Written Responses of Tom Casey to Follow-up Questions for the Record

Tom Casey

Chief Executive Officer

CURRENT Group, LLC

Before the House Select Committee on Energy Independence and Global Warming

"Get Smart on the Smart Grid: How Technology Can Revolutionize Efficiency and Renewable Solutions."

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WRITTEN RESPONSES TO QUESTIONS FOR THE RECORD FOR TOM CASEY, CHIEF EXECUTIVE OFFICER OF CURRENT GROUP, LLC

CURRENT Group, LLC ("CURRENT") hereby submits the written response to the follow-up Questions for the Record for Tom Casey, Chief Executive Officer of CURRENT.

1. What steps can Congress take to reduce the time to deploy smart grid technologies?

Response: The electric utility industry must be a central element of the nation's program to reduce carbon emissions. Congress has repeatedly recognized the industry's vital role and encouraged the adoption of Smart Grid solutions, including in Title XIII of the Energy Independence and Security Act of 2007 which among other things made Smart Grid the policy of the United States and in the American Recovery and Reinvestment Act of 2009 (ARRA) which provided funding for Smart Grid projects and encouraged the development of open standards.

Under traditional rate base regulatory models, prices are determined by forecasting how much revenue is necessary to cover a utility's operating expenses and to produce an adequate return on the capital such utility has invested in the regulated business. Usually, revenue is the product of the number of kilowatt hours sold multiplied by the price per kilowatt hour. Decreases in the amount of power delivered to customers (and therefore the amount of carbon emitted in generating that power) can be achieved through increases in efficiency in the transmission, distribution and use of electric power or by reductions in demand. Both of these results are essential to the nation's climate goals; both require a utility to monitor and manage its grid (through a Smart Grid) and, under a traditional rate base regulatory model, both would result in a utility losing money because a utility must pass operating efficiency gains on to the customer.

Thus, unless the incentives created by traditional rate base regulation are changed, there is no reason to believe that a for-profit entity will (or should) spend money in order to earn less. Additionally, because a utility can earn a much higher rate of return on new generation plants or on new transmission lines than on conservation, a utility is incented to spend more capital on such traditional assets. One utility has publicly acknowledged that "the real risk in a true coal-to-cool-air, wind-to-light implementation of the smart grid is that these technologies that transform conservation and efficiency efforts can lead to degradation of the regulated return and uncompensated demand destruction."[i]

Utilities traditionally are also subject to after-the-fact state regulatory review of their investment decisions. A utility faces the realistic prospect that cost recovery for an investment could be denied in a rate-making proceeding that occurs several years after the utility has completed its investment. This is one reason that regulated utilities are often averse to adopting new and innovative technology (utilities rank near the bottom of all industries in research and development spending as a percentage of sales[ii]) and may delay investment in Smart Grid technology absent prior regulatory approval. In addition, utilities typically received no higher rate of return or incentives for the effort of implementing new technologies and thus tend to focus on a business as usual approach.

Today, the electric grid, especially the local distribution system, which is the part that directly serves our homes and offices, works much the way it did 50 or even 100 years ago. As Dr. Michael W. Howard of the Electric Power Research Institute (EPRI) testified before the House Subcommittee on Energy and Air Quality, a Smart Grid combines millions of sensors throughout the grid and an "advanced communication and data acquisition system to provide real-time analysis by a distributed computing system that will enable predictive rather than reactive responses to blink-of-the-eye disruptions".[iii] A Smart Grid is more than just using meters and in-home energy management. It also encompasses sensors deployed on the distribution grid to monitor and manage the flow of electricity and the equipment used to do so.

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[i] Xcel Energy. 2008. *'Xcel Energy Smart Grid A White Paper'* Accessed 01 Oct 2008. Available from http://birdcam.xcelenergy.com/sgc/media/pdf/SmartGridWhitePaper.pdf.

[ii] S. Massoud Amin, D.Sc., Presentation given at the 2009 MIT Energy Conference, *'Smart Grid: Opportunities and Challenges Toward a Stronger and Smarter Grid'*, March 2009

[iii] *See* Testimony of Michael W. Howard, Ph.D., P.E., Senior Vice President, R&D Group, Electric Power Research Institute, "*Facilitating the Transition to a Smart Electric Grid*," Before the House Subcommittee on Energy and Air Quality, May 3, 2007.

It allows for improved efficiency and reliability on the grid and the increased use of renewables and distributed generation. Ontario Canada, who has one of the largest implementations of smart meters recently concluded, "[The] full promise [of conservation, renewable generation and smart meters initiatives] will not be realized without the advanced technologies that make the smart grid possible."[iv]

As an integrated end-to-end solution, the Smart Grid value chain extends beyond the utility to its end customers and to society in general in the form of lower outages, lower electric costs and less carbon emissions. But even beyond a utility's disincentive to make investments that reduce its profitability, as discussed above, any investment to promote societal benefits that do not directly result in lower prices or improved service specifically for that utility's rate payers would generally be denied cost recovery by state regulators. So state regulatory policy must be structured to assure that the entire value creation is included in the benefit case so that utilities can be assured appropriate rate recovery, a policy Congress could implement by requiring or promoting distribution Smart Grid policies in pending legislation.

In drafting upcoming energy and climate change legislation, Congress should recognize the inherent nexus between climate change, the realization of broadly deploying clean renewable energy resources and the efficient operation of a "smarter" national grid, including both transmission and distribution.[v] Similar to the way Congress created national priorities and policies in the telecommunications industry, Congress should provide that each distribution utility must implement a Smart Grid throughout its service territory. Both the U.S. electric grid and the climate change issue impact interstate commerce. The MIT Technology Review recently stated "without a radically expanded and smarter electrical grid, wind and solar will remain niche power sources."[vi] The estimated cost of outages in lost productivity to the U.S. economy is 50 cents for every dollar we spend on electricity annually[vii] with 90% of all outages resulting from

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[iv] Report of the Ontario Smart Grid Forum, *Enabling Tomorrow's Electricity System*, February 2009, available at: www.ieso.ca/smartgridreport.

