



**U.S. Department of Energy  
Electricity Advisory Committee Meeting  
NRECA Conference Center  
Arlington, VA  
June 2, 2016**

**Summary of Meeting**

## PARTICIPANTS

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**Speakers, Guests and Members of the Public:**

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University of Minnesota Energy Transition Lab

DOUG DAVIE  
Wellhead Electric

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**EAC Smart Grid Subcommittee Activities and Plans**

Paul Centolella, EAC Smart Grid Subcommittee Chair, gave a brief report on the Smart Grid Subcommittee's activities and future plans. He shared with the EAC that the Subcommittee sponsored a panel during the March EAC Meeting on DER Valuation and Integration, and this continues to be the principle topic for the Subcommittee. The March panel was followed up by the Transactive Energy Panel that was held on day one of the September meeting. For next steps, Mr. Centolella shared that the Smart Grid Subcommittee is in the process of discussing potential white paper topics, and a call is scheduled for later in the month with distribution planners from utilities to talk about real issues they are encountering. The Smart Grid Subcommittee also plans to have joint calls with the Grid Modernization Working Group on valuation and architecture foundational projects in the Grid Modernization lab call.

Mr. Centolella also shared that the Subcommittee met in the morning to discuss next steps for the Subcommittee. Members agreed that it will be beneficial to follow-up on what was heard from Srinivas' panel presentation on integrating responsive demand in buildings as a distributed energy resource.

Mr. Centolella projects that the Subcommittee will potentially develop a work product by the end of the calendar year. He presented a number of potential work product topics and the type of work that DOE could consider in the future.

#### *EAC Member Discussion of Smart Grid Subcommittee Work Products & Plans*

Mr. Cowart prompted Mr. Centolella to discuss potential panel topics for future EAC meetings. Mr. Centolella provided two topics that could be a possibility, which includes the Internet of Things, and how buildings play as a distributed resource and provide virtual storage.

#### **EAC Power Delivery Subcommittee Activities and Plans**

David Till, EAC Power Delivery Subcommittee Chair, discussed two topics that the Subcommittee will be pursuing. The first topic Mr. Till shared was High Penetration of Electric Vehicles (EV) into the market, and Bob Graham's presentation on the first day of the meeting was a precursor to that topic. Mr. Till noted that Mr. Graham's presentation was intended to provide an overall umbrella look at what is going on with EV. For the September EAC meeting, the Subcommittee expects to put together a panel that will go into more detail and specific areas related to the EV topic.

Mr. Till shared that the Value of a VAR Work Product is continuing to advance, but there is not yet a final version. He explained that the paper is to allow for four very distinct perspectives, so that all viewpoints are shared.

#### **EAC Member Discussion of the FERC Technical Conference**

Mr. Cowart asked for Mark Lauby, Billy Ball, and Roy Thilly, who all attended the FERC Technical Conference on June 1<sup>st</sup>, to provide the Committee an overview of the discussions held during the conference.

Mr. Lauby shared that there were three panels, one on the state of reliability. The second panel had a part 1 and part 2. Part 1 was a conversation with the EU representative and one from CRE from Mexico, which are regulators. The individuals discussed the transitions going on in those two areas. Part 2 was emerging issues, and part 3 was security focused around cyber and physical.

Mr. Lauby described the first panel on the state of reliability as a conversation around risks that are being seen that keep people concerned, a lot of those focused on security. The second part on emerging issues was a discussion more around the situation in the EU and Mexico, including the changes Mexico is going through to develop markets and move toward renewable energy. Mr. Lauby explained that the second panel on emerging issues was a discussion around jurisdictions between the gas and electric industry, and the jurisdiction between bulk electric system and distribution system. The third area was focused on the current and future state of cyber security.

Ms. Hoffman added that on the first panel there was a lot of discussion around modeling analysis and what could be done to improve the models and capabilities. She also added that on the first panel there was a compliment on the 2016 report that was a good foundation to start with respect to metrics.

Mr. Thilly shared that there seemed to be a significant agreement across the panels on what the issues are. Mr. Ball added that there was a lot of overlap in some of the conversation with the topics that are being discussed at the EAC meetings, which he said is encouraging.

Members continued to ask questions and get further clarification on the discussion held during the FERC technical conference, including the topics on natural gas, research and technology, and federal and state jurisdiction and how it relates to DER.

