U.S. Department of Energy
Electricity Advisory Committee Meeting
NRECA Conference Center
Arlington, VA
June 1, 2016

Summary of Meeting

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Speakers, Guests and Members of the Public:

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Welcome, Introductions, Developments since the March 2016 Meeting

Rich Cowart, EAC Chair, and Matthew Rosenbaum, EAC Designated Federal Officer (DFO), welcomed all of the EAC members to the meeting for the U.S. Department of Energy (DOE or the Department).

Mr. Cowart reminded meeting attendees that transcripts were being prepared, anyone can sign-up to make a comment during the public comment period that would be held at the end of the second day of the meeting and asked the EAC members to introduce themselves.

Update on the DOE Office of Electricity Delivery and Energy Reliability's Programs and Initiatives

Honorable Patricia Hoffman, Assistant Secretary for Electricity Delivery and Energy Reliability, DOE, thanked all of the attendees for coming to the meeting and thanked NRECA for hosting the EAC meeting. She also recognized EAC members who would be rolling off the Committee, including Richard Cowart, Sonny Popowsky, Wanda Reder, and Gordon van Welie, for their intelligent dialogue, interesting debates and discussion, and all of the activities and topics they were able to address during their time on the Committee.

Ms. Hoffman provided an update on the DOE Office of Electricity Delivery and Energy Reliability Program (OE) initiatives. She began by noting the discussion during the FERC technical conference regarding the transition in the electric industry, the change in generation mix, system flexibility and reliability moving forward, modeling, and system costs moving forward. These topics lead to the Grid Modernization Initiative, which OE is focused on supporting through any helpful means (e.g., tools, technologies, and partnering with states). Cyber security is another important topic for industry and the Department and OE is examining grid resiliency and the risks

industry has to deal with as they examine their investment strategies, especially in the face of hurricane season. She added that OE was signing a Memorandum of Understanding (MOU) with the National Science Foundation (NSF) later and the EAC will hear about the important mathematical and modeling activities that will come from that partnership.

Renewables and some of the activities under the Fast Act are another important OE update. The Emergency Authority is a significant part of the Fast Act that permits the Department to take action pre-events, or in a recovery mode, on the electric grid. Ms. Hoffman noted that the majority of efforts around the Fast Act will be focused on determining what activities can be done to support industry during system events and how to streamline coordination efforts. The Transformer Reserve was another requirement under the Fast Act that requires the Department to come up with a strategy for a transformer reserve by December 15, 2016. DOE is collaborating with FERC and industry and held a technical seminar to discuss the methodology for evaluating the current state of transformers in the U.S. The Electricity Sector Coordinating Council (ESCC) is a strong team, including partnerships with national labs, academics, and industry that aims to determine the technical needs. The ESCC recommended DOE incorporate the projected state of industry five years from now with the current state into their thought process, which would require continuous dialogue from industry on the actions they are taking to minimize system risk.

Ms. Hoffman noted the progress she has seen with transmission and explained DOE's pre-application process for getting transmission cited and permitted that DOE hopes to finalize in the fall of 2016.

Ms. Hoffman thanked the people who participated in the Clear Path emergency response exercise in Washington State, which aimed to educate the Federal government on some of the electric sector's processes, discussions, and information used for coordination during an emergency response and to educate the electric industry on some of the questions the Federal government asks during emergency events.

Lastly, the U.S. government is working with Canada on a joint U.S.-Canada grid security strategy, which was recently announced by the White House and Prime Minister Trudeau. DOE is working on security baselines and grid security under the QER and joint effort so the EAC should expect to see some activities coming out of those efforts in the near future. Ms. Hoffman summarized that the EAC topics were relevant to DOE, especially as the current Obama administration closes out and DOE determines what to focus on moving forward.

Mr. Cowart followed up Ms. Hoffman's comments by recognizing her dedication to the Committee and congratulating her and her colleagues for engaging in dialogue with the Committee.

DOE Presentation, EV Everywhere Challenge

Bob Graham, Director, EV Everywhere Challenge, DOE, provided an overview of the current status of electric vehicles (EV) and the work that DOE is doing.