[v] For example, The Center for American Progress's Wired for Progress 2.0, Building a National Clean-Energy Smart Grid (April 2009 at vii) states "The natural complement to a robust interstate transmission network for renewable electricity is an intelligent "smart grid" distribution system that delivers electricity right to the plugs in consumers' homes."

[vi] Talbot, David *"Lifeline for Renewable Power"*, MIT Technology Review, January/February 2009

[vii] Electric Power Research Institute. 2003. '*Electricity Sector Framework for the Future: Achieving the 21st Century Transformation'* Available at: http://www.epri.com, pg 40.

issues on the distribution grid.[viii] Absent a distribution Smart Grid, utilities and end users will be unable to take advantage fully of the economic and environmental benefits of renewable energy resources brought over transmission lines and distributed generation resources (e.g., rooftop solar panels, plug-in vehicles and wind turbines). Additionally, they will not be able to achieve the necessary and desired carbon reductions. Utilities should be assured that their investment in Smart Grid systems will be adequately recovered and that they, their shareholders and their customers will share in the benefits the Smart Grid creates.

Congress should also recognize that the Smart Grid can provide the most direct and certain form of energy efficiency and demand response by enabling the electric utility to operate its distribution system more efficiently and thus reduce the amount of generation required to serve the ultimate customers. It is estimated such optimization of the distribution grid can reduce electric generation requirements and related carbon by 3 to 5% without impacting on, or requiring any change in, customer behavior. These benefits can be realized as on-going energy efficiency, at peak load or a combination thereof. Many of these applications can be deployed on a modular basis without requiring an investment in "smart meters" and the National Association of Regulatory Commissioners now recommends that regulators and utilities focus initially on these "direct value" investments.[ix] Congress should work to include such benefits of distribution system optimization in any energy efficiency or demand response grants, funding or requirements. Examples of where such a requirement could be added include in the American Clean Energy And Security Act of 2009 (H.R. 2454) Part E, Section 141(6) where the definition of peak load reduction could be expanded to include "energy savings from efficient operation of the distribution grid resulting from the use of a Smart Grid," and in Part E, Section 144(d)(1) where "or through the use of a Smart Grid" could be added at the end of the sentence. Another example is in the Combined Efficiency and Renewable Electricity Standard section of the same bill, (Section 101(a) where "or other efficiencies from the use of a Smart Grid" should be inserted after the word "electricity"). Similarly in HR 2212: 21st Century Energy Technology Deployment Act (Inslee), the definition of *Clean Energy technology* should be expanded to include "distribution smart grid" in Section 3(5) and "efficiency or other improvements from a

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[viii] California Energy Commission, '*2007 Integrated Energy Policy Report'*, November 2007 at 196.

[ix] National Association of Regulatory Utility Commissioners (NARUC), '*The Smart Grid: Frequently Asked Questions for State Commissions'*, May 2009.

distribution Smart Grid" added to the list in Section 5(a).

2. **How much will the whole development of a smart grid cost? How should these costs be allocated?**

Response: According to the DOE, there are approximately 142 million customers of electricity in the U.S who purchase about $343 billion of electricity annually[x]. EPRI estimates a national distribution Smart Grid would cost $127 billion, with an additional $38 billion required to make the existing transmission grid smarter. EPRI projects that such an investment will produce benefits of $600 to $800 billion over 20 years (equal to 4 to 5 times the required investment).[xi] Assuming the 20-year investment cycle, EPRI estimates the combined investment to be approximately $8.3 billion a year, which represents only 2.5% of annual sales. It should be noted that the cost of a Smart Grid is a small portion of the Brattle Group's estimate of the approximately $1.5 trillion investment electric utilities will require over the 2010 – 2030 period (which includes $560 billion for new generation).[xii] CURRENT estimates that the core Smart Grid infrastructure (meters, sensing on the grid, real-time Internet Protocol (IP) communications and analytic software) would cost approximately $55 billion to cover all of the nation's local distribution networks and would provide the foundation for the other Smart Grid investments.

As to funding the investment, in the case of the local distribution networks, the local distribution company will make the Smart Grid expenditures with the existing applicable rate setting mechanism allowing such local distribution company to recover for such investments that are reasonable and prudent. However, in many cases as described in the response to Question 1, regulators and consumer advocates focus on the immediate rate impact without taking into account gains from efficiency, conservation, renewables or a world where carbon has a cost. In addition to any federal funding to offset the cost of a Smart Grid, Congress can further Smart Grid deployments by requiring state regulators to deem electric distribution Smart Grid investments as reasonable and prudent. Utilities also need to be encouraged through mechanisms

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[x] U. S. DOE Energy Information Administration, *"Electric Power Annual, Table 7-1 Number of Ultimate Customers Served by Sector, by Provide" and "Table 7.3. Revenue from Retail Sales of Electricity to Ultimate Customers by Sector, by Provider, 1996 through 2007"*, January 2009.

[xi] EPRI, *Power Delivery System of the Future, A Preliminary Estimate of Costs and Benefits*, July 2004 at 5-1.

[xii] Brattle Group, '*Transforming America's Power Industry: The Investment Challenge*' April 2008.

where they benefit from investing in a Smart Grid.

