Advancing Smart Electricity Networks



A Report of the First Aspen Institute Initiative on Smart Energy and Network Technologies (INSENT) Roundtable

Dave Grossman, Rapporteur

THE ASPEN INSTITUTE
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This report is written from the perspective of an informed observer at the Aspen Institute Initiative on Smart Energy and Network Technologies. Unless attributed to a particular person, none of the comments or ideas contained in this report should be taken as embodying the views or carrying the endorsement of any specific participant at the Roundtable.

FOREWORD

The inaugural roundtable of the Initiative on Smart Energy and Network Technologies took place in Queenstown, Maryland in May of 2013, bringing together experts from various sectors of the energy and ICT (information and communications technology) industries to discuss innovative solutions towards the advancement of smart energy. That is, how can we use ICT to bring about more efficient, cleaner, cheaper and safer energy? Government officials, academics, business executives and NGO directors addressed problems of capital formation, public policy and technical applications that have been impeding the growth of smart energy networks for years. The resulting report, "Advancing Smart Electricity Networks" captures the insights and opinions of those participating members.

This topic has critical importance. Both the energy and ICT sectors see the need for modernizing and transforming our traditional electricity grid. Yet there is no system currently in place that is moving forward to bring the U.S. to the envisioned end state. Hence the Aspen Institute Communications and Society Program and the Institute's Energy and Environment Program agreed to convene for a dialogue across the energy and communications sectors to encourage the development of a new vision for smart electricity networks and a road map to get there.

This report is a result of that dialogue. It begins with a largely agreed upon vision for smart energy networks to replace the mostly one-way "linear" electrical grids we have throughout the country. In moving to an integrated network vision, where energy, information and economic value are exchanged at all points on the network, the group contemplated a network system that not only aims to be universally accessible, affordable, safe and reliable, but also clean, transparent, private and secure. Yet a number of hurdles inhibit making this vision a reality.

- **Building a Smart Energy Network**: What policy framework and business methods working together best allow direct participation by consumers—enabling new products, services and markets—and accommodating new generation and storage options?

- **Business Considerations**: As the centrally controlled electricity structure evolves into a more decentralized smart grid network, what innovative business models are likely to create new value propositions for smart electricity applications?

- **Consumer, Privacy and Security Considerations**: After the largely failed attempt at the smart meter rollout, the smart grid has the potential to offer consumers a more active "two-way" role in their energy use. Additionally, as new technologies are creating larger, decentralized networks, what monitoring and security protocols will be necessary and appropriate?

- **Jurisdictional Issues**: How can players overcome the serious federal-state jurisdictional discrepancies and barriers that face providers in this field?

In sum, the report highlights the potential economic and consumer benefits of a new network system, but also asserts the need for a shared vision among utilities, policy makers and the business world. Ideally, this is a step in the right direction towards achieving that shared vision.

The Aspen Institute Communications and Society Program and the Aspen Institute Energy and Environment Program want to thank our participating sponsors for making this and our other conferences possible. Specifically, we thank AT&T, Comcast, Duke Energy, Intel, McKinsey & Company and Verizon. We would like to also express our gratitude to our rapporteur, Dave Grossman, for his intelligent account of the Roundtable discussions.

We also want to thank the Aspen Institute Energy and Environment Program team for their help designing the Roundtable content and participant composition, specifically Deputy Director Nicole Alexiev, and Project Manager Tim Olson. And we would like to thank the Communications and Society Program staff on this project: Tricia Kelly, Assistant Director; Sarah Eppehimer, Senior Project Manager, who managed the Aspen conference itself; and Program Associates Shanel Balloo and Rachel Pohl for assisting with the conference logistics and the production of this report.

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July 2013

EXECUTIVE SUMMARY

The first roundtable of the Initiative on Smart Energy and Network Technologies (INSENT), a collaboration of the Aspen Institute Communications and Society Program and the Institute's Energy and Environment Program, brought together experts from the information and communications technology (ICT), electricity and non-profit sectors, investors, business executives and government officials to discuss their visions for a "smart electricity network" in the United States, what the barriers are to such a network and how best to advance smart energy networks.

The convergence of the ICT and electricity sectors provides an enormous opportunity for a new era of smart energy innovation, with the potential for transformational impacts in the electricity sector on par with those achieved by the telecommunications revolution. Applying ICT in the electricity sector could, in fact, be seen not just as analogous to what happened in telecom but as the next step in ICT's transformation of the economy, yielding information-enabled efficiencies and fundamentally different strategies, opportunities and business models.

