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ADVANCING GRID MODERNIZATION AND SMART GRID POLICY: A DISCUSSION PAPER

Purpose

This paper is a result of the Advanced Energy Economy (AEE) Grid Modernization Policy Forum on June 18th, 2013 in Boulder, Colorado. The purpose of the forum was to identify the advanced energy industry's state policy priorities for smart grid utilization and deployment. The intended audience for this paper is state regulators, legislators, governor's' offices and other policy makers.

This paper is not intended to be a comprehensive report on the smart grid. Rather, it is a summary of the most relevant barriers to broader smart grid adoption and corresponding policy options put forth for consideration by legislators, regulators and industry participants.

Background

In 2011, U.S. electric power sector retail revenue from ultimate customers totaled $371 billion, representing a market of a little more than $1 billion per day.[1] Modernizing the grid with technology that makes electric power delivery more secure and reliable, and provides new ways to increase efficiency, represents a tremendous market opportunity for the advanced energy industry. However, realizing this opportunity will require policies that increase market access for new entrants and encourages deployment of new solutions, leading to the development of a secure, clean and efficient "grid of the future".

1. EIA. Electric Utility Revenues. http://www.eia.gov/electricity/annual/html/epa_01_02.html.

As of May 2012, there were 36 million smart meters deployed in the United States. Installations are expected to reach over 65 million by 2015, or more than half of all U.S. households.[2] For several years, regulators and policy makers at the federal and state levels actively pursued smart grid deployment. The largest influx of smart grid capital came from the American Recovery and Reinvestment Act (ARRA). In total ARRA allocated $4.5 billion to the U.S. Department of Energy (DOE) for a smart grid demonstration and investment grant program and another $100 million for workforce training.[3] Including matching private sector investment, total spending on ARRA-funded smart grid projects reached $8 billion, with advanced metering infrastructure (AMI) and what DOE refers to as "cross cutting" projects representing the majority of investment (see Figure 1).[4]

Figure 1. Total combined federal and private sector spending breakdown for the U.S. DOE Smart Grid Integration Grant (SGIG) program.

Despite this substantial level of investment in smart grid infrastructure, policy development is still in a formative stage. While enabling policies have been established by about half of the nation's state legislatures,[5] substantive policies to maximize the value of this developing infrastructure are still limited. In recent years, smart grid investments and general interest among policy makers and regulators seems to have slowed considerably.

Despite some debate over the customer and utility value of smart grid, studies have found that utilities and their customers stand to receive a net benefit from AMI and other intelligent utility infrastructure investments over the next 20 years.[6] In addition to these benefits, it is clear that unlocking the potential of existing investments and providing a solid policy foundation for additional intelligent infrastructure growth represents a substantial market opportunity for advanced energy companies and one that requires industry and policymaker alignment.

2. IEE. Smart Meter Installations by State. http://www.edisonfoundation.net/iee/ourwork/Pages/SmartMeterDeployments.aspx
3. Smartgrid.gov. Recovery Act Smart Grid Programs. http://www.smartgrid.gov/recovery_act/overview
4. Smartgrid.gov. Smart Grid Investment Grant Program (SGIG). http://www.smartgrid.gov/recovery_act/overview/smart_grid_investment_grant_program
5. National Conference of State Legislatures (2013). http://www.ncsl.org/issues-research/energyhome/states-providing-for-smart-metering.aspx.
6. Lisa Wood, Institute for Electric Efficiency. Electroindrustry. Weighing the Costs and Benefits of Smart Meters. November, 2001. http://www.edisonfoundation.net/iee/Documents/Wood_NEMA_11-2011.pdf

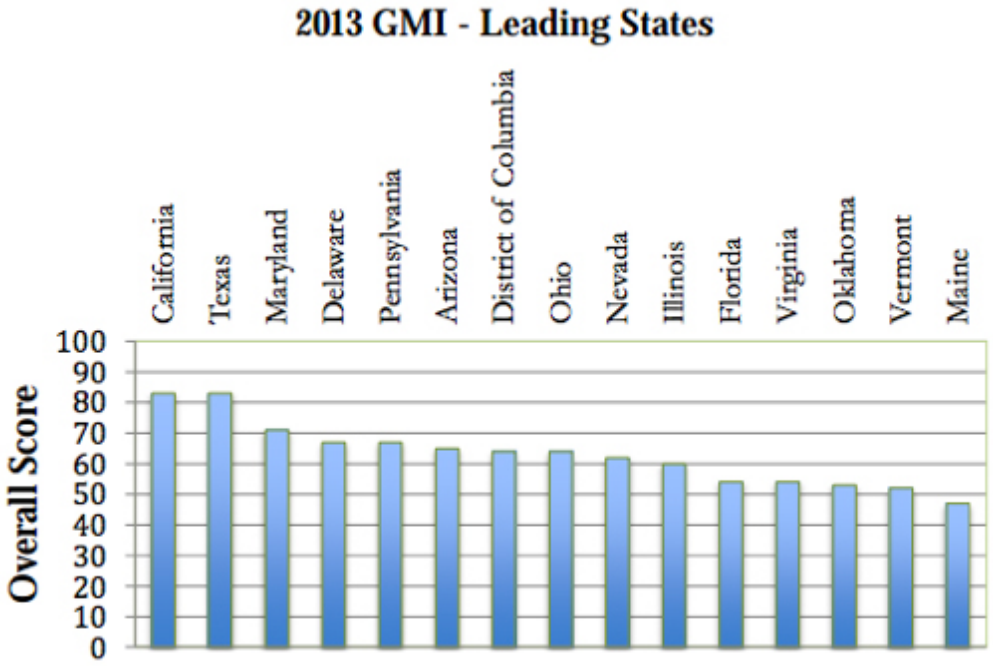
Recent Reports and Policy Opportunities for Consideration

A number of recent reports, white papers, and conferences have identified barriers to the broader deployment and utilization of smart grid technology and have proposed recommendations to address them.

Gridwise Alliance – Grid Modernization Index

The non-profit Gridwise Alliance released a study in July 2013 giving states a grid modernization ranking based on their success in establishing a good policy environment, consumer engagement capabilities and grid operations improvements to facilitate the move toward a more innovative and efficient smart grid.