3. **Do you support the inclusion of nuclear energy as a source of low-carbon electricity?**

Response: CURRENT's focus is on the electric distribution grid and not on nuclear generation. Thus, CURRENT does not have a position on the use of nuclear as a source of low-carbon electricity.

4. **How does the problem of intermittency in renewable energy add to the challenge of a smart grid?**

Response: Rather than renewable intermittency adding to the challenge of a Smart Grid, a Smart Grid helps to overcome the challenge of intermittency in renewable energy. There are two types of renewables: centralized (e.g. wind farms and concentrated solar) and distributed (e.g. roof top solar). Distributed renewables create several problems for the existing electric grid. First, as opposed to centralized power plants that send electricity one way from the plant to the home, renewables out on the grid itself (like a roof-top solar panel at a big box retailer) create a two-way power flow on a grid that is designed to go one way. This means that the utilities' assumptions about how the grid operates are no longer valid and that increased monitoring is required. Lines can be energized by distributed resources even in the event of an outage, which poses safety issues for line workers, and power flows can become inefficient and uneven based upon uncoordinated adoption of distributed resources. Thus, utilities are identifying a need to begin to monitor the output of distributed renewables. A Smart Grid enables the utility to monitor and manage these distributed renewables and know in real-time the power they are producing as well as any impact the two-way power flow is having on the grid itself.

Second, utility practices today are presently, and rightly, designed to minimize variability. Most forms of renewables, however, are inherently variable or intermittent. As electric grids must be in balance, a sudden drop in generation from renewables requires the utility to maintain balance by adjusting other generation sources, storage or consumption itself to keep the system in balance. Today this is typically accomplished by adding spinning reserves typically in the form of gas-powered peaking plants or by operating coal plants at less than peak

capacity (which allows operators to quickly increase load, but results in a less efficient coal plant operation and thus higher carbon output per megawatt produced). For example, to achieve the European 2020 targets (20% renewables, 20% reduction in CO2 by 2020), the United Kingdom estimates that short term reserve requirements such as these would double to almost triple.[xiii]

A distribution Smart Grid can mitigate these additional costs and emissions by dynamically adjusting overall load in real time, providing generation and transmission operators with a powerful new tool to manage generation fluctuations and transmission issues such as those associated with renewables. Sensors located throughout distribution systems can automatically adjust overall distribution system voltage by up to 3% or more of the load in response to fluctuations in generation and thus reduce the need for these spinning reserves.

By reducing or eliminating the need for backup coal or gas-based power generation plants, a distribution Smart Grid monitoring and managing renewables will reduce emissions and allow utility capital to be shifted from purchasing conventional power sources to buying more clean renewable power.

5. **The hearing pointed out the need for regulatory policies that reward electric utilities for their investment in smart grid technology and energy efficiency. Can you suggest ways that Congress can help make this happen?**

Response: Congress has already taken some very positive steps in the ARRA by providing both stimulus funding and by providing guidance on the use of IP and other standards. It is important that the stimulus funding be used to advance the deployment of a full Smart Grid as opposed to any one particular technology or technologies that the utility already received rate recovery approval to implement.

As discussed in the response to Question 1, a further positive step would be for Congress to find that a Smart Grid is in the interests of interstate commerce due to its impact on renewables, climate change and overall reliability and to require utilities to build a Smart Grid (including on the distribution systems) while protecting the utilities legitimate return on those investments.

Congress should also recognize that a distribution level Smart Grid can provide the most

[xiii] House of Lord Select Committee on Economic Affairs, "*The Economics of Renewable Energy*", November 2008 at 35.

direct and certain form of energy efficiency and demand response by enabling the electric utility to operate its distribution system more efficiently and thus reduce the amount of generation required to serve the ultimate customers. It is estimated such optimization of the distribution grid can reduce electric generation requirements and related carbon by 3 to 5% without impacting on, or requiring any change in, customer behavior. These benefits can be realized as on-going energy efficiency, at peak load or a combination thereof without requiring a change in consumer behavior. Many of these applications can be deployed on a modular basis without requiring an investment in "smart meters" and the National Association of Regulatory Commissioners now recommends that regulators and utilities focus initially on these "direct value" investments.[xiv] Congress should work to include such benefits of distribution system optimization in any energy efficiency or demand response grants, funding or requirements. Examples of where such a requirement include in the American Clean Energy And Security Act of 2009 (H.R. 2454) Part E, Section 141(6) where the definition of peak load reduction could be expanded to include "energy savings from efficient operation of the distribution grid resulting from the use of a Smart Grid." and in Part E, Section 144(d)(1) where "or through the use of a Smart Grid" could be added at the end of the sentence. Another example in the same bill is in Combined Efficiency and Renewable Electricity Standard, (Section 101(a) where "or other efficiencies from the use of a Smart Grid" should be inserted after the word "electricity"). Similarly in HR 2212: 21st Century Energy Technology Deployment Act (Inslee), the definition of *Clean Energy technology* should be expanded to included "distribution smart grid" in Section 3(5) and add "efficiency or other improvements from a distribution Smart Grid" as a part of the list in Section 5(a).

6. **What changes need to be made to the regulatory system for electric utilities that will provide them with incentives to invest in the energy efficiency of their customers? Are there ways to establish a market for other companies either working with the utilities or on their own, to make money by reducing the electricity use of consumers and business?**

Response: Grid based efficiency improvements are very important opportunities to reduce electric usage. It is important to recognize that their benefits are in addition to the potential

[xiv] National Association of Regulatory Utility Commissioners (NARUC), *'The Smart Grid: Frequently Asked Questions for State Commissions'*, May 2009

energy efficiency gains that customers can achieve through managing their usage or by using more efficient appliances. As described in the response to Question 1, the limited incentives of electric utilities and the exposure to having innovation disallowed retroactively need to be changed to encourage regulated utilities to invest and innovate in energy efficiency. The present disincentives are even greater when the utility owns generation and transmission facilities whose revenues would be also reduced by energy efficiency.

