DOE Smart Grid RFI

Titled "Addressing Policy and Logistical Challenges to Smart Grid Implementation"

Submitted by the Demand Response and Smart Grid Coalition (DRSG)

November 1, 2010

I. Definition and Scope

1. <u>What significant policy challenges are likely to remain unaddressed if we employ Title XIII's definition?</u>

In light of the fact that smart grid deployments are moving forward with pace and at scale, DRSG advises the DOE against seeking to redefine the term "smart grid" as a semantic exercise, as such an effort would introduce delay, generate uncertainty, and likely prove counterproductive.

In crafting the language of the provisions in Title XIII, the goal was not to craft a precise, all-encompassing definition of Smart Grid. The language was drafted and enacted to serve the purposes of the specific provisions elsewhere in Title XIII. At the time of enactment of EISA, the "Smart Grid" was for the most part seen as a collection of technologies. Today it is recognized as not just the introduction of new technologies. It is more appropriately recognized as a combination of technologies, utility and consumer actions, as well as new planning and operating concepts. The best example of this is Demand Response. At the time of EISA, many saw DR as something totally separate and detached from Smart Grid. Thus the inclusion of EISA's demand response provisions in a separate title from Title XIII. Today, it is accepted that demand response is indeed the "smart grid in action" and that a proper definition of Smart Grid must be a holistic one where it is not necessary to have a long list of smart grid components.

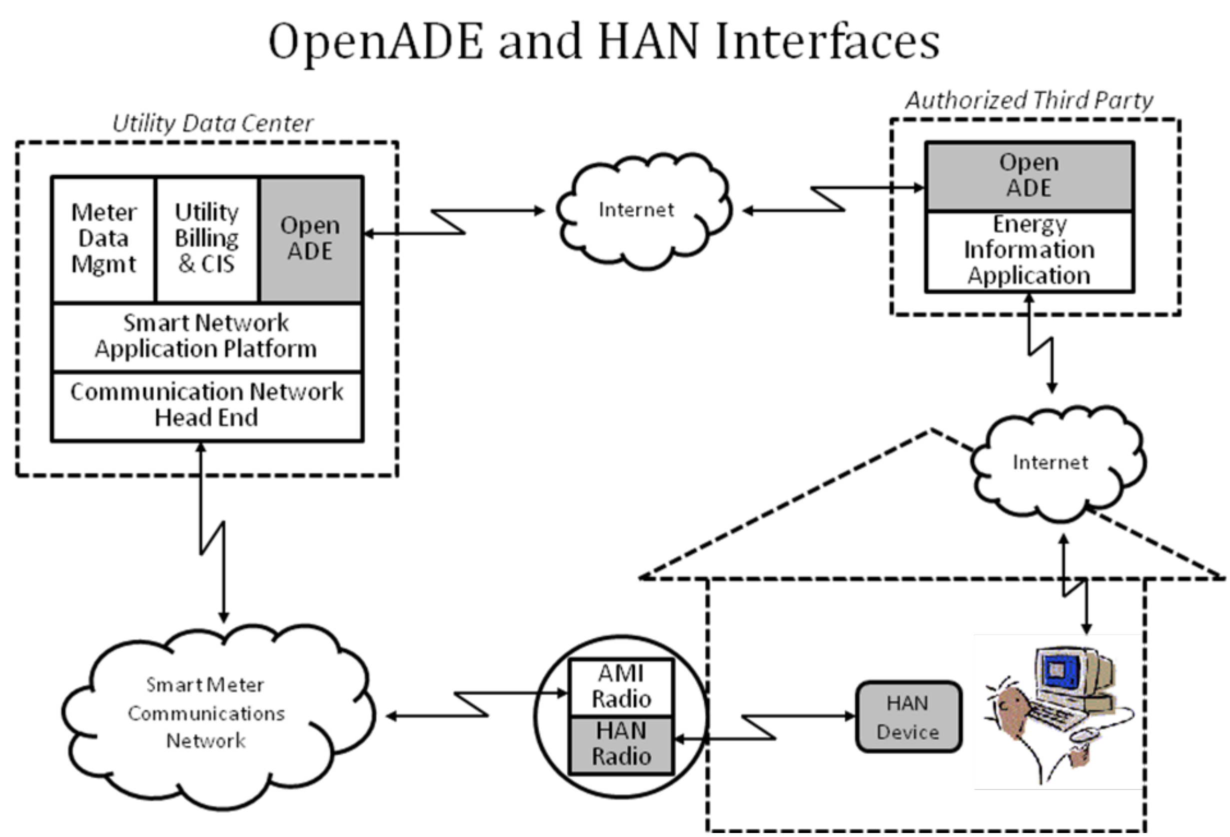
2. <u>If the definition is overly broad, what policy risks emerge as a result?</u>

Some legislative language, particularly that for tax provisions, may need to be precisely crafted based on the intent of a provision. Otherwise, for general policy making purposes, a broad definition is not only acceptable but best, as the Smart Grid will continue to evolve, and many policymaking jurisdictions will exercise flexibility on definitions regardless.

3. <u>Should smart grid technologies be connected or use the same communications standard across a utility, state, or region?</u>

   Not for communications between utility-owned devices and utility data centers. This would restrict options for utilities. In addition, this scenario would limit the opportunity to apply the best technology to solve the problem. For example, rural deployments are not well suited for certain technologies that do not have the capability to easily address a limited number of homes in a given geographic location.

However, to achieve efficient and active market participation by consumers, the interfaces to non-utility-owned devices need to be the same nationally. There are two key interfaces (see figure): 1) the interface between the utility meter and home area network (HAN) devices or networks used by C&I customers, and 2) the interface between the utility data center and third parties assisting consumers (of all sizes) with their energy usage data (but only with the customer's authorization!). For the first interface, the goal is ubiquitous availability of appliances and commercial equipment with a built-in HAN radio, just as all computers have built-in Wi-Fi radios and all smart phones have built-in Bluetooth radios. For the second interface, the goal is a standard interface for use by, ultimately, over 3,000 electric utilities. On the NIST list of acceptable Smart Grid standards published in January 2010, ZigBee is an example of the former and OpenADE of the latter.



That said, neither federal nor state regulators should specify the standard. The market – utilities – should be free to decide which standard to use from among a list of standards that have been vetted for suitability from technical and security perspectives by NIST.

Use of the term "communications standard" is often vague. We propose distinguishing between standards for physical communications (e.g., wireless, wireline) and networking (e.g., routing, addressing). In this context, we advise that a diversity of physical communications standards will be necessary to provide ubiquitous connectivity at the wide-area network (WAN, a.k.a. "backhaul"), neighborhood-area network (NAN), and HAN levels. However, across WANs/NANs/HANs, we strongly encourage uniform utilization of universally recognized, globally utilized networking standards that are being formalized by NIST.

1) <u>How does this vary between transmission, distribution, and customer-level standards?</u>

At all three levels, a diversity of standards for physical communications is not only tolerable, but mostly likely appropriate, and perhaps even ideal, since utility service territories vary significantly in geographic topology, and customer-level environments range from single-family residences in suburban concentrations to dispersed housing in rural locations to high-density urban tower condominiums and to larger C&I facilities. Again, we recommend uniform use of universally recognized, globally utilized standards. Again, where consumer-owned devices or interfaces to third parties are involved, a national standard, decided by the market within regulatory guidelines, is essential to achieving the vision of the smart grid.

a) <u>For example, is there need to go beyond ongoing standards development efforts to choose one consumer-facing device networking standard for states or regions so that consumers can take their smart appliances when they move and stores' smart appliance will work in more than one service area?</u>

While on face value this may seem easy, it will require some way for the utility to identify devices or at least have some record of devices deployed in their service territory. Network management and home area device discovery/management will require additional steps to be taken by the utility in order for this concept to be applied and properly administrated,

We recommend that the Federal Government avoid "picking winners" in this area, noting that it is already in the interest of smart grid appliance and equipment manufacturers and the technology firms that provide network connectivity to smart appliances to converge on a single applicable standard to network these devices. Utilities should be encouraged to support a national standard as well, to reduce costs and increase benefits. A handful of physical communications standards (e.g., WiFi, ZigBee, HomePlug) may be necessary to meet the needs of the typical range of environments in which residential and C&I customers will operate smart grid devices and equipment.

II. Interactions With and Implications for Consumers

1. <u>For consumers, what are the most important applications of the smart grid?</u>

For consumers, the most important applications of the Smart Grid are those that increase the reliability and lower the cost of electricity and empower customers to better manage their own consumption. A portion of the population is also conscious of environmental issues. More specifically, demand response -- which includes both Direct Load Control strategies and indirect strategies for changing consumer's behavior -- will be very important applications of the Smart Grid.

Consumers will participate in energy efficiency programs if the choices are rich and broad in scope. Consumers will want to use tools provided from utilities as well as consumer products such as devices, software, internet portals, and mobility products. These products must be based on familiar and easy to use technologies. For example, utilities could promote the need for consumers to access their device information from the same sites as their energy consumption in order to comprehend the cause and effect of changes.

Moreover, many of the most beneficial applications of the smart grid for consumers are ones with which consumers will never directly interact, such as distribution operations to enhance grid reliability, smart metering to reduce the cost of meter reading and field operations, and outage detection and management to accelerate service restoration. That said, important consumer-facing smart grid application in the early stages of smart grid deployments will be demand response and electric vehicles.