A "smart electricity network," however, can mean many things to many people, encompassing a wide range of functions, goals and attributes. Much of the discussion at the Roundtable was focused on debating, refining and clarifying participants' collective understanding of *what* a smart electricity network actually is at its core, distinct from *how* we would like it to operate and *why* we are pursuing such a network—though, of course, the *how* and *why* are integral parts of the *what*, as one cannot optimize a system without knowing the objectives one is optimizing for. Ultimately, participants seemed to coalesce around the idea of a smart electricity network as an open access, multi-directional transactional platform that enables optimization of a range of objectives. This includes not only those objectives that are the foundation of the current electricity system (providing universal, affordable, reliable and safe power), but also new objectives such as enabling clean power, distributed generation, consumer choice and innovation.

Development of a smart electricity network is unlikely to be consumer-driven. Even when financing is available, there appears to be a fundamental absence of consumer demand for such a network. This may be driven by a lack of awareness or understanding of the network as a necessary means to an end. An alternative view is that the problem is not the absence of demand per se, but rather the absence of products, services and business models (e.g., plug-and-play capability) to meet whatever latent demand does exist in the market. Either way, while there may end

up being consumer demand for some applications and pricing options that will flow from a smart electricity network, it seems that the network infrastructure itself will need to be built out in the absence of strong consumer demand. Governments and businesses will have to focus on key places and opportunities within the existing infrastructure to start building out the greater network and advancing policies (such as net metering and perhaps an open access distribution tariff) that could help create the platform on which the future network can emerge.

Apart from lack of demand, several other concerns and barriers could hinder the emergence of a smart electricity network. For instance, utilities are worried about entering a business "death spiral" and about identifying an earnings path out of the current asset-focused world and into a network-focused world. There are concerns about the physical and cyber security of the electricity system, too; while a networked system might ultimately prove to be more resilient and self-healing, worries about the cyber-vulnerability of assets like nuclear power plants in a networked system seriously constrain innovation. Privacy and data concerns also need to be addressed, as the flood of "big data" that will enable companies to provide valuable electricity-related services and products will also expose facts about people and companies (e.g., whether someone is home, whether a business is increasing its number of shifts) in a way that has not been the case up to this point. Other industries already have to deal with privacy concerns (e.g., internet usage), and the trajectory of attitudes towards privacy and personal data seems to be in the direction of people willingly sharing information. In fact, a number of firms in the ICT sector—including AT&T, Comcast, Intel and Verizon—have launched efforts to address privacy concerns triggered by the new energy services by applying voluntary, enforceable codes based on fair information practice principles to govern their data collection and usage practices. But there continue to be questions about what kinds of electricity usage data should be made public and about who owns and controls that data as utility companies move into, what is to them, uncharted territory. In addition, attempts to blend the ICT and electricity sectors can run into some sectoral cultural barriers, such as differences in earnings profiles, capital requirements, innovation cultures and regulatory environments.

Going forward, there appear to be a few areas where continued Aspen Institute engagement may help further development of a smart electricity network, including:

- Advancing some sort of prize for teams of cross-functional, multi-disciplinary thinkers to develop the concept of what grid architecture might look like in 20 years.
- Facilitating the process of developing voluntary best practice standards drawn from the individual smart electricity network efforts already underway.

- Coordinating a process to develop a roadmap for implementing a smart electricity network, including cataloguing what is happening now, narrowing the universe of barriers to the high priority ones, positing specific solutions for each priority barrier and describing the pathway for those solutions to materialize.
- Organizing a forum for discussing the level of government at which regulation of various aspects of a smart electricity network should occur and the model for cooperation between the different levels of government, perhaps with a focus on an open access distribution tariff.

Roundtable participants seemed to find general agreement on the *what*, *why* and *how* of a smart electricity network. They may be able to continue to play a key role in making such a network a reality.

ADVANCING SMART ELECTRICITY NETWORKS

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Dave Grossman

VISIONS OF A SMART ELECTRICITY NETWORK

The convergence of the ICT and energy sectors has the potential to have transformational, disruptive impacts similar to those experienced during the telecommunications revolution. As was the case with telecommunications, developing a smart electricity network can be viewed as an infrastructure transformation challenge within a heavily regulated industry, capable of spurring fundamentally different strategies, opportunities and business models in a relatively short period of time. The telecom analogy is not perfect, of course, but it is illustrative. In fact, Bracken Hendricks, Senior Fellow at the Center for American Progress, views electricity as "the next wave of ICT transformation in the physical economy" that will drive the same kind of information-enabled efficiencies. There may also be a similar dematerialization that occurs—a shift from providing a commodity to providing a service. Just as music is no longer vinyl but rather the ability to listen to music, so too will the way energy is sold, purchased and used, fundamentally change.

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– Bracken Hendricks, Center for American Progress

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This vision of a smart electricity network encompasses distributed generation, the smart grid, energy efficiency and many other elements, all of which have thus far operated mostly within separate policy silos. Most policymakers (and others) are not yet thinking in a focused way about these silos being part of a networked energy web.

