Discussion Summary (10/22/15)

State Energy Policy Innovation: Modernizing the Electric Grid[1] and the Quadrennial Energy Review

The concepts discussed in this overview paper are based on a roundtable meeting hosted by the National Association of State Energy Officials (NASEO) in partnership with the U.S. Department of Energy (DOE) Office of Energy Policy and Systems Analysis (EPSA) in September 2015. NASEO designed the theme of the roundtable meeting, "Modernizing the Electric Grid and the Quadrennial Energy Review," as an opportunity for states to elevate and provide input to EPSA on electricity issues – grid modernization, reliability, energy efficiency, the role of renewables, distributed generation, consumer choice, valuation, and workforce development[2] – that are of growing importance to the states and may be useful for EPSA to consider as it moves forward on the second installment of the Quadrennial Energy Review (QER). Meeting participants (Appendix 1), included representatives from State Energy Offices (SEOs) and the federal government. The meeting agenda (Appendix 2) incorporated discussion-oriented, policy-focused concepts and questions examining the potential for energy efficiency, the electrification of transportation, and power generation. The questions also addressed grid modernization strategies that mobilize, educate, and respond to economic development, resilience, and environmental demands, as well as the reliability, choice, and affordability needs of electricity end-users.

State Energy Policy Innovation Themes

Several interrelated themes emerged from participants' answers to these questions, including:

- **Theme 1:** Grid modernization is technically and technologically feasible, but may face political and economic challenges.
- **Theme 2:** "Consumer choice" is not a monolithic concept.
- **Theme 3:** Electricity *policy*, distinct from electricity *regulation*, is a necessary ingredient in both state and DOE's efforts to modernize the grid to most effectively address electricity production, distribution and end-use.

A uniting factor throughout the discussion and for each of the above themes is the need for state-federal coordination, analysis, and strategic messaging. In particular, a call for an "unpacking"[3] of grid services and needs to identify costs and benefits – valuation – to guide and inform both state policy and regulatory decisions was a top issue. The combination of these activities would accelerate the country's movement toward more innovative, nuanced, and effective electricity policies. The following sections describe these themes in further detail.

[1] In this summary, the term "grid modernization" applies to a broad definition of the transmission, generation, distribution and retail services portions of the electricity infrastructure.

[2] For more information on the QER, including the first installment released in April 2015, visit http://energy.gov/epsa/downloads/quadrennial-energy-review-full-report.

[3] In this context, the use of the term "unpacking" is not the same as the definition of "unbundling" in a legal sense. The "unpacking" contemplated by the meeting attendees appeared to envision a cross-cutting examination of benefits as well as costs, while attempting to evaluate the electric system on a holistic basis.

Theme 1: Grid modernization is technically and technologically feasible, but may face political and economic challenges.

Innovation has introduced both technical and political changes to processes governing electricity markets. Energy storage, internet and cloud-enabled electronics and devices, cloud analytics applied to grid voltage controls, transportation electrification, zero-net-energy (ZNE) and ultra-efficient buildings, and the integration of high levels of renewable energy on the grid have all moved from proof-of-concept to a visible, tangible reality in the country's major energy end-use sectors. As one small example, ZNE elementary schools have emerged in states such as Kentucky, Texas, and Virginia. Policy makers and local officials are considering an appropriate level of fixed and variable charges for the interconnection and operation of these facilities to the grid. The answer is unclear despite the obvious benefits to both the buildings and the grid.

While somewhat "in the weeds," the aforementioned ZNE is illustrative of the types of issues surrounding grid modernization and end-use electricity today and will increasingly demand grid, utility business model, and market changes in the coming decade. These market and technological changes are well within the time horizon of the electricity system investments being made today. They also signal the market entry and participation of actors that are typically not subject to electricity regulation, such as building designers and architects, device and telecommunications companies, individual vehicles and fleets, and private investors and developers. Such transformations are eliciting questions for energy policymakers and regulators, including:

- To what extent can the country's current, growing trajectory in energy efficiency and demand response allow states to offset the need for new power infrastructure?
- What is the interplay among high levels of intermittent renewable power on the grid, demand response, storage and resilience and how are the economic benefits of these services and energy sources be "unpacked"?
- Do technical innovations such as electric vehicles mean greater demand and strain on the electric grid, or can they be harnessed and integrated to promote grid management and improved operations?
- What new technologies warrant inclusion in states' comprehensive planning processes? How should states evaluate and assess promising innovations?
- What are the impacts of these technologies on consumers and vulnerable populations?

