Smart Grid Consumer Benefits
September 4, 2013

What is the so-called smart grid and how will it benefit consumers? Will a connected grid be more vulnerable to attack? Can we keep a connected grid more secure than the Internet? What is a smart self-healing grid? Can an intelligent grid help reduce carbon emissions? Will a modernized grid protect consumers' privacy?

IEEE Smart Grid industry experts cut through the fear, uncertainty, and doubt about what's to come with an intelligent grid and give us their reasoned responses to these questions and more.

Patty Durand, Executive Director at Smart Grid Consumer Collaborative

What is smart grid and how will it benefit consumers?
The grid is made to serve electricity consumers. They deserve to know how they can benefit, both individually and as a group, from innovations. What is more, they deserve to be shown how they actually are benefiting in practice.

The fundamental mission of serving customers has not changed with the advent of the smart grid. What is new and different today is the scale, complexity and cost of the new technology used to upgrade and add intelligence to the grid. As that effort takes place, consumers are becoming savvier and expect better service and value for their investments.

Dr. Massoud Amin, Professor of Electrical and Computer Engineering and Director of the Technological Leadership Institute at the University of Minnesota

Why do we need a smart grid?
Grid modernization is a global phenomenon, but in any day in the U.S., about a half million people are without power for two or more hours. The number of weather-caused, major outages in the U.S. has risen since the 1950s, from between two and five each year by the 1980s to 70–130 between 2008 and 2012. Two thirds of weather-related power disruptions have occurred in the past five years, affecting up to 178 million customers (meters), as changing weather patterns impact aging infrastructure.

The U.S. electric power system still relies on 1960s and 70s technology. The sector is second from the bottom of major industries in terms of research and development (R&D) spending as a fraction of revenue; only pulp and paper is worse. Electricity R&D received just 0.17 percent of net sales from between 2001 and 2006, and has not risen since.

Meanwhile, electricity needs are changing and growing fast. Tweeting, and the devices and infrastructure needed to operate the underpinning communication

network, data centers and storage alone adds more than 2,500 megawatt hours (Mwh) of demand globally per year that did not exist five years ago**.** Kilowatt hour (kWh) is commonly used by power companies for billing, since the monthly energy consumption of a typical residential customer ranges from a few hundred to a few thousand kilowatt hours. One Mwh is equal to 1,000 kilowatts of electricity used continuously for one hour. One Mwh is the amount of electricity used by approximately 330 homes in one hour. On average 2500 Mwh is equivalent to the electricity used by about 825,000 homes**.** Factor in Internet TV, video streaming, online gaming and the digitization of medical records, and the world's electricity supply will need to triple by 2050 to keep up.

What is a smart self-healing grid?
A self-healing grid uses digital components and real-time communications technologies installed throughout a grid to monitor the grid's electrical characteristics at all times and constantly tune itself so that it operates at an optimum state. It has the intelligence to constantly look for potential problems caused by storms, catastrophes, human error or even sabotage. It will react to real or potential abnormalities within a fraction of a second, just as a military fighter jet reconfigures itself to stay aloft after it is damaged. The self-healing grid isolates problems immediately as they occur, before they snowball into major blackouts, and reorganizes the grid and reroutes energy transmissions so that services continue for all customers while the problem is physically repaired by line crews.

A self-healing smart grid can provide a number of benefits that lend to a more stable and efficient system. Three of its primary functions include**:**

- **Real-time monitoring and reaction,** which allows the system to constantly tune itself to an optimal state;
- **Anticipation**, which enables the system to automatically look for problems that could trigger larger disturbances; and
- **Rapid isolation**, which allows the system to isolate parts of the network that experience failure from the rest of the system to avoid the spread of disruption and enables a more rapid restoration.

As a result of these functions, a self-healing smart grid system is able to reduce power outages and minimize their length when they do occur. The smart grid is able to detect abnormal signals, make adaptive reconfigurations and isolate disturbances, eliminating or minimizing electrical disturbances during storms or other catastrophes. And, because the system is self-healing, it has an end-to-end resilience that detects and overrides human errors that result in some of the power outages, such as when a worker error left millions of California residents without electricity in September 2011.

