ADVANCING GLOBAL COMMUNICATIONS

# Smart Grid Policy Roadmap: Consumer Focused and Technology Driven

A White Paper Providing ICT Industry Perspective on How to Maximize the Benefits of the Smart Grid

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# Smart Grid Policy Roadmap: Consumer Focused and Technology Driven

ADVANCING GLOBAL COMMUNICATIONS

## OVERVIEW

Smart grid is a more robust application of information and communication technologies (ICT) to transform the generation, transmission, distribution and consumption of electricity to provide greater automation, increase reliability, improve efficiency and reduce energy consumption. ICT also facilitates the integration of electric vehicles as well as the intermittent energy generated by solar and wind into the electric grid.

**TIA believes modernization of the U.S. electric grid is a vital component of the nation's energy strategy aiming to reduce U.S. dependence on foreign oil, decrease carbon emissions, create jobs and help U.S. industry compete successfully in global markets for clean energy technology.**

Electric utilities and the ICT industry share a long tradition of partnering to build and maintain the communications networks contributing to the security and reliability of the grid. While ICT is not new to utilities, the degree of seamless integration between ICT and electric utility infrastructure provided by the smart grid provides unprecedented opportunities for utilities and consumers. Representing the ICT companies that innovate, manufacture and supply the ICT products and services that will make the smart grid a reality, TIA believes modernization of the U.S. electric grid is a vital component of the nation's energy strategy aiming to reduce U.S. dependence on foreign oil, decrease carbon emissions, create jobs and help U.S. industry compete successfully in global markets for clean energy technology. The smart grid has the potential to provide the following benefits:

### *Smart Grid Benefits*

1. Reduce energy consumption and carbon emissions through:
   - Empowering consumers with usage and pricing data enabling better end-use energy efficiency and conservation through real-time feedback, 365 days a year.
   - Reducing peak demand through demand response programs.
   - Reducing line-loss in transmission and distribution.
   - Facilitating the integration of renewable energy sources into the grid.
   - Enabling utilities to manage the addition of electric vehicles to the grid.
2. Create thousands of high-value, permanent jobs in the United States.
3. Position the United States to compete in a rapidly growing, multi-billion dollar global market.

There are significant and complex policy, market and logistical barriers that limit the development of the smart grid. Relevant lessons learned from the development of the ICT sector demonstrate that overcoming these obstacles will require policy that is consumer-focused and technology-driven. In addressing consumer and technology-related obstacles, TIA recommends the following policies to maximize the benefits of the smart grid.

### *Policy Recommendations*

#### Consumer Policy Recommendations

- Provide consumers with access to usage, pricing and carbon mix data in machine-readable form for use in third- party applications.
- Provide consumers with uniform and consistent privacy policies.
- Coordinate smart grid stakeholders in a sustained consumer awareness and education campaign.
- Provide incentives to assist with the purchase of consumer smart grid devices.

#### Technology Policy Recommendations

- Establish appropriate federal-level policies that define common goals and establish a common market for smart grid technologies.
- Technology neutrality across an open smart grid architecture is critical for innovation of smart grid solutions.

- Allow for voluntary standards to support the dynamic nature of ICT innovation and to maximize flexibility and choice in a rapidly changing, market-driven ecosystem.
- Provide additional funding for both R&D and off-the-shelf smart grid deployments across the span of viable technologies and architectures to evaluate technology effectiveness at scale.
- The FCC and DOE should continue to study and engage stakeholders in evaluating the need for additional spectrum to support wireless broadband for smart grid.
- The FCC should allow utilities to use the local and regional public safety 700 MHz wireless broadband network.
- Policymakers should seek technical expertise from qualified and neutral third parties in decisions relating to cybersecurity.
- As the smart grid is a complex and interconnected system, it is critical that information sharing between stakeholders be supported in policy and in practice.
- DOE and state regulators should provide adequate funding for cybersecurity.
- The ability of software to be updated and/or upgraded should be a core engineering concept at all levels of the smart grid infrastructure.
- Internet Protocol (IP) should be the end-to-end network layer for smart grid communications.

**Smart grid adoption in the United States can enable the reduction of CO2 emissions by as much as 230–480 MMT of CO2 by 2020 and save $15–35 billion dollars in energy and fuel costs.**

## SMART GRID BENEFITS

### *Reduce Energy Consumption and Carbon Emissions*

ICT, or smart technology, is clean energy technology, and nowhere is this more evident than in its application to the electric grid and the buildings connected to it. Application of ICT to develop a smarter electric grid will significantly reduce energy consumption and carbon emissions. The *Smart 2020 Report* projects that smart grid adoption in the United States can enable the reduction of CO2 emissions by as much as 230–480 MMT of CO2 by 2020 and save $15–35 billion dollars in energy and fuel costs.[1] This is the equivalent of reducing emissions from electric power generation by 9–18 percent from estimated 2020 levels. As electric power generation accounted for 41 percent of all CO2 emissions in 2008, these savings are significant.[2] A January 2010 study by Pacific Northwest National Lab prepared for the DOE also projects that penetration of smart grid technologies will directly reduce electricity sector energy consumption and CO2 emissions by 12 percent by 2030 and will indirectly reduce emissions by an additional 6 percent by 2030.[3]

Smart grid technologies achieve these reductions in the following ways:

#### Providing Consumers Access to Energy Data

One significant benefit of a smart grid is that it can empower consumers to alter their energy consumption behavior 365 days a year by providing them with access to detailed and actionable energy usage data. Rather than receiving a monthly bill with a kilowatt hour and dollar figure without a point of reference, the smart grid enables consumers to receive near-real-time usage data and adjust their behavior to lower their monthly electric bills. Known as the Prius effect, smart grid pilot projects have demonstrated that providing consumers with actionable consumption and pricing data leads to decreased energy consumption. A recent study by the American Council for an Energy-Efficient Economy (ACEEE) projects that consumers with access to

1 Smart 2020: Enabling the low carbon economy in the information age, United States Report Addendum, 18, *available at* http://www.smart2020.org/_assets/files/Smart2020UnitedStates ReportAddendum.pdf.

