BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matters of	)	
	)	
A National Broadband Plan for Our Future	)	GN Docket No. 09-51
	)	
	)	
Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans In a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act	)	GN Docket No. 09-137
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	)	
International Comparison and Survey Requirements in the Broadband Data Improvement Act	)	GN Docket No. 09-47
	)	

COMMENTS OF
THE SEMPRA ENERGY UTILITIES
REGARDING THE IMPLEMENTATION OF SMART GRID TECHNOLOGY

The Sempra Energy Utilities hereby submit their comments in response to the Public Notice issued by the Commission in the above-captioned proceedings regarding the implementation of smart-grid technologies by the Nation's energy utilities.[1] By the Public Notice, the Commission requested comments so that the Commission may properly determine "how advanced infrastructure and services could help achieve efficient implementation of Smart Grid technology". The Sempra Energy Utilities applaud the Commission for addressing this separate and specific topic as part in the broader range of issues being considered in these dockets. The Sempra Energy Utilities agree there is an important nexus between achieving the

[1] See Public Notice, *Comment Sought On the Implementation of Smart Grid Technology"*, NBP Public Notice #2, DA 09-2017 (released September 4, 2009).

objectives of the Broadband Data Improvement Act[2] and the deployment of data-enabled smart-grid technologies and applications and that this nexus should be considered explicitly as the Commission proceeds to develop a national scheme for the regulation of broadband communications. As Congress and the Commission have made clear, the availability and proficiencies of broadband communications will have a direct impact on the Nation's welfare, competitiveness and security. Similarly, the deployment of smart-grid functionalities will also serve these vital national interests and the Commission correctly anticipates that many of these smart-grid functionalities will rely upon the broadband communications architecture now under development and deployment. Moreover, as the Commission acknowledges in the Public Notice, the ubiquity of the services delivered through the infrastructure owned and operated by the Nation's energy utilities assures that, at least with respect to this use of broadband communications services and spectrum, the benefits of broadband availability would be enjoyed by almost every consumer and business in the nation.

Because the Sempra Energy Utilities long ago recognized the scale, breadth and importance of the operational benefits and service enhancements enabled by smart-grid technologies, we acted quickly and early, assuming a leadership position in assessing, deploying and exploiting the capabilities of smart-grid technologies and applications. We fully expect that the system efficiencies and services enabled through the Smart Grid will greatly enhance customer comfort and safety and provide profound benefits related to system reliability, energy efficiency and environmental sustainability. We strongly encourage the Commission to consider the development of regulations and incentives in the context of its present inquiries that will contribute to the rapid and broad implementation of the fullest range of smart-grid technologies.

A. INTRODUCTION

1. The Sempra Energy Utilities

Sempra Energy is a Fortune 250 company headquartered in San Diego, California, and the parent corporation to a family of companies engaged in the development, construction and operation of energy-related infrastructure and projects located around the world as well as the

[2] See, *The Broadband Data Communications Act,* P.L. 110-385, 122 Stats. 4096 (2008), codified at 47 U.S.C. §§1301-1304.

provision of related commodities, services and products. The Sempra Energy Utilities represent that portion of Sempra Energy whose principal operating companies include the San Diego Gas & Electric Company ("SDG&E") and the Southern California Gas Company ("SoCalGas"). SDG&E is a regulated public-utility gas and electric corporation operating pursuant to authorities granted by the Federal Energy Regulatory Commission and the California Public Utilities Commission. The company provides integrated gas and electric services to over one million customers in San Diego and Orange Counties, California. SoCalGas is a regulated public-utility natural gas corporation operating pursuant to authorities granted by the California Public Utilities Commission. SoCalGas owns and operates the nation's largest natural-gas distribution system, serving over five million customers in the southern half of the State of California. Taken together, these companies provide gas and electric services to a population of nearly twenty-five million people living and working in a combined service area encompassing some 24,000 square miles.