How does a smart self-healing grid benefit consumers?
Beyond, managing power disturbances, a smart grid system has the ability to measure how and when consumers use the most power. This information allows utility providers to charge consumers variable rates for energy based upon supply and demand. Ultimately, this variable rate will incentivize consumers to shift their heavy use of electricity to times of the day when demand is low and will contribute to a healthier environment by helping consumers better manage and more efficiently use energy.

What's involved in creating a smart self-healing grid?
To transform our current infrastructure into a self-healing smart grid, several technologies must be deployed and integrated.

The ideal smart grid system consists of microgrids, which are small, mostly self-sufficient power systems, and a stronger, smarter high-voltage power grid, which serves as the backbone to the overall system.

Upgrading the grid infrastructure for self-healing capabilities requires replacing traditional analog technologies with digital components, software processors and power electronics technologies. These must be installed throughout a system so that it can be digitally controlled, which is the key ingredient to a grid that is self-monitoring and self-healing.

Much of the technology and systems thinking behind self-healing power grids comes from the military aviation sector, where I worked for 14 years on damage-adaptive flight systems for F-15 aircraft, optimizing logistics and studying the survival of squadrons and mission effectiveness. In January 1998, when I joined the Electric Power Research Institute (EPRI), I helped bring these concepts to electricity power systems and other critical infrastructure networks, including energy, water, telecommunications and finance. Following the September 11, 2001, terrorist attacks, resilience and security has become even more important.

Erich Gunther, Chairman and Chief Technology Officer, Enernex

How does the end consumer benefit from Smart Grid?
A major benefit of Smart Grid is that it empowers consumers to drastically improve the management of their individual energy usage. What's more, because there have been many demand-response projects, both manual and automated, we can demonstrate the inherent value for consumers when they understand what they are doing in terms of their electricity consumption and what it costs. If you don't measure it, you can't manage it. But, when you do there is clear value for consumers in having an infrastructure that allows them to see and manage energy use on a granular basis.
On the next level, utilities are just not that aware of the amount of work that's been done in terms of pilots and demonstration projects and the amount of information at their disposal. There are huge numbers of resources available to them, but they have not been exposed to it yet.

As an analogy, consider grocery shopping. We're used to walking down the aisles and seeing what everything costs and making our purchasing decisions. Every once in a while, we come across a sale that we might choose to take advantage of. Imagine if we bought groceries the same way we currently buy energy. We don't get to see the prices, and, while we know there are sales going on from time to time, we don't get to know when. We simply grab a bunch of stuff that we think we're going to need, and discover how much it all costs long after we've left the store. No other industry works this way. Building the Smart Grid to empower consumers to manage their energy usage and costs is an extremely valuable application.

Ganesh Kumar Venayagamoorthy, Duke Energy Distinguished Professor at Clemson University

What is the value of smart grid to consumers?
Smart grid will create a new lifestyle for electricity consumers. Today, customers do not know how the energy they consume is produced and delivered to them. With smart grid technologies deployed all the way to the end user, consumers will be able to know exactly how much electricity they consume to roast a chicken or when lights are left on instead of being turned off. Today, they pay for what they use at the end of the month, but there is no breakdown of how they used their energy. In-home energy management systems will enable interested consumers to keep track of how much energy they are using and for what purpose.

We waste a lot of energy today, but with smart grid technology and information available at home or on our smart phones, we will become cognizant of what we waste. I think this will encourage less waste, reduce consumption and help us become more conscious of our environment. We don't want to live in a way that will make life more difficult for our children. Smart grid can help us achieve more sustainable lifestyles that minimize energy waste and maximize the use of clean energy.