2 U.S. Energy Information Administration, Annual Energy Outlook 2010, Emissions Projections, *available at* http://www.eia.doe.gov/oiaf/aeo/pdf/trend_6.pdf. .

3 The Smart Grid: An Estimation of the Energy and CO2 Benefits, PNNL-19112, (January 2010), *available at* http://energyenvironment.pnl.gov/news/pdf/PNNL-19112_Revision_1_Final.pdf. The study assumed 100 percent penetration of smart grid technologies and a 25 percent renewable portfolio standard.

their energy usage data could cut their household electricity use by up to 12 percent and save $35 billion or more over the next 20 years.[4]

### Reduction in Peak Demand

Periods of peak demand, when utilities must provide significantly more electrical power based on daily, monthly, seasonal and annual cycles, require utilities to construct power generation infrastructure capable of meeting and exceeding consumer demand to avoid outages. Reducing peak demand reduces utility power plant requirements, saving consumers the increased rates that accompany increased capital costs for utilities. An additional cost savings results from an overall decrease in wholesale electricity prices, as utilities will typically call into service generators that are more expensive to operate during periods of peak demand.

**In a National Assessment of Demand Response Potential, the Federal Energy Regulatory Commission (FERC) found that demand response has the potential to decrease peak demand between 38 gigawatts (GW) and 188 GW, up to 20 percent of national peak demand through 2019, depending on how extensively demand response is applied.**

A study by the Brattle Group estimates that a 5 percent reduction in peak demand would save consumers $10 billion annually.[5]

Smart grid technology enables demand response, which allows utilities to communicate time-of-use pricing to consumers, and consumers can opt to decrease their energy consumption based on the actual price of electricity during peak and non-peak periods. Consumers benefit from savings on their bill as well as through incentive payments received through participation. Demand response also improves the reliability of the grid by improving the ability of electric utilities to avoid outages. In a National Assessment of Demand Response Potential, the Federal Energy Regulatory Commission (FERC) found that demand response has the potential to decrease peak demand between 38 gigawatts (GW) and 188 GW, up to 20 percent of national peak demand through 2019, depending on how extensively demand response is applied.[6]

### Line-loss Reduction in Transmission and Distribution

The U.S. Energy Information Administration reports that in 2008 transmission and distribution losses (T&D) were 6.14 percent of the total electricity used in the United States.[7] Utilities concerned with operating their transmission systems efficiently must try to reduce line loss in T&D. Smart grid would help utilities reduce T&D losses, saving $7 million and 45K tons of $CO_2$ emissions per million customers annually.[8] Smart grid technology would employ special protection schemes (SPSs) to allow for changes in demand or generation and stabilize the system as a whole. SPSs are smarter control systems, using better communication architecture to help reduce the peak load relative to loading on the distribution circuit, which would reduce line congestion and loss. All of this would work to improve the ability of the grid to respond to end-user demand, improving the reliability of the system.

In order to provide a utility with this T&D information, regional transmission organizers (RTOs) have employed the use of "syncrophasors" to provide utilities with improved data.

4 ACEEE, Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Savings Opportunities, available at http:.www.aceee.org/research-report/e105.

5 The Brattle Group, "The Power of 5 Percent," *The Electricity Journal,* October 2007.

6 FERC, *A National Assessment of Demand Response Potential* (June 2009), *available at* http://www.ferc.gov/legal/staff-reports/06-09-demand-response.pdf.

7 U.S. Energy Information Administration, *United States Electricity Profile*, 2008 Edition.

8 G.E., *The Smart Grid - The Transmission View*, Session 4, *available at* http://www.usea.org/USEA_Events/Smart-Grid-Briefings/Session_4-The_Smart_Grid-The_Transmission_View.pdf. The statistic assumes 0.2 percent loss reduction and 0.5 percent conservation voltage reduction (CVR) peak load reduction resulting in reduction in fuel costs and deferral of generation capacity.

Synchrophasors are able to measure transmission rates up to 30 times per second, providing grid operators with more information at a faster rate. Traditional technology provides operators with transmission data about once every four seconds. This information not only allows operators to respond to demand more quickly, but helps protect and maintain the grid. DOE is currently involved in a price-matching scheme with RTOs around the nation to provide incentives for their use of syncrophasors.

