



**U.S. Department of Energy
Electricity Advisory Committee Meeting
NRECA Conference Center
Arlington, VA
March 26, 2015**

Summary of Meeting

PARTICIPANTS

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TIMOTHY HEIDEL
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Welcome, Introductions, and Developments since the September 2014 Meeting

Mr. Richard Cowart, Electricity Advisory Committee (EAC or the Committee) Chair, and Mr. Matthew Rosenbaum, EAC Designated Federal Officer (DFO), welcomed the Committee. Mr. Cowart invited all members to introduce themselves.

Mr. Cowart reviewed the agenda and explained that one document is up for formal approval by the Committee (i.e., EAC Smart Grid Research and Development paper). He noted that all discussion will be recorded by transcript and made available to the public.

Update on the U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability's Programs and Initiatives

Patricia Hoffman, Assistant Secretary, Department of Energy (DOE) Office of Electricity Delivery and Energy Reliability (OE), provided an update on current OE initiatives.

The Office of Electricity is focused on priorities to help the industry advance grid modernization. These advancements are established by researching ways to better engineer system improvements. Ms. Hoffman highlighted OE's support on the Quadrennial Energy Review (QER) and the Quadrennial Technical Review (QTR). She noted that the QER will be published in the near future and the QTR will be published around a May timeline. The Office of Electricity also focuses on the issues of cyber and physical security.

Ms. Hoffman provided an update on the American Recovery and Reinvestment Act of 2009 (ARRA) programs, noting that several cost-benefit analysis have been completed.

Ms. Hoffman addressed OE's challenges and needs. The primary challenges include limited resources and time. Ms. Hoffman stated that once the QER is published, OE will establish a set of recommendations. She welcomed input and advice on priorities for OE.

Opening Remarks and Update on the DOE Quadrennial Technology Review

Dr. Lynn Orr, DOE Undersecretary for Science and Energy, provided remarks on the future of the grid.

Dr. Orr began by providing an update on the energy sector and its programs. DOE is making critical energy choices driven by the need to reduce greenhouse gas (GHG) emissions, while protecting the economic security of the nation. Dr. Orr commented that the President acknowledged the importance of energy and has made initiatives to reduce GHG emissions. He highlighted the dramatic transitions within the energy sector over the past years (e.g., natural gas boom). Dr. Orr noted that there is an abundance of primary energy sources and stated that DOE is tasked with finding a way to establish a portfolio that transforms energy and establishes a time scale for application.

Dr. Orr described a future grid that will require more resources, cross-cutting efforts, and next scale computing. He highlighted the power consumption issue and explained the need to be more efficient on how electricity is used. Dr. Orr addressed the QER and QTR. The QER is an attempt to look at the state of the energy infrastructure as it stands now to identify what sectors are vulnerable and establish policies to address those gaps. The QTR will look across the uses for primary energy (e.g., manufacture goods). The cross-cutting initiative plays a critical role of bringing science and energy programs together.

Dr. Orr explained that the investments made by DOE to deploy technology need to be paralleled by the regulatory and business environments to move forward. He commented on the FY16 budget and he encouraged stakeholders to address Congress to show the importance of DOE's work. Dr. Orr welcomed feedback from the EAC.

Mr. Morris said that states are struggling with recognizing utility adaptation rates and asked when DOE plans to have tools to assist with the process. Dr. Orr responded that DOE is currently working on creating tools to assist states, but cannot provide an accurate timeframe for completion. Ms. Hoffman added that DOE is setting up a process to examine open source tools and other parallel processes.

Mr. Ball requested additional information on the fundamental research at DOE. Dr. Orr stated that the National Academy of Engineering identified the grid as one of the most important innovations of the 20th century. DOE is challenged to create the grid of the future.

Mr. Bose commented that the budget for the grid system often falls through the cracks. Dr. Orr confirmed that DOE needs to improve their understanding of the complex link systems. He noted that additional information is included in DOE's research portfolio.