Ms. Hoffman concluded the discussion by adding that there was a comment made at the technical conference recognizing that there needs to be more in-depth conversations at the interconnection level or lower.

### **EAC Energy Storage Subcommittee Activities and Plans**

Ramteen Sioshansi, EAC Energy Storage Subcommittee Member, provided an overview of the Subcommittee's current activities and future plans. Mr. Sioshansi explained that there are two work products that the Subcommittee is currently working on.

Mr. Sioshansi provided some background on the work product and the idea behind it. He explained that there has been a fair amount of work and a lot of studies on what a high penetration of renewable energy future looks like, and the white paper is not supposed to do the analysis, it is supposed to lay the groundwork for that work to be done in the future. Mr. Sioshansi shared that a scenario-based approach is being used, and members are sketching out different visions of what a high penetration of energy storage future would look like. The Working Group met in-person after the March and June EAC meetings and in those drafted the axes that would build the four scenarios of what a high penetration of energy storage future looks like. The group is now drafting the scenarios and will meet in person after the EAC meeting to discuss those.

Mr. Sioshansi provided an update on the status of the other Work Product, the Biennial Storage Assessment. For the purposes of providing a brief background, Mr. Sioshansi shared that the legislation that established the Committee has two statutory requirements in relation to what the EAC relative to energy storage. He noted that every five years the EAC, in conjunction with the Secretary, shall develop a five year plan for the domestic energy storage industry for electric drive vehicle stationary applications, and electricity transmission and distribution. He also explained that every two years the Subcommittee shall assess the performance of DOE in meeting the goals established in the five year plan, and make specific recommendations to the Secretary on programs or activities that should be established or terminated to meet the goals.

Mr. Sioshansi explained that in 2016 the Biennial Storage Assessment is due, in 2017 the Five Year Storage Plan is due. The Subcommittee is aiming to fulfill both requirements in 2016. In

terms of the delivery of the assessment, Mr. Sioshansi noted that the structure will be different than the previous assessment. The goal is to keep the document much shorter and simpler, with a 1-2 page executive summary at the beginning that clearly states all of the recommendations to the Department. Mr. Sioshansi also mentioned that the Working Group has been conducting outside interviews of individuals in the energy storage world to get their opinions on what DOE is doing well and ideas for recommendations of things to place on DOE's radar. Interviewee groups included regulators, ISOs and RTOs, developers, and deployers. Once the interviews are completed, Mr. Sioshansi plans to have the Working Group comment on the input from interviews, potentially speak with DOE, and finally draft the report. The goal is to submit to the Committee for a vote at the September meeting.

#### *EAC Member Discussion of Power Delivery Subcommittee Work Products and Plans*

Members complimented Mr. Sioshansi on the steps taken in the development of the Biennial Storage Assessment. Ms. Hoffman added that the simpler, the better, and a large report is not necessary from the Committee. She also noted that the Committee should keep in mind the transition that will occur in December. There was also a comment from a member to provide some color around the insights provided in the interviews at the September EAC meeting.

#### **Update on Grid Modernization Initiative Working Group Activities and Plans**

Anjan Bose, Grid Modernization Working Group Chair, reminded the Committee that about three meetings ago Bill Parks and Kevin Lynn presented the Grid Modernization Initiative Plan, which involved department across DOE. He explained that at the end of the presentation, Bill and Kevin asked for guidance and assistance from the EAC, which prompted the creation of the Grid Modernization Initiative Working Group.

Mr. Bose brought the Committee up to speed on what the Working Group has been doing and what the next steps are. He shared that there are three areas that the group will be able to provide support. The first is looking at the portfolio of projects that are being funded through the GMLC Lab Awards and determine the gaps. The second area is the nexus of policy versus technical aspects because many technologies that are being developed will come up against policy issues. The final area is looking at the GMLC projects and determining what the success factors are. Mr. Bose shared that the Working Group is starting at is looking at the portfolio of GMLC Foundational projects and providing advice.

#### *EAC Member Discussion of the Grid Modernization Initiative Working Group Activities and Plans*

Ms. Hoffman agreed with Mr. Bose that one of the goals of the GMLC program is for DOE to determine the gaps in its research portfolio, which DOE will be looking at investing in. She also advised Mr. Bose to think about reasonableness and what does it mean for the transformation of the grid.