Mr. Graham began his presentation by providing some background information regarding the process of DOE's EV Everywhere project. The project is a broad effort with six initiatives (i.e.,

state engagement, grid modernization, research and development, EV Everywhere UP, electrification benefits awareness, and workplace charging challenge) and, because the Grid Modernization Initiative (GMI) is a billion dollar effort and electricity is a fuel that will be around for decades into the future, there is a focus on the importance of the market showing that the GMI effort is important for fuel security for vehicles.

Battery price reduction efforts were successful in bringing the price of lithium batteries down to $264, close to the goal of $125, so cost is no longer the issue. Mr. Graham explained that the issue is that the value proposition for EVs has not yet been developed. The market for EVs has remained strong, despite lower gas prices, and government funding for EVs has been maintained through the Bush and Obama administration. Additionally, EV charging stations are all and workplace charging is spreading across the country. The key for charging infrastructure is to ensure there is a good business model behind it (e.g., sales tax revenue, green image, and retail attraction). Charging stations have not yet impacted the distribution systems infrastructure but, as a utility industry, Mr. Graham understands and can predict the load requirements of the EV system and utilities know how to handle loads, which was exemplified by the utilities' ability to handle the introduction of air conditioning onto the distribution system. The infrastructure is not a problem but industry must be involved in EV charge station planning discussions, which is being facilitated, in part, by the Memorandum of Understanding (MOU) signed by Secretary Moniz and Edison Electric Institute that aims to identify the barriers and concerns and ensure that utilities are engaged and involved in EV charging station discussions.

Mr. Graham described the awareness campaign to get uninterested people (who are the majority of the populous) interested in EVs and get the market to realize that the EV market is happening. The campaign involves five message boards, industry engagement in the campaign, and the Clean Cities Coalition, which promotes the benefits of EVs across all communities to reduce the bipartisan viewpoint in the U.S. Tesla data found that market interest is first driven by consumer interest, followed by car performance and easy charging. Mr. Graham concluded by noting that additional data and information is available on EV Everywhere website.

Ms. Phyllis Currie, Mr. Graham, and Mr. Tim Mount discussed changes in funding availability from gas taxes due to the move to EVs and municipal incentives, including monetary (e.g., tax revenue and payable on the hood at the time of buy) and non-monetary incentives (e.g., California's carpool lane sticker and free charging). Mr. Graham explained that incentives are important in the near-term but the goal is to strengthen the value proposition so incentives are not needed, unless incentives are important to the business model. They agreed that electric vehicles should pay their way and be part of the mainstream market, which is reflected in the EV Everywhere program.

Ms. Hoffman and Mr. Graham discussed the standardization of EVs and charging stations across the country and how addressing the standardization issue with the DC fast charging systems could help the EV market, including NYSERDA's efforts to standardize billing and address the need to standardize standards and interoperability across the country.

Ms. Janice Lin and Mr. Graham discussed the level of engagement of EV Everywhere with charging developers and manufacturers and the level of charging station infrastructure ownership.

Mr. Graham explained the three filings with the California Public Utility Commissioners that took three different approaches to utility engagement and ownership and operation of charging infrastructure (i.e., own, stub up, and a hybrid approach). The facts that utilities need to serve all and someone needs to maintain the charging system long-term are issues that must be considered and EV Everywhere is using lessons learned from the three approaches and modeling to inform states as they make their business model decisions.

Ms. Sue Tierney, Mr. Mount, and Mr. Graham discussed the possibility of charger entities aggregating EV batteries to be part of grid infrastructure as an electricity sink (e.g., coordinate with renewable generation or participate in smart charging). Mr. Graham explained the migration of lithium ion batteries and their management control systems out of cars to serve as stationary storage on the distribution system and the importance of managing EV charging through education and price signals and use available technology to utilize the grid appropriately in order to maximize the grid benefits. Mr. Granger Morgan and Mr. Graham discussed the need for subsidies and incentives for the EV market and PUC mandates for smart charging. Mr. Graham explained that mandates would not be needed because smart charging can be achieved by developing the value proposition and through education and awareness of how the grid works and when to plug in, to which Mr. Morgan added that process might take more time than we have to lower emissions.