The above questions are a harbinger of grid evolution, integration, and modernization. However, they also raise issues that are contentious and challenging to overcome in certain political and regulatory processes. They put into question the ability of our current grid to respond to and accommodate changing demographics, varied energy and energy efficiency sources, changing patterns of electricity use, and diffuse consumer choice spread over a wide energy service territory. For these reasons, the answers often do not fit "neatly" into the regulatory processes that dictate electricity production and distribution in many states. Potential solutions, grounded in policy and analysis rather than solely in regulation, are discussed in further detail in Theme 3; included here is a discussion of the major challenges posed to regulators and policymakers in response to technological change in the electricity sector.

Reliability, revenue, and affordability are among the major concerns often raised by state policy officials, utility stakeholders, and state regulators in response to rapid advancements in energy efficiency and distributed generation technologies. As electricity use and demand react to fluctuating market dynamics (demographic change, increased energy efficiency and renewable energy, demand response, deployment of electric vehicles), so, too, is the electric grid expected to provide reliable service while accommodating these changes. These changes may potentially increase costs and the need for new investments and thus turn the utility industry and some end-use stakeholders against energy technology innovation.

Similarly, there are concerns about decreased electricity sales resulting from increased energy efficiency, on-site renewables, and consumers' growing understanding of the price impacts of where, when, and how they draw power from or supply capacity and energy to the grid. The utility industry's potentially stranded investments – spread of those costs to end-users – and resulting reactions to such trends will form an impediment to innovation or the pace of innovation and continued growth in energy efficiency and renewable energy. Fixed or higher utility prices, for instance, may make the most efficient of buildings (e.g., high performance or ZNE buildings) cost-ineffective if they do not help consumers realize a net decrease in utility costs.

Energy efficiency, demand response, and distributed generation advancements also raise questions about equity and workforce development that may require input and buy-in from stakeholders that have historically not been well-integrated into the energy regulatory process. Addressing energy equity would ensure that both the benefits and impacts of grid modernization, new market entrants, and high levels of energy efficiency and renewable energy have benefits that accrue fairly to low-income, underserved, and vulnerable populations. In addition, addressing vocational and educational needs would ensure that as the energy workforce approaches retirement, their knowledge of energy markets, equipment, and energy efficiency is shared with a younger generation of professionals.

To begin responding to these challenges, roundtable discussants strongly emphasized the need for analyses that "unpack" the benefits and attributes of various distributed energy resources and the strategies that can be used to deploy them to the electric grid. Such analyses would provide a robust quantification of the extent to which grid operators can have confidence in distributed resources (such as solar, wind, storage, combined heat and power, and others) to deliver energy and communicate with the grid reliably, at low-cost, and on demand. Improving states' understanding of grid resources and services would also serve an important decision-making function, enabling energy policy makers, regulators, system operators, and transmission organizations to better assess the need for new power production facilities and transmission/distribution infrastructure.

These challenges underscore the significant need for data, analysis, and coordinated messaging between state and federal energy policy makers, who are uniquely positioned (distinct from regulators) to act as conveners and purveyors of forward-looking, innovative electricity policy. These needs are described in more detail under Theme 3.

Theme 2: "Consumer choice" is not a monolithic concept.