The electricity grid we have now is linear, with one-directional flow from generation (supply) to transmission and distribution (network management) to end use (demand). This grid is largely inefficient and opaque, though it has admirably served the functions for which it was originally designed—namely to provide universal, affordable, reliable and safe energy. Hendricks's vision of a smart electricity network, in contrast, has supply, demand and network management happening everywhere. End use, for example, can be not only a source of demand but also a

source of supply (e.g., rooftop solar). The complexity of this system is undeniable, but that is also the source of its power and potential economic impact. In addition to fulfilling the same functions as the current grid, Hendricks's vision of a smart electricity network would also have the network be clean, transparent, private and secure. Within both sets of functions, there are principles and attributes (e.g., universal, affordable, clean) that reflect societal values and goals.

A "smart electricity network," however, can mean many things to many people, and it can be difficult to separate out *what* the network is from *how* we would like it to operate and *why* we are pursuing it (e.g., the desire for clean energy and energy efficiency, the ability to manage volatile supply and demand, improved resilience to storms, more support for innovation). Having a clear understanding of the what, why and how can be important in establishing a supportive framework for a smart energy network. Development of a smart electricity network will occur in part through natural evolutionary change, but enshrining some key high-level frameworks and principles early – as occurred with the telecom revolution (e.g., the internet is a space for commerce, there will not be censorship or regulation) – can help direct the development of the network.

The vision of the *what* around which Roundtable participants seemed to coalesce is basically an open access platform that enables optimization of a range of objectives. Supply, network management and demand functions would occur across the entire system. The network would empower consumers, but it would not be consumer-driven (especially since, as explained more below, there seems to be a lack of consumer demand). The network would consist of rules, connections, etc. that provide the ability to do transactions in a complex way we are currently unable to do. Larry Plumb, Executive Director of Emerging Issues & Technology Policy at Verizon, suggested that a change is needed to convert the grid from a distribution system to a "transactional platform." The network would enable improved, more efficient interactions between consumers and utilities so that everyone is empowered and can optimize business models. Raiford Smith, Director of Technology Development at Duke Energy, suggested that an analogy could be made to cable and telecom companies, which are not responsible for the cell phones, the cable-top boxes or, for the most part, the content that goes across the wires but rather "compete to be as efficient as possible" in connecting suppliers and consumers. The network would facilitate a world of what Dan Delurey, Executive Director of the Association for Demand Response and Smart Grid, referred to as "transactive energy," enabling multi-directional transactions to take

Supply, network management and demand functions would occur across the entire [smart energy network].

place within the electrical system, while policymakers would determine what the attributes of that broader system should be.

The objectives and attributes—the *why* and the *how*—are essential parts of the goal, however. William Webb, Chief Technology Officer at Neul, continually pushed Roundtable participants to think about the question "what are we trying to achieve?"—to think about what the actual drivers are for development of a smart electricity network. A purely technical *what* does not fully reflect what a smart electricity network would be, principally because you cannot have an optimized system without specifying the attributes for which you are optimizing.

Some aspects of the *how* and *why*—e.g., to help the U.S. maintain global competitiveness—are not really core to the goal so much as they are a by-product of having a smart electricity network. The centrality of other aspects of the *how* and *why* are less clear. "Clean," for example, is considered by some to be derivative. A network that enables consumers to get power with whatever attributes they want (green, low-cost, etc.) and that technologically enables distributed generation, renewable energy, energy efficiency and demand response will likely be inherently "cleaner," but the network itself is not about being "clean." In a very theoretical world, one could even have a "smart grid" powered entirely by coal-fired generation. For others, however, "clean" (or, more specifically, "low-carbon") is a fundamental goal and moral objective of a smart electricity network, and the network should be designed explicitly with optimization of that goal in mind. Both perspectives may be right; a smart electricity network may not have to be optimized for clean energy, but it should be.

Ken Ostrowski, Director at McKinsey & Company's North America Electric Power and Natural Gas Practice, suggested a slightly different vision of a smart electricity network that reflected his expectations that it would be built on top of the existing grid (as opposed to destroying the existing infrastructure) and would "accommodate and encourage 21st century advances in supply and demand side technologies and services." He offered a range of optimization dimensions (safe, reliable, affordable, universal access, secure, private and perhaps cleaner) and enabling actions (e.g.,

…a smart electricity network…would be built on top of the existing grid (as opposed to destroying the existing infrastructure) and would "accommodate and encourage 21st century advances in supply and demand side technologies and services."

– Ken Ostrowski, McKinsey & Company

distributed/expanded access, two-way flow/net metering, updated business models/pricing, improved intelligence and data privacy standards). In many ways, Ostrowski's vision was quite complementary, but Steve Hauser, President of New West Technologies, pointed out that it also reflected a somewhat more "evolutionary" and "incremental" approach as opposed to a more "revolutionary" and "non-linear" approach.