### Integration of Renewables

Renewable energy can play a significant role in reducing the United States' greenhouse gas emissions and providing us with a safe, sustainable energy source. Integrating renewable energy into our current electricity grid also poses several challenges. Renewable energy (i.e., solar power or wind power) is an intermittent power source — we cannot dictate when the sun will shine or the wind will blow. Intermittent energy, unlike centrally-generated energy, will bring with it considerable fluctuations of voltage and frequency throughout the system. This makes it challenging to coordinate the demand for energy with the supply of renewable energy available. Instead of receiving electricity from a power plant, renewable energy comes from widely distributed sources. These factors make integrating renewable energy into the grid a liability, with the potential to destabilize the grid.

Smart grid technology helps facilitate the integration of renewable energy into the grid. Smart grid can help interconnect renewable electricity with centrally-generated electricity without disruption. Smart grid offers quicker, more accurate distribution data, which helps the system deal with fluctuations in voltage and frequency, stabilizing the system. Smart grid's "smart" acceptance of intermittent renewable energy is the only way to allow the current grid to accept large amounts of renewable energy. The DOE seeks to use renewable and distributed systems integration (RDSI) to achieve a 20 percent reduction in peak load demand by 2015. Smart grid would be able to intelligently match the amount of incoming energy with the needs of consumers, helping renewable energy penetrate the market and become a more significant energy source.

### Integration of Electric Vehicles

Current estimates state that by 2015 more than 3 million electric vehicles will be on roads all around the world. While this is a huge step forward for electric vehicles and emissions reduction, it will also create a huge demand for electricity.[9] The electronic vehicle service equipment (EVSE) necessary to manage these plug-in hybrid vehicles (PHEVs) will have to be managed through ICT systems in order to aggregate power demands and enable a coordinated response to changing grid conditions.[10] Smart grid technology will be able to not only allow the grid to respond to peak demand, but also help drivers choose the best times to charge their cars. By charging their cars during periods of low demand, drivers would greatly reduce stress on the grid.[11]

"Smart charging" technology allows charging to be delayed until periods of low demand, or when wind or solar power is readily available. An Xcel Energy study found that delayed charging "dramatically improves" the load put on the grid.[12] The study found that users of PHEVs employing

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9 Pike Research, "Investment in Electric Vehicle IT Systems to Total $5.1 Billion by 2015," available at http://www.pikeresearch.com/newsroom/smart-grid-investment-to-total-200-billion-worldwide-by-2015.

10 *Ibid.*

11 Craig Carlson, "Ford Pioneers Smart Grid-PHEV Communication System," available at http://www.glgroup.com/News/Ford-Pioneers-Smart-Grid---PHEV-Communication-System-42625.html.

12 *See* National Renewable Energy Laboratory, Technical Report 640-41410, "Costs and Emissions Associated with Plug-In Hybrid Electric Vehicle Charging in the Xcel Energy Colorado Service Territory," *available at* http://www.nrel.gov/docs/fy07osti/41410.pdf.

"smart charging" techniques save approximately $450 per year on fuel costs. Off-peak charging equates to spending approximately $.62 per gallon, or 2 cents per mile. Xcel also found that widespread use of PHEVs could eliminate up to 50 percent of harmful vehicle emissions.[13] PHEVs using smart grid technology would put a "modest" demand on the grid, while saving consumers money and eliminating harmful emissions.[14]

### Create Jobs

TIA sees many similarities between the factors that led to the economic growth and job creation that followed the development of the Internet and the potential growth and job creation associated with the development of the smart grid. Like the communications sector, the electricity sector is ubiquitous. Both sectors touch virtually every person, every house, every school and every workplace, reaching into every other sector and enabling greater productivity and efficiency. The scale of the smart grid opportunity brings together ICT vendors, electric utility infrastructure vendors, high-tech start ups, service providers and system integrators. The economic activity associated with the innovation, deployment and services related to smart grid technology will lead directly to job creation. For example, KEMA projects that a disbursement of $16 billion in smart grid incentives would act as a catalyst in driving associated smart grid projects worth $64 billion. These projects would result in the direct creation of approximately 280,000 new jobs, with 140,000 of those jobs continuing as permanent, on-going high-value positions.[15]

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### Compete in Global Markets

The global smart grid technology market represents a significant opportunity for smart grid solutions providers as well as the U.S. economy as a whole. Goldman Sachs Group foresees $750 billion in incremental spending in the global transmission and distribution market over the next 30 years. Smart grid technology will be a key driver in that market. Pike Research predicts $200 billion will be invested globally in the smart grid network between 2008 and 2015, with $53 billion expected to be invested in the United States alone.[16] BCC Research says the U.S. market for smart grid-enabling technologies was $15.3 billion in 2008 and projects the sector will grow at a compound annual growth rate (CAGR) of 16.6 percent, increasing to $37.4 billion in 2014.[17] ABI Research estimates that cumulative global smart grid investment will reach $46 billion dollars by 2015, with $41 billion in transmission and distribution investments and $4.8 billion for smart meters.[18] Pike Research estimates that 250 million smart meters will be installed worldwide by 2015, up from 46 million in 2009. Pike predicts that in six years, 18 percent of the world's electrical meters will be either basic smart meters or advanced ones. North America will become the top region for smart meter adoption next year, reaching 55 percent penetration by 2015. If policy and logistical obstacles can be overcome, the United States is in position to become a global leader in developing smart grid technologies. The following countries with robust technology sectors also provide significant market opportunities, as well as competition in the global smart grid market.

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13 *Ibid.*

14 The study found that when 30 percent of the vehicles used in the study were replaced by PHEVs deriving 39 percent of their power from electricity, there would only be a 3 percent load increase on the grid if smart charging were utilized.