Ms. Carmody and Mr. Graham discussed some of the barriers to equal access to EVs in older, more densely populated areas like Baltimore, MD and Mr. Graham explained that the shorter trips with more light weight vehicles that are projected to occur in those areas are ideal for EVs but access will largely depend on the city's willingness to participate. He added that factors such as traffic patterns, pod locations, rural participants, dual system use, access to fast charging systems, vehicle price, and information dissemination must be considered and EV Everywhere does include environmental justice zones and economically depressed communities as a major focus.

Mr. Ake Almgren and Mr. Graham discussed the roadblocks for the EV market to grow at an exponential rate, including participation from the auto industry and utilities, education outreach to ensure consumer awareness of EV benefits and grid operations, and creation of the value proposition to create demand.

Mr. Cowart highlighted the possibility of an alternative low emission future, such as fuel cells and hydrogen vehicles and Mr. Morgan asked if DOE had similar efforts promoting alternative low emission technologies. Mr. Graham explained the factors pushing the future towards EVs (e.g., the existing electric infrastructure, the huge investments in electricity, and the movement towards driving habits that are ideal for EV) but noted that EV success pushes the costs of the fuel cell vehicle down and the ideal car would be a hybrid between the two. The Clean Cities organization is active in alternative fuels and DOE has an efficiency engine program and major fuel cell effort. Mr. Graham summarized by underscoring the importance of people buying the right car for their needs.

Mr. Paul Centolella and Mr. Graham discussed the shift in driving patterns towards more ride sharing, shorter trips, and autonomous cars, particularly in urban areas, and how those factors will drive cars to be smaller and lighter, all of which are ideal for EVs and will increase the size and of

the EV market. Mr. Graham added that utilities need to think about grid resiliency in the face of increasing EVs, particularly with autonomous cars.

Mr. Carl Zichella asked if DOE has selected certain geographies to focus on or get ahead of high penetration of renewables as potential area for high penetration of EVs and how to stabilize the grid in those areas. Mr. Graham explained DOE's efforts to provide states with as much information as possible to ensure that they make the best decision for utilizing the grid, including the infrastructure study in Massachusetts and dissemination of information that came from the California Plug-In Vehicle Collaborative and the three CUS filings.

Presentation on NAE Report: Analytic Research Foundations for the Next-Generation Electric Grid

Ralph Masiello, Quanta Technology and John Guckenheimer, Cornell University, presented on the National Research Council Committee Report.

Mr. Guckenheimer began the presentation by providing the National Research Council Committee (NRCC) membership, management structure, and charges from DOE. The Committee gave advice in how to address critical areas for the next-generation electric transmission and distribution system and to build the interdisciplinary community to achieve that goal. He explained the report context that contained the major topics of the accelerated pace of change in the physical structure, grid organizational issues associated with changes in the physical infrastructure, and the key areas of mathematics that are needed to help the industry evolve with these changes.

Mr. Guckenheimer provided and outline of the report, reviewed the topics covered under each of the eight report chapters, and noted that the Committee tried to write the report in a way that would be usable to both the scientific and engineering community. The first four chapters provide the report background, the fifth chapter covered the uncertainty in different future scenarios, the sixth chapter identified the math needed to help the evolution of the grid, the seventh chapter provided case studies to support the report, and the last chapter discussed building a multidisciplinary research community.

Mr. Guckenheimer summarized the key points of the report recommendations, which include developing an open source software for the electric grid; generating publicly available synthetic data libraries that can be used by the research community; make the information and text file formats used for utility computations that establish plans for surviving outages fully public; develop and test a full AC optimal power flow (ACOPF) model; support research on data-driven approaches to power system operations, planning and maintenance; prioritize research on the theory and computational methods from machine learning, dynamical systems, and control theory, and establish a geographically distributed power system research center that will serve as the interface between the math and power system research communities.