The recent action by several states and the language in the proposed American Clean Energy And Security Act of 2009 to require a certain percentage reduction in baseline energy consumption on an ongoing basis or at peak, or both, is an effective mechanism, especially if a utility can include in the saving targets any efficiency gains it receives from the use of a distribution Smart Grid. Another effective alternative is to reward utilities through incentives for being more efficient and for making its customers more efficient through concepts such as decoupling, efficiency gain sharing or the ability to recover energy efficiency related capital investments with a rate of return. In a similar manner, improving energy efficiency in appliance standards and in building codes are effective mechanisms for long term energy efficiency gains.

Energy efficiency businesses that help reduce energy cost for consumers and businesses exist today. With increasing attention on global warming, carbon and the cost of energy, it is likely investment in energy efficiency by consumers and businesses will continue, especially if standards and codes are raised. It is also likely that various new forms of businesses focused on changing the way electricity is generated and consumed will emerge, especially if we deploy an IP based Smart Grid, similar to the way the Internet has given risen to entirely new industries.

7. What can we do to provide regulatory incentives for businesses and customers to act to reduce their own use of electricity and adopt smart grid technologies?

Response: The CAFE standard for the auto industry seems to be an effective mechanism on improving fuel efficiency. In a similar manner, improving energy efficiency in appliance standards and in building codes can be effective mechanisms for long term energy efficiency gains. The American Clean Energy and Security Act of 2009 cap and trade provisions will also provide incentives for large generators of carbon.

While the concept of end-user energy management gets the most media attention and will certainly be part of the solution, the Climate Group estimates that 85% of the carbon reduction

benefits of a Smart Grid come from making the grid itself more efficient and from integration of renewables and only 15% will come from end-user energy management.[xv]

8. **What can we do to encourage electric utilities to conserve energy by operating more efficiently?**

Response: As further discussed in the responses to Question 1, 5 and 6:

- Provide Regulatory Assurance and Incentives: Electric utilities need to have assurance that they and their shareholders will be compensated (or at least not injured in the form of lower return) for their investment in conservation and efficiency.
- Mandate Reductions over a baseline: The recent action by several states and the language in the proposed American Clean Energy And Security Act of 2009 to require a certain percentage reduction in baseline energy consumption on a ongoing basis, at peak, or in both cases is an effective mechanism, especially if a utility can include in the saving targets any efficiency gains it receives from the use of a distribution Smart Grid.
- Mandate a distribution level Smart Grid

9. **Moving to a smart grid will be very expensive and take time, what are the first steps we should take in developing a smart grid?**

Response: While it will take a number of years for a Smart Grid to be deployed, a Smart Grid is not expensive compared to the benefits it will achieve. As noted in response to Question 2, the EPRI estimates a national distribution Smart Grid would cost $127 billion with an additional $38 billion required to make the existing transmission grid smarter and projects benefits of $600 to 800 billion over 20 years (equal to 4 to 5 times the required investment).[xvi] On an annual basis, this represents only 2.5% of annual sales. It is interesting to note that the estimated cost of outages in lost productivity to the U.S. economy is 50 cents for every dollar

[xv] The Climate Group *'SMART 2020: Enabling the low carbon economy in the information age'*, 2008 available at http://www.theclimategroup.org/assets/resources//publications/Smart2020Report.pdf pg 70.

[xvi] EPRI, *'Power Delivery System of the Future, A Preliminary Estimate of Costs and Benefits'*, July 2004 at 5-1.

spent on electricity annually,[xvii] an amount that in one year exceeds the total estimated cost of a 20 year investment in a Smart Grid.

Good first steps in the development of a Smart Grid:

1. *Focus on the Grid Efficiency itself before focusing on extending meters to every household.* Some smart meter rate cases for residential customers project a cost of $325 or more per household (before any investment in programmable thermostats, in-home displays or in-home energy management systems which would add hundreds to thousands of dollars to the cost of each home) and take nearly 20 years to breakeven in a cost benefit analysis taking into account both utility and consumer benefits.[xviii] It is estimated it would cost approximately $40 billion (the equivalent of 30% of the overall Smart Grid cost) to install residential metering alone for the approximately 124 million U.S. residential customers. Commissioner Frederick F. Butler, a member of the New Jersey Board of Public Utilities (NJBPU) and President of the National Association of Regulatory Utility Commissioners (NARUC) recently expressed his concern about focusing initially on the consumer in his testimony to the Senate Committee on Energy and Natural Resources, "This means that we should not focus immediately on the end user and demand response; rather, we must start with the backbone—the transmission and distribution systems—while proceeding carefully to go inside consumers' homes."[xix]

2. *Deploy High-Value Solutions First-* State regulatory commissions and utilities may not be prepared at this time to fully define a comprehensive and functional Smart Grid system complete with all the utility distribution grid and customer applications that could be supported. There are, however, highly cost-effective Smart Grid alternatives that enable utilities, as a first step towards full Smart Grid

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[xvii] EPRI. 2003. '*Electricity Sector Framework for the Future: Achieving the 21st Century Transformation*' Available at: http://www.epri.com, pg 40.

[xviii] For example, Southern California Edison is spending $1.981 billion to replace approximately 5.3 million meters ($373 per meter). Over a 20 year useful life, the project is expected to result in benefits of $1.990 billion or a net present value of $9 million. (See SCE Decision at http://www.sce.com/NR/rdonlyres/6DC13EB1-0AFA-40A8-B9E3-93546F24015C/0/081114_A0707026Final_Decision.pdf).