15 *See* KEMA, "The U.S. Smart Grid Revolution: KEMA's Perspectives for Job Creation," *available at* http://www.kema.com/Images/KEMA_SmartGrid%20Jobs%20Creation_01-13-09.pdf.

16 *See* Pike Research, "Smart Grid Investment to Total $200 Billion Worldwide by 2015," *available at* http://www.pikeresearch.com/newsroom/smart-grid-investment-to-total-200-billion-worldwide-by 2015.

17 *See* BCC Research, "Enabling Technologies for the Smart Grid," (March 2009), available at http://www.bccresearch.com/report/EGY065A.html .

18 See ABI Research, "Smart Grid Spending Will Top $45 Billion by 2015," *available at* http://www.abiresearch.com/press/1688-Smart+Grid+Spending+Will+Top+$45+Billion+by+2015.

### China

In 2010, China became the world-wide leader in smart grid investment, investing $7.3 billion in smart grid in the form of stimulus loans, grants and tax credits[19]. Eighty percent of this investment is input into the segments of power consumption, distribution, transformation and communications. The State Grid Corporation of China has set a goal to fully deploy smart grid technologies by 2020.[20] China is anticipated to account for 18.2 percent of the global household smart appliance market by 2015.[21]

### South Korea

South Korea is one of the top ten countries investing in smart grid, investing $824 million in smart grid in 2010.[22] South Korea plans on making substantial strides in smart grid investment over the next two decades, with the goal of completing a nationwide smart grid deployment by 2030.[23] Korea's Smart Grid Roadmap anticipates approximately $25 billion in investment, with the government directly investing $1.9 billion on smart grid research and development.[24]

### Japan

Japan is a world leader in smart grid investment, investing $849 million in smart grid in 2010.[25] Japan was the unchallenged leader in smart grid investment in the 1990s, investing over $100 billion in smart grid over the course of the decade. As a result of this period of investment and change, Japan is now focusing largely on "last mile" smart grid investment and home side management, as well as solar power in the home.[26] In addition to investing in its domestic smart grid market and integrating more renewable energy into the power grid, Japan is also currently engaged in smart grid trial products in other nations (including the United States).

### EU

The EU is poised for major growth in smart grid investments in both the short and long term. The European Electricity Grid Initiative has established a nine-year research and development program,[27] and the European Commission's Strategic Energy Technology (SET) plan calls for significant smart grid investment over the next ten years, in order to integrate renewable resources and to be able to operate half of their utilities according to "smart" principles.[28] Annual European smart grid investment is expected to reach around €5 billion per year.[29] The EU has set a 2022 deadline for full deployment of smart meters. European markets are expected to spend up to $25 billion in order to meet mandates requiring the installation of smart meters, rolling out 133 to 145 million by 2020.[30]

In surveying the global smart grid market, three themes quickly emerge. First, the size of the market opportunity is significant. Second, many countries with robust technology sectors are

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19 *See* Zpryme, "Smart Grid China Leads Top Ten Countries in Smart Grid Federal Stimulus Investments," *available at* http://www.zpryme.com/news-room/smart-grid-china-leads-top-ten-countries-in-smart-grid-federal-stimulus-investments-zpryme-reports.html.

20 *See* State Grid Corporation of China, *available at* http://www.sgcc.com.cn/ywlm/gsyw-e/234177.shtml.

21 *See* Zpryme, "Smart Grid Insights: Smart Appliances (March 2010), *available at* http://www.zpryme.com/SmartGridInsights/2010_Smart_Appliance_Report_Zpryme_Smart_Grid_Insights.pdf.

22 *See* Zpryme, *op. cit.*

23 *See* Korea's Smart Grid Roadmap, *available at* http://www.smartgrid.or.kr/10eng4-2.php.

24 Ibid.

25 *See* Zpryme, *op. cit.*.

26 *Ibid.*.

27 *See* European Electricity Grid Initiative and Roadmap, *available at* http://www.smartgrids.eu/?q-node/170.

28 *See* European Commission Strategic Energy Technology Plan (SET Plan), *available at* http://ec.europa.eu/energy/technology/set_plan/set_plan_en.htm.

29 *Ibid.*.

30 *See* Greenbang Smart Meter Outlook 2020, *available at* http://www.greenbang.com/research/smart-meter-outlook-2020.

competing in the space. Third, smart grid deployments are moving forward rapidly. Several countries are in a strong position to take advantage of the smart grid opportunity. As with other technologies, early smart grid adopters will hold a significant advantage in the smart grid market. Unnecessary delays in resolving policy and logistical obstacles will be detrimental to those wishing to compete. TIA appreciates the priority that DOE, the National Institute of Standards and Technology (NIST), FERC, other federal agencies and state regulators are giving to expeditiously resolve policy obstacles and is pleased to provide the following recommendations.