Dr. Massoud Amin, Professor of Electrical and Computer Engineering and Director of the Technological Leadership Institute at the University of Minnesota

How much do you estimate a nationwide self-healing smart grid would cost in the United States?
The cost of a smarter grid would depend on how much instrumentation you actually put in, such as the communications backbone, enhanced security and increased resilience. The total price tag ranges around $340 billion to $480 billion, which, over a 20-year period, would be something like $20-$25 billion per year. But right off the bat, the benefits are $70 billion per year in reduced costs from outages, and on a year where there are lots of hurricanes, lots of ice storms, and other disturbances, that benefit even goes further. Currently, outages from all sources cost the U.S. economy somewhere between $80 billion to $188 billion annually. Costs of outages reduced by about $49B per year, and reduced CO2 emissions by 12-18% by 2030. In addition, it would increase system efficiency by over 4 percent—that's another $20.4 billion a year.

The costs cover a wide variety of enhancements to bring the power delivery system to the performance levels required for a smart grid. They include the infrastructure to integrate distributed energy resources and achieve full customer connectivity but exclude the cost of generation, the cost of transmission expansion to add renewables and to meet load growth and a category of customer costs for smart-grid-ready appliances and devices. Despite the costs of implementation, investing in the grid would pay for itself, to a great extent.

But this is also about 1) increased cyber/IT security, and overall energy security,

with security built in the design as part of a layered defense system architecture, and 2) job creation and an economic benefit. With the actual investment, for every dollar, the return is about $2.80 to $6 to the broader economy. And this figure is very conservative.

What are the economic benefits of upgrading the grid?
A 2011 competitiveness report by the World Economic Forum ranked U.S. infrastructure below 20th among the world's nations in most of nine categories and below 30th for the quality of our air transport and electric power sectors.

The economic benefits of a modernized grid will accrue as investments are made. Indeed, in my view, our 21st century digital economy depends on us making these investments, regardless of the prognosis for more extreme weather to come as our climate changes.

Yet the economic argument is clear: the payback of smart grid technologies in the US is three to six times greater than the money invested, and grows with each sequence of grid improvement. For example the 2009 government stimulus plan funding and matching support from utilities and the private sector in the Smart Grid Investment Grant (SGIG) and Smart Grid Demonstration Project (SGDP) programs generated a significant impact on the U.S. economy:

- As of March 2012, the total invested value of $2.96 billion to support smart grid projects generated at least $6.8 billion in total economic output.

- Smart grid deployment positively impacted employment and labor income throughout the economy. Overall, about 47,000 full time equivalent jobs were supported by investments. Among smart grid vendors - an ecosystem of manufacturers, information technology and technical services providers - about 12,000 direct jobs were supported, with the remaining jobs being in those companies' respective supply chains and induced by the money spent throughout the broader economy.

- Investment in core smart grid industries supports high-paying jobs. Industrial sectors that benefit directly include computer systems design, technical and scientific services and consulting, and electrical/wireless equipment and component manufacturing. Industrial sectors that experience indirect and induced benefits include real estate, wholesale trade, financial services, restaurants, and health care. US Department of Energy (DOE) smart grid American Recovery and Reinvestment Act (ARRA) investments also supported employment in personal service sectors such as health care, financial services, real estate, and food/restaurants through indirect and induced impacts.

- The smart grid Gross Domestic Product (GDP) multiplier is higher than many forms of government investment. For every $1 million of direct spending, which includes both government ARRA funds and private sector matching, the GDP increased by $2.5 to $2.6 million, depending on the scenario being evaluated, which compares favorably against other potential government investments in general spending or other types of

infrastructure**]**.

What role does renewable energy play in the smart grid? What needs to be done to access sustainable energy resources?
Much of the renewable energy and natural gas potential in the United States is located in areas that are remote from population centers, lack high demand for energy, and are not well connected to our national infrastructure for transmission of bulk electrical power. The recent expansion of natural gas production in the U.S. has also affected development of the grid. To achieve public policy objectives, sufficient transmission capacity must link new natural gas generating plants, on-shore or off-shore wind farms, solar plants and other renewables to customers if those resources are to serve the energy needs of homes and businesses, and have the potential to replace significant portions of the oil used today in vehicle transportation.