To summarize, the consumer benefits of the smart grid are:

- increased utility operating efficiency through automation of manual functions,
- greater energy efficiency through consumer information feedback,
- peak reduction through dynamic pricing and automated control,
- better renewable integration through sensing and automated control,
- support for electric vehicles through dynamic pricing and automated sensing and controls, and
- greater support of intermittent renewable distributed generation through automated sensing and controls.

The Smart Grid should be designed and built to achieve these goals.

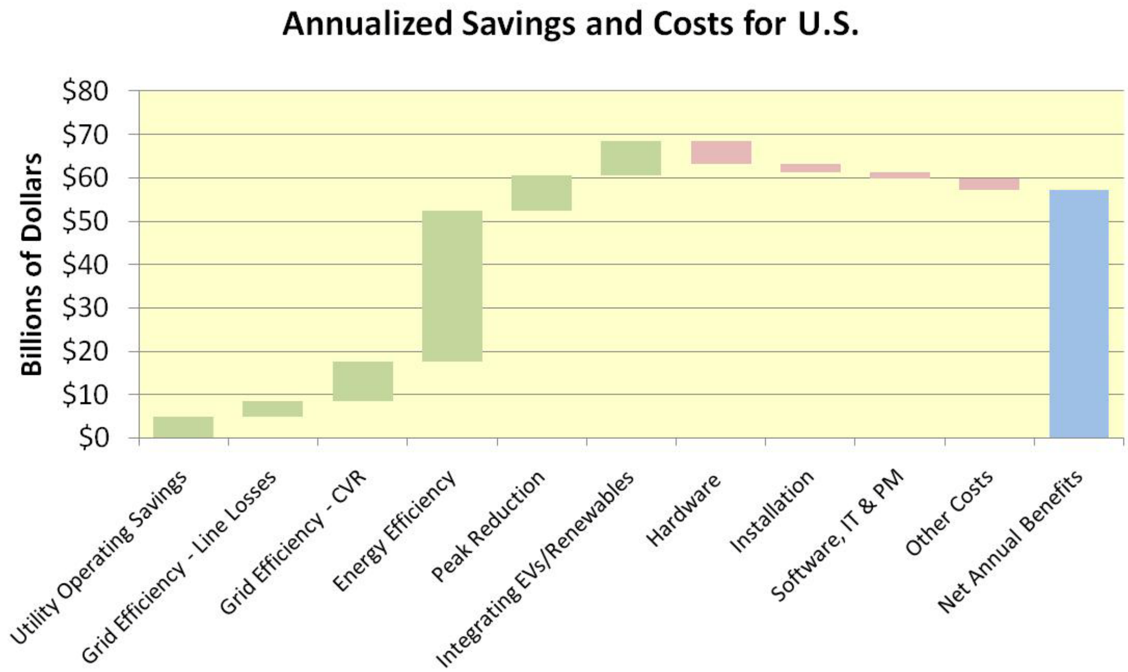
2. <u>What are the implications, costs and benefits of these applications?</u>

There are several implications, costs, and benefits of these applications.

Implications include the potential for utilities to reach into the home or business and control devices that are normally under the total control of the consumer. Possible implications include loss of comfort, a feeling of “big brother” entering the home, as well as the technical issues associated with supporting devices like this inside a consumer’s home or premise.

Consumers can intelligently decide how to use energy and remotely modify device settings. Benefits include lower peak demand, leading to sustainable growth in energy usage, sustainable cost growth, and overall environmental improvement. Broadening offerings to consumers allows them to participate and personalize their choices and provide similar benefits without the “big brother” feeling. These methods will lead to wider and increased participation levels.

From a purely economic perspective, the greatest benefits of the smart grid are on the consumer side: energy efficiency savings of 5-15% (according to Oxford University), peak demand reductions of 10-20% (according to a wide variety of dynamic pricing pilots, including the attached Washington DC, PowerCentsDC program report), and improved utility operations (line loss reductions of 15% and conservation voltage reductions of up to 2 ½ % according to McKinsey and others). Sensing transformers and other devices improves reliability, but the economic benefits are only a fraction of the previous items listed. The following chart summarizes potential costs and benefits of a fully-deployed smart grid in the U.S.



Source: eMeter Strategic Consulting.

Specifically, Demand Response not only provides proactive consumers with new opportunities to tailor their energy consumption to their personal preferences (e.g., budgetary, environmental), but also benefits all customers by deferring/avoiding expenditures in costly new generating and delivery infrastructure for peak capacity. Costs for demand response are associated with smart meters for time-sensitive interval recording, communications infrastructure for network connectivity, in-home displays and smart appliances, and related costs for marketing, education, and outreach. Customers who drive smart grid-enabled electric vehicles will benefit from lower energy costs for transportation, along with utility benefits from increased revenue and higher system load factor. Societal benefits from electric vehicles arise from reduce dependence on imported petroleum and lower emissions of criteria pollutants and greenhouse gas emissions, while the preponderance of costs are associated with the electric vehicles themselves and related electric vehicles support equipment (EVSE).

3. <u>What new services enabled by the smart grid would customers see as beneficial?</u>

There are potential new services enabled by the Smart Grid for consumers. These include the potential for lower energy usage and increased comfort and convenience through automated appliance/equipment and HVAC control.

For example, customers could control devices such as thermostats and air conditioners and have the ability to view their consumption. This information can lead to lower utility bills, increased home automation, and enabling adoption of electric vehicles.

Beyond energy savings, automation increases comfort and convenience through automated monitoring and control of lighting, doors and windows (for security), entertainment equipment, sprinkler systems (saving water as well), and other applications.

We have briefly described customer benefits from demand response and electric vehicles in the preceding answer, and we note that many customers will see intrinsic, if not necessarily economic, value in the societal benefits unlocked by these applications, as well.

4. <u>What approaches have helped pave the way for smart grid deployments that deliver these benefits or have the promise to do so in the future?</u>

Adaptation of standards and strong certification programs allow for delivery of these benefits for consumers. For example, a number of organizations have already certified thousands of products in use today. Consumers can buy Wi-Fi devices, use them anywhere in the world, and not worry about if they will work. A strong certification program will lead to the same types of consumer confidence in energy efficiency programs. In the smart grid space, in Texas, several devices have been tested and approved for compatibility with the ZigBee interface in smart meters, following the Smart Energy Protocol 1.0 standard.

Direct Load Control has been a forerunner of energy conservation and powerline congestion relief. Properly implemented demand response programs -- whether based upon price or participation -- have led to lower energy bills, better management of power generation, and improved power quality during times of peak consumption.

5. <u>How well do customers understand and respond to pricing options, direct load control or other opportunities to save by changing when they use power?</u>

Customer responsiveness to electricity pricing may be understood on two levels. First is the "Prius effect," named after the behavioral changes toward increased driving efficiency observed when drivers of the eponymous automobile were exposed to real-time information about their miles-per-gallon performance. With the smart grid, customers have been shown to reduce overall consumption ~5% when they are made aware of electricity costs through any variety of means (e.g., web portal, in-home displays, etc.). Second, is demand response to dynamic rates, where demonstrate price elasticity to variable electricity pricing to encourage off-peak energy consumption (e.g., EV charging, energy storage) and discourage on-peak demand for discretionary services (e.g., freezer defrost cycles, pool pumping) by as much as 20%, with reliability.

However, the overall awareness of how electricity is priced, and why time-based pricing should be an option, is low. More education to establish basic understanding is necessary.

a. What evidence is available about their response?

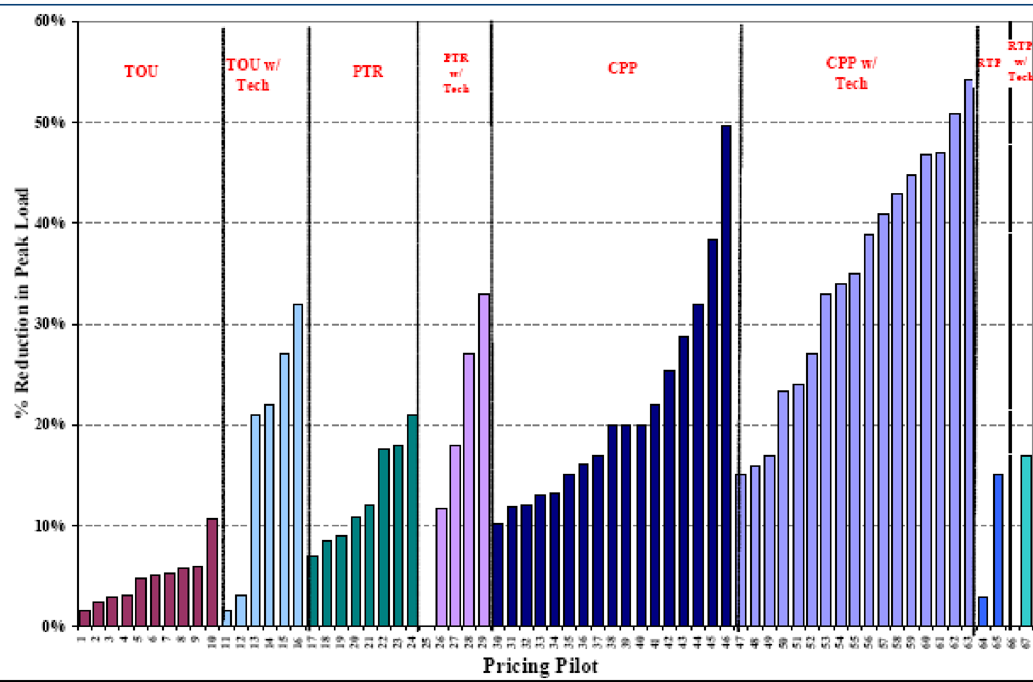
Dr. Ahmad Faruqui of the Brattle Group has performed meta-analyses that show that critical peak pricing reduced peak demand by 13-20 percent and that enabling technologies further enhanced this effect to reach 27-44 percent peak reductions.

b. To what extent have specific consumer education programs been effective?