**To maximize the capabilities and benefits of smart grid technology, federal, state and local policy-makers will need to coordinate their eff orts to create a policy framework that is consumer focused and technology driven.**

## SMART GRID POLICY

While pilots, studies and demonstration projects make the benefits of a smart grid clear, at this early stage in smart grid development, the policy and regulatory framework in which the grid matures will significantly impact how smart the grid can become and the benefits it can achieve in both the short and long term. The smart grid policy-making environment is extremely complex. The size of the market and the ubiquitous impact of the smart grid have attracted a large number of stakeholders with competing positions. Technology and solutions providers have distinct policy preferences suitable for their technologies, and it is not clear which technologies will be the most successful. Electric utility interests in the smart grid also vary significantly based on their organizational structure (investor-owned, public or cooperative), service territory and local political environment. The interplay between federal and state authorities and the regulated nature of electric utilities add an additional layer of complexity. Consumer and privacy advocacy groups also present diverse and sometimes conflicting viewpoints that further complicate smart grid policy making.

TIA believes this policy-making environment can be simplified by applying relevant principles from the ICT sector proven to benefit consumers and to facilitate technological innovation. In applying these principles to the smart grid, there will be a need for strong federal, state and local coordination and cooperation because of the unique challenges in bringing together state- and federal-regulated utilities and ICT. To maximize the capabilities and benefits of smart grid technology, federal, state and local policy-makers will need to coordinate their efforts to create a policy framework that is ***consumer focused*** and ***technology driven***.

### *Smart Grid Policy Must Be Consumer Focused*

As the end users, TIA believes consumers will ultimately determine how successful the smart grid can become. For utility-driven smart grid solutions, utilities can do only as much as politically-accountable regulators will allow. The success of consumer-driven smart grid solutions will rest largely on consumer value and adoption. TIA recommends consideration of the following issues:

#### Provide Consumers Access to Usage, Pricing and Carbon-Mix Data in Machine-Readable Form for Use in Third-Party Applications

While consumer preferences for both the manner and the amount of interaction with the grid will vary significantly by individual, the secure provision of energy consumption data to customers, utilities and third parties will be critical to the development of the smart grid. Consumers and utilities share a dual-ownership role with regard to the right to access customer energy consumption data. Customers should have a right to access consumption data in real time or near real time to both monitor and manage energy usage. Utilities should have a right to access consumption data necessary for management of the electric grid and billing purposes.

Third-party service providers will play a role in providing competition and innovation in consumer home energy management services. In addition to accessing the data themselves, consumers need the ability to authorize access to that data in real time or near real time to third-party service providers. Whether the data are generated by customer-installed sensors or by the utility provider, customers should maintain control over which third parties are authorized to access personal billing and energy consumption information. TIA encourages DOE to continue to work with stakeholders to define requirements for provision of the data, as well as the cost to utilities for providing the data directly from the meter. State and federal policymakers should work together to develop a uniform national policy.

### Provide Consumers with Uniform and Consistent Privacy Policies

Uniform and consistent privacy policies will be critical to protect consumer information. TIA believes Fair Information Practice Principles (FIPPs) as provided by the U.S. Federal Trade Commission should serve as the basis for developing policies regarding the privacy of energy consumption information. In developing specific policies and practices for energy data, DOE and other policymakers should examine policies and self-regulatory models from other sectors that rely on both technology and strict procedures to protect critical data. The privacy framework for the smart grid should protect privacy without sacrificing innovation. In taking a comprehensive and in-depth look at smart grid privacy, the Privacy Subgroup of the Cybersecurity Coordination Task Group at NIST has published NIST IR-7628, which outlines their relevant findings and provides a broad framework for the privacy of smart grid data.[31] As a general rule, TIA believes customer authorization should be the prerequisite for releasing data to a third party.

### Coordinate Smart Grid Stakeholders in a Sustained Consumer Awareness and Education Campaign

At this early stage in smart grid development, smart grid deployments will require strong consumer and stakeholder engagement to educate consumers about the technology and alleviate concerns pre- and post-deployment. While consumer awareness of smart grid technology is improving, it remains relatively low. A GE study found that 79 percent of American consumers are not familiar with the term “smart grid,” and only 4 percent of consumers have a good understanding of what a smart grid is.[32] The same GE study found that 96 percent of consumers who are familiar with smart grid are “overwhelmingly positive” about smart grid technology and what smart grid can do for the United States.[33] Some consumer advocacy groups have voiced concerns about the cost, accuracy, safety and privacy of smart grid technologies. Because negative occurrences will receive more press than positive experiences, a sustained communication program will be critical to consumer adoption. TIA recommends sustained coordination between FERC, DOE, state regulators and other stakeholders to communicate positive smart grid accomplishments and to share what is being done to address customer concerns. FERC’s National Action Plan on Demand Response is a positive development, as are other consumer outreach programs.

### Provide Incentives to Assist with the Purchase of Consumer Smart Grid Devices

The cost-benefit analysis for consumers is a crucial element of smart grid policy-making. Several smart grid deployments have been delayed based on state regulator concern with increasing rates. As utilities replace aging infrastructure and integrate renewables into the grid,

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31 *See* NIST Guidelines for Smart Grid Cybersecurity: Vol. 2, Privacy and the Smart Grid (August 2010), *available at* http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf.

32 *See* GE Energy, U.S. Smart Grid Survey, Fast Facts: U.S. Consumer Impressions of the Smart Grid, *available at* http://itsyoursmartgrid.com/pdf/assets/resources/downloads/GE_U%20S%20/20smart%20grid%20survey%20fast%20facts.pdf.

33 *Ibid.*.

consumers will likely be facing rate increases. Overall, bulk energy prices are also predicted to increase. Smart grid has the potential to significantly offset these rate increases by empowering consumers with data to adjust their behavior, enabling demand response programs bringing down peak demand and making electric utility operations more efficient, with savings passed onto consumers. Communication of this value proposition to consumers will need to come from industry and from federal and state governments.