New transmission will play a critical role in the transformation of the electric grid to enable public policy objectives, accommodate the retirement of older generation resources, increase transfer capability to obtain greater market efficiency for the benefit of consumers, and continue to meet evolving national, regional and local reliability standards. With a stronger and smart grid, 40% of our electricity in the U.S. can come from wind by 2030.

Wanda Reder, Vice President, Power Systems Services at S&C Electric Company

How is consumer electricity consumption changing and how does this influence the need for smart grid?
Customer electricity usage characteristics are changing. We're now in a digital society and the consumer electronics category represents one of the largest single sources of domestic electricity consumption in developed regions. Furthermore, electricity consumption associated with digital devices in the residential sector is expected to increase significantly in coming years.

This trend will influence the general expectations consumers have regarding their electricity services. With more and more electronic products driving electricity demand, more consumers will expect uninterrupted power availability and near-perfect power quality. And more commercial businesses, including home-based businesses, will need electric service assurances in order to fully operate and compete.

Electric service outages for a typical customer, depending on where they live in the country, range from 90 to 214 minutes or more per year. And those figures don't even include rare events and extreme storms like Hurricane Sandy. The industry must accommodate the need for increased electrical reliability to support consumers' digital lifestyles and ensure the economic viability of the country's businesses that are heavily dependent on computers and information technologies.

Jim Wendorf, Director Industry Connections, IEEE Standards Association

How will computing and consumer technologies becoming part of smart grid?
Consumer electronics will become part of smart grid as customers employ user-friendly devices, applications, and interfaces on their household appliances to understand, control and monitor their energy usage. Consumers will be able to use their devices to adjust the patterns of their electricity consumption to reduce their energy costs and their contribution to the utility load, or to give feedback about their services to their electricity suppliers. These devices and capabilities will transform utility services because they will engage consumers as direct participants in smart grid.

Dr. Massoud Amin, Professor of Electrical and Computer Engineering and Director of the Technological Leadership Institute at the University of Minnesota

Is the smart grid secure, private and safe?
Noteworthy that smart grid is modernization of the entire end-to-end system, from fuel source to smart homes. At the end-use a smart meter, which is a sensor node, is a digital upgrade to the decades-old mechanical meters used in homes and businesses. Some smart meters use wireless technologies that transmit radio frequencies (RF) to provide two-way secure communication of the aggregate data on the electricity usage to the electric company through remote communication technologies.

This means electric companies no longer will need to send meter readers to read our meters on a monthly basis, and instead as consumers we receive the information as we choose, on an hourly, daily, weekly or monthly basis, rather than receiving the bill at the end of the month with no ability to adjust our usage.

Some consumers have expressed concerns about security/confidentially of their information (important to note that as customers we own our own data/information):

- Cybersecurity threats can cause disruptions in the flow of power and other problems if cyber intruders send computer signals to the electronic controls used in some electric generation and transmission infrastructure. The electric power industry takes cybersecurity threats very seriously. In fact, electric companies must meet mandatory cybersecurity standards that require companies to implement training, physical security, and asset recovery plans to protect against the threat of cyber attacks.

- As the smart grid is built, electric companies are incorporating cybersecurity protections into both the grid architecture and the new smart grid technologies. The electric power industry is working closely with vendors, manufacturers, and government agencies to ensure that the smart grid is secure. These measures also help to ensure that customer data remains protected from cybersecurity threats.

Are there potential health impacts of the radiofrequency (RF) signal emitted by wireless smart meters?
The RF exposure levels from smart meters are far below the levels permitted by the U.S. Federal Communications Commission (FCC), which sets health standards for RF exposure, based on extensive reviews of the biological and health literature. All scientific studies, including a request by the California State Assembly for a study conducted by the California Council on Science and Technology (CCST) on potential health impacts from smart meters.