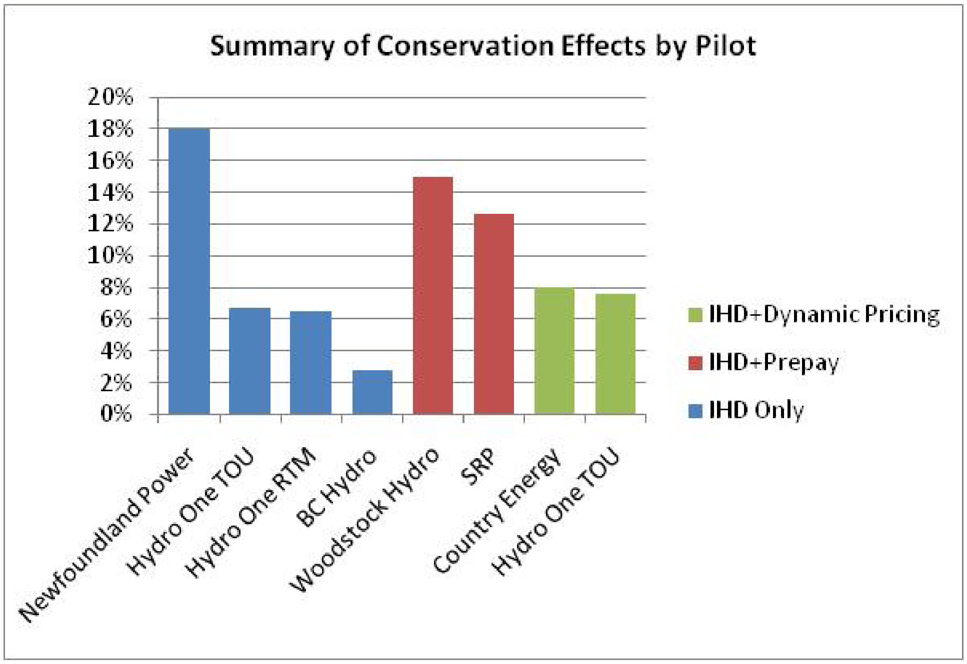
PowerCentsDC had a consumer education program that resulted in high levels of customer satisfaction in the Washington, D.C. smart meter pilot. Toronto Hydro (Ontario) and San Diego Gas & Electric have received awards for their consumer education programs as well.

c. What tools *(e.g.* education, incentives, and automation) increase impacts on power consumption behavior?

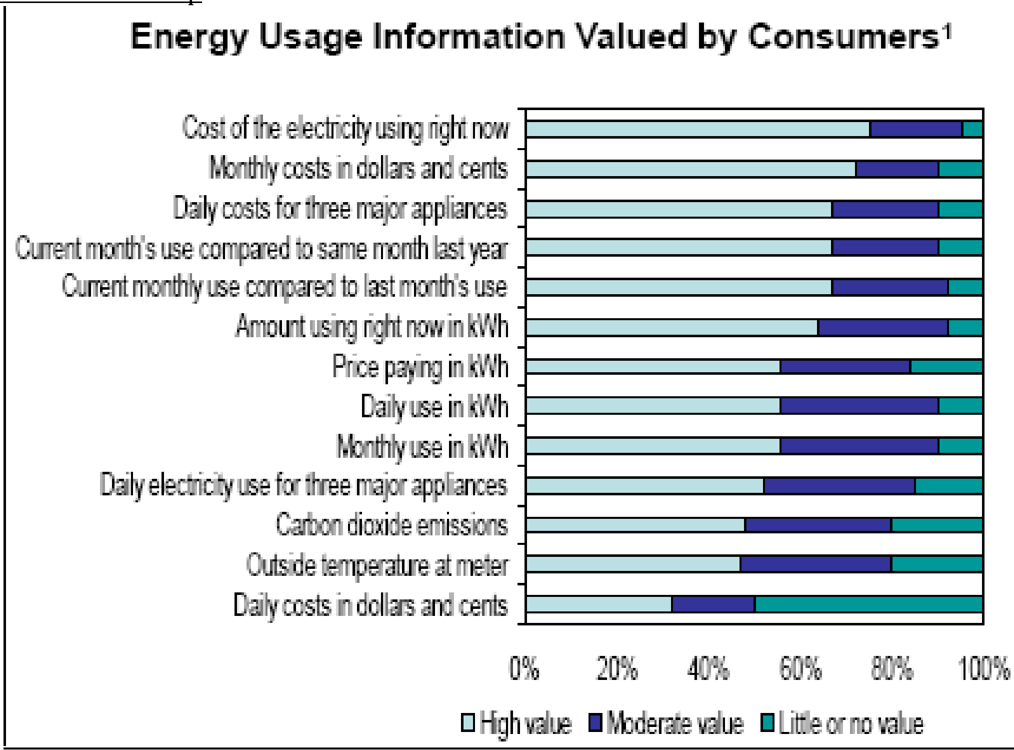
Education, pricing incentives, and automation all increase the amount by which consumers reduce their energy consumption overall and during peak times. The first chart below shows the results of approximately 60 pricing pilots. The second chart shows the results of energy information feedback displays. The third shows consumer preferences for receiving data to educate them about their energy use.



Source: Brattle Group



Source: Brattle Group



Source: Energy Insights

d. What are reasonable expectations about how these programs could reshape consumer power usage?

The extensive literature on pricing and information feedback pilots – cited and illustrated above – provide reasonable expectations.

Universal participation in demand response is not required to make smart meters useful, as these devices provide important benefits besides enabling demand response (e.g., operational savings from reduced meter reading, field collection, and outage detection and management costs). In fact, it is widely-recognized that neoclassical supply-and-demand economics reveals that demand response from even a subset of consumer benefits all consumers by reducing high marginal electricity prices, in addition to the even larger cost savings in the long-run associated with deferred and/or avoided peak capacity infrastructure. However, we note that even though universal participation is not necessary, universal access to demand response opportunities (e.g., ubiquitous HAN-enabled smart meters) is appropriate, for reasons of network connectivity and equity.

The question as to whether behavior changes are sustainable without automation is yet to be answered. Consumers in general do not understand the details of electricity pricing but do understand the basic concepts when exposed to them. For example, in surveys, customers with inverted tier rates are aware that their price goes up the more power they use. This is similar to cell phone rates, where consumers know peak rates are higher, but few could say exactly how much. Younger generations will be more apt to adopt these changes. Certainly the cellular model has shifted the behavior of telephone usage.

Any Smart Grid deployment requires an extensive customer outreach program with goals to educate and communicate. Tying electricity cost directly to power generation or congestion-related charges (peak demand) will require that the consumer be informed that prices change hourly and be given notifications of high price periods in advance. Residential consumers in Illinois and District of Columbia programs have shown that such consumers can understand and successfully utilize even hourly pricing (though most residential consumers likely do not desire such pricing).

6. <u>To what extent might existing consumer incentives, knowledge and decision-making patterns create barriers to the adoption or effective use of smart grid technologies?</u>

   a. <u>For instance, are there behavioral barriers to the adoption and effective use of information feedback systems, demand response, energy management and home automation technologies?</u>

      Barriers may include:

- Lack of incentive -- Consumers have no incentive to shift consumption from peak to other hours, because, except for a small minority, they do not have time-varying prices.

- Privacy concerns – Who owns the data? Consumers may want to keep the cost of their electricity bills private and not share the information with their neighbors.

- Behavior barriers – may depend on generational boundaries. Younger generations will adopt technology and controls much faster than older generations.

b. <u>What are the best ways to address these barriers?</u>

One of the best ways to address these barriers is to create appropriate incentives. Pricing has been the best motivator for behavior change. In addition, customers need more information about their energy use and presented in convenient and easily understood ways (e.g. consumers prefer that data be sent to them rather than having to log into a website, though they desire both options). On the privacy side, policymakers should provide clear consumer protections. For example, California has adopted legislation that protects both the privacy and security of consumer energy information, unless the consumer voluntarily chooses to provide the data to a third party chosen by the consumer.