Briefing by the National Laboratory Consortium Representatives

William Parks, Senior Technical Advisor for DOE OE, presented an update on grid modernization. He began the update with an overview of the grid modernization cross-cutting initiative. One of the new cross-cutting programs was requested by Secretary Moniz in the FY16 budget at \$350 million and includes all grid related program activities within OE. Mr. Parks explained the formation of the Grid Modernization Laboratory Consortium (GMLC), which consists of 14 national laboratories. The GMLC will develop a

multi-year program plan (MYPP) that aligns activities across the laboratories and recommends DOE programs FY16 activities through one aligned Annual Operating Plan.

Mr. Parks provided an overview of the GMLC organization and explained its connection to DOE strategies for grid activities. He highlighted the six activity areas and summarized MYPP major DOE achievements for 2020 that will be integrated across the six key activity areas. Mr. Parks reviewed three major DOE achievements including lean reserve margin grid operations, clean resilient distribution feeder, and modernized grid planning and analytics platform.

Mr. Parks provided an overview of the MYPP outcomes and impacts. The new cross-cutting effort will build on past successes and current activities to help the nation achieve at least three key outcomes within the next ten years. If achieved, these three key outcomes would yield more than \$7 billion in annual benefit to the U.S. economy. In addition, efforts will ensure the future modernized grid is a flexible platform for innovation by entrepreneurs and others who can develop tools and services to empower consumers and help them make informed energy decisions.

Mr. Zichella commented on the lack of environmental indicators included in the MYPP outcomes and impacts. Given the GHG goals and trajectories, he stated that one aspect should address environmental performance targets.

Mr. Shelton asked if DOE will be taking a holistic architecture view of the electric system as part of its activities. Mr. Parks confirmed that architecture fueled the QER discussion and will continue to be taken into consideration when creating the future grid.

Ms. Zibelman supported the concept of aligning with the laboratories to establish specific focuses. She said that within the next 5-10 years she will be working towards meeting 111(d) obligations with a system that has very different resources. She asked how the EAC can be most helpful during this process. Mr. Parks responded that having a subgroup of the EAC provide advice on the connectivity back to the states, regions, and private sectors would be helpful. He noted that having stakeholder input is critical and invited all members to help DOE engage in stakeholder communication. Mr. Hudson noted the input from people on a daily basis. Mr. Parks said that activity levels are part of the reason why DOE wants to create a cultural shift to get better information and increase their presence in states and regions. By including the laboratories across the country, DOE hopes to see improved communication. Mr. Thilly suggested including a baseline in the discussion. Mr. Curry commented on baselines and terminology. Mr. Parks agreed with Mr. Curry on the importance of common terminology across the national laboratories. Ms. Hoffman acknowledged the internal debate on regional diversity on the various topics and priorities, which add a layer of complexity to the issue.

Mr. Centolella requested additional information on the discussion of flexibility for innovation. The future grid will be different from what it has been in the past. Mr. Parks agreed that there is no single solution so the discussions of appropriate metrics, remaining gaps, and new ideas are continuing. He assured that the intent of DOE is to be transparent throughout the process.

Mr. van Welie asked about the process for arriving at the three key outcomes. Mr. Parks explained the three key outcomes (i.e., reliable, clean, affordable) began with the challenges identified by the Secretary and were the results of several discussions on what was achievable and cross-cutting. Mr. van Welie supported the cross pollination within DOE. He highlighted the importance of addressing the speed and timeline for changes to the grid. Mr. Parks explained the general concept is to prepare a five year plan, while being cognizant of a 10-15 year focus.

Grid Modernization Session

Mr. Clark Gellings introduced the Grid Modernization Session speakers including: Steven McMaster, DOE Office of Technology Transitions (OTT); Tim Heidel, Advanced Research Projects Agency – Energy (ARPA-E); Paul De Martini, Newport Consulting Group, and Jeffrey Taft, PNNL.