[xix] Written Testimony of Honorable Frederick Butler, Commissioner, New Jersey Board of Public Utilities on behalf of the National Association of Regulatory Utility Commissioners to the U.S. Senate Committee on Energy and Natural Resources, '*Smart Grid*', March 3, 2009.

implementation, to conduct a pilot project of a sufficient magnitude to provide a thorough comparison between a distribution grid that benefits from Smart Grid technology and one that does not. For example, a utility could conduct a pilot project in which it deployed sensors at carefully selected locations on the electric distribution grid to implement system optimization that reduces line losses and optimizes voltage levels. State regulatory commissions should allow utilities to recover the costs of such Smart Grid pilot projects. The potential benefits of a Smart Grid system are enormous, and a thorough examination of the technology on a scale sufficient to effectively gauge the potential costs and benefits to all ratepayers warrants inclusion of pilot project costs in system wide rates. It is estimated such optimization can reduce electric generation requirements and related carbon by 3 to 5% without impacting, or requiring any change in, customer behavior. Further, such a targeted infrastructure approach to Smart Grid allows utilities incrementally to deploy individual applications with a lower cost of entry, while retaining the option to grow and expand the overall Smart Grid system as needed. Significantly, if deployed with open standards, this basic Smart Grid infrastructure system would serve as a communications backbone that can support full smart grid implementation at a later date, while providing the utilities and customers with immediate and demonstrable benefits that far exceed those expected from "smart meter" or Advanced Metering Infrastructure programs.

3. *Encourage Smart Grid Innovation* - There are various forms of regulatory treatment that could be afforded utility investments in Smart Grid on a larger scale. For example, as discussed in the response to Question 1, a shared savings incentive ratemaking mechanism would encourage Smart Grid investments. To the extent that a utility invests in Smart Grid infrastructure and applications that result in quantifiable savings in distribution operations and maintenance, a sharing of the savings between ratepayers and shareholders provides the right economic incentive for the utility to continue to make cost effective Smart Grid investments and maximize shareholder earnings while simultaneously continuing to reduce system costs for its customers. This would encourage a more innovative approach

to a Smart Grid and allow different utilities to try out projects they think will best deliver results based on their particular operating circumstances. The results could be shared to encourage other utilities. Congress should direct or at least encourage the States to adopt such regulations that will provide incentives that promote utility deployment of Smart Grids that actually reduce the cost of electric delivery.

10. Are you seeking federal stimulus money from the Department of Energy to deploy your technology?

Response: CURRENT is in discussions with a number of utilities about potential projects under the federal stimulus. We believe that the ARRA language and the initial DOE rules encourage some of the innovation described in the response to Question 9. This will especially occur if the focus is on awarding new projects and innovations, not funding projects that already are or will likely be approved by state regulators for recovery in the rate base.

11. What sort of interoperability standards need to be developed to facilitate a transition to a smart grid? How will the development of those standards affect the deployment of your products?

Response: To achieve the Smart Grid vision, it is important that standards be adopted including that a network use real-time communications as well as the open standards like IP as required for funding under ARRA. The Smart Grid will provide the network platform for the distribution of electricity and also enable the attachment of currently unimagined numbers and kinds of devices and software applications to improve both the performance and the usefulness of electricity. For example, it is highly likely the "iPod" of home energy management has been invented yet and it is just as likely that it will not be invented by a traditional vendor of utility equipment. If the Smart Grid network, the devices that attach to it and the software applications that run on them are not designed to a common open standard, the Smart Grid will be delayed or degraded and rate payers will have to pay to replace devices before the end of the their useful lives. CURRENT believe that ultimately, in many cases, it may be appropriate to leverage existing IP public networks like the existing cable, DSL or wireless 3G or WIMAX networks.

In addition to communications standards, it is important that common interoperability standards and data descriptions be defined to facilitate the exchange of data between various Smart Grid applications and databases and existing utility systems.

CURRENT has already integrated its open standard technology with multiple grid device manufacturers, in-home energy management systems and a variety of back office utility systems. If each interface must be custom developed, substantial delays and additional costs will result.

CURRENT is also working in Europe on the open standards. Europe has actually advanced further than the United States in certain standards areas, especially meters data collection. For example, in the United States, the communications portion of the meter and the collection devices that collects the meter data from various meters have usually been part of a closed proprietary system sold by a metering company. Thus, once utilities choose a meter communication system, they can not move to a different vendor if another vendor develops a better collection system without replacing the meters. Europe has recognized that a common metering standard where any meter can talk to any collection device will result in a lower cost for the metering system and greater flexibility to adopt and adapt to new technologies and applications. CURRENT is a member of a consortium of utilities and technology providers working on a European Commission-funded project to develop an Open Metering Standard, which is expected to significantly reduce smart meter costs.

12. What sort of cyber-security concerns need to be addressed? Are you confident that a smart grid can resist a cyber attack?

Response: While no system can be absolutely invulnerable, we believe that the Smart Grid can resist a cyber attack, especially if the utility industry leverages the security knowledge and technology of other industries. For example, significant and continual investment is made to keep our online shopping, banking and other financial transactions safe and secure with Internet sales alone exceeding $127 billion in 2007.[xx] One of the reasons the use of IP standards is very important is that the U.S. expertise in IP and open standards (and the related security) is very advanced from our experience in the telephone, computer, Internet and other technology based markets. While no one can ever be confident and constant vigilance and security improvements

[xx] U.S. Census Bureau, '*The 2009 Statistical Abstract, 1016 - Online Retail Spending, 2001 to 2007, and Projections, 2008'*.

are required, CURRENT believe a properly designed IP based open standards Smart Grid that continually leverages best practices in other industries can resist a cyber attack.