Simplicity and automation, coupled with transparency, can also help to address some of the barriers in this area.

c. <u>Are steps necessary to make participation easier and more convenient, increase benefits to consumers, reduce risks, or otherwise better serve customers?</u>

The technology must be easy to use and easy to support. Most of the technology should be transparent to the consumer. Options such as Wi-Fi, a heavily adopted technology already in the home, and ZigBee, which dominates utility smart meter deployments, can serve as backbones for home area networking technology for the Smart Grid.

d. <u>Moreover, what role do factors like the trust, consumer control, and civic participation play in shaping consumer participation in demand response, time-varying pricing, and energy efficiency programs?</u>

Trust, consumer control, and civic participation are all important factors in these programs. Consumers have a high level of trust in information from their utilities; it is important to maintain this trust and take advantage of it in providing new data and programs to consumers. Consumers expect to control their own homes and businesses, but are very open to utility load control in well-implemented programs. For example, FPL has nearly a million households that voluntarily allow the utility to control air conditioners in critical peak conditions. Such programs should be voluntary. Regarding civic participation, focus group results in the PowerCentsDC program showed that joint participation in program marketing by the utility with other civic organizations – consumer groups, public service commission, and labor unions – was seen as beneficial by consumers.

e. <u>How do these factors relate to other factors like consumer education, marketing and monthly savings opportunities?</u>

These factors are equally important and synergistic. Recycling is a great example of the interplay of civic participation, consumer education, and consumer behavior. Energy savings and peak demand reductions can benefit from the same interplay and have the added benefit of monthly savings.

7. <u>How should combinations of education, technology, incentives, feedback and decision structure be used to help residential and small commercial customers make smarter, better informed choices?</u>

There needs to be a constant reinforcement of messaging and education. Informing people once and letting it go will not be sustainable. The Internet is an inexpensive medium; however, there will still be a large segment of the population who may only view what is in their bill or on a TV ad.

Consumer surveys and experience in both energy pilot programs and various other services in the marketplace make clear that consumers like to have many methods of obtaining information. In the context of energy, the following are important sources:

- Utility bill insert (it's very difficult to modify utility bills, but adding a customer-specific insert with added information has proved highly successful in pilot programs)
- Utility website
- Utility emails and text messages
- Real-time interface to meter with display on computer, smart phone, or other device
- Third-party reports and websites, with proper consumer authorization

8. <u>What steps are underway to identify the best combinations for different segments of the residential and commercial market?</u>

Many pilot programs using different technologies are currently in play across the country. Feedback on consumer behavior changes brought about by these pilot programs is critical to understand the market and implementation of future, large-scale programs. In addition, the market is being allowed to decide the best means in some major markets. For example, in Texas and California, consumers have (or will have) access to online data via authorized third party providers and real-time data through the HAN interface in smart meters. Regulators should not attempt to identify the best combinations; instead, in exercising free choice in these information markets, consumers will vote with their feet to identify the best combinations.

9. <u>Are education or communications campaigns necessary to inform customers prior to deploying smart grid applications?</u>

   Yes, consumer awareness and early communications to the consumer will definitely play a role in the adoption rate of demand response/energy efficiency programs.

   a. <u>If so, what would these campaigns look like and who should deploy them? Which related education or public relations campaigns might be attractive models?</u>

      Without a doubt community outreach/education campaigns are necessary. Utilities should relay the advantages of the technology and their benefits to consumers. Consumers will see utilities as the parties responsible for the introduction, deployment and operation of the smart grid. Utilities need to structure their communications efforts to maximize outreach.

      In communications and outreach efforts, a balance must be struck between direct consumer benefit and societal and other benefits. Behavioral change should be a design objective.

      In addition, reaching out to the consumer advocate community will ease the after-effect of deployment issues, such as those that are currently hampering the smart meter deployments in California. Outreach will also help the PUC handle public-related issues.

      Smart meters are a foundational aspect of the smart grid, and also are the most visible change to customers. Accordingly, to ensure customers achieve intended and potential benefits, utilities must deploy changes in call center processes to communication the benefits of smart meters. It is very important to establish greater customer communication from the start so customers realize the benefits smart devices can provide.

      Utilities must help customers understand how this can benefit them long-term in reducing their energy usage and lowering bills. Utilities are finding that they must address and eliminate fears that this is just another way for a utility to monitor and control what their consumers are doing at their homes. This means utilities must invest more in educating their customers and creating a positive customer experience as they start implementing smart metering programs. Education requires using all channels of communication like call center, web, interactive voice response (IVR), bills and inserts, television channels, newspaper advertisements, etc.

As utilities roll out new demand response programs coupled with time-sensitive pricing models, adequate business processes need to be in place for notifications to customers to reduce usage during peak periods. This means effective and timely communications to customers, their acceptance to participate, and enhanced billing processes to handle the event. Appropriate deployment of this process can go a long way in customers managing their bills.

The major challenge facing utilities is not just to educate and engage customers on programs and applications that result from AMI deployment, but to inform and educate them at an even more basic, rudimentary level on how energy is generated and then moved (transmission and distribution) to their homes, as well as how their usage is measured and what things in their homes use relatively how much electricity. If AMI programs are to stand a reasonable chance of enabling utilities to meet state and federal peak and overall consumption reduction goals, they must develop a comprehensive smart customer communication approach to education.

The benefits of a smart metering program for an enhanced customer experience are apparent, but utilities need to establish new procedures to reap the benefits. The key is to create a smart customer communication plan across multiple channels to increase customer satisfaction, improve service quality, lower utility costs and manage energy demand.

Finally, DRSG notes the major focus on communication, outreach and education contained in the National Action Plan on Demand Response issued in June 2010 by FERC in cooperation with DOE. The NAP contains well-thought-out and well-vetted approach to developing communications and educational assistance to utilities, policymakers, and other stakeholders aimed at supporting demand response and smart grid. The NAP represents a vehicle to use in accomplishing much of what is being discussed in this section of the RFI.

10. <u>What should federal and state energy policymakers know about social norms (e.g. the use of feedback that compares a customers' use to his neighbors) and habit formation?</u>

Federal and state energy policymakers should support efforts that are aimed at educating consumers and businesses on demand response and smart grid. Some, but not all, of those efforts may be directed at emphasizing behavioral changes in response to comparative information within a community. The role of policymakers should be to ensure that utilities and third parties clearly state comparison criteria and relay information to consumers in ways that they understand. Policymakers must also realize that privacy is important and comparisons should be stated in aggregate only.

11. What are the important lessons from efforts to persuade people to recycle or engage in other environmentally friendly activity?

    Public recycling has become part of day-to-day life in many communities; engagement in recycling and energy efficiency programs often begin in grade schools as a method to help children engage in community efforts. Children frequently bring this awareness home to parents.

    The Energy Star program began slowly, but public awareness has grown significantly with the promotion of the Energy Star brand to the mass market.

12. What are the implications of these insights for determining which tasks are best automated and which should be subject to consumer control?

    The key point is that consumers should be making the determinations of which tasks are best automated or left to manual control; regulators should enable the infrastructure but allow consumers to decide. For those customers who choose to automate, simplicity in establishing settings and defaults is paramount, and the easier the better and the more effective.

13. When is it appropriate to use social norm based tools?

    It is appropriate to use social norm based tools when all parties agree to use their data and to not disclose data on an individual basis.

14. How should insights about consumer decision-making be incorporated into federal-state collaborative efforts such as the Federal Energy Regulatory Commission's (FERC) National Action Plan on Demand Response?

    The combination of information, price incentives, and education is the most effective means to modify behavior for recurring usage and demand reductions.

    As insights and understanding about consumer behavior, preferences, and decision-making begin to accumulate, it is important to have an organized, coordinated way to disseminate and share that information and content within the demand response and smart grid community. Policymakers, utilities, technology companies, consumer advocates, DR practitioners and many other stakeholders, if aware and armed with such information and knowledge, may be able to agree and work together more constructively on demand response and smart grid.

DRSG is a member of the National Action Plan Coalition (NAPC) that has sprung up to help implement the National Action Plan proposed by FERC in conjunction with DOE. The NAPC represents the "Coalition of Coalitions" that was recommended in the National Action Plan as a way to implement the Plan. The NAPC includes utility trade associations, technology groups, state policy associations, environmental groups and consumer advocate organizations.

The National Action Plan was developed over 18 months with significant input by stakeholders. The National Action Plan is a vehicle that is "on the track" and ready to go in terms of providing support for outreach, communications and education with respect to demand response and smart grid. DRSG recommends that DOE fully embrace the Plan and support it with funding and other types of support.

III. Interaction With Large Commercial and Industrial Customers

1. <u>Please identify benefits from, and challenges to, smart grid deployment that might be unique to this part of the market and lessons that can be carried over to the residential and small business market.</u>

First, it is important to separate commercial and industrial customers into three generic sizes. There are small, "mom-and-pop" type commercial customers which share some similarities with residential customers. Second there are the very large customers such as steel mills, oil refineries and mining operations. These typically consume so much energy that they employ their own energy managers, are relatively sophisticated and often have custom tariffs or contracts to procure their energy. Finally, there are the medium sized customers; schools, hospitals, office buildings, big box stores, cold storage facilities, waste water treatment plants and small factories. These customers are characterized by an extremely heterogeneous use of energy and a lack of specialized personnel to deal with their energy usage.

That said, it is important to state that the key to achievement of a smart grid and the widespread adoption of smart grid practices is to not treat all customers the same and to not expect that all customers will want the same thing or accept the same thing. This is easiest understood when one considers a large industrial facility vs. a small commercial facility or residential household. But it must also be recognized that customer customization within major customer segments will be necessary. For example, a large industrial facility is likely to be very different than a large commercial facility and different still from a government or military facility or complex.