Mr. Steven McMaster, Deputy Director of the DOE OTT, presented on the structure and responsibilities of the newly created Office within the DOE. Mr. McMaster explained that OTT will work to expand on its mission to increase the commercial impact of the DOE’s portfolio of research, development, demonstration, and deployment (RDD&D) activities over the short, medium, and long term. He noted that OTT will develop goals for technology commercialization with business and industrial sectors to achieve maximum benefit and impact. Some goals include assuring more uniformity, considering additional organizational or funding changes that should be made, and meeting congressional and stakeholder expectations. Mr. McMaster expanded on how OTT will work with various program offices, understand how research output fits into technology commercialization space, and reach out and engage with other agencies. Mr. McMaster mentioned challenges that OTT is currently facing, such as measuring effectiveness, as well as finding strategies to coordinate transition technology into the commercial sphere. Mr. McMaster concluded his presentation with a brief mention of cross-cutting programs and success stories to highlight breakthroughs within OTT.

Mr. Tim Heidel, ARPA-E’s Program Director, delivered remarks on the electricity research programs at ARPA-E. He discussed the ARPA-E mission to ensure national, economic, and energy security; maintain technological competitiveness; reduce imports; improve efficiency; and reduce emissions. Since the 1930s, ARPA-E has worked to improve reliability, improve emissions, improve tool utilization to support operations, increase security and resiliency, and enhance flexibility of energy technologies. Mr. Heidel expanded on ARPA-E programs that have been launched over the last six years. Mr. Heidel discussed technical challenges and problems that ARPA-E has faced, such as layering new requirements on a series of old requirements, finding early market opportunity, and defining short-term value to the customer. He elaborated on the challenges that teams face when transitioning from developing a fundamental idea to carrying it through to proof of concept. Mr. Heidel emphasized that big ideas alone are often not enough to have impact on the world, especially if teams are inadequate, if implementation is poor, and if value is insufficient. Mr. Heidel concluded by stating that tremendous consideration is necessary in order to bridge energy technology valleys of death.

Mr. Paul De Martini, Managing Director, Newport Consulting, presented on making the distribution grid more open, efficient, and resilient. Mr. De Martini discussed the three stages of evolution as distributed energy resource adoption grows and market opportunities expand. He also expanded on strategies to develop and operate power grids that focus on customer value and user needs. Mr. De Martini presented on the distribution planning process that incorporates consideration of evolving capacities, variability of systems, a spectrum of possible designs, and strategies for managing dispatch. Mr. De Martini concluded that tremendous opportunities have been made available to leverage work products because of DOE efforts in the national laboratories.

Mr. Jeffrey Taft, Chief Architect of the Electric Grid Transformation and the Energy and Environment Directorate, Pacific Northwest National Laboratory, presented on system architecture as a tool for managing electric grids. System architecture is a model of a (complex) system whose purpose is to help think about the overall shape of the system, its attributes, and how the parts interact. Mr. Taft reviewed the elements of system architecture and the system qualities. He addressed the differences between the consumer and provider viewpoints. Mr. Taft explained that grid architecture is system architecture for power delivery chains that focuses primarily on structure. He explained grid architecture methods and paradigms, noting the need to think differently from large systems. A good architecture is one that meets the needs of the stakeholders (especially the users) to their satisfaction, does not violate established principles

of system architecture, and takes into account the relevant “ilities” by allowing for maintenance, evolution, further development, embedding, etc. as the customer requires. Mr. Taft noted that the architecture must be consumable (i.e., understandable) by the users. He provided several examples of systems. Mr. Taft also summarized the DOE grid architecture work to date.

EAC Members Discussion of Grid Modernization Session

Mr. Gellings thanked the Grid Modernization Session speakers and invited EAC members to ask questions.

Mr. Morris stated that technologies are developed in laboratories and face difficulties in making it in the commercial marketplace. He asked how DOE could leverage other kinds of resources to address this issue. Mr. McMaster replied that OTT is looking for as many accommodations as possible. He also added that OTT is trying different variations of strategies to see which one is most effective.