13. You note your contributions to the development of a smart grid in the European Union. What has been the most challenging aspect of the E.U. project? Are there lessons learned that can be applied here in the United States?

Response: Smart Grid technology will eventually be deployed worldwide and if the United States does not promote the development, improvement and deployment of a wide range of Smart Grid technologies, other countries will do so and such countries and their citizens will enjoy the benefits of a worldwide market. For example, Cisco recently estimated that the Smart Grid opportunity could rival the size of the Internet.[xxi] This means "green jobs" and exports and billions of dollars to the economy. The United States has the opportunity to be a global leader and must capitalize on such an extraordinary opportunity.

Europe has done a good job in pushing towards open standards such as the open meter collection project mentioned in Question 11 and in promoting utilities and various technology providers work together on a wide variety of pilot projects. One challenging part of the E.U. project has been the E.U. mandate to install smart meters for all residential customers. We have seen in a number of places that this mandate has made it harder to move the broader vision of the Smart Grid forward as utilities and regulators have focused their entire efforts on a narrow metering solution. Based on our experience, CURRENT believes it is in the best interest of the United States from a market leadership standpoint (as well as to achieve our efficiency and climate goals) to focus on deploying a wide range of Smart Grid technologies including those focused on improving the efficiency and reliability of the distribution grid. As noted in the response to Question 1, Ontario Canada who made a similar decision to focus on meters has already decided that a broader Smart Grid is necessary and we are actively engaged in discussions in a number of countries where there is a desire to expand from metering focused priorities to a full Smart Grid.

14. How do you anticipate renewable electricity will be delivered without a significant

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[xxi] Martin LaMonica, CNET News, '*Cisco: Smart grid will eclipse size of Internet'*, *M*ay 18, 2009.

upgrade to the existing grid regardless of "smart" technology? Does CURRENT support FERC's authority to designate National Transmission Corridors?

Response: There are two different types of renewable energy, centralized (e.g. wind farms, concentrated solar) and widely distributed renewables such as roof top solar. A distribution Smart Grid allows the increased use of both centralized and widely distributed renewables, as explained in the response to Question 4. The use of centralized renewables may require an additional investment in transmission to connect the sources of these renewables to the load centers. CURRENT generally supports the FERC's Proposed Smart Grid Policy Statement and Action Plan and its efforts to improve the efficiency, reliability and security of the Nation's transmission and bulk-power systems. The Federal Power Act excludes local distribution systems from FERC's jurisdiction over the bulk-power system, but FERC's Policy Statement recognizes the inherent nexus between a smart transmission system and the local distribution systems. As such, in its Comments in response to FERC's Policy Statement, CURRENT called upon FERC to encourage the promotion of parallel policies at the Federal and State levels to implement distribution-level Smart Grid systems contemporaneously with the implementation of Smart Grid technology at the transmission level. Distribution-level Smart Grids will significantly aide in easing the increasing constraints on the bulk-power system in part, by allowing utilities to have a dynamic control of the distribution grid load which will help the transmission systems and grid operators manage congestion and deal with the intermittent nature of renewables.

15. **What gains in energy storage capacity must be attained prior to wide scale deployment of a smart grid? Without adequate storage capacity, how can a smart grid resolve the underlying problem of intermittency in renewable electricity? Even with the existence of a smart grid, isn't there a basic need for base load generation?**

Response: CURRENT does not develop storage technology. Nevertheless, our understanding is that while storage will be an important tool to address intermittency of renewables, cost effective widely deployed storage is not yet available. As discussed in the response to Question 4, a Smart Grid provides both a monitoring capability for widespread renewables and a powerful new tool for generation and transmission operators to manage intermittent generation fluctuations by

dynamically adjusting overall load in real time. This Smart Grid System Optimization, which utilizes sensing throughout distribution feeders, real-time communications and analytical software, can automatically adjust overall distribution system voltage by up to 3% or more of the load in response to fluctuations in generation and thus reduce the need for the spinning reserves. By reducing or eliminating the need for backup coal or gas-based power generation plants, emissions are reduced and utility capital can be shifted from purchasing conventional power sources to buying cleaner renewable power.

A Smart Grid can reduce overall load and enable renewables. CURRENT submits that, between efficiency gains, demand reduction enabled by a Smart Grid and the more rapid deployment of centralized and distributed renewables, it may be possible that the forecasted load growth could be served without the need to build conventional power plants.

16. What is the best manner to overcome the "chicken and the egg" problem of selling smart meters vs. real-time pricing?

Response: Whether real-time pricing will ever be adopted in the United States in a meaningful manner that reduces electric consumption warrants further study. In looking at both meters and real-time pricing, the success of these systems from an overall energy policy perspective will largely be based on several issues – 1) will consumers be mandated to participate, and if not will they voluntarily choose to participate, 2) what behavior changes will they make that they could not be otherwise encouraged to make and 3) what is the carbon impact of those changes.

It is important to focus first on demographics. Approximately 63% of the total electricity is used by the 18 million commercial and industrial customers,[xxii] with meters for all those customers estimated to cost approximately $10 billion. Many of those commercial and industrial meters are already installed although not necessarily integrated to building and industrial control systems. Since such a small number of customers make up such a large percentage of the overall electric usage, it clearly makes sense to focus on advanced meters, pricing and control systems for these commercial and industrial customers.

[xxii] U. S. DOE Energy Information Administration, '*Electric Power Annual, Table 7-1 Number of Ultimate Customers Served by Sector, by Provide' and 'Table 7.3. Revenue from Retail Sales of Electricity to Ultimate Customers by Sector, by Provider, 1996 through 2007'*, January 2009.