TIA believes that incentives can play an important role in both funding and promoting awareness for consumer devices that interact with the smart grid. Incentives can act as a catalyst to spur consumer interest and accelerate greater interest and investment in the market. As the ICT industry has witnessed with the development of other technologies, low-income consumers will be best served through a regulatory environment that encourages innovation and competition, which brings down costs, making technologies accessible to low-income consumers. Technological innovation throughout the ICT sector is improving performance and the decreasing cost of deployment for smart grid applications. As initial costs could make home-to-grid technologies cost-prohibitive to some low-income consumers, TIA recommends that the government provide incentives to assist with the purchase of consumer smart grid devices.

## *Smart Grid Policy Must Be Technology Driven*

### Technology Overview

Electric utility smart grid communications requirements will vary significantly based on the function, geography and service territory of each utility. Each utility will need to assess its technology requirements on a case-by-case basis. Because of the diversity of applications and the evolving nature of the smart grid, there is no single technology or platform best suited for smart grid applications. For each application, there is a choice of more than one technology that may be suitable, depending on the needs of the utility. Smart grid deployments may include a combination of private wireless, commercial wireless, unlicensed mesh, point-to-point microwave, private fiber, leased wireline, power-line carrier (PLC), land-mobile radio and satellite communications based on application requirements, availability and cost. These technologies can be roughly divided between those better suited for point-to-point core (e.g., fiber and microwave) or point-to-multipoint access (e.g., unlicensed mesh, private/commercial wireless (WiMAX™, LTE, cdma2000® EvDO, HSPA, GSM), fiber, PLC or a customer's existing broadband connection) applications based on utility requirements for reliability, security, latency, bandwidth, coverage and cost of deployment. Additionally, there are multiple consumer-facing technologies involved in smart grid deployments including home energy management systems, software, in-home displays, smart phone applications, Internet portals, and consumer electronics devices as portals, along with smart home appliances that can be connected to the grid.

In short, there is a multitude of technologies that can compete and are actively competing to provide smart grid solutions, and utilities will adopt technologies based on their requirements. To harness the innovation available from these technologies, it is critical to establish appropriate federal-level policies that define common goals and establish a common market for smart grid technologies. As a starting point, TIA recommends that the policymakers, regulators, and standards bodies take into account the following points:

### Technology Neutrality Across an Open Smart Grid Architecture Is Critical for Innovation of Smart Grid Solutions

At this early stage, it is impossible to predict which technology or combination of technologies will ultimately be the most successful. TIA recommends that federal and state governments, through either the policy-making, regulatory or standards-setting process, avoid excluding viable technologies or architectures and instead focus on the coexistence and interoperability of a group of viable technologies. As we have seen at the early stages of other developing technologies, technology neutrality is critical to create an ecosystem of competition and innovation. Technology neutrality will lead to increased innovation in smart grid technologies and increased options for a range of customer needs and preferences, and provide a reliable and secure grid that reduces energy consumption and costs for consumers. Allowing multiple technologies to compete to achieve the goals of a smart grid will increase investment in the market, spur more innovation in products and solutions, and future proof the grid, allowing it to realize its potential. An open architecture where multiple interoperable technologies can coexist and compete is the most beneficial approach both for consumers and for the development and deployment of the smart grid in the short and long term. Smart grid deployment plan requirements will need to provide adequate flexibility for utilities to adopt and integrate new solutions as they become available.

### Allow for Voluntary Standards to Support the Dynamic Nature of ICT Innovation and to Maximize Flexibility and Choice in a Rapidly Changing, Market-Driven Ecosystem

Nowhere is the principle of technology neutrality more important to the development of the smart grid than in the standards development and identification process being coordinated by NIST. Alternative architectures could include a variety of combinations of smart meters, home energy management systems, Internet-based energy management services and other methods to support ongoing innovation. At this stage, technology neutrality, flexibility in standard-setting and reliance on voluntary standards are key to the development of the smart grid. Standards are important tools to promote efficiency, interoperability and innovation by making products and services work together better. By helping to enhance interoperability among products and services within a market and by being responsive to real marketplace needs, standards can help promote innovation, fuel market growth, protect investment in new technologies and bring down costs. However, standards are only a means to an end. They are useful tools if they are effective at addressing a real marketplace need.

Given the dynamic nature of innovation and ICT standards development, governments should be cautious about mandating adherence to any particular standard without demonstrating sufficient need and without support from impacted industry and relevant stakeholders. Mandated standards can disrupt normal marketplace outcomes and discourage competition. In addition, identifying a single standard that is appropriate for all circumstances is extremely difficult, if not impossible. The breadth and depth of the ICT environment means that there is rarely, if ever, a one-size-fits-all solution. Moreover, because the world of technology typically moves at a far greater pace than the policy-making, regulatory and legislative processes, it is quite possible for a government to mandate a standard that becomes irrelevant in the marketplace over time. Standards do best as part of an active, competitive habitat. For governments that want to foster innovation in their technology sectors, it is vital to encourage new technologies, valuable intellectual property, improved human capital, venture investments, and economic growth. Mandating distinct standards potentially dampens incentives to innovate in a technology area and can have adverse effects on both economic and social outcomes.