After having attended one of the regional breakout meetings, Ms. Reder provided some insight on the opportunities that she saw, and also provided lessons learned on the ARA work she was involved in. She noted that contemplating an outreach mechanism to get the information out to industry would be worthwhile.

Mr. Zichella and Mr. Bose discussed the idea of conceptualizing how to evaluate the projects and prioritize that evaluation. Ms. Currie brought up a point from an earlier discussion regarding capital investment, and the need to have ongoing communication with public utility commissioners, legislators and others in order to have a receptive audience. She shared that the group discussed how DOE could have a role in providing that communication because of its neutral position throughout the budget and funding process.

### **Update on the Clean Power Plan Working Group Activities and Plans**

Carl Zichella, Clean Power Plan Working Group Chair, provided a brief overview of the activities and plans to the Committee. Mr. Zichella noted that there is not much to report on due to the rule itself being stalled. The Working Group has been discussing where to focus their attention on. There has been a lot of work turned towards modeling needs at DOE, EAC, other agencies, and private institutions. Mr. Zichella shared that the Working Group has decided to come up with a series of webinars so that DOE can provide the status of some of the topics and the group can get a better understanding of what is going on. The purpose of these webinars is to figure out where to focus recommendations for moving forward. Caitlin Callaghan has offered a list of potential topics for the webinars, and Mr. Zichella will be sorting those out over the next few weeks.

### **Panel: Storage Market Environment: Reports from Experts in the Field**

Chris Shelton introduced the Storage Market Environment panelists including: Ellen Anderson, Executive Director at the University of Minnesota Energy Transition Lab; Chris Campbell, Vice President of Business Development at Schneider Electric; Praveen Kathpal, Vice President at AES; and Michael Toomey, Project Director of Storage at NextEra Energy Resources.

The first panelist, Ellen Anderson, University of Minnesota Energy Transition Lab, presented on advancing the energy storage market across the country.

Ms. Anderson explained energy storage as an emerging market with high potential and interest. She noted cost as a barrier but her projects focused on advancing the energy transition in order to be ready for when the potential growth of storage takes off. She reviewed the Energy Storage Alliance (ESA) effort in Minnesota, created by the Energy Transition Lab, that is technology neutral, consists of a variety of stakeholders, and aims to determine how to advance storage in Minnesota. ESA is working with MISO to facilitate PUC's understanding of energy storage opportunities and policy and regulatory frameworks that take advantage of those opportunities, including efforts with energy storage practitioners and for high-level stakeholder marketing strategies.

In the Midwest, the quick shift from traditional coal to renewable energy is expected to continue to grow, which provides a lot of opportunities for integrating energy storage onto the system. Ms. Anderson explained some of the market barriers and some rules Minnesota would like to see implemented in order for energy storage to participate in the wholesale markets. Storage resource aggregation and the high MW threshold for participation are barriers and Ms. Anderson encouraged the development of more fast-ramping resources and simplified interconnection. Ms. Anderson concluded by reviewing some of the topics that the ESA could benefit from EAC or DOE advice, such as determining how to value energy storage effectively, conducting cost benefit analysis and analysis of overall storage value, developing models of alternatives to storage, technical assistance for rate design and distribution planning, and funding for demonstration projects and cases.

The second panelist, Michael Toomey, NextEra Energy Resources, explained energy storage markets from a developer's perspective. He began his presentation by providing some background information on NextEra Energy, noting their 21+ GW of energy, 75 percent of which is renewable, across the entire U.S.

The NextEra team dedicated to developing energy storage projects have developed a good understanding of energy storage markets and required participants, with a total of 44 projects with various partners, such as PJM, IESO, and a number of states. Projects focus on both in front of and behind the meter storage application. Mr. Toomey explained some of these things going well in the various energy storage markets that NextEra's projects are in from a developer's perspective. The PJM market values and utilizes energy storage appropriately. California procured batteries to address their capacity needs. However, cost is limiting energy storage development in front of the meter but Mr. Toomey explained why that may not be the case for behind the meter storage.