Mr. Shelton commented that ARPA-E has done a great job with defining conceptual and directional needs and targeting programs to those needs. Mr. Shelton suggested that a clearly-defined present need will help to get through the valley of death.

Ms. Zibelman remarked that a lack of capital is not the biggest problem. She noted that an important challenge is the business model needed to get a product out of pilot and get capital deployed to produce systemic change. Mr. Curry supported Ms. Zibelman’s statement and added that there are presently very few utilities that are willing to invest, and thus, teams are struggling with commercial deployment of a pilot product.

Mr. Coe inquired about how ARPA-E interfaced with DOE. Mr. Heidel responded that many internal briefings and discussions took place. He noted that ARPA-E is still at an early stage with their government role and they are facing difficulties in finding funding and vendors with private money.

Mr. Centolella asked about the coordination framework. Mr. Taft explained that the grid is challenging because there are so many different and complex operating modes. He offered to share information resources and stressed the importance of having a coordination mechanism that can create an interface and specification on what information flows there. Mr. Bose asked if OTT’s work has been used by others. Mr. Taft stated that the laboratory is working to develop control system designs that are validated through simulation testing.

Mr. Shelton asked about the level of principle design. Mr. Taft explained that utilities do not have the luxury of turning off for a while, creating a complex transition plan. He noted that work going forward has to take the whole grid into consideration. The constraints need to be identified to determine what aspects need to change.

Mr. Meyer noted that markets occur where unintended consequences are encountered. Mr. Taft responded that there are a small number of people who know how the market works. If new markets are created at the distributional level there is a chance they will be considerably faster. Mr. Taft explained that markets and operations have traditionally remained separate communities.

Mr. Zichella commented that the solution might include moving to systems that are not unnecessarily complex and reduce complexity when possible. Mr. Taft confirmed that systems should not be made more complex than they need to be, but cautioned that complexity sometimes accidentally evolves. He stated that grid modernization is a good opportunity to relieve constraints and reduce complexity.

Mr. Morris asked about the cost to transition from deterministic to dynamic engineering. Mr. De Martini

stated that his colleagues at the California Institute of Technology reported an additional 10 to 15% incremental distribution to put a layer in system integration cost.

Mr. Popowski inquired about the locational values of distributed energy resources. Mr. De Martini responded that the locational values are separated into energy and capacity value. He noted that he has focused on near-term distribution level values and how far they can extend value into systems.

Mr. Cowart asked about the future role of the distribution utility. Mr. De Martini responded that the role depends on the type of utility and the location within the United States. He provided examples of states that are undergoing restructuring and mentioned states (e.g., California) that had included utility, but is now reconsidering the amount of charging. Mr. De Martini concluded that some individuals are concerned about a potential for divide and that the market may leave some people behind.

Mr. Mount asked about the extent to which Mr. De Martini has looked at avoiding problems regarding how residential customers are viewed within the system. Mr. De Martini responded that this issue has just begun to arise. He mentioned that there is a growing interest to see innovative thinking around how to move to a more service-based model.

Mr. Morgan commented on the substantial evolution in the nature of the grid. Mr. Morgan stated that some of the regulatory structures needed to facilitate some of the transformations are not yet in place. He concluded that balancing the need for which there is no viable market environment needs to be considered. Mr. Heidel added that he has not seen technology that does not have niche application. He stated that the pinpoint can be found if companies listen to customers, even if it means adjusting what the technology looks like.

A member asked if there were existing opportunities and barriers to take new technologies that are not yet commercial and build them into planning processes and market developments. Mr. De Martini responded that planning is technology neutral, it provides a better starting point, and it is centered on defining needs. Mr. De Martini mentioned that the values this technology has is beginning to be understood, which exposes capabilities of the device. Mr. De Martini stated that transmission-level devices will be more exposed in the future. He concluded that the ways in which technology becomes adapted into the mainstream is something that the industry could look into.