The Sempra Energy Utilities are among the companies leading the utility industry in the development and deployment of operational and customer-service strategies enabled by the deployment of smart-grid technologies. Both SDG&E and SoCalGas have launched ambitious and wide-ranging plans to deploy those technologies.[3] The actions that may be taken by the Commission in these dockets and in response to the American Recovery and Reinvestment Act of 2009 could have a direct impact on our business strategies and plans to implement smart-grid technologies and upgrade the vital infrastructure through which we serve our customers. We agree that the Commission is in a position to speed and enhance the deployment of smart-grid technologies and thereby increase the efficiency and reliability of America's energy infrastructure. Our comments are aimed at providing the real-world context within which the Commission should evaluate potential policies, regulations and incentives so as to assist the Nation's energy utilities in achieving these important goals. The Sempra Energy Utilities

[3] The Sempra Energy Utilities are deploying smart-grid equipment and functionalities throughout both the natural gas and electric systems we operate. This is, in part, due to the fact that the California electricity system is heavily dependent on gas-fired electric generation. This creates interdependencies between the power system and the natural gas transmission and distribution system. Smart-grid applications on the natural gas system will allow for multi-level and intersystem coordination between the two separate, but linked, utility systems. Therefore, the Sempra Energy Utilities encourage the Commission to proceed with the understanding that the concept of "smart grid" extends beyond the electricity system.

anticipate that the Commission's actions will serve to further our interests in smart-grid deployment and the public benefits that will come from our investments and actions, and lay the foundation for the national-scale deployment of smart-grid technologies encouraged by Congress. We offer these comments and any further assistance that the Commission might ask of us in that light and in the spirit of promoting and achieving the national interests represented by these exciting new technologies.

2. The California Perspective

California has long led the nation in the design and implementation of innovative and comprehensive energy-efficiency and demand-response standards and programs. Collectively, California's regulated energy utilities will spend over $3 billion on customer-level energy-efficiency and demand-response programs over the next three years alone. The California electric utilities lead the nation in the procurement and integration of renewable-energy resources and in the construction and development of new and upgraded electric-transmission facilities whose principal purpose is to connect these resources to the grid and deliver their energy to retail consumers. In this regard, California's policymakers and utilities are committed to achieving a goal of delivering not less than thirty-three percent (33%) of annual energy requirements from renewable resources by the Year 2020.[4] Additionally, the California utilities are striving to be on the forefront of the deployment and integration of electric and alternative-fuel vehicles in an effort to contribute significant reductions in carbon-dioxide emissions under the State's groundbreaking Climate Change Solutions Program. Recently reinvigorated national policies and attention promoting electric-vehicle technologies, including plug-in, hybrid- and battery-driven vehicles, have accelerated the plans of automobile manufacturers to offer these vehicles. Consumer interest in these products is high in California, and we are well-positioned to speed market entry and acceptance of these products.

To support these ambitious energy-efficiency, demand-response, renewable-energy, and transportation goals, California's utilities have been investing billions of dollars a year to expand

[4] In assessing the daunting nature of the California goals and the State's aspirations here, the Commission should keep in mind that energy from large-scale hydroelectric facilities and facilities burning waste-coal or -petroleum products cannot be used to meet the California requirements as is the case in several other states.

and modernize the state's gas and electric transmission and distribution systems and explore and develop a vision of a multi-level, end-to-end "Smart Grid" enabled through the deployment of new and innovative technologies and equipment. Recently, the California Public Utilities Commission ("the California Commission") and its sister agency, the California Energy Commission, initiated a rulemaking proceeding[5] to evaluate Smart Grid opportunities and policies for the California utilities and address the need and criteria for standards recognized by Congress in Title XIII of the Energy Independence and Security Act of 2007.