Customer differentiation is a challenge to an industry which has for the most part not been required to adopt basic marketing principles and practices.

It is true that large customers have been the "early adopters" of demand response. Their large loads and sophisticated business operations have made them obvious candidates. But at the same time, some large customers have expressed a desire that they not be seen as the only customers that contribute to the development and operation of a smart grid.

Large commercial customers are the principal consumers of energy. Overall, Smart Grid programs have focused on residential customers. Commercial customer participation is critical for peak load reduction.

To give this question some scale, consider that a utility may only serve 2,000 homes but experience a peak consumption of 20 or 30 MW due to localized irrigation or a small factory operation. Consumers made aware of this are often inclined to help and allow the utility to control residential energy consumption. Their actions provide localized commercial and industrial companies an opportunity to maintain lower operating costs by avoiding the need to purchase energy on the spot market. Additionally, the utility avoids using un-synched spinning reserve during these small peak periods.

2. <u>Please identify unmet smart grid infrastructure or policy needs for large customers.</u>

Large customers have the same need for open interfaces to access their data as small customers, if not more so. Specifically, larger customers are in a good position to use real time data directly from their meters to facilitate their participation in demand response and to manage their consumption of energy generally. They need to be able to access their data directly from the meter, through an industry standard communication protocol, rather than waiting for the data to be backhauled to the utility. Also, large consumers have the same needs for protection of data privacy and security, with an ability to authorize third parties to receive the data, if desired, to present, report, or analyze the data on the customer's behalf. However, larger customers are more experienced in commercial agreements to share data and buy and sell services than the average residential customer. Therefore, standardized consumer protections that may be appropriate for residential customers can be constricting and counter-productive for commercial, industrial and institutional customers.

IV. Assessing and Allocating Costs and Benefits

1. <u>How should the benefits of smart grid investments be quantified?</u>

There are many metrics needed to adequately quantify the benefits of Smart Grid investments. To properly quantify all benefits – whether through the wholesale price of energy or other markets, benefits associated with broader societal objectives, environmental improvement, grid reliability, etc. - incurred costs must also be included in the analysis. For example, one possibility is to measure changes in consumption. This method will not detect substitution, however, such as electric vehicles versus gasoline. Energy consumption should not be the only metric.

Specific suggested metrics are:

- Trends in total electricity consumption per capita
- Trends in peak demand per capita
- Number of customers using the HAN interface with the meter (as distinguished from HAN devices that do not directly interface to the meter; the utility should not be burdened with tracking such devices)
- Trends in utility line losses
- Trends in Conservation Voltage Reduction
- Reliability indicators (SAIDI, SAIFI, MAIFI)
- Customer participation in dynamic pricing or other demand response programs

2. <u>What criteria and processes should regulators use when considering the value of smart grid applications?</u>

Capability to address localized issues is very important. Forcing one technology to address an entire deployment will not satisfy all aspects of an AMI or Smart Grid system. Flexibility of technology while requiring some level of software interoperability allows a utility to build the best system for their particular need.

The smart grid benefits utilities, customers, and society. We recommend that benefit-cost analyses for smart grid consider all three categories.

Utility benefits result from operational savings and/or improvements, and are the category classically assessed by commissions. Typically, utility smart grid business cases include such items as savings resulting from reduced labor costs for meter reading, fewer truck rolls for service connects/disconnects improvements in revenue collections, and reductions in energy theft.

Customer benefits accrue directly to consumers, and can include both cost savings (e.g., bill impacts) and less tangible – but no less important – indicators, such as the value of having choices in how actively to participate as a consumer in the energy system. We take particular care to note that deferred and/or avoided utility investments for peak power generation and energy delivery, which by some estimates will exceed $1.5 trillion through 2030, represent potentially the largest area of customer benefits from the smart grid.

Societal benefits result from an overall increase in general welfare, often associated with improvements in capturing externalities that cannot be accrued by either utilities or customers. Examples include mitigation of climate change resulting from smart grid-enabled greenhouse gas reductions, enhanced economic production stemming from smart grid-enabled reliability improvements, and stronger national security borne out of reduced oil imports from smart grid-enabled transport electrification.

We further believe that, if possible, regulators should avoid least-cost, use-case-driven approaches to smart grid planning that may fail to capture the benefits arising from interoperability and limits future integration of forthcoming devices and applications. A more appropriate framework might be referred to as "best-cost," which seeks to maximize the net present value, factoring in benefits across utility, customer, and societal categories

3. When will the benefits and costs of smart grid investments be typically realized for consumers?

   As seen in the many pilot programs, consumers begin to realize benefits when the applications go live. This applies to both grid-oriented applications, like outage management, as well as consumer-oriented applications, like dynamic pricing and energy information feedback. Importantly, some benefits will grow dramatically over time. For example, Texas consumers can now utilize the HAN interface in smart meters, but it may take years for a wide variety of HAN-equipped smart appliances to be available and for consumers to replace existing appliance stock.

4. How should uncertainty about whether smart grid implementations will deliver on their potential to avoid other generation, transmission and distribution investments affect the calculation of benefits and decisions about risk sharing?

   As can be seen in the business case summarized in the graphic above, most smart grid benefits flow directly to consumers in the form of lower costs for energy, better reliability, or better customer service. At the same time, under traditional ratemaking, shareholders bear most of the risk, because they are liable for failed implementations. Accordingly, regulators are encouraged to explore mechanisms other than traditional ratemaking to enable utility shareholders to share in the rewards of successful smart grid investments. In general, first principles should be considered: benefits should flow to those who take the risks, and those who take the risks should receive the benefits.

5. How should the costs and benefits of enabling devices (e.g. programmable communicating thermostats, in home displays, home area networks (HAN), or smart appliances) factor into regulatory assessments of smart grid projects?

   Each project should be evaluated independently, with the specific costs and benefits associated with such project included in the analysis. To the extent multiple elements are included – e.g. both smart meters and smart thermostats – the costs and benefits of each should be determined independently to support good policy decisions on each. This separation means that both costs and benefits must be allocated to the separate projects. As more elements are added, complexity goes up, along with risk. One strategy to handle this is to identify a set of minimum implementation that then generates a minimum set of benefits (for example, smart meters alone with only utility operating benefits). Then, if each incremental device or feature (e.g. adding dynamic pricing to smart meters) has a positive cost benefit analysis, risk is minimized. This approach has essentially been the one used by many commissions in evaluating smart meter projects.

6. <u>If these applications are described as benefits to sell the projects, should the costs also be factored into the cost-benefit analysis?</u>

   Yes. Sometimes the costs are shared, such as using the same communications network or software application platform for receiving meter reading data and for sending price and control signals to HAN devices.

7. <u>How does the notion that only some customers might opt-in to consumer-facing smart grid programs affect the costs and benefits of AMI deployments?</u>

   Universal participation in smart grid programs, such as demand response, is not required to make smart meters useful, as these devices provide important benefits besides enabling demand response (e.g., operational savings from reduced meter reading, field collection, and outage detection and management costs). In fact, it is widely-recognized that neoclassical supply-and-demand economics reveals that demand response from even a subset of consumer benefits all consumers by reducing high marginal electricity prices, in addition to the even larger cost savings in the long-run associated with deferred and/or avoided peak capacity infrastructure. However, we note that even though universal participation is not necessary, universal access to demand response opportunities (e.g., ubiquitous HAN-enabled smart meters) is appropriate, for reasons of network connectivity and equity.

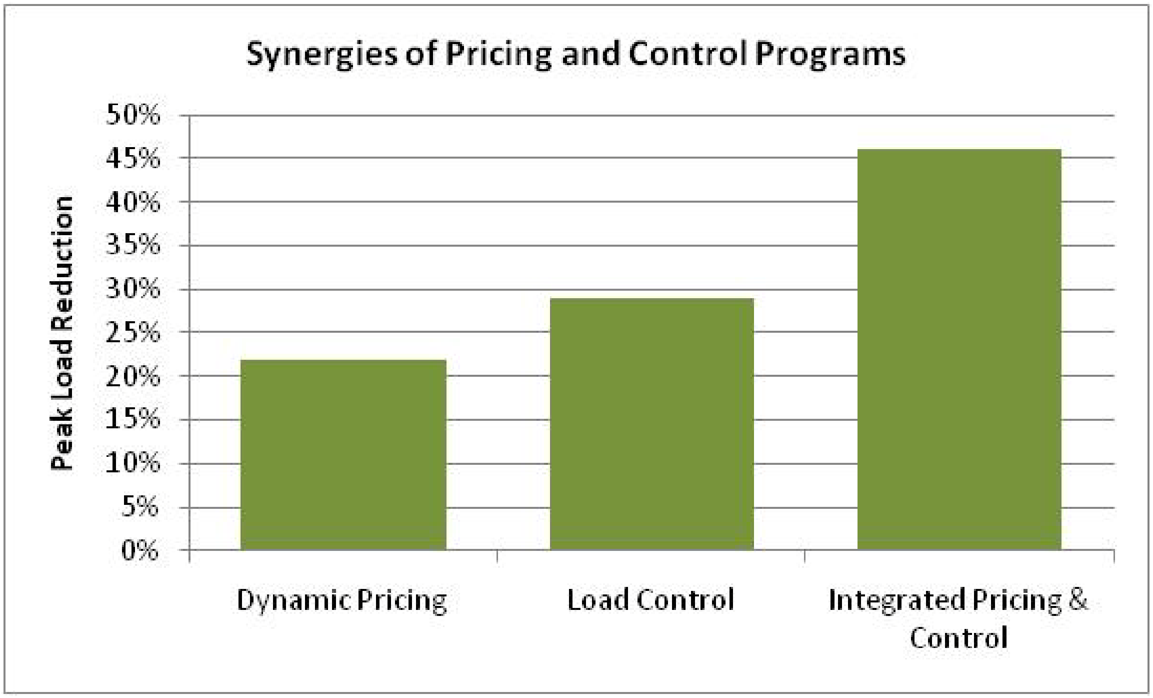
8. <u>How do the costs and benefits of upgrading existing AMR technology compare with installing new AMI technology?</u>

