from members involved with the customer side.

Demand, Demand Response, Buildings, and Energy Efficiency

Mr. Moreno provided a brief introduction to the Demand, DR, Buildings, and Energy Efficiency slide.

Q1. Mr. Kressner said state regulators are actively trying to develop alternatives to gas technology to offload the need for additional distribution capacity. Part of this stems from the goal to eliminate fossil fuels. Overall, this will shift what is being delivered through the gas pipeline.

Q2. Mr. Mroz said to keep in mind that states no longer do planning—companies now do this. He said to think about what DOE can give to commissions or planning offices. The key is to give them the tools for how to interact with industry, and industry will come back with plans.

Q3. Mr. Ayers encouraged DOE to be proactive when reaching out to regulators. DOE has given helpful presentations to commissioners and staff in his state about storage. The next step is unlocked when sitting down with regulators and having an educated, technical dialogue.

Q4. Mr. Heyeck described the process of a building with a solar panel producing DC that is converted to AC and eventually back to DC. He said there is a need for a dual system to plug in DC directly.

Q5. Mr. Adams said there is a desire for individuals to own their own energy resources. The cost-effectiveness arguments show this does not make sense, but the emotional desire supersedes costs. At this point, there are too many barriers to make this happen at an affordable level. The biggest problem is getting capital investment in their resources. Mr. Adams suggested that DOE think about the marketing being done to encourage this and to identify barriers to individuals and businesses.

Q6. Mr. Cummings brought up the unintended consequences of overloading the electric grid. Even if one form of energy is unavailable, people will just use another that could potentially be even worse.

Q7. Mr. Morris said there will be a stacking order within buildings to interact with the grid as a storage medium. The value question will be the resilience piece inside the building. If there is no value from the grid coming into the building, then it is even more crucial to know how much storage is needed to operate critical functions in the building. From a policy perspective, a growing number of cities say they will be carbon neutral by “x” year which will bring up problems in the energy transition. The existing infrastructure that will have to be replaced is not factored in, and storage will play an important part in this phase-out.

Mr. Moreno closed this slide with an open invitation for members to follow up with him about any additional insights they may be able to add.

Near-Term Planning

Mr. Moreno introduced the Near-Term Planning slide by saying there is certainly overlap between near-term and long-term planning, but near-term focuses directly on the day-to-day operations.

Q1. Ms. Phillips asked what hybrid resources look like from DOE’s perspective.

Q2. Mr. Heyeck said to add black start.

Q3. Mr. Weaver said that when talking about differing or eliminating new T&D investments, his company has looked into some and there are good ones. The new investments will provide incremental reliability with new tech that a local area has been waiting for. Bridging this with storage will go beyond incremental reliability.

Mr. Moreno asked what utilities have real-time insight into where congestion or potential failure of lines is most likely to happen. This way they would be able to locate storage quickly and nearly automatically.

Q4. Mr. Weaver responded that he was talking from a distribution perspective, not transmission. His company has a lot of insight on this.

Q5. Ms. Phillips said they do not have as much visibility as they would like, but if they did it would help show alternative options to their present status.

Q6. Mr. Hudson said the duck curve is getting fatter. There is a lot of information about 4-hour storage, but a gap in the market for 8- to 12- hour storage.

Mr. Moreno clarified that 8- to 12- hour storage is helpful for pump hydro as well. His office is doing a long-duration storage methodology geared to pumped storage. He offered to provide Mr. Hudson with this study.

Q7. Mr. Morris noted that there is interesting data from Hawaii about grid-defection price points from various costs. He added it is important to understand grid-defection costs for long-term planning.

Q8. Dr. Bialek said, in the context of wires versus storage, it is not necessarily an exact comparison. Part of the challenge is having the granular knowledge to identify the needs. He added that there will be challenges about the assumptions being made and how the technology will eventually be used or the service it provides.

Q9. Drew Fellon said they've had a lot of success in New York City driving the installation of thermal storage. This has allowed deferred maintenance while leveraging renewable technologies.

Q10. Bryan Olnick said there are a lot of n minus 1 conditions already planned for in the near term when looking at large cities. With n minus 2 situations popping up, he has found that battery storage would be a valuable asset to have.

Q11. Mr. Kressner commented that one of the disadvantages to grid alternatives is often they are too lumpy. He provided the example that investments are only 150 MW or 250 MW when often all that is needed is 5 MW–10 MW. He suggested developing modular approaches, such as a 30 MW–40 MW substation, because the door will open to more possibilities.

Chris Lawrence will set up a follow-up Webex to continue this conversation to discuss the slides that were not presented today.

Policy, Regulations, and Markets

Mr. Moreno introduced the final slide presentation saying it was a perfect way to wrap up the session because it touches on all the other tracks. DOE is not able to dictate the market structure at all but does have the ability to make sure those designing market structures have all the resources they need to make informed decisions.

Q1. Mr. Weaver advised that DOE has to understand the business case of a utility, developer, and customer for them to pencil it into their plans. DOE has to then figure out the components these three cannot get and what is preventing them from penciling them in. He said the policy and regulations would help utilities, developers, and customers be more successful. Mr. Weaver clarified there are multiple components that need to be considered and then a myriad of benefits. The golden question for DOE to address is how to make it so all the benefits make their way into the business cases for each of the classes.

Q2. Mr. Heyeck commented that there is a plethora of market opportunities. There will be a work product coming about state-federal coordination. For procurement policy, Mr. Heyeck said there should not be a common denominator for storage devices due to national security. He also suggested that safety codes include fire codes.