The aggregate input from Roundtable participants suggests that the following might represent a consensus goal statement for the group:

> *To create open access, information-enabled electricity network(s) that accommodate and encourage 21st century advances in technologies and services and that enable multi-directional transactions in generation, power delivery and use, optimized to achieve the following objectives:*

- *Clean*
- *Distributed*
- *Flexible and adaptable*
- *Universal access and ease of access*
- *Promoting innovation*
- *Enabling consumer choice*
- *Safe, affordable, reliable, secure*

Some of the terms in this statement are rather vague. What, for instance, does "affordable" mean? Does it mean providing a subsidy for the poor, not allowing bills to go up even if costs do, or something else? Does "open access" mean the electric grid version of net neutrality, where the network is neutral and everything else is exogenous? The use of such vague terms risks conveying an impression of agreement while masking deep divisions about what the goals actually are. Still, consensus goal statements by their nature can get only so specific, and Roundtable participants seemed to find general agreement on the *what*, *why* and *how* of a smart electricity network.

DEMAND FOR A SMART ELECTRICITY NETWORK

With the development of any new network, consideration of economic and financial markets is usually quite important. While this holds true for a smart electricity network as well, a more fundamental issue with a smart electricity network—even when the economics and finances seem to be in place—is the lack of consumer demand. All of the data gathered by "the internet of things"—all of the different devices with microprocessors, only a quarter of which are personal devices such as smart phones—create a "big data" ecosystem in which analytics will be essential for

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– Reed Hundt,

Coalition for Green Capital

devising products and services for which consumers might be willing to pay. But demand continues to be a problem. Even when financial arrangements are made so that clean energy is cheaper than carbon-intensive energy, Reed Hundt, CEO of the Coalition for Green Capital, has found that "almost no one wants to buy any of the outcomes of any of the business models." Connecticut's green bank, for instance, enables low-cost finance that would make rooftop solar less expensive than the regular electric bill for many homeowners, but only a small fraction of these homeowners have adopted solar. Connecticut's C-PACE program, which launched just this year, already has over 100 building applications on the table and has closed two deals totaling over $500,000. New York has decided to capitalize a green bank with $1 billion of capital, which could actually leverage $10 billion in available finance. Money is therefore available. A fundamental problem seems to be the absence of consumer demand.

A key question is what the value propositions of a smart electricity network are for different consumers—as Jon Froehlich, Assistant Professor in the Department of Computer Science at the University of Maryland, asked, "who can win, and why?" End users will still basically flip a switch and have the lights come on, and most people, especially in a residential setting, do not want to pay much attention to their utility bill and electricity usage (though we tend to be very aware of how much transportation fuel costs). The existence of a smart electricity network would likely give consumers many new choices in terms of service, responsiveness, "apps," pricing options and the like, but consumer demand for the existence of the network itself is weak. If demand starts anywhere, it will likely be with commercial and industrial customers, who have the most to gain.

An alternative perspective is that the problem is not the absence of demand per se, but rather the absence of products, services and business models to meet the latent demand that does exist in the market. There may be a need for different business models and creative pricing options to drive demand (e.g., fixed price models for suites of services or for levels of usage, which Rick Gasloli, Senior Vice President of Engineering for Comcast Corporation, noted is the model used in

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– Rick Gasloli,

Comcast Corporation

the telecom sector). There is a business model question, for instance, concerning how to own and extract economic value from information technology and controls across a number of buildings; financing for large centralized energy assets is easier to plan, build and own. Companies and people do want cheap green energy and energy efficiency, but the challenge is figuring out how to efficiently provide it. And not all customers will have the same demands: some, for example, may want choice, while others may want clean power or cheap power or a predictable bill. Dan Delurey, Executive Director of the Association for Demand Response and Smart Grid, suggested that smart networks are about injecting information controls, sensors and the like into the electric system so it is optimized to provide "all of the information, all of the choices, all of the options, all of the time."

Given that most people are not going to actively manage their energy consumption at the residential level, Michael Pfau, Assistant Vice President at AT&T Services Inc., suggested there may be a need for a device in the house that performs some function that people want but that also allows other applications to be put on it that stimulate more sophisticated decisions without a lot of homeowner engagement – the electricity equivalent of smart phones. Lorie Wigle, General Manager of Eco-Technology for Intel Corporation, noted that the current grid is also very far from plug-and-play capability, where someone could go to the store, buy a little backyard vertical wind turbine, easily plug it into their electrical system, and have a panel in the home recognize and draw power from the new generation source. These would represent new levels of service and choice, and their absence inhibits demand for smart electricity networks.

It is important to recognize the distinction between the network infrastructure and the applications that sit on top of that infrastructure.

It is important to recognize the distinction between the network infrastructure and the applications that sit on top of that infrastructure. Once the network infrastructure is in existence, then applications can drive dramatic change. (Of course, visions of the applications can mobilize industry and drive development of the infrastructure.) There may well be consumer demand for some of those applications, but it seems that the network infrastructure will have to get built out in the absence of strong consumer demand.