The growth of innovative, "smart" and learning/intuitive energy technology is enabling consumer-driven energy choice and management at unprecedented scales and speeds. For example, at a recent NASEO conference, Nest relayed that thousands of "Nest-ready" smart products from a variety of manufacturers were under development. To respond to these market dynamics, regulators and policymakers face the challenge of understanding what consumers want, how to mobilize consumer choice and excitement (where it exists), and the level of consumer choice that will occur without policy or regulatory guidance or support. Whether consumer-driven or policy-driven, quantification of these actions, which support concepts like energy efficiency and demand response, need to be understood and factored into grid modernization.

Several important nuances help paint a more detailed picture of the concept of consumer choice in the electricity sector. First, consumers are not uniformly engaged or interested in their energy use, and there is an even smaller subset of (mostly high-income) consumers that are considered enthusiastic "early adopters" of energy efficiency, distributed generation, and alternative vehicle technologies. Automated and "learning" energy saving and demand response devices (e.g., consumer, industrial, facility) are a new and rapidly emerging technology trend that rely upon data and cloud analytics. Because these devices are typically marketed to excite consumers' imagination, they also sidestep the issue of actively incentivizing consumer interest in favor of simpler and more effective measures that essentially automate efficiency choices for consumers (e.g., home thermostat and lighting controls available through one's smart phone or email account, commercial building controls and sensors).

Second, there exist several different ways to interact with consumers. Electricity rates and prices are one major interface between utilities and their consumers. However, consumer-driven energy technology (such as the "Learning" Thermostat and cloud-based energy data analytics systems) are becoming increasingly important communications channels and feedback loops between individual consumers, properties, communities, utilities, and governments. Government, private and utility-run public information campaigns, marketing, and communication can also educate and mobilize consumers on energy use, efficiency, and alternative sources.

Third, consumer choice can create vulnerabilities for energy systems and for energy consumers themselves. As more facilities, products, and energy systems are "plugged" in to the internet, threats to cybersecurity and personal privacy increase. Many energy companies' administrative systems and the nation's electric and other critical infrastructure were not built to be placed in an uncontrolled online environment. Even in cases where cyber threats are considered insubstantial, vulnerabilities remain and, as a result, compel regulators to address issues that the utility industry typically has limited expertise in, such as data access, consumer anonymity, and information security.

Overlaying consumer choice on an aging grid using lagging policy and regulatory frameworks may result in sub-optimal outcomes or prioritize current utility, business, and consumer needs over future demands. State Energy Offices are well positioned to inform and drive policy innovation by creating non-regulatory, robust, and open forums for stakeholders to express their perspectives and interests, and as venues to introduce new concepts, data, and educational materials as described in further detail in Theme 3. The integration of energy assurance

planning, grid modernization, and third-party innovation is critical, in order to avoid major system problems.

Theme 3: Electricity <u>policy</u>, distinct from electricity <u>regulation</u>, is a necessary ingredient in both state and DOE's efforts to modernize the grid to most effectively address electricity production, distribution and end-use.

The speed at which technological, market, environmental, and demographic changes catalyze grid modernization is closely linked to the pace of state policy and regulatory actions. Sometimes, private companies; federal, state, and local government officials; and educational groups turn to state regulatory processes in an attempt to achieve or delay significant market change. Where these issues are most contentious (i.e., where they raise important questions regarding reliability, revenue, equity, and workforce capacity), the results of a "regulatory first and only" approach can mean limited or delayed action and outcomes that are less than optimal. The substantial economic and environmental impact of electricity markets on any state or community means that unanticipated or disruptive changes (e.g., technological, environmental, climate) can create contentious debate. A lack of agreement on the direction of electricity policy, as distinct from regulation, makes attempts to achieve changes through regulation less effective and even inappropriate in some cases. Conversely, pursuing such changes through stakeholder processes coupled with executive and legislative leadership actions lend themselves to greater consensus-building and policy buy-in that would allow the regulatory processes to implement the agreed upon policies.