Mr. Toomey explained some of the things that need to be addressed for energy storage growth (e.g., understanding the market values, demand charge management for behind-the-meter applications, and more clearly defining utility needs so storage can be applied appropriately and for multiple functions). Energy storage is in gray area between participating in markets and being a transmission service provider, which makes the procurement and value difficult to quantify. Energy storage can provide avoided costs by making the deployment of other resources a lot more efficient, particularly with renewables. Mr. Toomey concluded by explaining in-front-of-the-meter energy storage applications on the transmission system and how energy storage is penalized in citing projects because energy storage is both load and generation so the worse of the two applications are used in citing and energy storage is undervalued.

The third panelist, Praveen Kathpal, AES Energy Storage, began his presentation by explaining AES as an energy storage developer and solution provider with global ES projects that use a wide range of grid technologies and include ES operation, construction, and development. Most of the AES ES projects provide ancillary services but domestic projects are expanding beyond that to capacity solutions. Mr. Kathpal explained the MW storage project in Long Beach, California as a capacity project example and added how the project signified storage is a proven alternative that is economically feasible, compared to conventional solutions, for providing flexible grid capacity at scale.

Mr. Kathpal explained how DOE is well positioned to provide analysis to stakeholders to help illustrate that energy storage provides more capacity and T&D benefits than traditional energy solutions. Mr. Kathpal noted that building grid capacity is a big problem facing the industry and reviewed some of the additional challenges facing the grid, particularly the grid turnover and the associated planning generation capacity and transmission issues. He added that DOE has already done some analysis on the benefits of energy storage, such as the national lab papers analyzing the system-wide benefits of storage, and good analytic frameworks are available that include the ancillary and capacity benefits. However, not enough of energy storage benefit analysis has been conducted and not enough of the analyses tie ES benefits to relevant big problems that the industry faces.

The fourth panelist, Doug Davie, Vice President, Wellhead Electric, presented on issues in the energy storage market from an independent power producer perspective. The biggest issue is with the lack of understanding and appreciation of the problems associated with deploying storage and how some of the rules and regulations pose barriers to ES applications.

Mr. Davie reviewed the multiple large scale energy storage projects that Wellhead Electric had underway. He provided an overview of the EGT system Wellhead Electric is developing with General Electric Co. that will fully integrate a Battery Energy Storage System with existing technologies to increase system efficiency to 100 percent for ancillary services. The integrated system has some battery storage and a control system so it can provide ancillary services (e.g, frequency response, voltage response, and internal system management) with no gas requirements, which eliminates the state of charge issue.

Mr. Davie explained the business case for the EGT system, including the benefits from ancillary services, the reduction in GHG emissions, and the reduced life cycle costs of operations. EGT would re-optimize the entire system, which would benefit consumers and load-serving entities by reducing the overall cost of producing power and market price and would help support the expected high penetration of renewable generation. There has been interest in the system from a number of organizations but there are still some issues.

Mr. Davie provided some key observations on the status of the energy storage market, noting denial of the reliability issues associated with a renewable future, the interest in effective energy storage use, the issues with analytics regarding energy storage valuation, the rules and regulations lag behind storage innovation, interconnection, and the long stakeholder processes required when working with ISOs.

Mr. Davie highlighted that storage valuation is another challenge facing the energy storage market. He explained the load that must be followed by a generated resource to reduce the wear and tear from thermal use and the additional challenge that the volatility created by renewable generation adds to that. Storage can help reduce the system wear and tear by reducing the peak burden and over-generation from renewables.

Mr. Shelton thanked the panelists for their presentations and opened up the discussion to questions.

Mr. Toomey, Mr. Kathpal, Mr. Shelton, and Mr. Davie discussed positive aspects of the energy

storage market not already discussed, including the ability to finance long-term energy storage projects, the recent California PUC energy storage procurement that will boost their ES market, the fact that storage is a bipartisan topic, and the prospect of the EGT system which does not require huge capital investment to provide ancillary services with zero GHG emissions. They further discussed the financing challenges associated with low energy storage value streams in organized markets like PJM and the issues associated with storage market growth due to the need to clearly define system needs. Ms. Anderson added that clear definition and sustainable revenue streams issues have come up in her work and ESA is working to develop a basic platform to inform decision-makers about regional markets.