   Upgrading existing AMR may appear less capital-intense than installing new smart grid-enabled AMI, but significant benefits cannot be achieved with most AMR upgrade paths (e.g., remote connect/disconnect, load-limiting, HAN messaging, and outage detection and management) and many AMR upgrade approaches rely on Internet connectivity at the premise, which inherently and severely limits the applicability of this option, particularly for disadvantaged customers. The overarching goal should be to provide all Americans with the opportunity to benefit from smart grid applications. We should be careful not to create an "energy divide".

9. <u>How does the magnitude and certainty of the cost effectiveness of other approaches like direct load management that pay consumers to give the utility the right to temporarily</u>

<u>turn off air conditioners or other equipment during peak demand periods compare to that of AMI or other smart grid programs?</u>

Most importantly, the pilot programs have found that dynamic pricing and load control are synergistic, as seen in the figure below.



Source: eMeter Strategic Consulting

Other Smart Grid programs that might fit into this category include the use of AMI / Direct Load Control to protect aging assets such as transformers or overloaded distribution substations.

One-way direct load control technologies have disadvantages in achieving achieve demand response. Direct load control technologies are like AMR, in that they ostensibly deliver a specific smart grid-like functionality for an attractive price, but cannot deliver any additional benefits in the future and become less effective, rather than more useful, over time (e.g., no way to confirm whether direct load control endpoints radios actually received a signal or have even permanently failed; and there is no cost-effective means to upgrade firmware to improve features/functions/security).

10. <u>How likely are significant cost overruns?</u>

Cost overruns are no more likely than for other comparable large-scale systems consisting of networks and devices. Many, if not most, smart grid technologies are mature technologies (e.g., microprocessors, digital memory, and radio communications) whose primary claim to innovation is being applied to a new sector. There have been many large-scale AMR and AMI deployments, with no significant cost overruns.

11. What can regulators do to reduce the probability of significant cost overruns? How should cost overruns be addressed?

Utility assurances of cost caps have succeeded in addressing concerns of near-term cost overruns. More importantly, long-term cost overruns can be mitigated by deploying an open and interoperable networking platform for smart grid devices from the beginning. Emphasizing field-proven technology backed by empirical performance data will eliminate “science projects” with intrinsically high risk of later cost overruns; requiring openness and interoperability will rein in costs for future devices – and accelerate the realization of benefits – that will be connected to the smart grid network.

The use of open standards is one way to reduce the probability of cost overruns, because it enables market forces and competition to provide a check on costs.

Beyond the amount of any cost cap agreed to by a regulated utility, it is utility shareholders that bear the risk of cost overruns. Between the expected cost and the cost cap, ratepayers should be prepared to assume this risk. However, we suggest that creative opportunities may exist for ratepayers and shareholders to share the responsibilities for cost overruns if effective mechanisms for similarly sharing in higher-than-expected benefits can be devised.

12. With numerous energy efficiency and renewable energy programs across the country competing for ratepayer funding, how should State Commissions assess proposals to invest in smart grid projects where the benefits are more difficult to quantify and the costs are more uncertain?

Indeed, we note that smart grid investments can accelerate and enhance the implementation of measures that promote energy efficiency and renewable energy. Examples include continuous building commissioning and demand response to offset intermittent generation, neither of which is possible at scale without the smart grid.

13. What are appropriate ways to track the progress of smart grid implementation efforts?

The FERC’s annual survey of smart meter installations and demand response is a good precedent. The challenge with smart grid is defining terms, such as “automated substation.” In any case, specific suggested metrics are:

- Trends in total electricity consumption per capita
- Trends in peak demand per capita

- Number of customers using the HAN interface with the meter (as distinguished from HAN devices that do not directly interface to the meter; the utility should not be burdened with tracking such devices)
- Trends in utility line losses
- Trends in Conservation Voltage Reduction
- Reliability indicators (SAIDI, SAIFI, MAIFI)
- Customer participation in dynamic pricing or other demand response programs

14. <u>What additional information about, for example, customer interactions should be collected from future pilots and program implementations?</u>

    We assert that many, if not most, smart grid technologies are mature, and therefore obviate the need for small-scale (1000s of homes) technology pilots. Instead, we note the need for large, city-scale (100,000+ homes) projects to refine implementation issues and resolve regulatory matters.

    Customer interactions will continue to evolve in energy, just as they continue to evolve in other areas of society and the economy. Smart companies will continue to explore innovations with consumers on a continual basis, learning from those tests and advancing the efficiency and effectiveness of those interactions.

15. <u>How are State Commissions studying smart grid and smart meter applications in pilots?</u>

    The best starting place is the literature, because there is a wealth of information about pilot programs in all aspects of energy. State Commissions usually focus their efforts on applying information to specific projects or proposals being made by utilities. Because this is usually in an adversarial process, the best sharing of information is not always possible. Thus, it may be beneficial for State Commissions to obtain further information from sources such as the Demand Response Coordinating Committee, which conducts regular webinars (free to State Commissions) on smart grid topics utilizing industry experts. Information is available at www.demandresponsecommittee.org.

16. <u>In conducting pilots, what best practical approaches are emerging to better ascertain the benefits and costs of realistic options while protecting participants?</u>

    There are many practical approaches documented in the literature, a recent example being the final report of the PowerCentsDC Program.

17. <u>How should the costs of smart grid technologies be allocated?</u>

    State Commissions should use the same cost allocation principles for smart grid technologies as for other investments. However, as noted above regarding the smart grid business case, most smart grid benefits flow directly to consumers under traditional allocation of benefits. To promote the capturing of the greatest possible net benefits of the smart grid, State Commissions should look at measures that would allow utility shareholders a greater return on their investment in return for their shouldering of the investment risk.

18. <u>To what degree should State Commissions try to ensure that the beneficiaries of smart grid capital expenditures carry the cost burdens?</u>

    This is a "first principle." Those who benefit should bear the cost – subject to practical limitations regarding allocation. For example, every customer benefits from lower wholesale prices caused by a portion of customers lowering peak demand (see the MADRI study). Yet, there is no practical way to identify benefits and costs at the individual customer level, so, just as the benefits are spread over a large customer group, the costs should also be spread over the group. State Commissions will ensure that overall the benefits will exceed the costs or will not approve the project.

19. <u>Which stakeholder(s) should bear the risks if expected benefits do not materialize?</u>

    This same stakeholder should be conversely allowed to retain any benefits in excess of projections.

20. <u>How should smart grid investments be aligned so customers' expectations are met?</u>

    A primary challenge here is that much of the benefit of smart grid is in avoided costs, which amounts to a counterfactual explanation that is difficult for consumers to grasp, much less embrace. We advise that managing consumer expectations should be a priority, particularly by helping consumers to understand that much of the smart grid is about keeping things the same (reliable, sustainable, affordable) in the most cost-effective way possible.

21. <u>When should ratepayers have the right to opt out of receiving and paying for smart grid technologies or programs like meters, in home displays, or critical peak rebates?</u>

    Smart grid infrastructure, up to and including HAN-enabled smart meters, should be deployed ubiquitously to maximize system performance and functionality while also minimizing per-home costs. Smart grid devices beyond the meter (e.g., in-home displays and smart appliances) and related programs (e.g., dynamic rates), on the other hand, are well-suited for opt-in/out. Indeed, lack of state regulatory commission jurisdiction over consumer behavior and, in some states, statutory prohibitions against mandatory dynamic pricing require optional consumer participation in these areas.

22. <u>When do system-wide benefits justify uniform adoption of technological upgrades?</u>

    This requires a case by case analysis of each project.

a. How does the answer depend on the nature of the offering?

Since a case by case analysis is required, the nature of the offering is necessarily a part of each analysis.

23. How should regulators address customer segments that might not use smart grid technologies?

We encourage engagement and education to make non-participating customers aware of the opportunities to become involved in smart grid programs, but advise that such outreach be conducted with a light hand. Universal participation in smart grid programs, such as demand response, is not required to make smart meters useful, as these devices provide important benefits besides enabling demand response that do not require customer interaction (e.g., operational savings from reduced meter reading, field collection, and outage detection and management costs). In fact, it is widely-recognized that neoclassical supply-and-demand economics reveals that demand response, from even a subset of consumers, benefits all consumers by reducing high marginal electricity prices, in addition to the even larger cost savings in the long-run associated with deferred and/or avoided peak capacity infrastructure. However, we note that even though universal participation is not necessary, universal access to demand response opportunities (e.g., ubiquitous HAN-enabled smart meters) is appropriate, for reasons of network connectivity and equity.