The remaining 37% of electricity is used by the approximately 124 million residential customers for whom it would cost approximately $40 billion to install smart metering. This is exclusive of the additional needed consumer investment in programmable thermostats, in-home displays or in-home energy management systems that would add hundreds to thousands of dollars to the cost of each home. These smart meters themselves do not "automatically" reduce customer electricity use.[xxiii] They simply enable a utility to record how much the electricity is used at different intervals and, in some cases, to communicate that information to a display or device within the home that has been purchased at an additional cost by the consumer. This, in turn, permits the utility to discourage usage during peak periods by imposing higher charges at such times. Consumers who are able to do so may respond to these higher prices by shifting some of their usage to off-peak periods. They can do so in many ways, from choosing not to run certain appliances during the peak period, turning their thermostats up or down as the case may be, etc.

Business Week recently had an article[xxiv] questioning if time-of-use rates or other plans would be mandatory and noting that consumer advocates express concern about such programs. California tried to mandate the utility control of programmable thermostats in new homes and in renovations but public opinion was strongly negative and the policy was not approved. California and New York Public Utility commissions have both interpreted existing laws to prohibit mandatory time-of-use rates.[xxv] Most other consumer-focused industries (long distance, internet usage, cellular phone minutes and even movie rentals (Netflix)) have moved from time-of-use rates to all-you-can use packages. Thus, consumer acceptance of time-of-use rates should be validated before $40 billion is spent on meters whose justification presupposes it.

Another area that needs further study is whether people will agree to change their behavior on a long-term basis. In the California State Wide Pricing Study, which is often quoted as evidence of the demand reduction potential of meters, a little-mentioned fact is that only 20% of the people contacted agreed to participate despite an offer of a $175 cash

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[xxiii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate, '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 7 (July 2008).

[xxiv] Business Week, '*The Static Over Smart Grids'*, April 2, 2009.

[xxv] CPUC Rulings and Alexander, Barbara, *"Smart Meters, Real Time Pricing and Demand Response Programs: Implications for Low Income Electric Customers"*, Report prepared for Department of Energy, May 2007, pg 32 and 52.

payment.[xxvi] Of the participants, 22% moved or otherwise dropped out in the first year, indicating that a new participant pool would need to be recruited every 5 or so years. In an East Coast study, the estimated penetration was closer to 17% of homes with air conditioning or roughly 10% overall.[xxvii]

As to the potential savings, the Brattle Group estimated a house with central A/C could reduce its load by 1.4 kwh of which 85% is a result of controlling the central air conditioning while a house without central air can reduce its load by only 0.3 kwh.[xxviii] It must be noted that 40% of U.S. homes do not have central A/C and thus have no use for a programmable thermostat or the capability to substantially reduce their load.[xxix] As for any permanent load reduction, a recent survey of people interested in using smart meters in the United Kingdom showed the primary way they would save energy is turning off the television, turning off computers/printers, turning the heat down or turning lights off in a room.[xxx] It is unlikely a meter and a display are required to tell people to take these actions since, as NERA Economic Consulting noted in studying smart meters for Australia; much of any projected load reduction from a smart meter program likely could be achieved by education alone without requiring an investment in smart meters.[xxxi] Additionally, many classes of customers, such as retirees, night workers and families with young children at home may find it difficult to change their electric usage patterns and thus would be potentially penalized by higher time-of-use rates during peak periods. Similarly, many low income customers already minimize their consumption and will not be able to afford or inclined to pay for the in-home devices necessary to control their appliances and many high income customers can afford to pay the higher rates and will do so rather than endure the

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[xxvi] Charles River Associates, '*Impact Evaluation of the California Statewide Pricing Pilot'*, March 2005 pg 30-32.

[xxvii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate, '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 10 (July 2008).

[xxviii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate (referencing Brattle Group), '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey'* at 9 (July 2008).

[xxix] U. S. DOE Energy Information Administration (EIA), Office of Energy Markets and End Use, "*2005 Residential Energy Consumption Survey*". The same survey indicates of the people who have central air conditioning. According to data from the same study and EIA total sales data, electric heat represents less than 1% of overall electric sales.

[xxx] Energy Savings Trust Green barometer measuring environmental attitude issue 4 Clever Clocks – introducing smart meters (March 2008).

[xxxi] NERA Economic Consulting. 2008. '*Cost Benefit Analysis of Smart Metering and Direct Load Control'*. Report for the Ministerial Council on Energy Smart Meter Working Group at 206 Available from http://www.mce.gov.au/assets/documents/mceinternet/SmartMetering%20BAPhase2Stream1_overviewNERA20080305175957.pdf.

inconveniences of making changes to their lifestyle.

Unfortunately, real-time pricing and smart meters will not necessarily reduce CO2 emissions since the primary benefit is reducing load at the 50 or so peak hours of a year, not to eliminate the usage itself.[xxxii] Ironically, this usage shift may actually increase CO2 emissions by moving usage from a time (peak) at which the incremental power source is gas to a time (off-peak) when the base power source is coal. Indeed, the DOE has recognized this and has warned that "policymakers should exercise caution in attributing environmental gains to demand response, because they are dependent on the emissions profiles and marginal operating costs of the generation plants in specific regions."[xxxiii]

Additional studies and pilots should be undertaken to explore the cost effectiveness of smart meters and real-time pricing. Smart meters are a small portion of the overall Smart Grid. Commissioner Frederick F. Butler, a member of the New Jersey Board of Public Utilities (NJBPU) and President of the National Association of Regulatory Utility Commissioners (NARUC) recently expressed a similar concern in his testimony to the Senate Committee on Energy and Natural Resources, "This means that we should not focus immediately on the end user and demand response; rather, we must start with the backbone—the transmission and distribution systems—while proceeding carefully to go inside consumers' homes."[xxxiv]

17. Who should pay for smart meters? Consumers? Utilities? What incentive do consumers have to spend a large sum on the device?