Included in the report are a series of policy recommendations, many of which were echoed by participants in the AEE policy forum on grid modernization including policies to address consumer data control, requirements for utilities to submit grid modernization plans, cost recovery mechanisms, cyber security provisions and incentives for advanced energy systems.



U.S. Department of Energy Office of Electricity Delivery and Energy Reliability, Smart Grid Peer-to-Peer Workshops and Regional Reports.[7]

7. U.S. DOE. Across the U.S. Utilities Share Experiences from Smart Grid Deployments. Regional Reports. http://www.smartgrid.gov/federal_initiatives/featured_initiatives/across_us_utilities_share_experiences_smart_grid_deployments.

In 2011 and 2012, DOE hosted four regional meetings with utilities and smart grid implementers to discuss customer engagement and technology implementation experiences. From these conversations, the DOE highlighted the following common threads:[8]

- Communicate and engage customers and community leaders early
- Be prepared to address customer concerns
- Opt-out provisions are important
- Prepay is showing promise for low income customers
- Establishing new technologies with old systems is difficult
- Data management is a challenge
- We need a clear smart grid strategy
- Customers and communities are diverse with different needs and preferences.

Edison Electric Institute - Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business[9]

This utility industry report highlights how the utility business model stands at a crossroads in the face of new "disruptive challenges" represented by distributed energy generation, energy efficiency and demand-side management programs "that promote lower electricity sales." While the report is primarily defensive in the nature of the recommendations rather than proactive in identifying policy changes that will facilitate this shift for the expansion of energy services to the public, it does acknowledge that the suite of advanced energy technologies "could directly threaten the centralized utility model…if public policy is not addressed to normalize this competitive threat." AEE believes it is incumbent upon the innovation and advanced energy business community to similarly address the opportunity inherent in the "disruptive" forces that they represent, which, to borrow from the language of the report, can be characterized by new markets, new value networks, lower costs and improved products and services.

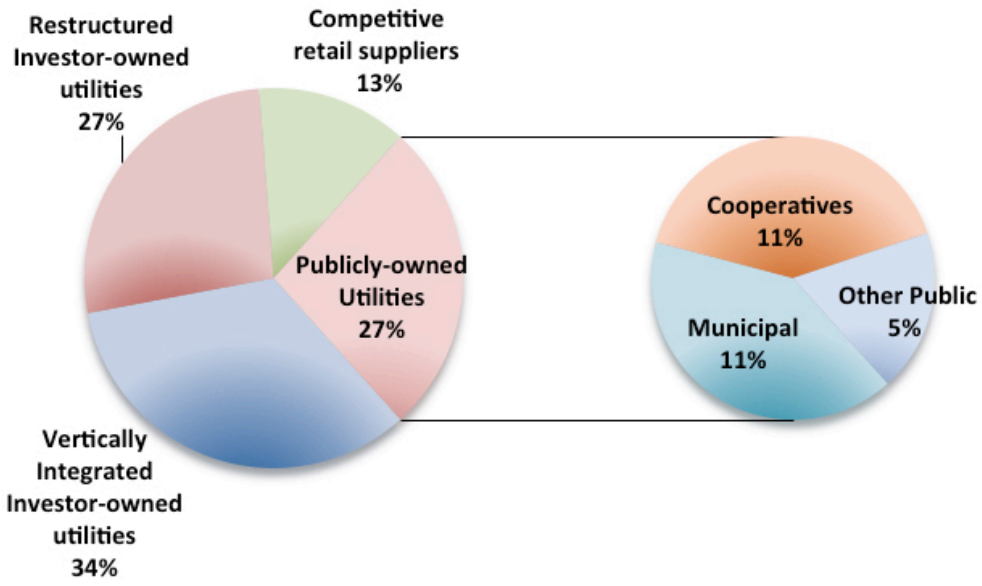
The report concludes:

> ***"This paper encourages an immediate focus on revising state and federal policies that do not align the interests of customers and investors, particularly revising utility tariff structures in order to eliminate cross subsidies (by non-DER participants) and utility investor cost-recovery uncertainties. In addition, utilities and stakeholders must develop policies and strategies to reduce the risk of ongoing customer disruption, including assessing business models where utilities can add value to customers and investors by providing new services."***

8. U.S. DOE. Across the U.S. Utilities Share Experiences from Smart Grid Deployments. Regional Reports. http://www.smartgrid.gov/federal_initiatives/featured_initiatives/across_us_utilities_share_experiences_smart_grid_deployments.
9. Energy Infrastructure Advocates. Prepared for the Edison Electric Institute. (January 2013). http://www.eei.org/ourissues/finance/Documents/disruptivechallenges.pdf

Addressing these issues through policy will be a challenge. The wide diversity of utilities and regulatory regimes around the country renders blanket state smart grid policy recommendations difficult. There are over 3,000 electric utilities in the United States. They can be organized into a few categories, represented below by their share of annual revenue:

Share of U.S. Utility Revenue by utility type



Policy and regulation tend to focus on investor-owned utilities (IOUs), which represent the majority of the market. Many public power entities (municipal utilities and rural cooperatives) are exempt from some, or all, public utility commission jurisdiction. Nevertheless, while they may not be subject to the direct authority of the utility commissions, these utilities are heavily influenced by the market structures established for the IOUs, and many legislative policies are equally applicable to all utilities regardless of their ownership status. Despite this diversity in utility regulation, some overarching regulatory and statutory policy elements have been identified as important to fostering greater deployment and utilization of smart grid technologies and solutions. We have summarized these in seven general categories below.

1. **Raise Consumer Awareness of, and Engagement in, the Smart Grid**

Despite the steep deployment curve of smart grid technologies, the single greatest barrier to widespread utilization may be consumer awareness. This barrier is not surprising considering how little time consumers spend interacting with their utility. A recent study by Accenture found that the average American household spends only nine minutes, on average, interacting with their utility company over a 12-month period.[10]

The good news is, those customers aware of the smart grid are overwhelmingly optimistic about the prospects of reducing energy consumption and faster grid response during outages. A GE survey found that, of those Americans familiar with the term "smart grid", four out of five believe it will help them manage their energy consumption and enable the utility to respond to outages more quickly.[11] However, in the same survey, GE found that fewer than 10 percent of Americans have heard of the smart grid and are familiar with what it is. With the increasing pervasiveness of technology in all aspects of society, much of the groundwork for communicating benefits is established. Consumers have a base of reference to understand the potential role technology could play in facilitating services they may not even know exist today.