24. How might consumer-side smart grid technologies, such as HANs, whether controlled by a central server or managed by consumers, programmable thermostats, or metering technology (whether AMR or AMI), or applications (such as dynamic pricing, peak time rebates, and remote disconnect) benefit, harm, or otherwise affect vulnerable populations?

Peak Time Rebates entail no risk for customers who choose not to reduce peak demand and are favored by consumer groups for this reason. In addition, it is accepted that customers with flatter load profiles, including many vulnerable populations, subsidize customers with "peakier" loads, including many high-income households. Correctly implemented, dynamic pricing can address these cross-subsidies in a manner than reduces the burden placed on vulnerable populations, who are now paying more than their fair share of peak capacity.

25. What steps could ensure acceptable outcomes for vulnerable populations?

Adoption of Peak Time Rebates ensures no harm to vulnerable populations while affording the ability to save money (see savings of low income customers as documented in the PowerCentsDC program). In addition, bill inserts with individual energy information in easy to understand formats ensure that all customers get the ability to view their detailed energy usage information. Another possibility is subsidized equipment, such as free in-home displays or smart thermostats for low income consumers (Texas has such a program).

V. Utilities, Device Manufacturers and Energy Management Firms

1. How can state regulators and the federal government best work together to achieve the benefits of a smart grid?

   There is no more challenging a barrier to the advancement of the smart grid than the complexity of the law, regulation and governance pertaining to the electricity and utility industry. While the very nature of the smart grid concept would seem to imply a "national" grid (both from an infrastructure and pricing standpoint) that was developed in a timely and coordinated fashion, the strict delineation of responsibilities and jurisdiction between federal and state governments make that concept difficult. Yet smart grid discussions to date have not focused on what changes, if any, can be made to the existing policy regime. Instead, discussions have been based on the idea that any changes are non-starters.

   If such changes are indeed off limits, then the question becomes one of cooperation. At present, FERC and NARUC are working together on issues and topics via the (newly named) Smart Response Collaborative. More active and timely cooperation may be needed. It could be that if federal and state policymakers agreed to a facilitated dialogue conducted by professional facilitators that some type of an MOU or other governing agreement might be reached that would facilitate the development of the smart grid. It may be that the use of Federal-State Joint Boards is applicable. Whatever the vehicle, the process should not be undertaken simply as a process – it should be pursued with an agreement to reach a meaningful outcome.

2. For example, what are the most appropriate roles with respect to development, adoption and application of interoperability standards; supporting technology demonstrations and consumer behavior studies; and transferring lessons from one project to other smart grid projects?

   The federal government can best assist by providing information resources and information sharing opportunities, including workshops, hearings, and seminars. State regulators remain responsible for local implementation decisions.

3. How can federal and state regulators work together to better coordinate wholesale and retail power markets and remove barriers to an effective smart grid (*e.g.* regional transmission organization require that all loads buy "capacity" to ensure the availability of power for them during peak demand periods, which makes sense for price insensitive loads but requires price sensitive loads to pay to ensure the availability of power they would never buy)?

Demand response should be allowed equal footing to other capacity sources. Dynamic pricing load reductions should be treated as a reduction in the load forecast.

4. <u>How will programs that use pricing, rebates, or load control to reduce consumption during scarcity periods affect the operations, efficiency, and competiveness of wholesale power markets?</u>

   While the rise of DR over the past decade is in large part due to the growth of capacity-based programs at the wholesale level, DR today is more than that. DR is also recognized as being something that is integral to the smart grid, and not something different and unrelated. As such, DR programs based on pricing, peak-time rebates, load control, auto-DR, and even information-based DR can help optimize the planning and operations of wholesale markets. This has been demonstrated by the introduction of additional markets for different types of DR at ISO-NE, PJM and other regional markets. Surely, different DR products will have different characteristics and attributes, and their role in various submarkets may differ in terms of timing, reliability, etc. But there is no reason to exclude any form of DR from the planning for and operation of wholesale power markets.

5. <u>Will other smart grid programs have important impacts on wholesale markets? Can policies improve these interactions?</u>

   The concept of smart grid is to employ new technologies that provide new practices and new information to utilities and consumers that allows each to take actions that optimize the planning and operation of the electricity system overall. Therefore, any smart grid program should contribute to the optimization of wholesale markets. Policies can indeed play a role in this optimization by ensuring that there is a level playing field among all DR and smart grid options and that there is a rebuttable presumption that demand side options should be pursued. Policy should also be put in place that stimulates investment in smart grid infrastructure and technologies.

6. <u>Do electric service providers have the right incentives to use smart grid technologies to help customers save energy or change load shapes given current regulatory structures?</u>

   For the most part, providers do not have the right incentives. While decoupling policy has been enacted in several states and is being pursued in others, decoupling is not the barrier to DR and smart grid that is to traditional energy efficiency. However, the main problem is not disincentives, but lack of incentives. Electric service providers still rely on a cost-of-service rate-base type of business structure that does not incent utilities to make changes that could impact its revenue. Because consumers will capture the majority of smart grid benefits, either immediately or ultimately, policymakers have an obligation to consider what incentives to utility shareholders are consistent with achieving those benefits.

7. What is the potential for third-party firms to provide smart grid enabled products and services for use on either or both the consumer and utility side of the meter?

   With the market opened up via OpenADE and HAN interfaces, third parties will have many opportunities to provide products and services. The keys are the interfaces and providing consumers with price incentives in the form of dynamic pricing. In this regard, Peak Time Rebates have been shown to be effective in reducing peak demand and are favored by consumer groups.

8. In particular, are changes needed to the current standards or standard-setting process, level of access to the market, and deployment of networks that allow add-on products to access information about grid conditions?

   No changes in the standards or standard-setting process are needed. What is needed is to "go live" with the OpenADE and HAN interfaces.

9. How should the interaction between third-party firms and regulated utilities be structured to maximize benefits to consumers and society?

   The responsibilities of regulated utilities should be clearly specified by regulators and include protection of consumer privacy and data. Once consumers have authorized a third party to access data, the utility should be protected from any liability once the third party receives the data. Instead, state or federal privacy laws of general (or specific) application should take effect. California's energy data privacy law is an example.

10. How should customer-facing equipment such as programmable communicating thermostats, feedback systems, energy management systems and home area networks be made available and financed?

    Such customer-facing equipment should be made available as it has been for many years: in multiple ways. Consider smart thermostats. Consumers buy their own, receive rebates from utilities for qualifying purchases, or receive fully-subsidized devices as part of load control programs. The specifics of the program should determine availability and financing, with no preconceived solution. State commissions and other utility regulators have many good options available to them already.

11. Are there consumers behavior or incentive barriers to the market achieving efficient technology adoption levels without policy intervention?

    There is no consumer behavior barrier; consumers have consistently shown that they respond to more energy information and to price signals. On the incentive side, consumers have virtually – the exception is calls for civic action – no incentive to shift load away from peak hours without a dynamic pricing incentive. Policymakers set rates, so policymakers must intervene and provide such an incentive (as noted above, Peak Time Rebates are a good way to start).

12. Given the current marketplace and NIST Smart Grid Interoperability Panel efforts, is there a need for additional third-party testing and certification initiatives to assure that smart grid technologies comply with applicable standards?

    The need for additional third-party testing and certification initiatives should only apply to devices operating at the interface between the consumer world and the utility world. Within the consumer world, such testing should be left to the market; UL certification is an excellent example of a market-driven service. More apt is Wi-Fi compatibility, which manufacturers ensure through voluntary efforts. The Wi-Fi alliance performs certification, but not every device goes through such certification, nor is there any legal or regulatory requirement for such certification.

    Within the utility world, utilities perform their own testing and certification. Without a compelling need, the existing system should remain unchanged.

    At the interface between utilities and consumers – the meter HAN radio talking to the consumer-owned device with a HAN radio – national certification makes sense. This is because the connection between devices has critical security elements and the connection fundamentally affects the utility's operations (because the utility's device is involved).

13. If there is a need for additional certification, what would need to be certified, and what are the trade-offs between having public and private entities do the certification?

    a. Is there a need for certifying bodies to oversee compliance with other smart grid policies, such as privacy standards?

    Yes; see answer to immediately preceding question.

VI. Long Term Issues: Managing a Grid With High Penetration of New Technologies

1. What are the most promising ways to integrate large amounts of electric vehicles, photovoltaic cells, wind turbines, or inflexible nuclear plants?

    Through a combination of proper price signals (via dynamic pricing) and automated controls (these may, but not need, be HAN enabled). Our nation uses price signals to manage most other resources, because it works better than regulatory command and control. For intermittent resources, the price signals and automated control will stimulate the availability of storage and responsive loads to minimize the cost of those resources, including reducing the current requirement for having a standby backup power plant equal in capacity to the wind or solar resource.