While standards can promote interoperability, they do not guarantee it. Standards can best support interoperability when they are part of a multi-faceted approach incorporating open standards-setting processes, proactive standards maintenance and a strong effort to ensure that different implementations of the same standard will in fact interoperate.

Under NIST Special Publication 1108 (the NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0), some of the "Guiding Principles for Identifying Standards for Implementation" include:

- Is well-established and widely acknowledged as important to the smart grid.
- Is an open, stable and mature industry-level standard developed in consensus processes from a standards development organization (SDO).
- Has, or is expected to have, significant implementations, adoption, and use.
- Is supported by an SDO or Users Group to ensure that it is regularly revised and improved to meet changing requirements and that there is strategy for continued relevance.

Before mandating adherence to any standard recommended by NIST and the Smart Grid Interoperability Panel, FERC should first consider whether the standard is in fact likely to be widely implemented by stakeholders on a voluntary basis. In that situation, FERC should consider recommending such standards instead of including them in a regulatory framework in order to preserve further innovation and competition in the marketplace and the opportunity to make further improvements to the standard over time in response to perceived needs for improvements.

TIA recommends that state regulators should defer adoption of standards until NIST has progressed in identifying smart grid standards and protocols. Adoption of standards and protocols at the state level is premature, given the ongoing status of the NIST process. The ICT industry is actively engaged with the NIST in helping them fulfill their responsibility of coordinating standards and protocols for the interoperability of smart grid solutions. After the NIST process has progressed, TIA recommends that state regulators then evaluate any additional issues involving standards or protocols that they will need to address beyond the NIST process.

**Provide Additional Funding for Both R&D and Off-the-Shelf Smart Grid Deployments Across the Span of Viable Technologies and Architectures to Evaluate Technology Effectiveness at Scale**

TIA believes DOE stimulus funding for smart grid projects has played and will continue to play a critical role as a catalyst for the smart grid market, across the span of viable technologies and architectures to evaluate technology effectiveness at scale. For these reasons, TIA encourages additional funding by the DOE for both R&D and off-the-shelf smart grid deployments. The DOE received 565 applications totaling requests of $14.6 billion for the Smart Grid Investment Grant (SGIG) program and the Smart Grid Demonstration program, which were budgeted only $4.5 billion. The initial funding provided significant stimulus and investment in the smart grid market, and TIA encourages additional funding in both R&D and actual deployments. TIA encourages DOE funding for each viable technology and architecture. In addition to stimulating interest in the market, DOE funding serves another significant benefit for early adopters as they submit applications to their relevant state regulatory bodies. Providing a financial cushion removes some of the risk for regulators in approving rate increases for the adoption of relatively new technologies. For future smart grid funding, the DOE and Congress will evaluate the impact of these initial smart grid projects in terms of increased energy efficiency and jobs created and will then determine whether to provide more funding in the future.

For the same reasons, state governments should also provide funding for smart grid R&D, as well as for deployments.

### *Spectrum*

#### The FCC and DOE Should Continue to Study and Engage Stakeholders in Evaluating the Need for Additional Spectrum to Support Wireless Broadband for Smart Grid

Additional wireless capacity is essential to support future smart grid application bandwidth demands. Both unlicensed and licensed spectrum play important roles in enabling smart grid wireless technologies, and increased smart grid deployments will place greater demand on both. While Service Providers are calling on the FCC to allocate additional licensed spectrum to serve increased wireless broadband demands, many utilities are also calling for additional utility-licensed wireless spectrum to support anticipated increases in demand for robust smart grid communications. In the National Broadband Plan, the FCC observed, "The amount of data moving across Smart Grid networks is modest today but is expected to grow significantly because the number of devices, frequency of communications and complexity of data transferred are all expected to increase."[34] In its review of Communications Requirements of Smart Grid Technologies, the Department of Energy also noted, "Smart Grid technologies will introduce incremental demand for wireless services."[35] TIA recommends that the FCC and DOE continue their active engagement of the smart grid stakeholder community in order to evaluate both potential wireless spectrum needs that may arise resulting from the evolution and deployment of smart grid technologies and potential technological solutions to the need for additional wireless capacity.

For example, some utilities currently rely on 900 MHz Unlicensed Mesh for basic Advanced Metering Infrastructure (AMI) for last-mile communications to customer premises. Unlicensed Mesh is a cost-effective, point-to-multipoint technology typically deployed in high-density urban and suburban deployments. Because of the short distance between meters, basic AMI functions like meter reading can currently be accommodated on 900 MHz Unlicensed Mesh, as they are delay-insensitive, low bandwidth and require significantly lower data rates than other smart grid applications. As AMI becomes more advanced, however, increased data rate requirements and potential spectrum interference in unlicensed bands may present challenges for the use of 900 MHz Unlicensed Mesh for future smart grid applications, and may require migration to other wireless technologies that support broadband communications. Other wireless technologies may also prove valuable to support smart grid communications in other grid domains, as well.

TIA understands that many utilities have indicated their intent to rely on commercial networks for certain high-capacity smart grid applications, such as AMI and electric vehicles. TIA also recognizes that many utilities have expressed a preference to transition to utility-licensed wireless broadband smart grid systems where possible, citing coverage, a low cost of deployment and proven reliability during storm events. At the same time, TIA considers carrier networks an important option to fulfill smart grid communications needs, particularly in view of, recent deployments of wireless broadband technologies and improvements in carrier-utility service level agreements, as well as a demonstrated record of incorporating robust cyber security into their networks.