Response: Under our regulatory system, the customer ultimately pays for capital investments. While some customers will benefit from a smart meter, it is not clear that all customers will benefit, especially as additional equipment such as programmable thermostats, in-home displays or energy management systems are required for the consumer to interact with the smart meter. Most smart meter rate cases for residential customers project a cost of $325 or more per household (before the additional equipment which can cost hundreds or even thousands of dollars) and take nearly 20 years to breakeven in a cost benefit analysis taking into account both

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[xxxii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate, '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 13 (July 2008).

[xxxiii] U.S. DOE Report to Congress, Feb 2006 "*Benefits of Demand Response and Recommendations*" pg 29.

[xxxiv] Written Testimony of Honorable Frederick Butler, Commissioner, New Jersey Board of Public Utilities on behalf of the National Association of Regulatory Utility Commissioners to the U.S. Senate Committee on Energy and Natural Resources, '*Smart Grid*', March 3, 2009.

utility and consumer benefits.[xxxv] In most cases, approximately 55% of the 20 year benefit payback from smart meters comes from operating cost reductions, primarily as a result of eliminating meter related jobs.[xxxvi] The remaining benefit payback comes from a forecast of reduced load either at peak or a permanent change in life style. The largest estimated savings is from using programmable and communicating thermostats and in home displays to reduce central air conditioning load at peak but the cost of such devices are excluded from the benefit projections since rate payers are expected to purchase those devices on their own.

The Brattle Group estimated a house with central A/C could reduce its load by 1.4 kwh of which 85% is a result of controlling the central A/C while a house without central air can reduce its load by 0.3 kwh.[xxxvii] The U.S. average cost for a kwh is approximately 15 cents. Thus a home with central air would save 21 cents an hour and a home without central A/C would save less than 5 cents an hour. Even if we use a peak rate of five times the normal rate, the savings would be a $1.00 per hour with central A/C and approximately 25 cents without it. Such savings are estimated to occur at the 50 or so peak hours of a year.[xxxviii]

As noted in the response to Question 16, 40% of U.S. homes do not have central air conditioning and thus do not have a use for a programmable thermostat[xxxix] and probably would not benefit from a smart meter. Additionally, many classes of customers, such as the elderly, night workers and families with young children at home may find it difficult to change their electric usage patterns and thus would be potentially penalized by higher time-of-use rates during peak periods. These people would all be paying what ever the peak rate is, with little potential for savings.

[xxxv] For example, Southern California Edison is spending $1.981 billion to replace approximately 5.3 million meters ($373 per meter). Over a 20 year useful life, the project is expected to result in benefits of $1.990 billion or a net present value of $9 million. (See SCE Decision at http://www.sce.com/NR/rdonlyres/6DC13EB1-0AFA-40A8-B9E3-93546F24015C/0/081114_A0707026Final_Decision.pdf).

[xxxvi] Brockway, Nancy, National Regulatory Research Institute, '*Advanced Metering Infrastructure: What Regulators Need to Know About Its Value to Residential Customers*', February 2008 pg 18 highlights two different utility regulatory filings where between 53 and 60% of the operational benefits related to eliminating manual meter reading costs.

[xxxvii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate (referencing Brattle Group), '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 9 (July 2008).

[xxxviii] Synapse Energy Economics, Inc for New Jersey Department of Public Advocate, '*Advanced Metering Infrastructure – Implications for Residential Customers in New Jersey*' at 13 (July 2008).

[xxxix] U. S. DOE Energy Information Administration (EIA), Office of Energy Markets and End Use, "*2005 Residential Energy Consumption Survey*". The same survey indicates of the people who have central air conditioning. According to data from the same study and EIA total sales data, electric heat represents less than 1% of overall electric sales.

18. In your testimony you mention the possibility of PHEVs and their integration into the existing grid. Even with enhancements that may accompany a smart grid, how much additional generation and infrastructure will be necessary to support the additional demand? Who should pay for the additional investment and how would this affect the timeline for the development and deployment of smart grid technologies?

Response: The use of PHEVs creates both opportunities and challenges. PHEVs have the potential to contribute significantly to reducing transportation emissions as well as to serve as a source of energy storage. At the same time, they represent the potential for a new type of electric usage – a device that can appear on the grid anywhere (i.e., home, work, shopping center or even vacation destination) and in large numbers, especially at peak hours when people arrive home from work. A study done by the Pacific Northwest National Laboratory found that existing "off-peak" electricity production and transmission capacity could fuel 70% percent of the U.S. light-duty vehicle (LDV) fleet, if they were plug-in hybrid electrics.[xl] A Smart Grid will be required to manage the complexity of both the storage capability and the variable nature and location of the charging - but new generation will not necessarily be required.

As noted in the response to Question 2, according to estimates by the EPRI and the Brattle Group, the required investment for Smart Grid is less than 10% of the overall investment required for the U.S. electric system and on an annual basis is 2.5% of industry revenues. EPRI also projects benefits of $600 to $800 billion over 20 years (equal to 4 to 5 times the required investment).[xli] Due to the small percentage of total investment and annual revenues and the high benefits, a distribution level Smart Grid should be prioritized and accelerated to address PHEVs.

[xl] Pacific Northwest National Laboratory Press Release, 'Mileage from megawatts: Study finds enough electric capacity to "fill up" plug-in vehicles across much of the nation', December 2006.

[xli] EPRI, *Power Delivery System of the Future, A Preliminary Estimate of Costs and Benefits,* July 2004 at 5-1.