While the MOU signing occurred, Mr. Ali Ghassemian explained that the MOU was a result of the National Science Foundation recommendation 8 asking the DOE to sponsor the development of an open source library of simulation software intended for the next-generation electric grid research community. The MOU signing signified the intent to invest in fundamental mathematical

and statistical algorithms to enhance the reliability, resiliency, security, and efficiency of electric power grid. Patricia Hoffman, Assistant Secretary for the Office of Electricity Delivery and Energy Reliability, and also from NSF, to have Fleming Crim, Assistant Director for Directorate of Mathematical and Sciences signed the MOU. Mr. Cowart then turned the meeting back over to Ralph Masiello to describe the NRCC report recommendations in more detail.

Mr. Masiello provided an overview of some of the specific challenges to analytical development in the power system language, including the lag in common data formatting behind new research, the lack of accessibility to commercial databases, and the small commercial analytics market that likely will not be able to support R&D needs. He further explained the challenges to the electric power environment, including the separation of the distribution and transmission systems and segregated time domains used in dynamic analysis. Mr. Masiello provided specific examples of analytical issues that pose challenges to fuel availability for generation, market design and operations, and grid support. He concluded by noting that all of the ISOs use the same math and solver engineers so there has been a focus on uniting the math and engineering groups together to determine other optimization math available to solve these problems.

Mr. Clark Gellings, Mr. Masiello, and Mr. Guckenheimer discussed the interactions between the three domains of the power system (i.e., transmission, distribution, and utilization) and the research into restructuring the hierarchy of the power system in order to change how the transmission and distribution systems interact so the entire power system can be integrated in the planning space. Mr. Mount noted the two methods of system operations (i.e., overseeing everything on the grid and hierarchical operations) and asked who would act as the distribution system operator and if the system would be operated from the system or customer point of view. Mr. Guckenheimer and Mr. Masiello explained how storage could play a critical role in future grid operations, even at current prices, but added the caveat that the electric power system needed more data to further develop the demand curve in order to increase economic efficiency through storage.

Mr. Mount. Mr. Guckenheimer, and Mr. Masiello discussed the market time steps, including the differences and interrelationship between the different time steps and the assumptions used in optimization software dealing with markets and the powerful computational resources that are needed to operate the system in real-time. Mr. Masiello added that market time steps issues are not technical but are more around the way things are done.

Mr. Granger and Mr. Guckenheimer discussed recommendation six, to support research on extended dynamical systems theory. Mr. Guckenheimer explained the bifurcations theory used to describe grid blackouts and how that theory becomes obsolete when switches are added or becomes drastically different with different time series, which is quite interesting from a mathematician's perspective. Mr. Guckenheimer added that putting more resources into this research would make a significant progress in this effort.

Overview of DOE Grid Modeling Efforts & Memorandum of Understanding

Ali Ghassemian, Advanced Grid Modeling Program Manager, DOE, began his presentation with an overview of the current state of the electric grid and explained the many factors that are driving the grid to be more complex than ever before (e.g., increased demand, environmental and reliability

regulations, aging infrastructure, etc.). He explained some of the challenges associated with today's grid (e.g., making sense of the enormous amount of data the grid generates in real-time from a grid operator perspective, the increased demand that causes utilities to operate at a greater level of uncertainty, and managing uncertainty) and the solution of developing faster computational and analytical algorithms for real-time grid operations analytics to ensure reliability, resiliency, security, and efficiency.

Dr. Ghassemian explained the Advanced Grid Modeling (AGM) Program objectives (e.g., development of software, hardware, real-time visibility into grid conditions, and improvement of grid operations modeling tools) that will ultimately improve system reliability, security, and flexibility. He further explained how AGM planned to achieve those objects by working within three main areas (i.e. data management and analytics, mathematical methods and computation, models and simulations) and utilizing their multiple partnerships. Dr. Ghassemian provided some examples of how AGM currently worked and explained some of their projects. He noted that the Grid Modernization Laboratory Consortium funding would provide critical R&D support to aspects of the AGM program, particularly load modeling and protection.