Q3. Ms. Phillips said the timing is concerning for PJM because they are on the hook for compliance efforts regarding Order 841 (State of Charge). They have received feedback about Order 841 that leads into potential product offerings for various resources. Overall, PJM is already thinking through some of these issues but cannot think of all of them. PJM would be happy to further discuss this topic with Mr. Moreno. Ms. Phillips would like to create a group to address this in the coming weeks or months.

Q4. Mr. Adams gave context on ERCOT (the Electric Reliability Council of Texas). ERCOT has higher penetrations and zero marginal costs of energy resources since the only source of revenue for their resources is energy prices. The energy prices are minus 20 in a lot of cases, which brings up the issue of building capacity. Mr. Adams suggested there can be either a capacity market or an energy-only market that puts a premium on scarcity. ERCOT has chosen the latter, operating in an energy-only market. He concluded that premiums have to be put on for scarcity in order to allow building of capacity to be profitable in an energy-only market.

Q5. Mr. Morris said there is a retail market now but the distribution market is not listed. This is where customers can choose to hook up their storage to the distribution system. He gave the example that in Puerto Rico a lot of people who have storage do not connect it to the grid. He added that sometimes there is no value connecting to the distribution system.

Q6. Dr. Sioshansi added there is a potential third way to define new market products that could supplement what either capacity or energy-only markets do.

Mr. Heyeck concluded this panel saying this new format “hit the mother lode.” It allows the EAC to get into the thought process of DOE. In the future, he suggested having a single-issue Webex like the format done today. Mr. Heyeck also highlighted that the presentation hit all sectors.

Mr. Lawrence agreed to the Webex idea and emphasized his vision on making actionable and measurable changes for these programs. Mr. Lawrence thanked the panelists and wrapped up the session.

Energy Storage Subcommittee Update

Mr. Heyeck pivoted to the subcommittee updates. He reminded members that the next meeting is Thursday, May 28, and Friday, May 29.

Dr. Sioshansi started with three main updates from the committee, on 2020 Biennial Storage Review, 2021 Biennial Storage Review, and the Panel on Long-Duration Energy Storage. The subcommittee is wrapping up the review of all DOE's energy storage activities. He gave context that the Energy Independence and Security Act of 2007 (EISA) states that the subcommittee has to provide an assessment to the Secretary of Energy about the efficacy of R&D activities meeting DOE's goals. He clarified that they are looking across all program offices and using a broad definition for energy storage. Dr. Sioshansi proceeded to highlight reviews that EAC has done over the past several years, including taking a deeper look into the 2020 review. There will be a full committee vote in May 2020.

Dr. Sioshansi shifted to discussing the 2021 Biennial Storage Review saying this is the goal-setting process. At a high level, the 2021 assessment aligns well with ESGC because DOE is already doing a 10-year strategic roadmap. Dr. Sioshansi concluded by giving an update about the Long-Duration Energy Storage panel for the May meeting. This stemmed from discussing the idea of power-to-gas energy storage. He outlined the roadmap for planning the panel.

Mr. Heyeck and Dr. Sioshansi discussed some of the details about the planning process for the 2020 Biennial report and May Long-Duration panel. Mr. Heyeck asked Dr. Sioshansi to send the committee the template to review. Dr. Sioshansi said the webinar is the crux of the panel, because once it occurs the members will be able to identify speakers and have a strong idea of what the panel entails.

Ms. Denbow said she has speakers lined up for the May panel. Ms. Givens will also be part of this planning process and will help identify speakers. Ms. Denbow described her vision for the upcoming panel. She said natural gas will be integrated into the discussion along with hydrogen.

Smart Grid Subcommittee Update

Mr. Adams provided an update on the Grid Planning with Renewables and DER panel for May. He asked DOE to participate in the planning process to better align the panel with Assistant Secretary Bruce Walker's vision. This panel will be led by Ms. Flygt and Mr. Ayers and has already been approved by EAC leadership. He then brought up the state-federal coordination track led by Dr. Bialek and Mr. Morris. They are looking for an October panel, but nothing is planned yet. He noted there is a lot of member interest on this topic.

Mr. Adams then talked about Big Data Research, Part III. He expects there to be an October panel about this, led by Dr. Kezunovic. The aim is to have a template ready for May and this panel will close out the big data topic. Last, Transmission-Distribution Coordination was discussed. It is led by Dr. Bialek and Joe Paladino, with the scope still in the works. Mr. Adams noted that ERCOT and others have received many applications about this.

Mr. Heyeck emphasized the importance of the subcommittee calls because that is where the panels are really planned. The calls are also a good check-in with DOE to make sure the proposed panels align with DOE's operations.

Public Comments

There were no public comments received.

Wrap-Up

Mr. Kosak thanked everyone for taking time out of their schedules to be here. He reiterated his vision of the Transmission Permitting and Technical Assistance (TPTA) division forming an even stronger bond with EAC. The next step is that Mr. Kosak will send TPTA's updated vision to the EAC once it is finished.

Ms. Reder emphasized the great participation noting that the committee seemed rejuvenated. She said the lightning-round format will definitely continue for future meetings. Ms. Reder said there should be a lot of follow-up given the amount of input and outstanding interest of the GMLC and ESGC.

Mr. Heyeck concluded the meeting.

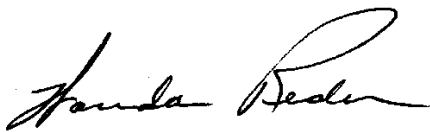
Respectfully Submitted and Certified as Accurate,



Michael Heyeck
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04/30/2020

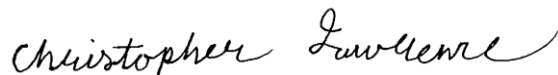
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