No causations or correlations and no health impacts were found, based both on lack of scientific evidence of harmful effects from RF signal and also on the observation that the RF exposure of people in their homes to smart meters is likely to be minuscule compared to RF exposure to such items as cell phones, microwave ovens, baby monitors, wireless routers, televisions, and laptop computers, which most of us already have in our homes.
(**Resource:** Hess, David J., and Jonathan Coley. 2013. "Wireless Smart Meters and Public Acceptance: The Environment, Limited Choices, and Precautionary Politics", *Public Understanding of Science*).

According to the Electric Power Research Institute (EPRI), the "relatively weak" strength of the RF signals generated by smart meters means that any impact of RF exposure would be minimal—similar to the levels of the exposure from televisions and radios.
(**Resource:** "An Investigation of Radiofrequency Fields Associated with the Itron Smart Meter" Electric Power Research Institute, December 2010):

- RF exposure from a smart meter is far below—and more infrequent—than other common electric devices. In fact, smart meters typically broadcast their signal for less than a minute at a time and usually less than a total of 15 minutes each day. The communication is usually from outside the customer's home, so exposure to radio waves is minimal. In addition, the electric panel and wall behind the meter actually block much of the radio signal from entering the home.

- RF is measured in units of microwatts per square centimeter. A microwatt is very small—it's one-millionth of a watt.

    - Held at your ear, a cell phone's RF signal would be 1,000 to 5,000 microwatts per square centimeter.

    - Standing two feet from a microwave oven, the RF signal would be 50 to 200 microwatts per square centimeter.

    - Standing 10 feet from a smart meter, the RF signal would be 4 microwatts per square centimeter.

In summary, the RF signal emitted by a smart meter is one order of magnitude less than proximity to the microwave oven, and 1000 fold less than cell phones held to our ears.

What will it take to address concerns that communications linked to energy services will invade consumers' privacy?
Customer concerns are of vital importance. When it comes right down to it, what would the power supply or power grid be without consumers? If there is any compromise of the privacy or security of the service, it will undermine everything. An incident would not only create a breach of confidentiality for the information that has been compromised, but it might also compromise the potential future markets the technology might have been able to create if it the service had been secure.

The bottom line is that security cannot be added to a system as an afterthought. We need to start from scratch, at the very beginning of any microgrid project, and consider privacy and security in all design criteria. Strategic consideration of these issues will make a huge difference in the confidence and protection that the overall system provides. This is necessary whether the design effort is focusing on silicon chips, network components, end-user devices, the architecture, or the system as whole.

In our work we have proposed and tested several different layers of technologies that monitor and support the privacy of customer information. Security technologies are employed for traffic analyzers, signal analyzers, and agents that monitor voltages, frequency, current (along with their rates of changes), and user behavior. Each component is secured independently and locally so the security precautions cannot be reverse engineered.

This is not a hierarchical system that can be destroyed or taken down. If one or two layers fail, the system does not fail. It’s essentially a self-reconfiguring, self-healing architecture. If anybody attacks it or tries to compromise one part of it, the system reconfigures to not only protect itself but to localize and fend off such attacks.

Steven E Collier, Vice President of Business Development, Milsoft Utility Solutions

Is the smart grid susceptible to hackers?
The cyber security bogeyman for the smart grid is the possibility that having a centralized grid tightly interconnected with and controlled by two-way digital communications will make it susceptible to hackers who could severely adversely affect operations and/or compromise corporate and consumer confidential information and financial accounts. The latter concern is endemic to the Internet and is being managed acceptably today and will continue to be. Civilization is even less likely to abandon the benefits of the Internet than the benefits of readily available electric power and energy so the access and information security issues will be resolved.

Robert Saint, Principal Engineer at NRECA (National Rural Electric Cooperative Association)

Will smart grid take away consumer choice?
Smart grid will allow more choices for the consumer. Whether they want to make that choice or not, they will have that choice available and maintaining the relationship with the utility if they want to and that's a choice as well, to let the utility continue to do the managing of the grid and maintaining the best way to operate the grid in the power flow, etc.