Mr. Bose asked whether or not various ARPA-E programs had a better response on the marketplace. Mr. Heidel responded that the answer was dependent on individual teams, individual technologies, partners, and what specific problem was being solved. Mr. Heidel stated that, early on, ARPA-E hardware teams admitted that the hardest challenge to solve was developing software. Mr. Heidel added that once the teams could develop cheap and reliable prototypes, the products would proliferate everywhere. On the other hand, ARPA-E software teams admitted that their challenges were based on the algorithms. Mr. Heidel concluded that it is important to get the two groups to realize that both problems are difficult.

Mr. Shelton applauded the discussion about work that has been accomplished in California. Mr. Shelton mentioned that it is beneficial to focus on making needs transparent, which will introduce opportunities for technology to participate. He concluded that figuring out how to incorporate new technologies and test performance-based rates is essential.

EAC Member Discussion of Cyber Security Working Group Plans

Mr. Andy Bochman, Idaho National Lab, explained the strategy for cyber threat intelligence capabilities in the electric sector. Mr. Bochman began with a background on cyber threat intelligence (CTI). CTI is the determination of the tactics, tools, and procedures (TTP) and associated indicators of compromise (IOC).

He noted that this also includes sharing this information with other potential targets of the threat actors. A CTI Ecosystem has both producers of CTI and consumers of it. Since there are different threat actors associated with different sectors, each sector can be thought of as a unique CTI ecosystem. Mr. Bochman explained that experience from the Defense Industrial Base (DIB) CTI ecosystem shows that a critical mass of CTI producers needs to be established to ensure that CTI is relevant to the sector it is being discovered and shared in. Equally important is that the majority of the sector be setup to be a consumer of CTI. Finally, a fully functional information broker needs to exist to share the CTI between the producers and the consumers.

Mr. Bochman explained that while the electric sector has an active and engaged CTI broker (i.e., the ES-ISAC), most entities are not setup to be CTI Consumers, let alone being able to produce CTI for the sector's ecosystem. While most entities should strive to become a CTI consumer, the sector only needs a subset (a critical mass) of CTI producers to become healthy and self-sustaining. Mr. Bochman summarized where DOE can play a role in maturing the security process.

Mr. Centolella referenced an article that cited only 4% of the information being shared is coming from the electric sector and there is only 20% overlap from one sector to another. Mr. Centolella provided three possible explanations for the data, but noted each explanation was troubling. Mr. Bochman acknowledged the confusion on the statistic and explained that the data is targeted to IT systems because asset intensive industries receive those types of attacks (i.e., laterally).

Mr. Gellings suggested recognizing the coincidence between a physical and cyber-attack. Mr. Bochman confirmed the term "cyber-physical" is often used in that context and is increasingly prevalent.

Mr. Morgan expressed concern over protecting and defending against attacks rather than getting ahead of attacks. Mr. Bochman acknowledged that attacks occur now because of the increasingly interconnectedness of systems and networks.

Mr. Zichella commented on the structural approach of having organized markets and consolidated control areas. He suggested that not all areas will have equal levels of protection given the amount of renewables. Mr. Bochman responded that intelligence is IT oriented instead of sector-specific. He cited the lateral movement of attacks and explained that even in larger markets a lateral attack can move from operational system to operational system.

Mr. Ball encouraged the use of peer-to-peer information sharing between organizations. Mr. Bochman acknowledged the awareness and acceptance that addressing threats is a continual process and discussed ways to get feedback on preparedness.

Wrap-up and Adjourn Day One of March 2015 Meeting of the EAC

Richard Cowart, EAC Chair, thanked everyone for their comments and adjourned the first day of the meeting.

Respectfully Submitted and Certified as Accurate,



Richard Cowart
Regulatory Assistance Project
Chair
DOE Electricity Advisory Committee

5/12/2015

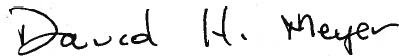
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