Similarly, one of the biggest unknowns from existing deployments is the true level of consumer response. Recognizing the need to engage customers, the National Association of Regulatory Utility Commissioners (NARUC) has given clear direction with respect to customer engagement, as articulated in the association's Resolution on Smart Grid Principles:[12]

Consumer Engagement. *Consumer education and engagement are essential to a successful smart grid deployment. State commissions should require smart grid implementation plans to include comprehensive consumer education programs…Consumer behavior studies and well-structured experimental design may inform consumer education approaches, as may the emerging market demand for smart-home applications and services.*

The U.S. DOE has also recognized the need to engage customers,[13] having launched a customer engagement workshop and a series of deployment studies addressing consumer behavior.[14]

Policy Proposals:

- **Regulators:** Require minimum customer outreach, awareness and satisfaction targets with any smart grid or AMI deployment.

- **Legislators:** Require state regulators to follow the direction of the NARUC Resolution on Smart Grid Principles and adopt rules to implement the recommended prioritized metrics such as customer awareness, customer engagement and customer satisfaction in utility smart grid deployments.

10. Accenture: Actionable Insights for the New Energy Consumer, 2012. http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-Actionable-Insights-New-Energy-Consumer.PDF
11. General Electric. National Survey: Americans Feel a Smart Grid Will Help Reduce Power Outages, Personal Energy Usage. http://www.genewscenter.com/Press-Releases/National-Survey-Americans-Feel-a-Smart-Grid-Will-Help-Reduce-Power-Outages-Personal-Energy-Usage-26c9.aspx
12. National Association of Regulatory Utility Commissioners (NARUC). Resolution on Smart Grid Principles. Adopted by the NARUC Board of Directors July 20, 2011. http://www.naruc.org/Resolutions/Resolution%20on%20Smart%20Grid%20Principles.pdf
13. U.S. DOE. Smart Grid Investment Grant (SGIG), Consumer Engagement Working Group. http://www.smartgrid.gov/federal_initiatives/featured_initiatives/department_energy_convenes_smart_grid_customer_engagement_working_group.
14. U.S. DOE. SGIG, Consumer Behavior Studies. http://www.smartgrid.gov/recovery_act/consumer_behavior_studies

2. Advance "Green Button" Implementation and Evolution

In the fall of 2011, the White House issued a call to action for a Green Button program modeled after a successful federal "blue button" program, which enabled easy access to military health records.[15] The initiative was led by Aneesh Chopra, then Chief Technology Officer for the White House, and the data standards were developed at the National Renewable Energy Laboratory.[16] The concept is simple – encourage utilities to allow customers to access their historical energy usage data (Green Button) and provide that data to a third party (Green Button Connect).

In total, 38 utilities have committed to providing this functionality to their customers. However, only seven utilities have actually implemented it and many utilities have yet to commit to a specific implementation plan. Regulators governing these utilities should ensure that this functionality is established in a timely fashion. Further, the Green Button Initiative has identified opportunities to establish ongoing information feeds, or "Green Button Connect," that regulators should ensure are pursued by the utilities within their jurisdictions.

Many feel that Green Button and Green Button Connect are just the beginning and are eager for a more powerful approach – a "Green Button 2.0". Toward this vision, the Institute for Energy Efficiency (IEE) has made some recommendations on how to take Green Button to the next level:[17]

- Push toward the automation of data transfer
- Establish frameworks for third-party authorization
- Create a "go-to" marketplace for Green Button applications

Similar to the Green Button, the Federal e-KNOW Act would amend the Public Utility Regulatory Policies Act of 1978 to grant consumers the right to access their retail electric energy information in an electronic form.[18]

Policy Proposals:

- **Regulators:** Seek implementation timelines for utilities that have committed to Green Button and Green Button Connect.
- **Legislators:** Adopt a state resolution urging the federal government to pass S.1029, the eKNOW Act.
- **NARUC** should convene a working group comprised of representatives from the Department of Energy, state regulators, utilities and industry smart grid technology providers to develop a framework for "Green Button 2.0".

15. The White House. Modeling a Green Energy Challenge after a Blue Button. (September, 15th, 2011) http://www.whitehouse.gov/blog/2011/09/15/modeling-green-energy-challenge-after-blue-button
16. Scanlon, Bill, National Renewable Energy Laboratory. 2012. New tool makes Saving Electricity Easier. http://www.nrel.gov/news/features/feature_detail.cfm/feature_id=2003
17. IEE. Green Button: One Year Later. http://www.edisonfoundation.net/iee/Documents/IEE_Green%20Button%20Report_Final.pdf.
18. e-KNOW Act, S.1029, sponsored by Senator Mark Udall (D-CO) and Senator Ed Markey (D-MA), 112th Congress. http://www.opencongress.org/bill/112-s1029/show.

3. Establish Utility Performance Metrics for Delivery Infrastructure

Participants in the policy forum shared in the belief that investments in the modernization of utility infrastructure have been under-utilized in their potential to make the electric power system more efficient. The existing generation, transmission and distribution infrastructure is sized to meet peak electricity demand, which is typically two to three times higher than baseload demand. As a result, the generation fleet has operated at average asset utilization rates of below 50%, while many transmission and distribution systems operate at even lower utilization levels.[19] Utility-facing intelligent infrastructure investments have the potential to increase this utilization. Consumer-facing technologies such as AMI have many functions that could allow much greater consumer control of energy usage, energy cost and home energy management strategies, but they are not enabled. Similarly, utility facing grid management opportunities are underutilized because they don't inherently contribute substantially to the utility's shareholder returns as viewed by Wall Street. Innovation throughout the system is seen as a "risk" with very little potential financial reward. These and other "non-wires" solutions could positively impact the utilization of existing infrastructure while deferring or avoiding the need to invest in new traditional infrastructure.