Mark McGranaghan is Vice President of Power Delivery and Utilization for the Electric Power Research Institute (EPRI)

Should consumers be concerned about security and privacy issues with respect to smart grid?
Privacy of information that is inherent in smart grid and cyber security for the power system grid infrastructure and its monitoring and control systems are both critical issues at a national level. The Department of Energy, the Department of Homeland Security and utilities are all working to develop guidelines, technologies, best practices, and rules for compliance in this area.

We are continually working on new technologies and approaches to make sure that the grid's control systems are secure. It's a challenge today and it's going to be more of a challenge as we extend those controls deeper into the system and closer to the customer. Privacy is a concern for consumers. We all have decisions to make in terms of the privacy of our data. With smart grid moving into advanced metering and maybe into people's homes to control their appliances and smart grid devices, privacy is a very important issue. It is getting a lot of attention in terms of what people want to enable and who should have access to information associated with smart grid applications. We can put systems in place that maintain the privacy of that data, while still enabling access to provide many valuable applications to customers.

John McDonald, Director, Technical Strategy and Policy Development, GE Digital Energy

Will consumers begin to see sweeping changes, such as significantly lower electricity prices, fewer and less frequent blackouts, and more efficient delivery of power to their homes and businesses? Or, will they simply see "business as usual" in the electrical industry?
The smart grid evolution will be far from "business as usual" over the next several years. The biggest near-term impact will be on the electrical grid itself, as utilities both large and small further the expansion and implementation of advanced smart grid technologies. Additional developments occurring in parallel with grid expansion, such as Demand Response programs, will have an effect on the average consumer, though these effects will probably be felt more in the mid-term rather than in the near-term.

As smart grid evolves over the next three to five years, consumers will probably not see sweeping economic differences in their everyday lives. But during that

time, their voice can serve as a guide for utilities and regulators in steering smart grid to greater success, and perhaps even accelerate the timetable during the process. By getting involved in two-way educational programs, actively participating in available pilot programs, and embracing smart grid as the long-term solution to our nation's energy and economic challenges, consumers can serve as the vital missing link in the "human smart grid." The window of opportunity is open to make tomorrow's history… today.

What policies does the industry need to benefit consumers?
One policy that can be implemented at the state level is dynamic pricing. This will facilitate demand response programs, which give consumers information and tools to manage their own energy use. These approaches can save a consumer 15 percent per month on their electricity bill.

Patty Durand, Executive Director at Smart Grid Consumer Collaborative

How are consumers' best interests being addressed?
Regulators, whose mission is to serve the consuming public, are demanding objective evidence that the investments they approve are cost effective and deliver customer value.

Today, industry discussions of consumer value have advanced to the point of developing metrics that establish tangible value. We're not quite all the way there yet, but clearly understanding how consumers benefit from smart grid investments and the metrics that support them is well underway. Establishing clear-cut consumer value in return for investments in smart grid technologies is critical to the success of grid modernization.

The **Smart Grid Consumer Collaborative (SGCC)**, a national nonprofit based in Atlanta, Georgia, has a mission of accelerating the adoption of consumer-friendly, consumer-safe and consumer-approved smart grid technologies. We think consumers want to know the answers to three basic questions: 1) What is the smart grid and why should I learn about it? 2) What's in it for me? and 3) What's in it for "us"? Stakeholders need to answer those questions clearly and convincingly.

What are U.S. consumers concerned about with smart grid?
We can assume that consumers have valid self-interests in mind when they are asked to learn about important public issues such as grid modernization; naturally they are concerned about material payback. But our research at SGCC has identified groups of consumers who also are motivated by factors other than self-interest, including issues of the environment, energy independence and U.S. economic prosperity.