Dr. Ghassemian reviewed DOE's three charges to the National Research Council (NRC) and underscored the NRC's recommendation 8 that asked DOE and NSF to sponsor the development of an open-source library of simulation software for use by the next-generation electric grid research community and summarized what the reported defined as important factors to include in the open-source software. Dr. Ghassemian concluded by providing a summary of future AGM work, including defining future uncertainties, fully addressing the dynamic and uncertain behavior of the system, grid operations and planning risk management, and manage uncertainty in all aspects of models.

Ms. Hoffman explained that DOE was still trying to build a constituency for this important but relatively under the radar issue of developing models and computations for electric system next-generation research and Ms. Tierney added that recommendations from DOE about how they could help to build a constituency around this issue would be helpful. Ms. Tierney, Mr. Centolella, and Mr. Mount all agreed that the efforts to develop advanced grid modeling were very important. Mr. Morgan recommended DOE pursue a strategy to find the best actors, both within and outside the national labs. Mr. Centolella recommended DOE examine areas involved in solving the dimensionality problem in the distribution system and dynamic load modeling and big data analytics be a larger part of the grid modeling effort. Mr. Mount added that he hoped new methods for designing and managing distribution systems more effectively would be emphasized. Mr. John Adams added that the dimensionality problem is also a business problem, in addition to a computational problem, that reduces the industry's ability to keep up with system changes.

Mr. Jeff Morris and Dr. Ghassemian discussed the system transition from a reactive and rescue system to a predictive and preventative system, particularly around data privacy issues (e.g., data collection and sharing). Dr. Ghassemian explained DOE's efforts to promote industry and utility collaboration to help address some of those issues.

Ms. Wanda Reder stated that working across departments and with the National Academy to frame multidisciplinary scopes and big problems is a best practice that should be further leveraged.

Mr. Adams asked if everyone agreed on the proposal to share power flow cases and data and Ms. Hoffman responded that DOE would need to figure that out.

Transactive Energy Panel

Paul Centolella introduced the Transactive Energy Panelists including: Dr. Lynne Kiesling, Associate Professor of Instruction in Economics at Northwestern University, Dr. Richard Tabors, with the MIT Energy Initiative, Dr. Srinivas Katipamula, Staff Scientist at PNNL, and Curt Kirkeby, Fellow Engineer at Avista Utilities.

The first panelist, Dr. Lynne Kiesling, Northwestern University, presented on the conceptual economics perspective of Transactive Energy.

Dr. Kiesling discussed the challenges that are involved in the Transactive Energy space, including research, and computational and modeling aspects. She defined Transactive Energy as "techniques for managing the generation consumption or flow of electric power within an electric power system through the use of economic or market-based constructs while considering grid reliability constraints. Dr. Kiesling went into breaking down the definition she provided and noted the fusion of technology and economic aspects that underlay Transactive Energy.

Dr. Kiesling explained the complex decentralized, bottom-up decision making that is involved with Transactive Energy. She also described the importance of using the idea that parties will engage in mutually beneficial exchange through price-mediated transactions which will enable coordination. Dr. Kiesling also discussed how transactivity can become useful when creating a set of institutions to define use rights within the grid.

Dr. Kiesling described what a fully transactive system looks like in terms of price and the economic perspective. She noted that the intersection of Transactive Energy and the transactive capability of consumers with autonomous price responsive devices and the contracts that enable them to see the price signals, is very compatible with the Internet of Things. Dr. Kiesling explained that microgrid around the distribution edge are also a good application of transactive technology. Additionally, she believes that the idea of Transactive Energy is fundamental to the kind of heterogeneity seen in the vision of the integrated grid. Dr. Kiesling closed her presentation with discussing some of the challenges and implications of Transactive Energy, including how the grid will work with grid management architecture.

The second panelist, Dr. Richard Tabors, MIT Energy Initiative, discussed the work he has been involved in related to valuing distributed energy resources using distributed locational marginal pricing, and taking it from the transmission system down to the meter.