In practice, the lack of recognition of the distinction between the policy and regulatory role means that changes that would optimize the electricity system by accounting for new technologies, improved environmental quality, changes in market demand, and a calls for improved resilience are slower or may even cause unintended backlash. For example, utilizing data and analysis from the unpacking of the value of various grid components and resources, as discussed earlier, will inform the policymaking and stakeholder process and better allow regulators to act on informed policy decisions and directions. Distinguishing the policy from the regulatory role can enable states to draw on the strengths of these respective functions to move forward more rapidly and effectively.

State Energy Offices' policy role and linkage with governors, legislators, and economic development agencies often allow them to serve as conveners and connectors between disparate actors and enable them to "translate" issues and create agreement on core issues among stakeholders. The policy approach of State Energy Offices and the legislative and executive branches of state government can be used to make incremental - rather than disruptive - changes for utilities that are concerned about revenue and reliability, while attempting to align economic, energy, and environmental policy priorities. This approach also helps to increase public confidence in new market approaches, technologies, and can better address underrepresented communities and longer-term energy and economic goals. Obviously, the key priority for Governors, state energy offices and legislators is maintaining a reliable electric system at a reasonable cost.

This role has, also, historically enabled State Energy Offices and other policy-focused agencies to identify analytical needs and partnerships that would help inform the development of forward-looking, innovative electricity policy and planning. High-level analytical needs identified during the roundtable discussion include:

- A "redefinition" of energy efficiency, investigating not only specific energy measures, but also energy use on a system-wide basis, including both demand-side and supply-side efficiency.
- The creation of standardized methodologies and valuations that would assist states in evaluating and assessing new energy efficiency, distributed generation, and advanced vehicle technologies, particularly for inclusion in comprehensive state energy plans.
- The creation of common methodologies and baseline calculations for energy efficiency and renewable energy valuation, including an investigation of the different attributes of various renewable energy resources and their impacts on electricity reliability.
- Modeling and analysis that fully incorporates the transition to cloud-based data analytics for transmission, distribution, and energy end use, as well as consideration of cutting edge, commercially available high-efficiency systems and products (e.g., light-emitting diode and organic light-emitting diode lighting (LED and OLED), zero-net-energy facilities, advanced manufacturing and materials).
- Economic analyses documenting the costs of inaction versus the costs of modernizing the grid, including a discussion of the responsibilities of the private sector and the public sector each in supporting and financing grid modernization over the long term, is a key effort.

Conclusions

The themes expressed in this white paper illustrate important trends and evolution taking place in U.S. electricity markets, catalyzed by rapid and exciting technological advancements promoting energy efficiency, distributed generation, storage, and consumer involvement. These advancements are at once enhancing the grid (e.g., by diversifying energy resources and promoting communications among energy suppliers and end-users) but also putting into sharp focus the need for concerted policy and regulatory actions to modernize the grid and update critical energy infrastructure across the country.

The assumption that changing the electricity regulatory process alone will help the country substantially modernize the grid paints an incomplete picture. There is a growing list of "unconventional" public and private stakeholders (such as low-income communities, consumers, energy professionals, security experts, and new market entrants and innovators in energy efficiency, distributed generation, and advanced vehicle technologies) who can (and should) help determine the way the U.S. electric grid is modernized and expanded. Their views and impacts may not fit neatly into most states' energy regulatory processes, which are dictated by institutionalized rules, tests, and discussion formats; but their perspectives are nevertheless significant to integrate into states' and the federal government's efforts. It is these dynamics that make policy innovation, grounded in data and analysis, all the more crucial in informing grid modernization efforts and directing electricity regulation.