Regulators should establish performance metrics to advance energy efficiency and distributed energy resources. Using those metrics as a foundation, they should then establish rate recovery mechanisms that support additional investment in modernization efforts that can serve as a platform for innovative products and services. Many smart-grid enabled solutions - from time-of-use pricing to dynamic volt-VAR control - have yet to be truly embraced by utilities as a result of disincentives to reduce sales volumes. These disincentives are the byproduct of traditional 'cost-of-service' ratemaking processes still employed in 35 states for investor-owned utilities (and for most municipal- and co-operatively-owned utilities).

In the case of IOUs, traditional incentives to invest capital in the distribution system still exist. But unlike traditional distribution investments such as circuit or substation capacity increases, which are 'used and useful' immediately upon commissioning, the creation of value from smart grid investments is not a given, or may not fully manifest itself for several years. New distribution performance measures and metrics are needed to address the disincentives and recognize the challenges of smart grid value creation. In such a framework, utility performance, rather than level of capital investment, would serve as the basis for utility compensation. Regulators should consider both performance metrics and changes in compensation models that share risk and reward innovation if the efficiency, economic, reliability, and environmental potential of smart grid investments are to be fully realized.

Policy Proposal:

- **Legislators:** Instruct regulators to open an investigatory docket to examine ways in which performance metrics may be tied to utility revenues by expanding the intelligent infrastructure of the utility grid for increases in asset utilization rates.

- **Regulators:** Require utilities to develop and propose performance-based metrics that will maximize the value of utility smart grid investments, building upon successful models currently in place in California, Ohio, Maryland, and Illinois.[20,21]

19. Centolella, Paul A. Analysis Group. A Pricing Strategy for a Lean and Agile Electric Power Industry. http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/2012_Centolella_Dynamic_Pricing.pdf
20. Alvarez, Paul. Wired Group. Smart Grid News. Is this the Future? A simple method for performance-based smart grid regulation. http://www.smartgridnews.com/artman/publish/Business_Policy_Regulation/Is-this-the-future-A-simple-method-for-performance-based-smart-grid-regulation-5163.html#.UbDFLefVArU.
21. Alvarez, Paul. Smart Grid News. A better way to do smart grid cost recovery (PUCs pay attention). http://www.smartgridnews.com/artman/publish/Business_Policy_Regulation/A-better-way-to-do-smart-grid-cost-recovery-PUCs-pay-attention-5089.html#.UbJbP_lOSSp

4. **Leverage the Smart Grid to Advance Energy Efficiency, Renewable Energy and Demand Response Integration**
AMI and real-time information systems can be used to support the integration of energy efficiency and renewable energy at both wholesale and retail levels.[22] In order to support the best resource deployment, regulators should establish open planning methodologies that allow both utility and non-utility service providers to understand where energy resources are needed the most. For example, this could include how to use energy management services to support grid operations and renewable energy integration. Increased transparency with regard to the real impacts and benefits of distributed energy interconnection and net metering policies will help optimize utility planning and develop new markets for energy services.

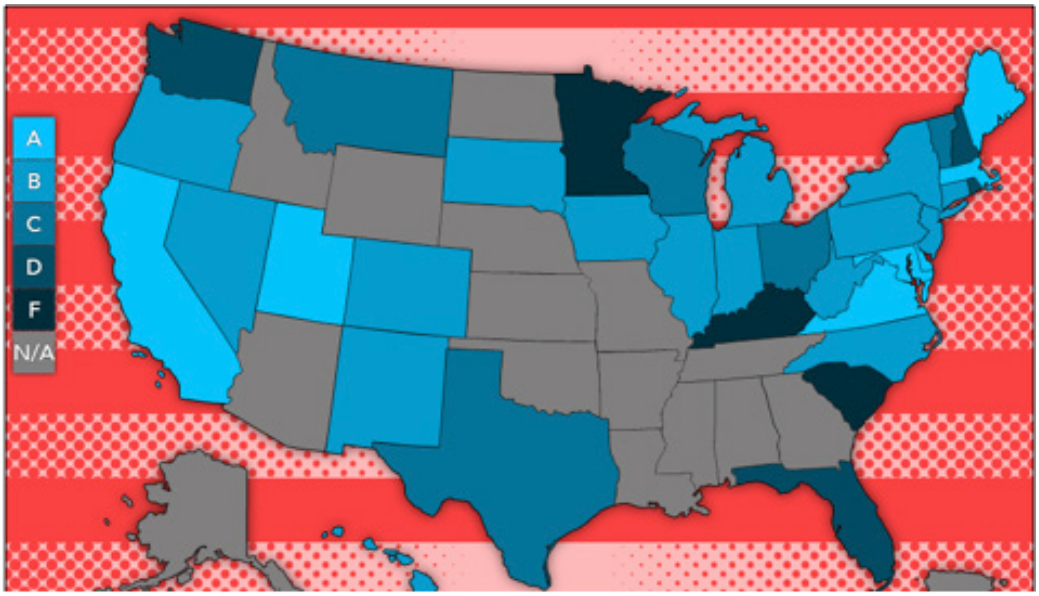


Figure 2. Freeing the Grid Report state scores for Interconnection polices.

Renewables

Utilities and regulators should examine grid technologies that more effectively allow for integration of large-scale wholesale renewable resources, to forecast weather impacts and to automate resource deployment for higher reliability and maximized use of renewable generating capacity. For distributed generation resources, utilities should be using software that will allow them to manage these localized resources more effectively and allow those resources to be managed within the system as with other generation resources for both lower emissions and greater grid resiliency. The smart grid's ability to leverage renewable energy investments on the customer side of the meter is governed to some extent by the maturity of a given state's interconnection and net metering policies. (See the recommended policies in the "Freeing the Grid" Report.[23])

22. Smartgrid.gov. Examples of smart grid projects that have enabled customer engagement, efficiency, demand response and renewable integration in ID, MT, MI, MN, FL, & TX. http://www.smartgrid.gov/recovery_act/program_impacts.
23. Freeing the Grid Report. Best Practices in State Net Metering Policies and Interconnection Procedures. http://freeingthegrid.org/.
A collaboration of the Vote Solar Initiative, Interstate Renewable Energy Council, North Carolina Solar Center, Network for New Energy Choices.