Dr. Tabors explained the importance of three products in the distribution system – real, reactive, and reserves. Dr. Tabors discussed how to deal with reactive power in the world of wholesale. He also explained why one should care about the distribution system. Which is because the differences in the locational value of energy in the distribution system is quite dramatic going through the day.

In New York, Dr. Tabors and colleagues tried to correct vocabulary because it was not exactly right from an economic perspective. Dr. Tabors highlighted the fact that the concept and economics of what is a platform is different from the generic vocabulary that is used, and in an economic sense it is a business ecosystem that matches producers and consumers who transact directly.

Dr. Tabors discussed architecture shifting over from having a centralized market to a more peer-to-peer market. As far as next steps goes, Dr. Tabors explained that they have a modeling or analytic system to do the analysis at the wholesale level and then in distribution feeders below that. After running the model and finding the price at each substation node, then it gets fed down into the distribution feeder and a calculation can be done.

The third panelist, Dr. Srinivas Katipamula, PNNL, discussed the challenges and opportunities associated with how and why buildings are critical when scaling Transactive control or Transactive Energy.

Dr. Katimpamula explained that improving the operating efficiency and adding more distributed renewable energy to buildings are two areas where Transactive controls has a huge play. In terms of challenges to deploy Transactive controls in buildings, there

Dr. Katipamula described a number of challenges related to hardware infrastructure. The lack of building automation systems that can easily be leveraged to deploy transactive controls or the Transactive Energy concept, is a major challenge in large commercial buildings. Additionally, Dr. Katipamula explained that there is not one single standard or protocol that is predominant, which makes it difficult to deploy something. In terms of what is needed, Dr. Katipamula explained that in order for Transactive controls to be deployed in buildings, there has to be models that can predict what would happen with the deployment of a Transactive controls strategy. Dr. Katipamula suggested that empirical models that are adaptive and can provide a reasonable estimate of what the load would be in the future.

Dr. Katipamula discussed a number of challenges associated with large commercial buildings. Challenges discussed included diverse and complex HVAC systems, heterogeneous end uses, multiple energy markets and sub-markets within a building, and a long control response.

Dr. Katipamula discussed trasactive control challenges associated with small commercial buildings, which include less complex HVAC systems, end uses are heterogeneous, markets are simpler, loads take several minutes to respond, and fewer loads that can be continuously modulated.

The final challenge Dr. Katipamula discussed is without a market structure there is no incentive for buildings to participate in the transactive control or Transactive Energy concept.

Dr. Katipamuila shifted his presentation to the opportunities that Transactive Energy provides in buildings. The first opportunity Dr. Katipamula discussed is that in buildings where automation systems exist, those can be leveraged to provide transactive controls at very small incremental costs. In those cases, infrastructure is not an issue for those buildings and empirical models that

can be developed and adapted to provide controls. There is also open source scalable platforms that can be integrated with existing building automation systems to provide transactive control for large buildings. For smaller builders they can be used as a control platform to coordinate the loads that exist. Dr. Katipamula explained that buildings have a lot of virtual capacity, and a lot of thermal mass that can be used to mitigate short-term imbalances. Another opportunity is room for investment in infrastructure.
In Dr. Katipamula's closing remarks he noted that many challenges can be overcome, but more pilots and demonstrations are needed, and are currently underway. As part of the Northwest Pioneering Regional Demonstration project, PNNL hopes to create a number of "recipes" or "how-to guides." Additionally, a number of applications are being developed to improve building energy efficiency, increase hosting capacity of renewables and support grid reliability though building-grid integration. Dr. Katipamula noted that the key to widespread adoption of Transactive Energy concepts is a favorable market structure.

The fourth panelist, Curt Kirkeby, Avista Utilities, discussed his viewpoints of Transactive Energy from the utility perspective.

Mr. Kirkeby began by discussing the background and how Avista Utilities is involved with building infrastructure and the foundation that allows for a transactive type of signal to be leveraged. Avista received three grants from ARRA as part of the Pacific Northwest Smart Grid Demonstration Project. The Smart Grid Investment Grant allowed Avista to accelerate the number of customers that were affected; The Smart Grid Demonstration Grant allowed Avista to test transactive control and to test technologies that could be complementary to an automated distribution system; and the Smart Grid Workforce Training Grant allowed Avista to prepare their workforce properly and change work rules.