Some isolated building blocks of the network infrastructure are already in place (e.g., neighborhood-scale solar, tri-gen plants), and there will be more incremental advancements that make the business case for a much bigger transformation. There is a need to identify the key places within the infrastructure on which to focus in

There is a need to identify the key places within the infrastructure on which to focus in order to begin to build out the greater network and the hard-to-predict end-game applications. For instance, the new national emphasis on resilience and reliability….

order to begin to build out the greater network and the hard-to-predict end-game applications. For instance, the new national emphasis on resilience and reliability in the face of disasters such as Superstorm Sandy might be an opportunity to begin some of the strategic investments that could help build out the broader smart electricity network. Microgrids could be another area for exploring how to take advantage of new technology; microgrids are located on the edge right now but could begin to penetrate into the utility system. In addition, Graham Richard, CEO of Advanced Energy Economy, made the case that "the technologies and the innovation coming community by community" enable certain cities to "build and model new systems of delivery of electric power within the city" and to "reframe and rethink the way all kinds of services are delivered."

Ultimately, governments and businesses need to go with the technological trends, expedite some and redirect others. "It's always said that governments should not pick winners. That's just completely false," argued Reed Hundt, who is also the former chair of the Federal Communications Commission. "Of course you should pick the winners; that's what it means to believe in a technological trend and to open the door for it to succeed." Hundt explained that this is what happened in the telecom revolution, where government and business leaders agreed that mobility was superior to fixed line telephony and that the internet beat any other form of transmitting data. With a good winner-picking, trend-selecting process, changes in the electricity sector can be just as dramatic and rapid as they were in the information sector.

Policies such as net metering and true price signaling may be critical for creating the platform on which the future network can emerge and would enable people to be "prosumers" that can both buy and sell power. An open- access distribution tariff could further facilitate the transition from grid to network.

CONCERNS AND BARRIERS FOR A SMART ELECTRICITY NETWORK

There are many social, political and cultural concerns and barriers associated with a new smart electricity network. Despite all the potential benefits and pilot projects,

there are several reasons why we do not have a smart electricity network yet, including:

- Some utilities foresee a "death spiral" whereby cost-competitive distributed generation combined with a smart grid could lead to the utility losing customers, until the utility is just carrying the system costs ("disintermediation").
- Utilities are trying to figure out what Raiford Smith, Director of Technology Development for Duke Energy, calls an "earnings path out of the asset-focused world they are in" and into the "network-focused world" that seems to be coming.

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– Raiford Smith, Duke Energy

- Utilities like to comply with rules, but a networked market would require utilities to shift from complying with rules to innovating with the market as it grows—which can be a challenge for a sector that is usually not thought of as particularly entrepreneurial.
- The environmental and energy efficiency communities have not been significant advocates for a smart electricity network.
- There are 50 states that have to take action within their own regulatory frameworks.
- Utilities are struggling with the privacy and interoperability challenges involved in getting data out of devices (and out of utilities) and to entrepreneurs who can innovate—and many are concerned with questions of potential liability as they begin to contemplate what it might mean if they make new forms of energy use data available.
- Open grids in which anyone can put power in or take power out could lead to concerns about safety, reliability, security and price volatility.
- The existing legal and regulatory systems were basically designed for incumbent utilities and pose significant hurdles for "edge" companies (e.g., solar leasing, demand response).

The existing legal and regulatory systems were basically designed for incumbent utilities and pose significant hurdles for "edge" companies (e.g., solar leasing, demand response).

- As noted above, consumers really do not know about and have not been demanding the services that could come from a smart electricity network.

In particular, the convergence of ICT and electricity delivery raises issues of security and data privacy, as well as the potential clashing of two distinct corporate cultures.

Security

According to Lorie Wigle, General Manager of Eco-Technology for Intel Corporation, 41 percent of cyberattacks in the U.S. are on energy (including oil and gas). While some of these attacks are localized (e.g., manipulating smart meters), the attacks of greater concern are the ones that can have more sweeping system-wide effects (e.g., attacking synchrophasors). Electricity systems generally have one network for the control system and a separate one for IT, in an effort not to expose the control side of the system to the internet, but the system is still vulnerable (e.g., "you still have people going between the two of them with things like thumb drives"). There is a need for security that spans the entire system – and for good IT hygiene.

Bracken Hendricks of the Center for American Progress referred to the current grid as having a "hard shell and a soft center," meaning that once someone gets past the hardened exterior, the entire grid is vulnerable. While a smart electricity network still has lots of security vulnerabilities, it can also be more resilient and self-healing.