2. <u>What approaches make sense to address the possibility that large numbers of other consumer devices that might simultaneously increase power consumption as soon as power prices drop?</u>

   Except in the extreme case, power always costs something, so energy users – both homes and businesses – always have a financial incentive not to turn something on. Moreover, the whole purpose of dynamic prices is to reflect relative abundance or scarcity. If large numbers of "other" consumer devices increased power consumption at lower prices, the prices would go up in response to the higher demand. Markets are very effective at balancing supply and demand, provided price signals are allowed to reach market participants.

3. <u>For instance, what is known about the viability of and tradeoffs between frequently updated prices and direct load control as approaches to help keep the system balanced?</u>

   Hourly pricing and automated control of air conditioning has been shown to be effective in residential programs in both Illinois and District of Columbia in reducing system peak demands.

4. <u>How do factors like the speed of optimization algorithms, demand for reliability and the availability of grid friendly appliances affect those trade-offs?</u>

   Availability of automated appliances and commercial equipment will grow over time and provide an increasingly valuable resource in matching supply and demand, especially needed for taking best advantage of intermittent renewable resources.

5. <u>What are these strategies' implications for competition among demand response, storage and fast reacting generation?</u>

   The implications are not relevant. The key is allowing effective – and fair – competition between demand response, storage, and fast-reacting generation. The market – in this case State Commissions, RTOs, and utilities – will decide on the appropriate mix in each of their own specific regions.

6. <u>What research is needed to identify and develop effective strategies to manage a grid that is evolving to, for example, have an increasing number of devices that can respond to grid conditions and to be increasingly reliant on variable renewable resources?</u>

One area of additional research, in the form of demonstration programs, is in using existing energy storage and automation to offset variation in generation by renewable resources. There is substantial storage capacity in the form of existing building envelopes and building mass that can be pre-cooled or pre-heated over a period of time that can be extended to account for some renewable resource variability. Substantial storage capacity in refrigeration exists as well, though the control technology is a bigger problem (buildings can be retrofitted with automated sensors and thermostats; refrigeration, especially at the household level, cannot be easily adjusted).

Demonstration projects, building on existing work being done at Lawrence Berkeley National Laboratory, should explore the potential in this area.

7. <u>What policies, if any, are necessary to ensure that technologies that can increase the efficiency of ancillary services provision can enter the market and compete on a level playing field?</u>

   FERC should adopt wholesale market policies allowing demand response to compete effectively and fairly in wholesale power markets for ancillary services.

8. <u>What policies, if any, are necessary to ensure that distributed generation and storage of thermal and electrical energy can compete with other supply and demand resources on a level playing field?</u>

   These policies are appropriately handled at the state level, though federal agencies can provide expertise in analyzing options for specific projects and initiatives.

9. <u>What barriers exist to the deployment of grid infrastructure to enable electric vehicles? What policies are needed to address them?</u>

   To date, EV charging tariffs do not meet all of the essential goals:
   - to allow EV owners to save money by charging at low off-peak rates,
   - to provide an economic incentive to avoid charging during high-cost peak hours, and
   - to provide an economic incentive to minimize rapid charging, because it creates very high demand that ultimately could threaten distribution transformers.

   Hourly pricing – opt-in – offers the best solution to the first two goals. However, hourly pricing is determined in the generation and transmission markets. Therefore, there is no price signal from the distribution grid to avoid rapid charging unless necessary. Time-of-use pricing provides a good, continuing incentive as well, but also without the distribution incentive.

The classic solution is a monthly demand charge, but this provides no continuing incentive once the first high demand peak is reached during the month. As one solution, this could be modified into a daily demand charge to make the incentive continuing.

Another possibility would be to impose a demand charge when a threshold is exceeded. However, because there is great variation in individual home peak demands, such a threshold would have to be individually tailored relative to something like total monthly usage. This is complex and difficult.

Another would be to impose a surcharge any time rapid charging is used. This could be determined by monitoring the charger or using an algorithm to determine when rapid charging is used.

In any case, this area remains ripe for discussion.

VII. Reliability and Cyber-Security

1. <u>What smart grid technologies are or will become available to help reduce the electric system's susceptibility to service disruptions?</u>

The smart grid can move forward without compromising interoperability or security by deploying technologies that have been tested by third-parties, deployed at scale, proven in the field, and built upon standards-based security implementations and practices. Building the smart grid upon an open, interoperable network platform that has sufficient capacity and performance to ensure the availability of swift over-the-air firmware upgrades to all connected smart grid devices and endpoints is also critical to maximizing the "future-proofness" of the system.

We also note that the existing energy delivery system is neither fully secure against, nor particularly resilient to, malicious attacks or natural disaster. Smart grid technologies can improve the security and resilience of the grid through the use of rigorous security analysis, selection of proven security technologies, and implementation of robust techniques and procedures. The North American Electric Reliability Corporation's (NERC) Critical Infrastructure Protection (CIP) approach is an excellent example of how security is partially a matter of selecting robust technology, but also a matter in which great importance must be placed on introducing rigorous human processes for implementation and maintenance of the system.

For example, the smart grid technology fundamentally increases the capability to monitor every entity in the T&D systems more closely and accurately. Investments in smart grid should therefore include the development of systems and processes to leverage such technology to detect intrusions and anomalies in order to reduce the risk and minimize the impact of hackers seeking to do harm to the system.

2. What policies are needed to facilitate the data sharing that will allow sensors (*e.g.*, phasor measurement units) and grid automation to achieve their potential to make reliability and performance improvements in the grid?

3. Is there a need to revisit the legal and institutional approaches to generation and transmission system data collection and interchange?

4. What is the role of federal, state, and local governments in assuring smart grid technologies are optimized, implemented, and maintained in a manner that ensures cyber security?

   These governments should ensure that all technology 1) within the utility's control and 2) connected digitally with utility equipment meets security standards identified by NIST. Also see response to Question V.12 above.

5. How should the Federal and State entities coordinate with one another as well as with the private and nonprofit sector to fulfill this objective?

VIII. Managing Transitions and Overall Questions

1. What are the best present-day strategies for transitioning from the status quo to an environment in which consumer-facing smart grid programs (*e.g.*, alternative pricing structures and feedback) are common?

   Since much of the control over pricing and utility investments resides with policymakers at the state or local level, options must be pursued that encourage action by such policymakers. Federal incentives for smart grid investment help stimulate such action, as demonstrated in the ARRA Smart Grid Investment Grant Program. Another option and approach is education. When customers, policymakers and stakeholders are better educated on smart grid, there are fewer grounds for misunderstanding and myth building and more ground for working together in pursuit of smart grid.

2. What has been learned from different implementations?

   The simple fact is that while many implementations offer lessons learned that others can benefit from, each implementation will require a custom plan designed for the factors specific to that case.

3. <u>What lessons fall into the "it would have been good to know that when we started" category?</u>

   This will be case specific. However, this type of narrative, case-study type of information can prove invaluable to others and an effort to extract it from a many different projects and implementations is appropriate.

4. <u>What additional mechanisms, if any, would help share such lessons among key stakeholders quickly?</u>

   The National Action Plan Coalition, a multi-organizational effort to implement the FERC-DOE National Action Plan on Demand Response is such a mechanism. It has work underway now to develop a number of narrative-style, interview-based case studies that will flesh out the lessons learned in certain implementations and present them to others who can determine for themselves which might constitute "best practices" they might adopt.

5. <u>Recognizing that most equipment on the electric grid, including meters, can last a decade or more, what cyber security, compatibility and integration issues affect legacy equipment and merit attention?</u>

6. <u>What are some strategies for integrating legacy equipment into a robust, modernized grid?</u>

   Flexible software that bridges the gap between the old and new equipment and accounts for the differences in functionality is important.

7. <u>What strategies are appropriate for investing in equipment today that will be more valuable if it can delay obsolescence by integrating gracefully with future generations of technology?</u>

8. <u>How will smart grid technologies change the business model for electric service providers, if at all? What are the implications of these changes?</u>

   Utilities will have to manage the interface between meter HAN radios and consumer-owned HAN devices. This is not a major change.

9. <u>What are the costs and benefits of delaying investment in metering and other smart grid infrastructure while the technology and our understanding of it is rapidly evolving?</u>

   A primary risk in delaying smart grid investment is that, due to rapidly aging infrastructure and workforce, such a delay would likely result in continued investment in traditional grid technologies that will become stranded due to being out of date even before being implemented. We will have, in effect, encouraged the stranding of assets.

10. How does that affect the choice of an appropriate time to invest?

11. What policy changes would ensure that the U.S. maintains global competiveness in smart grid technology and related businesses?

    Many in the smart grid and demand response community consider the U.S. to be squandering a lead it once had in the areas of DR and Smart Grid. Other countries and region are taking advantage of political and regulatory structures that are not so diverse and disaggregated to enact policy that supports smart grid development at home while at the same time supporting smart grid-related exports to the world clean tech market.

    Federal and state tax policy should be used to encourage smart grid investments and pricing policy changes such that each occurs on a pace to ensure international competitiveness. Policy should also be enacted which funds the education and outreach that is needed to ensure smooth and timely development of smart grid technologies and deployments.

12. What should be the priority areas for federally funded research that can support smart grid deployment?

Respectfully submitted
/s/ Dan Delurey
President
Demand Response and Smart Grid Coalition
Dan.delurey@drsgcoalition.org
202-296-1640