Energy Efficiency

The Alliance to Save Energy has produced a thorough report with solutions for enabling energy efficiency from AMI deployments.[24] In the report, ASE notes that "Consumers must receive perceptible benefits from smart grid systems, especially smart meters and appliances; the ability to analyze and reduce energy use can provide such a benefit, provided that ability is easily accessible and easy-to-use."

The "easy-to-use" component is key. It is important to note that providing large quantities of energy consumption data to consumers has proven to not motivate customers to reduce their energy consumption.[25] The NARUC Smart Grid Principles also address the importance of customer insights to enable energy efficiency:

Dynamic Rates, Usage Data and Controls. *State commissions should consider whether to encourage or require the use of tools and innovations that can help consumers understand their energy usage, empower them to make informed choices, and encourage consumers to shift their usage as appropriate…*[26]

Demand Response

One of the key opportunities for putting AMI data to work is in load shifting and the provision of some ancillary services enabled through smart appliances.[27] In order to encourage greater smart appliance manufacturing, and consumer adoption, policy makers should direct balancing authorities and utilities to offer rates and price signals that allow appliances to respond. Requiring these pricing signals in a given market would give appliance manufacturers the certainty they need to design and deploy new product offerings.[28]

Policy Proposals:

- **Distributed energy resources.** "Freeing the Grid" is a report issued each year by the non-profit group Vote Solar. In it, they evaluate the best practices for expanding solar generation specifically, however their recommendations on interconnection and net metering have merit and value across the spectrum of distributed resources. Each state with a smart grid deployment should implement the state-by-state policy recommendations contained in the Freeing the Grid Report.

- **Energy efficiency resources.** Policy makers should require programs that provide consumers with easy to use insights, not just interval and historical consumption data.

- **Demand response.** Regulators and legislators should require minimum utility pricing signals in order to drive innovation in the smart appliance industry.

24. Alliance to Save Energy; Tom Simchak & Lowell Ungar. Realizing the Energy Efficiency Potential of Smart Grid (May, 2011). http://www.ase.org/sites/default/files/ASE-smart_grid_white_paper_0.pdf
25. Katie Fehrenbacker, GIGAOM. Five Reasons Why Microsoft Hohm Didn't Take Off. http://gigaom.com/2011/07/01/5-reasons-why-microsoft-hohm-didnt-take-off/
26. National Association of Regulatory Utility Commissioners (NARUC). Resolution on Smart Grid Principles. Adopted by the NARUC Board of Directors July 20, 2011. http://www.naruc.org/Resolutions/Resolution%20on%20Smart%20Grid%20Principles.pdf
27. Pacific Northwest National Laboratory. Use of Residential Smart Appliances for Peak-Load Shifting and Spinning Reserves; Cost/Benefit Analysis. http://www.aham.org/ht/a/GetDocumentAction/i/51596
28. GE's Energy-Efficient Appliances Just Got Smarter – What a Brillion™ Idea. http://pressroom.geappliances.com/news/ge-s-energy-efficient-appliances-190126

5. Establish Consumer Data Policies

Smart meters will soon serve a majority of American households. Yet outside of two states (California and Texas) consumers do not have a way to directly access their AMI data. Policies that put consumers in charge of the access to their data will also allow for innovation in consumer-focused applications and consumer-oriented services.

While it is true that most utilities with smart meters offer home energy reports and web portals, they do not allow the kind of data portability that is required to foster innovative products and services using these data. To address this "freeing of the data" problem, state regulators should consider implementing data access policies that rely on nationally recognized standards. At a minimum, these standards should ensure:

(1) access to interval energy data and the ability to share with other service providers

(2) ability to monitor real-time energy information (i.e., for a customer to be able to "listen in" on their smart meter).

Who owns the data?

A 2010 DOE report argues that consumers should be able to authorize third-party usage of their data. Generally, utilities consider the data generated from consumer usage to be their property and they may grant access to that data to the consumer – yet ownership may allow the utility to block third-party access that could benefit consumers without yielding a similar benefit to the utility. It may be preferable to establish that ownership of data lies with the consumer and that utilities have unrestricted access to that data as a provision of the consumer/utility relationship.

Third-Party Data Access, Scope and Regulation

Third-party providers are expected to play a key role in driving innovation in the smart grid. The NARUC Smart Grid Principles state that

Rules that govern data access must balance privacy with innovation…The North American Energy Standards Board (NAESB) Third Party Access to Smart Meter-based Information provides a good reference point when developing such rules.

A 2012 DOE report illustrates the complexities of third-party data access and the need for standardization (see summary chart on the next page).[30] In the report, DOE observes that:

The inability for energy efficiency service providers (EESPs) to gain access to the data because of legitimate privacy concerns creates a barrier to realizing many of the benefits from these services. Often, regulatory commissions confront and must resolve two competing policy imperatives: (1) the need to facilitate access to customer data for energy efficiency purposes while (2) safeguarding customer privacy and providing consumer protections in connection with unwanted uses of data.

When considering the wide variety of standards currently in place, the first distinction is with regard to who is allowed access to data and secondly, the level to which customers control and have a voice in the sharing of that data. For example, in VT and OR, the state PUC is allowed access to data without customer consent. WI has negotiated data

29. U.S. DOE. Data Access and Privacy Issues Related to Smart Grid Technologies. (October 2010). http://energy.gov/sites/prod/files/gcprod/documents/Broadband_Report_Data_Privacy_10_5.pdf
30. U.S. DOE, EERE. A Regulator's Privacy Guide to Third Party Data Access for Energy Efficiency (December, 2012). http://www1.eere.energy.gov/seeaction/pdfs/cib_regulator_privacy_guide.pdf.

access between program administrators and utilities at the utility's discretion and without confirmation of access from customers; CO and OK allow Contractors for program implementation to look at the data without customer consent. CO, VT, and OK allow Energy Efficiency Service Providers to look at energy data without customer consent, but CO, OK, and TX allow customers to choose to keep that information confidential through an opt-out provision. Finally, CA, CO, IL, OK, PA, TX, and WA allow customers "unfettered access" to their own energy data.