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34 Federal Communications Commission, *Connecting America: The National Broadband Plan*, 251 (March 16, 2010) (National Broadband Plan).

35 Department of Energy, *Communications Requirements of Smart Grid Technologies*, 55 (October 5, 2010).

Whether licensed to a commercial carrier or a utility, wireless broadband is an essential technology for the current and future operation of the smart grid. Technology advances in wireless broadband are improving latency and increasing data rates, enabling wireless technology to serve ever more critical core grid functions.

#### TIA Recommends That the FCC Allow Utilities to Use the Local and Regional Public Safety 700 MHz Wireless Broadband Network

As the FCC noted in the National Broadband Plan, utilities and public safety entities have very similar communications requirements. Allowing the use of this secure network by these groups will increase coordination between public safety and other vital entities and allow quicker, more educated and better harmonized efforts. TIA supports, as the FCC reviews waiver petitions to deploy local and regional public safety interoperable broadband networks, early, rapid approval allowing public safety the discretion to allow appropriate entities to operate in the 700 MHz public safety broadband network, which will further their mission.

### *Cybersecurity*

#### Policymakers Should Seek Technical Expertise from Qualified and Neutral Third Parties in Decisions Relating to Cybersecurity

By addressing cybersecurity early in the process, smart grid stakeholders can benefit by instituting optimal security policies and principles prior to the deployment of new technologies. Cybersecurity requires good security processes up front and ongoing management to mitigate current and emerging threats. Utility regulators can benefit from best practices developed in other industries, such as finance, information technology and healthcare, that rely on ICT to protect assets and information.

On technical matters, TIA encourages policymakers and utility regulators to seek the opinion of qualified neutral third parties when evaluating and rendering smart grid decisions that involve ICT, as well as looking to established guidelines such as those provided by NIST. The convergence of ICT and energy services represents a major transformation of our energy infrastructure, and TIA believes consumers would be best served if the capabilities of ICT are well understood by regulators and leveraged where appropriate. In particular, the technical aspects of securing smart grid and smart meter communications and protecting customer data are highly complex. Smart grid decisions based on inadequate information may result in systems containing vulnerabilities that negatively impact the reliability of energy services, the privacy of consumers, and the ability of the smart grid to deliver its full potential. It may further result in undesirable post-deployment costs to remediate security shortcomings that could have been avoided through an independent information security assessment during the planning stage and the use of proven secure development and deployment processes. There are several qualified sources of important information about security and privacy best practices in the government and private sector that can assist in evaluating the security of a proposed implementation.

#### As the Smart Grid Is a Complex and Interconnected System, It Is Critical That Information Sharing Among Stakeholders Be Supported in Policy and in Practice

Information regarding threats, incidents and other events should be voluntarily shared through established channels. There needs to be a robust, transparent process and climate for sharing this type of information and the assurance that the information shared will be treated confidentially where necessary. In this manner, stakeholders are able to collaborate across sectors and even borders to better manage threats. Each party brings its expertise to the table, and all benefit from one another's continuous, shared contributions.

## DOE and State Regulators Should Provide Adequate Funding for Cybersecurity

DOE recently provided $30 Million in funding for projects aiming to address cybersecurity for the electric grid. DOE should continue to fund cybersecurity projects as smart grid technologies become more widespread. State regulators should provide adequate funding to enable utilities to acquire the necessary resources to build robust cybersecurity into their networks. State regulators should coordinate efforts in communicating best practices for cybersecurity.

## TECHNOLOGY CONSIDERATIONS

### *The Ability of Software to Be Updated and/or Upgraded Should Be a Core Engineering Concept at All Levels of the Smart Grid Infrastructure*

One of the core value propositions of a smart grid infrastructure will be adaptability through the use of software integrated into devices at all levels. This provides benefits in terms of extending the useful lifetime of equipment as new techniques become available. The ability to update is also critical from a cybersecurity perspective as new vulnerabilities are uncovered. The ability to quickly and efficiently mitigate those vulnerabilities with a software updating process becomes a critical component. In order to realize these benefits, components of the smart grid must be able to be updated on a faster schedule than traditional electric power equipment.

### *Internet Protocol Should Be the End-to-End Network Layer for Smart Grid Communications*

TIA recommends the use of Internet Protocol (IP) as an end-to-end network layer for smart grid communications where feasible. IP has many characteristics ideal for the development of the smart grid:

- IP is a proven and mature suite of protocols.
- The security of IP is understood, and tools and applications exist to manage and deploy it securely.
- IP is interoperable, which minimizes costs and discourages technology silos.
- IP is reliable and self-healing, as the technology will automatically avoid failed transmission links to ensure delivery of communications.
- IP is scalable and flexible, allowing loose coupling between the physical communications network and the applications on the network, regardless of the underlying physical infrastructure.

## CONCLUSION

The smart grid offers significant benefits that can help address some of the greatest energy, environmental and economic challenges we are facing today. The ICT industry has learned important lessons regarding consumer engagement and technological innovation that will be critical to the development of the smart grid moving forward. TIA welcomes the opportunity to continue the dialogue between policy makers and stakeholders to maximize the benefits that the smart grid can provide.

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