Joel Eisen, Professor of Law at University of Richmond Law School, noted that "from a legal standpoint, the complexity of cybersecurity…is mirrored in the complexity of the regulatory response to it," with many local, state and federal agencies involved. This creates multiple entry points for those looking to do harm.

Cybersecurity concerns can also be a barrier to innovation in the electricity sector, particularly where nuclear power plants are involved. The feeling there is often that an unconnected ("dumb") grid is a safer grid.

Privacy

The flood of data that is feeding "big data" analytics will yield important insights and products related to electricity use, and transparency is critical for creating industries around the data. But the flip side is that the data can also reveal whether someone is in the house, how many people are home, whether a business is going from two shifts to three, etc. The privacy concerns should not be dismissed; people's lives and companies' operations could be exposed in a way they have not been to this point. Still, other industries have already dealt with similar concerns (e.g., privacy concerns around internet usage), and people currently provide all sorts of data to retail stores that track their purchases. Lorie Wigle explained that attitudes towards privacy and personal data are rapidly evolving, with the trajectory apparently towards people willingly sharing information, but there is the potential for a backlash.

A key question is who owns and controls electricity usage data – the utility or the consumer? One possibility is that consumers could control their own (disaggregated) data, while utilities might control aggregated data. Green Button, Connect My Data is trying to facilitate the former, giving power to consumers to provide data access to third parties with whom they want to do business. Data distinctions also may go beyond aggregated and disaggregated. For example, David Kolata, Executive Director of the Citizens Utility Board, argued that sub-minute data and real-time data on electricity usage might reveal sensitive information that consumers should control. In addition, obtaining data can be very difficult for third party companies; requirements are different in every jurisdiction, and customer data can be stored in a range of formats (presenting another interoperability challenge).

State public utilities commissions are pursuing a dozen different fundamental approaches to privacy issues, posing a potential barrier to innovative companies seeking to offer services or products to customers nationwide. Eric Lightner, Director of the Federal Smart Grid Task Force at the U.S. DOE, is leading a multi-stakeholder process to develop "a voluntary code of conduct around data privacy" – common elements for fair information practices that could be used across states. The DOE effort is building, in part, on the example of a successful, multi-stakeholder effort to develop voluntary enforceable codes to protect privacy while enabling energy services innovation. Companies displaying a TRUSTe "PrivacySmart" seal signal they will ensure that when they receive energy data, they will care for consumer privacy concerns. Larry Plumb, with Verizon, noted that a group of firms, including AT&T, Comcast, Intel and Verizon joined forces with the Future of Privacy Forum, an advocacy organization, to spearhead development of the "PrivacySmart" seal program. San Diego Gas & Electric and Candi Controls are examples of two firms that used the seal program recently to certify that their data collection and usage policies conform to industry best practices for protecting consumer privacy.

Illinois, under its smart grid law, is pursuing pilot projects and tests to try to tackle some of the controversial big data questions. In general, some people would accept having their electricity consumption be a matter of public record (as it already is in Gainesville, Florida, which has municipality-wide sunshine laws and a municipal utility), to be used by third parties to innovate and deliver customer solutions (or by government to regulate). Others have a deeply held conviction that what goes on within the confines of someone's home is private, as well as concerns about how data might be used (e.g., revealing competitive business secrets, facilitating looting

during power outages). A line will have to be drawn somewhere that both fosters innovation and protects privacy.

Corporate Cultures

Attempts to blend the IT and electricity sectors can run up against some sectoral cultural barriers, including:

- Different earnings profiles, leading to concerns about explaining to telecom investors why the company is diluting its earnings with a new energy business.
- The large amount of capital in the power generation business that is tied up in collateral, with extreme volatility in capital requirements.
- Regulatory staff in telecom companies that are disinclined to spend additional time to manage new relationships with state energy regulators (especially for relatively low levels of net income).
- Energy companies' inability to recover technological R&D costs in their rate base and their lack of a portfolio of R&D investments across which to spread the risk.
- The gut-level discomfort of many energy companies with using technologies to enable people to use significantly less energy.
- Different regulatory environments, with energy companies generally rewarded based on the amount of capital they invest in assets (cost of service) as opposed to the services they actually provide, whereas telecom companies often operate under price cap regulation.

It is possible that these barriers can be surmounted by forcing them to be overcome, such as via a merger or a buyout. It is also possible that demand response companies or others with an understanding of the electricity regulatory environment but without the utility institutional culture will be the primary ones meshing with the telecom culture. As one participant explained, though, the traditional utility is "the elephant in the room" and likely cannot be ignored. In addition, while utilities all have high levels of inertia and focus on the earnings they make from capital investments, they are far from homogenous in their cultures and contexts: some are integrated, some have just wires, some are in states aggressively pursuing renewable energy and energy efficiency, some are in states doing little on clean energy, and so on.