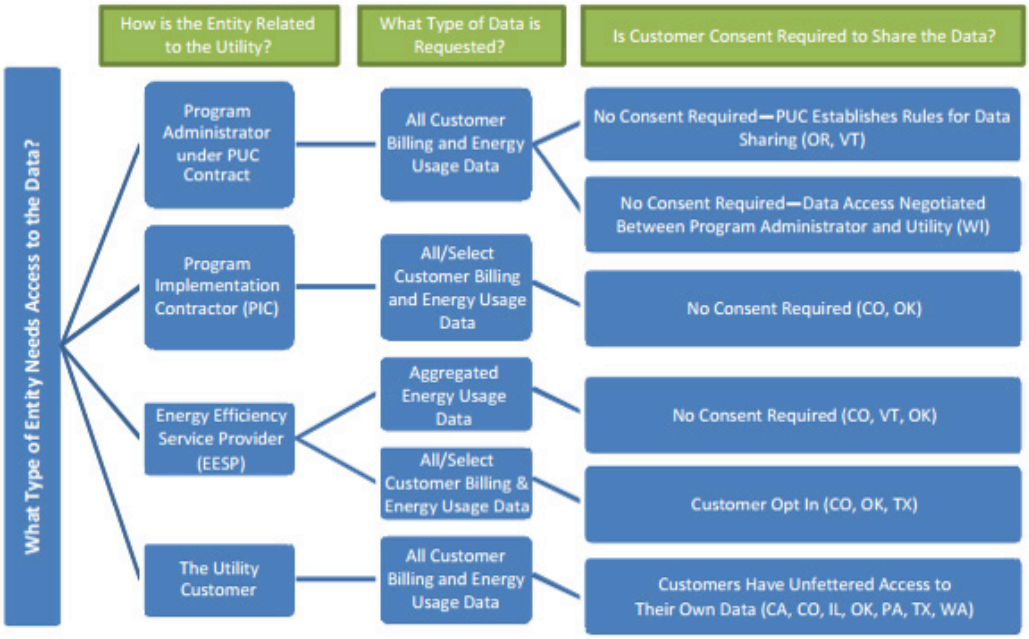


Figure ES-1. Overview of state approaches on accessing customer utility data

Perhaps even more important than the process for accessing data are the guidelines and provisions for use of customer data by a third party. California has found a fairly simple way to define this scope by limiting the use of customer-specific energy use data (CEUD) for a "primary purpose". In July 2011, the California Public Utilities Commission (CPUC) adopted rules to protect the security and privacy of data generated by smart meters. In the rules, the CPUC defined a "primary purpose" governing third-party "covered entities" as limited to: (1) provide or bill for electrical power, (2) fulfill other operational needs of the electrical system or grid, (3) provide services as required by state or federal law or specifically authorized by an order of the Commission, or (4) implement demand response, energy management, or energy efficiency programs under contract with an electrical corporation, under contract with the Commission, or as part of a Commission authorized program conducted by a governmental entity under supervision of the Commission.[31]

Policy Proposals:

- States should clearly address who owns customer AMI data without denying customer access to their own data.
- The scope of third-party use of customer data should be clearly defined (Example: California PUC rules defining a "primary purpose").
- States should move to standardize rules for third-party data access.

31. CPUC Decision 11-07-056 July 28, 2011. DECISION ADOPTING RULES TO PROTECT THE PRIVACY AND SECURITY OF THE ELECTRICITY USAGE DATA OF THE CUSTOMERS OF PACIFIC GAS AND ELECTRIC COMPANY, SOUTHERN CALIFORNIA EDISON COMPANY, AND SAN DIEGO GAS & ELECTRIC COMPANY http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/140369.htm

6. Standardize and Adopt Data Privacy Policies

A great deal of work has been done to develop privacy policies that protect consumer privacy while also enabling meaningful consumer benefits. Several states have promulgated rules based on these privacy principles. It is important to draw the distinction between customer-specific energy usage data (CEUD) and personally identifiable information (PII) such as customer account numbers. Sound data-privacy standards protect customer PII while enabling CEUD to be used by third parties, in anonymous and aggregate form, for a variety of energy and demand related services.

Establishing data privacy standards for utilities and third parties is a minimum requirement for states looking to promote deployment of smart grid products and services. Model policies include those found at: Future of Privacy Forum, Privacy by Design, NIST Guidelines for Guidelines for Smart Grid Cyber Security. California, Colorado, Vermont and Texas have established robust standards via regulatory rulings, but more states need minimum standards. As a basis for a conversation on minimum standards, the DOE also provides the following business practice recommendations to increase accountability for entities under the jurisdiction of a state PUC that possesses customer information. These policy options may be useful practices for states to consider:[32]

- Require that each utility and contractor be covered by a privacy policy, obtain regulatory approval of the policy, follow the policy, and make the policy available to customers
- Require utilities to submit annual reports that include their written privacy policies, compliance statistics, and information about each complaint received, including its resolution
- Encourage periodic "privacy audits" for utilities and third parties to assure the public that these entities are faithfully maintaining the privacy of customer data and using it only for authorized purposes
- Encourage "for cause audits" when major changes (e.g., bankruptcy) occur to the corporate structure of an entity handling CEUD, or when a data breach has occurred

During the July 2011 NARUC meeting, several committees adopted a Smart Grid Principles resolution that identified the NAESB Data Privacy Standard as a good reference point for commissions considering rules related to data access by consumers.

32. U.S. DOE. Smart Grid Privacy Workshop Summary Report. (January, 2012). http://www.smartgrid.gov/sites/default/files/doc/files/Privacy%20report%202012_03_19%20Final.pdf. www.naesb.org/misc/data_privacy_bd120910.ppt

Policy Proposals:

- **Legislators**
  - Require PUCs to establish minimum consumer data privacy standards for customer energy usage data. Model legislation: California

  - States should follow the lead of California, Wisconsin, Vermont and Colorado in establishing data privacy standards:

    - California Public Utilities Code §8380(f); 4 Colo. Code Regs. 723-3 Part 3 §3976;

    - Wisconsin Public Service Commission. (2009). Provision of Energy Utility Customer Information to Focus on Energy. Docket No. 9501-GF-101;

    - Vermont Public Service Board. (2010). Investigation into Petition Filed by Vermont Department of Public Service Re: Energy Efficiency Utility Structure. Docket No. 7466.