*Appendix 1 - Roundtable Participants**

John Chatburn, Idaho
Amber Gray, Wisconsin
Maria Redmond, Wisconsin
Greg Guess, Kentucky
John Davies, Kentucky; NASEO Board
Gene Therriault, Alaska; NASEO Board
Amy Kidd, DOE
Jennifer Gardnes, Utah
Taresa Lawrence, District of Columbia
Doris Jansky, Nebraska
Andrew McAllister, California; NASEO Board
Elizabeth Grimes, Alabama
Chani Vines, DOE
Robert Jackson, Michigan
Lisa Smith, Maine
Jessica Burdette, Minnesota
Jessie Stratton, Connecticut; NASEO Board
Marisa Slaten, New Jersey
Megan Levy, Wisconsin
Starlette Hodge, North Carolina
Brad Atkinson, North Carolina
Russell Duncan, North Carolina
Tristan Vance, Indiana; NASEO Board
David Bracht, Nebraska
Marion Gold, Rhode Island; NASEO Board
Tommy Wells, District of Columbia
Jeff Pillon, NASEO
Ken Hughes, New Mexico
Dub Taylor, Texas; NASEO Board
David Baker, Energy Resources Center
Barbara Tyran, Electric Power Research Institute; NASEO Board
Alexa Voytek, Tennessee
Maggie Joyce, Tennessee
Tony Usibelli, Washington
Mark Glick, Hawaii; NASEO Board
Rick Minard, New Hampshire
Kristy Manning, Missouri
Janet Streff, Minnesota; NASEO Board
David Terry, NASEO
Jeff Genzer, NASEO
Sandy Fazeli, NASEO
Karen Wayland, DOE
Matthew McGovern, DOE
Jenah Zweig, DOE

** Participation in this meeting does not signify agreement with the concepts presented in this white paper.*

Appendix 2 – Roundtable Agenda

State Energy Policy Innovation Roundtable: Modernizing the Electric Grid and the Quadrennial Energy Review

September 13, 2015, 12:00pm-2:30pm Wyndham San Diego Bayside, Pacific D Ballroom, Lobby Level
San Diego, California

I. Opening Remarks and Introductions
David Terry, Executive Director, NASEO
Gene Therriault, Vice-Chair, NASEO (AK)
Jeff Genzer, Counsel, NASEO
Karen Wayland, Deputy Director, DOE - Energy Policy and Systems Analysis

II. Market and Policy Drivers for End-Use Energy Efficiency and Distributed Energy Resources
David Terry, Executive Director, NASEO
Karen Wayland, Deputy Director, DOE - Energy Policy and Systems Analysis

III. Roundtable Discussion

Defining the trend line and potential around super-efficient buildings (e.g., Zero Net Energy, or ZNE), transportation, and power generation (e.g., storage, T&D, distributed generation). How energy-efficient and resilient could various market segments become? What implications do these trend lines have for emissions reductions and climate change mitigation, affordability, and reliability?

Mobilizing consumer choice. What actions can states and the federal government take to (1) enable consumer choice in energy end use and (2) ensure that consumers are informed on clean energy?

Valuing energy efficiency, demand response, and distributed resources. Given changing utility business models and markets for power, how (and at what level) should we value and monetize these resources?

Identifying transportation efficiency opportunities. While current liquid fuel efficiency levels are known, how will electric vehicle deployment impact affordability and emissions? To what extent and how will states need to respond to their increased impact on the grid and electricity use? If "self-driving" vehicles advance more rapidly than anticipated, how will it impact efficiency and emissions?

Defining private sector energy efficiency potential. Many policy makers and analysts think of energy efficiency as a function of regulation, standards, and utility ratepayer- funded utility energy efficiency programs. However, increasing private sector innovation and investment are defining how we use energy (e.g., Nest, Tesla, IBM, ESCOs). Where is the private market headed with energy efficiency, interconnectivity, and the Internet of things?

Identifying workforce development and job skill needs. How will technology and equipment innovations, along with Cloud-enabled and data-driven energy efficiency, affect job training and

the ability of states to track job creation and growth?

IV. **Facilitated Wrap-up Discussion and Priority Actions**

Knowing that it is often difficult to synchronize state and local energy policy across jurisdictional lines, what are the possibilities for coordinated action of the local, state, regional, and national level on efficiency issues?

Which policy and analytical areas are high-priorities or high-opportunities for advancing energy efficiency in your state?

What would be useful for DOE to know about state actions on each of the areas above? Does your state have success stories, data, or analysis needs (or resources) that may inform DOE's understanding and the direction of the second QER?

V. **Adjourn**