Under virtually any model, there needs to be a system for supporting the wires and infrastructure in a consistent, reliable way; this could be a way to create a safe economic space for utilities around certain core functions. As Joel Eisen, Professor

of Law at University of Richmond Law School, explained, there should be some mechanism that provides "fair compensation for the common-carrier function that the distribution utilities provide" that also makes open access possible.

NEXT STEPS

There are many dialogues, conferences and other meetings exploring various aspects of smart electricity networks. The Aspen Institute will only seek to have further dialogues in this space if there are useful next steps it can help foster.

There is still more that could be done on the technology side. There could be some sort of Grid Prize (perhaps via Innocentive) for teams of cross-functional, multi-disciplinary top thinkers to develop the concept of what grid architecture might look like in 20 years. Aspen Institute INSENT Roundtable participants could be the competition judges. There may also be a need for the Aspen Institute to facilitate the process of developing voluntary best practice standards drawn from the individual smart electricity network efforts already underway.

That being said, the technological and engineering aspects of how to do a smart electricity network are already mostly understood. The issues going forward are more about business models, demand, markets and policy (e.g., how to address the barriers to treating demand resources and distributed generation equally with other supply resources, how to change policies to incentivize private capital to rebuild the infrastructure). There are bright spots here and there that illustrate progress in achieving a smart electricity network, but there are barriers to accelerating those. It might be a useful exercise to map out the regulatory, cultural, economic, and other barriers, decide which are the top priority impediments, and then determine how best to address each one. In other words, the Aspen Institute could coordinate a process that leads to a roadmap for implementing a smart electricity network, cataloguing what is happening now, narrowing the universe of barriers to the high priority ones, positing specific solutions for each priority barrier and describing the pathway for how those solutions can become reality.

Michael Kagan, Principal of MPK Energy Advisors, broached the idea of an "open access distribution tariff" (OADT) as one such solution "to facilitate the transition from the grid to the network." An OADT would be similar to the open access transmission tariff (OATT) that requires public utilities to provide open access transmission service on a comparable basis to the transmission service they provide

themselves. A similar tariff for distribution could help companies figure out where to locate distributed resources, where a microgrid could be helpful, where demand response could be valuable (and how valuable it would be), etc. Holly Rachel Smith, Assistant General Counsel for the National Association of Regulatory Utility Commissioners, noted that an OADT is a relatively new, complex idea, with many implications that need to be explored (e.g., stranded costs). Moving the concept of expanded distribution access forward may be best achieved via a federalism approach, talking seriously and early with state regulators about how some national structure and national leadership could facilitate regulators in advancing an OADT, so that there is a joint effort instead of a usurpation of authority. In other words, it may be best to pursue a national strategy with state/local action. In fact, for many issues relating to the smart electricity network, decisions have to be made about the level of government at which regulation should occur and the model for cooperation (or lack thereof) between the different levels of government. An Aspen Institute forum that surfaces that federalism discussion, perhaps focusing on the OADT, could be valuable.

Going forward, other key voices and perspectives to incorporate in Aspen Institute discussions include more investor owned utilities, state regulators, industrial and commercial energy consumers and the companies making the smart grid devices.

APPENDIX

The First Aspen Institute Initiative on Smart Energy and Network Technologies (INSENT) Roundtable

Advancing Smart Electricity Networks

Wye River Campus, Maryland • May 15—May 17, 2013

Roundtable Participants

Dan Delurey
Executive Director
Association for Demand Response and Smart Grid (ADS)

Joel Eisen
Professor of Law and Austin Owen Research Fellow
University of Richmond School of Law

Charlie Firestone
Executive Director
Communications and Society Program
The Aspen Institute

Jon Froehlich
Assistant Professor
Department of Computer Science
University of Maryland

Rick Gasloli
Senior Vice President, Engineering
Comcast Corporation

Dave Grossman *(Rapporteur)*
Principal
Green Light Group

Steve Hauser
President
New West Technologies

Bracken Hendricks
Senior Fellow
Center for American Progress

Reed Hundt
Chief Executive Officer
Coalition for Green Capital

Michael Kagan
Principal
MPK Energy Advisors

David Kolata
Executive Director
Citizens Utility Board

Eric Lightner
Director, Federal Smart Grid Task Force
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy

David Monsma
Executive Director
Energy and Environment Program
The Aspen Institute

Ken Ostrowski
Director
McKinsey & Company

Michael Pfau
Assistant Vice President
AT&T Services Inc.

Larry Plumb
Executive Director
Emerging Issues & Technology Policy
Verizon

Graham Richard
Chief Executive Officer
Advanced Energy Economy

Julie Simon
Deputy Director
Division of Policy Development
Office of Energy Policy and Innovation
Federal Energy Regulatory Commission

Holly Rachel Smith
Assistant General Counsel
National Association of Regulatory
Utility Commissioners

Raiford Smith
Director, Technology Development
Duke Energy

William Webb
Chief Technology Officer
Neul

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About the Author

Dave Grossman is the founder of Green Light Group—a consultancy firm specializing in environmental and energy research, writing, and strategy. Mr. Grossman has been studying and working in environmental policy, politics, law and organizing since the mid-1990s. He has developed expertise with issues ranging from climate change and energy efficiency to international environmental compliance, with perspectives drawn from domestic and international non-governmental organizations, state government and political campaigns.