    - Colorado Public Utilities Commission. (2011). In the Matter of the Proposed Rules Relating to Smart Grid Data Privacy for Electric Utilities. Docket No. 10R-799E.

- **Regulators** – Adopt minimum privacy guidelines using the DOE recommendations for third parties and the NAESB Data Privacy Standard as foundations.

The advanced energy industry should be directly involved in shaping the development of a multi-stakeholder Voluntary Code of Conduct for Smart Grid Data Privacy, an effort being hosted by the Department of Energy .

33. U.S. DOE, Office of Electricity Delivery and Energy Reliability. Voluntary Code of Conduct for Smart Grid Data Privacy. http://energy.gov/oe/downloads/notice-open-meeting-february-26-2013-multi-stakeholder-process-develop-voluntary-code

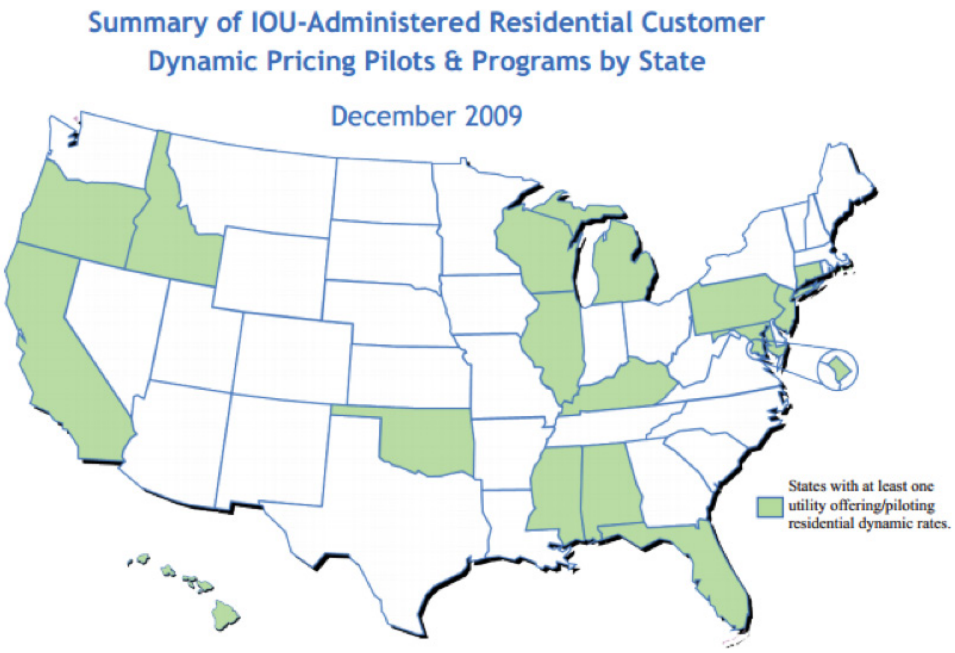
7. Modernize Rate Offerings

One of the most prominent declared benefits of smart grid investments, including advanced metering and control systems, has been the potential to introduce innovative rate structures that promote changes in consumer behavior to make the electric power system more efficient.[34] "Many of the benefits, particularly on the customer side of the meter, are driven by rate design."[35] Peak power can often cost as much as 10 times the rate of base load power (sometimes even more), yet most consumers see no difference in price, with electricity sold at a fixed rate regardless of when it is used or what it cost to produce at that time. Economists and advocates have long favored the use of time-varying "dynamic rates" as a way to more closely match retail rates with varying wholesale prices. However, for the typical consumer, these more innovative rate designs are far from their day-to-day experience. Despite a series of high-profile pilot programs throughout the country, the fact remains that very few customers have access to meaningful time-varying rate options. By some estimates, less than 1 percent of U.S. consumers have access to dynamic rates.[36]

Additionally, dynamic rates are an important strategic component of integrating renewable energy. Many ISOs are identifying new ramping and flexibility requirements driven by increasing penetration of variable generation resources. At the consumer level, the capabilities required for participation in dynamic rate offerings and renewable energy integration involve technology that automates demand management with grid conditions that can change throughout the day.

A focus on rate design in the coming years to allow for a better matching of energy efficiency, renewable energy and smart grid resources with consumer demand can allow utilities to maximize the value of these resources. Regulators should strive to establish an array of consumer rate options that can better match their usage profile and preferences. At a minimum, consumers should be able to select from among time-varying rates, demand response incentives, and rate plans that support the fair value of privately owned distributed energy resources. State regulators might cause dynamic pricing to gain a foothold in the residential market by making time of use rates mandatory for the largest customers in a rate class.[37]

34. Joskow and Wofram. MIT, UC Berkeley. Dynamic Pricing of Electricity. (January, 2012). http://faculty.haas.berkeley.edu/wolfram/Papers/AEA%20DYNAMIC%20PRICING.pdf.
35. Chuck Goldman & Roger Levy. Lawrence Berkeley National Laboratory. An Introduction to Smart Grid, Chapter 5, Rate Design. http://www.naruc.org/FERC/SmartGrid101/SmartGrid-101-Chap5-RateDesign-Final-031511.pdf.
36. Ahmad Faruqui, Jenny Palmer. Brattle Group. Dynamic Pricing of Electricity and its Discontents. (August 2011). http://www.smartgridnews.com/artman/uploads/1/Dynamic_Pricing_of_Electricity_and_its_Discontents_1.pdf
37. Ron Binz. Conquering Consumer Resistance: Time to Cross the Bridge to Time-of-Use Rates. http://www.energybiz.com/magazine/article/258021/conquering-consumer-resistance



Source: IEE[38]

Policy Proposals:

- **Legislators** – Require PUCs to initiate investigatory proceedings to identify the potential of dynamic pricing to drive economic efficiency, energy savings and integration of renewable energy in their jurisdiction. They should further direct PUCs to require a range of rate offerings that consumers can voluntarily select, especially in cases where consumers have distributed energy resources on their premises.

- **Regulators** – Establish proceedings that will lead to innovative rate designs from which consumers can select. This should begin with investigatory proceedings to identify the technical and market potential of dynamic rate structures.

The advanced energy industry should be directly involved in shaping dynamic rate offerings that will recognize the economic value of distributed energy resources, demand management systems, energy storage and electric vehicles. The industry should advocate for open market mechanisms that can allow their technology solutions to be integrated into existing utility programs and into organized wholesale markets.