What are the benefits of smart meters?
Smart meters enable several direct benefits to individual consumers. They enable the delivery of household energy use data to help customers understand and manage their electricity use. Smart meters also enable swifter, automated outage detection and restoration. And smart meters allow new services and programs tailored to specific customer groups and/or individuals. All these

benefits are the focus of past and present studies to determine appropriate metrics, as we shall explore here.

What are the benefits of smart grid to the consumer?
Three chief benefits will be in lower environmental impacts, greater energy independence and economic productivity. A more modern, efficient grid pollutes less, particularly with the addition of renewable energy sources. The transition from fossil fuels to renewables promises to provide greater energy independence. And improved energy infrastructure greatly enhances national economic productivity. Expert analyses show that **the monetized benefits of grid modernization in terms of jobs created and economic payback far exceed the cost of investments**.

How can smart grid benefits to consumers be quantified and demonstrated?
The states of Maryland, Illinois and California are showing what can be done with consumer-centric performance metrics. These states cross the spectrum of U.S. geography and, thus, prove that such metrics can work throughout the country. The California Public Utility Commission (CPUC) has adopted 19 smart grid metrics, nine of which address smart metering or AMI, seven which address operational issues, one pertains to plug-in electric vehicles, and one addresses energy storage. The CPUC has also established a working group to define and document related goals and metrics. For instance, one goal calls for dynamic pricing and a metric to gauge consumer response.

The Illinois Power Agency Act introduced “performance-based ratemaking," which requires rigorous performance metrics and improvements over time. Such rates provide for cost recovery and a set return-on-investment as well as incentives for local utilities to meet operational, environmental and customer-related metrics. Commonwealth Edison (ComEd), for instance, has established “smart grid trackers” that document metrics in these areas. They include customer enrollment in dynamic pricing programs, the number of premises capable of receiving grid information, and peak load reductions enabled by demand response (DR) programs.

Maryland regulators and the state’s utilities (Baltimore Gas & Electric and Pepco) calculated that half the operational benefits of grid modernization would come from system efficiencies and the other half from peak load reduction. Also, regulators made cost recovery contingent on the effectiveness of related investments.

In one important area —peak load reductions through DR— a peak load reduction credit appears to have driven Maryland’s high rate of customer participation in this program. Maryland is second only to Connecticut in DR participation.

Maryland also tracks smart grid program deployment and related customer engagement. It probably has the highest number of metrics and currently employs more than 55 metrics relating to capital and operational savings and other system benefits. Seventeen focus on customer education and engagement including whether and how customers are using tools at their disposal to manage

their energy use and their participation in the peak load reduction program.

These three states currently appear to be in the vanguard of articulating customer value and defining the metrics that will establish how value has been delivered and that it has been delivered.

How can we raise awareness of smart grid among consumers?
In mid-July, the U.S. Department of Energy released ***Voices of Experience: Insight on Smart Grid Customer Engagement***, a simple-to-use guide on consumer-oriented smart grid benefits and step-by-step direction on communicating that value. The guide is based on successful utility practices and metrics that establish their efficacy. The SGCC will steward the document and continue to raise awareness of its existence. Readers are urged to peruse the guide; a particularly useful one-page quick reference for tenets and steps in successful consumer engagement can be found on page 6.

Our sense at SGCC is that the power industry has grasped the importance of documenting consumer value-related metrics and that the actual work has begun. Now we need to spread the word and offer resources to accomplish this important goal.

To view the complete range articles visit: http://smartgrid.ieee.org.

View **A Smart Grid for Intelligent Energy Use** video:
http://www.youtube.com/watch?v=YrcqA_cqRD8

Engage in the discussion and dialog with the smart grid community on:

- Twitter (@ieeesmartgrid)
- LinkedIn (http://bit.ly/IEEESGI-LinkedIn)

Access U.S. Department of Energy (DOE) Smart Grid Impact Reports
Click on the link below to access the four new Office of Electricity Delivery and Energy Reliability (OE) reports on the DOE's Smart Grid Investment Grant (SGIG) program:
http://www.smartgrid.gov/all/news/department_energy_releases_smart_grid_impact_reports