Mr. Shelton, Mr. Kathpal, Ms. Anderson, and Mr. Davie discussed ways in which DOE could help further energy storage markets across the country. Mr. Kathpal suggested that DOE can help address the issues that come from absence of stakeholder understanding, analysis of ES benefits, and recognition of storage applications by developing regional analyses that can be run to compare storage with traditional solutions (e.g., building a peaking plant or a new transmission line). Panelists recommended that DOE analysis be regionally-specific so decision-makers can tailor it to their conditions and only include benefits because the national labs usually put energy storage costs way too high. DOE should promote research sharing and help utilities understand their needs and the cost of possible solutions. The technology is not the issue but rather making utilities and reliability operators more comfortable with deploying ES to offset peak loads so they consider storage as a viable and solution.

Ms. Anderson and Mr. Kathpal discussed ways in which DOE could support the energy storage market, including DOE commercialization and research support of all the storage technology types (e.g., thermal storage) that have high potential to get the technology to market; examination of the technical research agenda 20 years into the future to predict the implications of the future on today's system and how today's decisions coincide with the future system; and support of local demonstrations to help utilities learn how to operate energy storage in conjunction with wholesale markets.

Mr. Shelton and Mr. Davie discussed the interface between the energy storage market and policy, noting the importance that inevitable mistakes in early projects don't hurt policy down the road, the importance that policy promotes new technology in order to promote progress and ensure markets are addressing issues (e.g., adding storage based on the system's service needs).

Ms. Heather Sanders highlighted the importance of determining cost through procurements added by markets to ensure that the markets produce the cheapest solution and agreed that DOE can help utilities understand their needs, the tools available for addressing those needs, and the equivalence and affordability between their possible solutions. She suggested DOE help utilities with a deferral framework for distributed energy resource planning and Mr. Toomey suggested that PUCs and everyone involved in the procurement process be included in that effort as well.

Mr. Davie, Ms. Anderson, Ms. Sanders, Mr. Toomey, and Mr. Kathpal discussed how to overcome the reluctance of utilities to rely on energy storage rather than build a substation, how to build the system hierarchy of use and control energy storage if deployed, and how to provide the framework and foundation needed for Commissioners to agree to look beyond avoided costs and let the market

determine energy storage cost. They agreed that storage as a system issue solution should be considered in places where it is not already, the market should set the energy storage price, and the multiple uses of storage should be included in the justification for procurement.

Mr. Zichella summarized the common key areas discussed that DOE could do to help the energy storage market, with the biggest ones being the valuation and identification of energy storage services and products. Mr. Davie added it is important to also make sure you are identifying performance; specify what you want, not how you are going to do it, especially don't write specific technologies into policy. Mr. Shelton added that this rule should apply to all demand-response technologies across the board and Mr. Davie agreed.

Ms. Tierney, Mr. Shelton, and panelists discussed examples of technology-neutral and performance oriented procurements for actual market performance and the reasons behind energy storage procurements in frequency regulation markets and in need-based cases. They agreed it is important for Commissions to understand that, along the spectrum of procurements, capacity procurements that totally exclude storage as a possible solution are the worst and procurements that are carefully worded so the needs are clearly defined and all the possible solutions are eligible are the best. There is a need to educate stakeholders about energy storage as a viable alternative, Commissions need to be careful that their procurements don't limit possible outcomes and create barriers to project competition, and evaluation frameworks need to be further defined and improved, which is something DOE could help with.

Ms. Tierney asked for clarification on how the EGT system battery is seen as a zero carbon resource when electricity has to be added to the battery to charge it, which could come from a fossil fuel? Mr. Davie explained how the EGT can provide spinning reserve services that would have otherwise had to be provided by an online thermal unit, which can move the thermal unit off of its optimum load point and decrease system efficiency. Adding EGT allows all of the performance requirements to be met without having to allocate resources to spinning services, making the energy behind the spinning services zero GHG emissions.

Mr. Cowart, Mr. Shelton, and panelists discussed the current calculations of the net carbon benefit of storage available, including NextEra's work with E3 in California, the PLEXOS model that included GHG reductions as one of a few benefits expected from the EGT project, the PJM Market Monitor Report that calculated carbon reductions in frequency regulation markets, the brief Energy Storage Association analysis of the Clean Power Plan (CPP) that showed significant reductions in NO<sub>x</sub>, SO<sub>2</sub>, and CO<sub>2</sub> when peaker plants were replaced with alternative methods, and the NREL paper modeling storage deployment equal to California's legislated targets that included some carbon reduction figures. Mr. Shelton noted that, generally, storage reduces carbon emissions by a significant amount but carbon reduction calculations from energy storage can be difficult to do because they are very market specific and dynamic. Ms. Anderson added that storage is not on the list for Minnesota's plans to reduce GHG emission under the CPP so calculations on the net carbon reduction from storage would be helpful.