Mr. Kirkeby shared what the hierarchy looked like with respect to the Pacific Northwest demo. There was node for all 11 participants, and Avista received that transactive signal at the Avista node and there were also non-WSU feeders, all primarily residential customers with smart thermostats. Customers were given $100 incentive to participate on an annual basis. Mr. Kirkeby explained that Avista calculated a locational marginal cost to serve to each customer to make a determination on whether they should or should not raise or lower their temperature as part of a particular received transactive signal. He noted that the key point is that this is not static, it is all predicted forward.

Mr. Kirkeby continued to discuss the Pacific Northwest demo and explained that there were a lot of analytics that provided very precise information about which thermostats should play and whether they would. The biggest challenge was how to place an economic value. Mr. Kirkeby shared that there were five WSU Tiers, which included three tiers of backup generators (two natural gas and one diesel), HVAC, and chillers. A four quadrant valuation system was developed and used for forward prediction every five minutes.

Mr. Kirkeby also shared another project Avista worked on in energy storage, which was funded by the State of Washington and DOE. With partners with the lab, WSU, and industry they were able to put in a vanadium flow battery and look at all the different values that could have been achieved with different modes of operation. In thinking about moving the technology forward, Mr.

Kirkeby explained that they can leverage the foundational and create a shared economy in electricity. He went on to explain that shared economy gets into taking advantage of distributed assets with a transitive energy service that would act in a microgrid mode. As a follow-on, Avista is launching the next project they call the micro-transative grid.

Mr. Kirkeby closed his presentation by adding that it is critical to have grid intelligence that takes all the options for both the prosumer and the utility, honors both of them, optimizes them together for maximum combined value, all at the meter. Avista is looking into whether or not Blockchain on those meters is necessary to facilitate the transactions meter-to-meter because the technology is all peer-to-peer communication capable.

EAC Discussion of Transactive Energy Panel

Mr. Centolella thanked the panel and opened up the floor for discussion and questions.

Ms. Lin asked a question related to the topic of focusing on the distribution system and the load and what the worth is if load could be massaged and a distribution system could be optimized. Mr. Kirkeby and Dr. Tabors provided answers and noted that getting the price right and understanding what the price value cost point is then value can be calculated. Dr. Kielsing added that the important thing about getting the prices right is that it is a market process and any value stack created is going to be a set of estimates of the results that emerge out of that market process.

Mr. Cowart asked how to deal with the question of total disaggregation where every customer is like an Uber customer and is being told minute to minute what the cost is. In response, Dr. Kiseling made the comparison between surge pricing for Uber and surge pricing in the distribution network and that both have the geographical factor. She also noted that the other way to look at the question is one of retail market design.

Ms. Reder prompted the panelists to comment on the top two or three criteria that need to happen in order to fully adopt Transactive Energy. Mr. Kirkeby's explained that calculating the value is important, and if you can calculate the value then the rest of the platform is fairly easy. Dr. Katipamula believe that having market incentives and developing a strong infrastructure is important.

Mr. Zichella and Srinivas had a discussion about standards and controls for devices so that they can interoperate across geographies.

Wrap-up and Adjourn Day One of March 2016 Meeting of the EAC

Rich Coward, EAC Chair, thanked the panelists for their participation and adjourned day one of the EAC meeting.

Respectfully Submitted and Certified as Accurate,

Susan Tierney
Analysis Group
Chair
DOE Electricity Advisory Committee

8/18/2016
Date

Carl Zichella
Natural Resources Defense Council
Vice-Chair
DOE Electricity Advisory Committee

8/18/2016
Date

Matthew Rosenbaum
Office of Electricity
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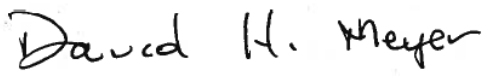
Date



David Meyer
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8/18/2016
Date