38. IEE. Summary of IOU Dynamic Pricing Pilots. http://www.edisonfoundation.net/iee/Documents/IEE_DP_Map_Residential_1209.pdf

Conclusions

Advanced information systems offer an opportunity to transform the energy landscape as it has transformed so many other aspects of modern life. However, the current structure of energy management and regulation along with the disconnection of the consumer from the marketplace of opportunities creates a challenge for the development of a robust and innovative market.

There is nothing inevitable about what the competitive utility industry will look like in the future; it is the result of a well-established regulatory process within which the innovation community has been historically under-served. Following a flurry of activity relative to investments in smart grid infrastructure through the American Recovery and Reinvestment Act, the ensuing decline in regulatory activity represents an opportunity. Regulators (and, in particular, "champion" regulators) are learning more about both the challenges and the opportunities associated with smart grid capabilities and are looking for a reason to move forward.

Following the policy forum on grid modernization, the companies assembled identified some initial public policy steps that may be taken to begin to change this condition and create a foundation for energy innovation in grid modernization.

Raise consumer awareness of, and engagement with, the smart grid

1. **Regulators:** Require minimum customer outreach, awareness and satisfaction targets with any smart grid or AMI deployment.

2. **Legislators:** Require state regulators to follow the direction of the NARUC Resolution on Smart Grid Principles and adopt rules to implement the recommended prioritized metrics such as customer awareness, customer engagement and customer satisfaction in utility smart grid deployments.

Advance "Green Button" implementation and evolution

1. **Regulators:** Seek implementation timelines for utilities that have committed to Green Button and Green Button Connect.

2. **Legislators:** Adopt a state resolution urging the federal government to pass S.1029, the eKNOW Act.

3. **NARUC** should convene a working group comprised of representatives from the Department of Energy, state regulators, utilities and industry smart grid technology providers to develop a framework for "Green Button 2.0".

Establish Utility performance metrics for delivery infrastructure

1. **Regulators:** Require utilities to develop and propose performance-based metrics that will maximize the value of utility smart grid investments, building upon successful models currently in place in California, Ohio, Maryland, and Illinois[39,40].

Leverage the Smart Grid to Advance Energy Efficiency, Renewable Energy and Demand Response Integration

1. **Renewable energy resources.** Each state with a smart grid deployment should implement the state-by-state policy recommendations contained in the Freeing the Grid Report.

2. **Energy efficiency resources.** Policy makers should require programs that provide consumers with easy to use insights, not just interval and historical consumption data.

3. **Demand response.** Regulators and legislators should require minimum utility pricing signals in order to drive innovation in the smart appliance industry.

Establish Consumer Data Policies

1. States should clearly address who owns customer AMI data without denying customer access to their own data.

2. The scope of third-party use of customer data should be clearly defined (Example: California PUC rules defining a "primary purpose").

3. States should move to standardize rules for third party data access.

39. Alvarez, Paul. Wired Group. Smart Grid News. Is this the Future? A simple method for performance-based smart grid regulation. http://www.smartgridnews.com/artman/publish/Business_Policy_Regulation/Is-this-the-future-A-simple-method-for-performance-based-smart-grid-regulation-5163.html#.UbDFLefVArU.
40. Alvarez, Paul. Smart Grid News. A better way to do smart grid cost recovery (PUCs pay attention). http://www.smartgridnews.com/artman/publish/Business_Policy_Regulation/A-better-way-to-do-smart-grid-cost-recovery-PUCs-pay-attention-5089.html#.UbJbP_IOSSp

Standardize and adopt data privacy policies

1. **Legislators**
   - Require PUCs to establish minimum consumer data privacy standards for customer energy usage data. Model legislation: CA.

   - States should follow the lead of California, Wisconsin, Vermont and Colorado in establishing data privacy standards:

     - California Public Utilities Code §8380(f); 4 Colo. Code Regs. 723-3 Part 3 §3976

     - Wisconsin Public Service Commission. (2009). Provision of Energy Utility Customer Information to Focus on Energy. Docket No. 9501-GF-101

     - Vermont Public Service Board. (2010). Investigation into Petition Filed by Vermont Department of Public Service Re: Energy Efficiency Utility Structure. Docket No. 7466.

     - Colorado Public Utilities Commission. (2011). In the Matter of the Proposed Rules Relating to Smart Grid Data Privacy for Electric Utilities. Docket No. 10R-799E.

2. **Regulators** – Adopt minimum privacy guidelines using the DOE recommendations for third parties and the NAESB Data Privacy Standard as foundations.
   The advanced energy industry should be directly involved in shaping a Voluntary Code of Conduct for Smart Grid Data Privacy[41].

Modernize Rate Offerings

1. **Legislators** – Require PUCs to establish investigatory proceedings to identify the potential of dynamic pricing to drive economic efficiency, energy savings and integration of renewable energy in their jurisdiction. They should further direct PUCs to require a range of rate offerings that consumers can voluntarily select, especially in cases where consumers have distributed energy resources on their premises.

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Advanced Energy Economy (AEE)
Advanced Energy Economy is a national association of businesses and business leaders who are making the global energy system more secure, clean, and affordable. Advanced energy encompasses a broad range of products and services that constitute the best available commercial technologies for meeting energy needs today and tomorrow. AEE's members include companies involved in technology development; component and product manufacturing; project and infrastructure development; equipment installation; and engineering, finance, and advisory services, among other activities that help business and residential consumers meet their energy needs in better ways.

http://www.aee.net

Center for the New Energy Economy (CNEE)
Colorado State University's Center for the New Energy Economy was founded in February 2011. CNEE is a privately-funded initiative to support the growth of a clean energy economy across the United States. The Center is led by former Colorado Governor Bill Ritter and is assisted by some of the nation's most important thought leaders in clean energy research, development and commercialization. The Center works directly with governors, legislators, regulators, planners, policy makers and other decision makers with technical assistance to help them create the policies and practices that will facilitate America's transition to a clean energy economy. The mission of the Center is to incorporate best practices from around the nation and world to accelerate the development of a New Energy Economy.

http://cnee.colostate.edu