Ms. Janice Lin circled back to the conversation about the need for utilities and other stakeholders to understand their needs and solution options so the ES market can be adopted and grow. Ms. Lin Mr. Kathpal and noted the effectiveness of DOE hosted workshops and suggested DOE do more

advanced work to identify regional challenges and link storage capabilities to those issues before the regional meetings in order to get regulators to understand the value and apply storage to their systems across regions. DOE can help people agree on the core problems and see an objective array of solutions. Ms. Lin noted that she and her colleagues developed a short film on Edison's procurement that covers the legislation, regulatory implementation, and energy storage procurement and she would be happy to send the link to anyone who is interested.

Ms. Reder and Mr. Davie discussed issues and solutions surrounding the denial of the extent of reliability issues, including the inability to quantify reliability issues, reliability concerns resulting from over-generation from renewable integration, and options to increase system flexibility and reliability. Ms. Reder suggested that DOE help develop more specific metrics for system flexibility and reliability to address these issues.

Mr. Cowart, Mr. Kathpal, Ms. Anderson, and Dr. Davie discussed their varying viewpoints on if performance requirements for storage should be written in a way that would allow projects that aggregate hot water heaters or smart-charging EVs to beat out projects with battery storage if they can meet performance requirements. Answers included yes, the most effective technology should win; a hybrid solution would be best; and no, requirements should only include system needs and the market should deliver the service.

Mr. Adams, Ms. Sanders, and Mr. Shelton discussed the markets that currently had a storage model in their system optimization, including California's Non-Generation Resource Model and NY's model that includes energy storage as a designated resource type.

Mr. Adams and Mr. Davie discussed the reasons why Wellhead only provided capacity services and not ancillary services and the different scenarios in which the Wellhead system can sell inertia.

Mr. Morris explained how the regulatory construct in the West is such that adding renewables actually hurts carbon emission reductions because single-cycle turbines are not counted as base load but are still be used to firm all the qualifying base loads. He further explained how the CPP is likely to have similar results and suggested articulating this problem into the integrated resource planning process that looks at the lifecycle risk of these technologies. He recommended that industry or DOE help address the issue that policymakers do not have a good dataset or known credible fact source to determine the net carbon benefits or levelized annual cost of different technologies to help them make planning decisions and engage in the appropriate dialogues. Mr. Morris, Mr. Kathpal, and Mr. Shelton discussed the efforts from industry to develop a reference source for a range of costs for the integrated resource planning proceedings happening nationwide. They agreed that DOE and industry could provide more information around installation costs and operating characteristics, which would also require a framework for valuation, and the importance of looking at the entire system when determining if storage will be cost effective to add.

Mr. Lauby explained the current standards around operating continued spinning and non-spinning reserves and the new standard that would eliminate the distinction between spinning and non-spinning reserves, which would promote storage as a solution and provide more system relief. Mr. Davie agreed that regulations are progressing towards more inclusion of energy storage but the

issue is not that storage isn't allowed to be used for contingency reserves but rather that it is unclear under current regulations, which is bad for investors.

### **Public Comments**

No public comments were made.

### **Wrap-up and Adjourn June 2016 Meeting of the EAC**

Ms. Hoffman expressed her gratitude and appreciation to Wanda Reder, Rich Cowart, Sonny Popowsky, and Gordon van Welie for all the work and support they provided to the Committee to which Mr. Cowart seconded those sentiments.

Mr. Cowart, EAC Chair, thanked meeting participants for their comments and adjourned the June 2016 meeting.

Respectfully Submitted and Certified as Accurate,



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Susan Tierney  
Analysis Group  
Chair  
DOE Electricity Advisory Committee

8/18/2016  
Date



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Carl Zichella  
Natural Resources Defense Council  
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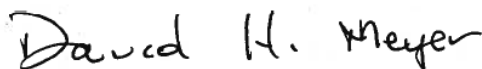
8/18/2016  
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Matthew Rosenbaum  
Office of Electricity  
Designated Federal Official  
DOE Electricity Advisory Committee

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Date



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David Meyer  
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