In his consulting, Mr. Grossman has helped foundations plan and execute strategies on change grantmaking, helped institutional investors and businesses explore the risks and opportunities posed by climate change, represented non-profit clients at the annual UN climate negotiating sessions, kept clients up-to-date on fast-moving domestic policy processes, advised clients on how best to hone their ideas and strategies, helped organize and report on workshops and roundtables, prepared thoroughly researched strategy memos and public reports, and helped numerous clients transform complex concepts and processes into logical, organized and clear results.

Prior to founding Green Light Group, Mr. Grossman was a Staff Attorney with the Institute for Governance & Sustainable Development, managing projects for the International Network for Environmental Compliance and Enforcement (INECE). Before that, he worked in the 2004 presidential campaign cycle, first on Howard Dean's campaign in the Democratic primary and then in the general election with Environment2004 conducting outreach to women, sportsmen and independent voters. He also served as a law clerk for the Chief Justice of the Alaska Supreme Court, did environmental law work with Earthjustice and the Alaska Attorney General's Office, and was a grassroots organizer on endangered species and fisheries issues with the National Audubon Society (through Green Corps).

He graduated summa cum laude from Princeton University with a degree in Politics and received his law degree from Yale Law School.

The Aspen Institute
Communications and Society Program

www.aspeninstitute.org/c&s

The Communications and Society Program is an active venue for framing policies and developing recommendations in the information and communications fields. We provide a multi-disciplinary space where veteran and emerging decision-makers can develop new approaches and suggestions for communications policy. The Program enables global leaders and experts to explore new concepts, exchange insights, develop meaningful networks, and find personal growth, all for the betterment of society.

The Program's projects range across many areas of information, communications and media policy. Our activities focus on issues of open and innovative governance, public diplomacy, institutional innovation, broadband and spectrum management, as well as the future of content, issues of race and diversity, and the free flow of digital goods, services and ideas across borders.

Most conferences employ the signature Aspen Institute seminar format: approximately 25 leaders from diverse disciplines and perspectives engaged in roundtable dialogue, moderated with the goal of driving the agenda to specific conclusions and recommendations. The program distributes our conference reports and other materials to key policymakers, opinion leaders and the public in the United States and around the world. We also use the internet and social media to inform and ignite broader conversations that foster greater participation in the democratic process.

The Program's Executive Director is Charles M. Firestone. He has served in this capacity since 1989 and also as Executive Vice President of the Aspen Institute. Prior to joining the Aspen Institute, Mr. Firestone was a communications attorney and law professor who has argued cases before the United States Supreme Court. He is a former director of the UCLA Communications Law Program, first president of the Los Angeles Board of Telecommunications Commissioners, and an appellate attorney for the U.S. Federal Communications Commission.

The Aspen Institute
Environment and Energy Program
www.aspeninstitute.org/policy-work/energy-environment

The Energy and Environment Program provides nonpartisan leadership and a neutral forum for improving energy and environmental policy-making through values-based dialogue. For over 35 years, the Program has directly sought to improve the quality of thought leadership and the formation of policy through dialogue on the environmental challenges facing societies and organizations. The Program creates impartial venues for global leaders to engage in informed discussion around some of the most important and complex issues of our time through its policy dialogues, public programs, annual energy forums and the Catto Fellowship, an environmental leadership initiative.

Our core competency is professional, high quality and high-level content-driven policy, science, finance and business dialogue convening. The Energy and Environment Program also enters "Program Partnerships" with sponsoring organizations and has the capability, "honest-broker" reputation and convening power for pioneering new civil society partnerships, customized forums and intentional dialogues on specific environmental and sustainability topics.

The Program's efforts to advance collective knowledge about critical environmental problems have included collaborative dialogues on the impact and governance of climate change in the Arctic, conservation and human development, improving water access, sanitation, and hygiene policy, and international institutional responsibilities for validating emerging carbon markets.

We welcome your interest in our work and encourage you to become, or remain, part of this shared community that values lasting associations and connecting peers in the quest to make a difference, locally and in our wider shared world.

THE ASPEN INSTITUTE

The Aspen Institute is an educational and policy studies organization based in Washington, DC. Its mission is to foster leadership based on enduring values and to provide a nonpartisan venue for dealing with critical issues. The Institute has campuses in Aspen, Colorado, and on the Wye River on Maryland's Eastern Shore. It also maintains offices in New York City and has an international network of partners.

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