The transformations occurring in the national electricity markets and national broadband policies are well understood in California. Considerable experience has already been accumulated in the state with respect to the integration of new resources and the deployment of technologies that will enable the modernization of the electric grid. By coordinating the two distinct but interdependent technology paths represented by broadband communications and smart-grid technologies, the Commission can leverage the potential offered by each so as to maximize the benefits and advantages they can provide. The questions posed by the Commission in its Public Notice demonstrate an apt appreciation of the complexity of Smart Grid policies and programs and, importantly, their dependence on the availability of broadband technologies that will facilitate the vital communications infrastructure linking the integrated end-to-end systems comprising the smart grid. We strongly believe that the experience gained in California can be of great assistance to the Commission as it proceeds to develop a national broadband policy and encourage the Commission to take note of our learnings.

3. Status of the Sempra Energy Utilities' Comprehensive Smart-Grid Program

The Sempra Energy Utilities long ago determined that the deployment of smart-grid technologies within a redesigned system architecture offered the potential for significant operational efficiencies and service enhancements. To that end, SDG&E devoted substantial resources to public and industry efforts to develop common standards for the equipment and technologies that would constitute the Smart Grid and has participated in and provided leadership to many of these efforts. SDG&E was among the co-founders of the OpenAMI,

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[5] See California Commission Rulemaking No. 08-12-009. Documents in filed in this docket are available at the California Commission's website at http://docs.cpuc.ca.gov/published/proceedings/R0812009.htm.

OpenHAN and OpenSG standards groups.[6] In addition, SDG&E was a co-founder of GridWise Alliance and has served as an advisor and participant to many federal agency working groups, including the Department of Energy's GridWise Architecture Council to which we contribute expertise and leadership through several of the Council's Domain Expert Working Groups. The Council and its working groups provide and share information to and with the National Institute for Standards and Technologies (the "Institute") in the Institute's work to design and adopt a framework for standards and protocols, as well as specific interoperability standards and protocols, for the full range of smart-grid technologies. We are active in every national smart-grid initiative and collaboration of which we are aware and contribute significant levels of resources to these efforts to ensure that progress is made by the industry towards the important and farreaching objectives of grid modernization, system reliability, and infrastructure protection and cybersecurity.

In addition to adding intellectual capital to the efforts aimed at modernizing the national electric system, SDG&E has substantial financial capital invested in smart-grid applications, programs and projects. SDG&E has been installing supervisory control and data acquisition ("SCADA") devices throughout its transmission and distribution system since the early 1990s. This strategy has laid the foundation for distribution automation, remote operation of switches and improved system reliability, fundamental precursors to and early forerunners of a host of smart-grid functionalities such as self-healing circuits. SDG&E is deploying the technologies and equipment enabling these functionalities wherever they are found to be cost-effective. SDG&E currently has seven distribution circuits that are self-healing, two of which use distributed intelligence with peer-to-peer communications (a decentralized approach to self-healing) and five of which are controlled by software algorithms residing in SDG&E's SCADA Master System (a centralized approach to self-healing) and that use Feeder Automation System Technologies (FAST) capable of isolating faulted feeder segments and transferring load between circuits without operator intervention (an automated approach to self-healing). SDG&E was among the first electric utilities to perform pilot tests on first-generation broadband-over-

[6] Generally, in this context, "AMI" is an industry abbreviation for "Advanced Metering Infrastructure", "HAN" for "Home Area Network" and "SG" for "Smart Grid".

powerline technologies. Our experience with these tests informed our decision regarding the advanced-meter technologies we are now actively deploying.

On a larger scale, SDG&E has designed and begun to implement a number of strategic plans and projects we believe will transform our system and, more importantly, our relationship with our customers. As we were participating in the development of common standards and protocols for the constituent elements of the smart grid we envisioned and began our early tests and deployment of certain smart-grid technologies, SDG&E was designing, with the encouragement and advice of the California Commission, the overarching business plans, system changes and enhanced services that the deployment of smart-grid technologies enables. As SDG&E described in its recent filing to the California Commission's Rulemaking No. 08-12-009, the company is in the midst of launching ambitious smart-grid plans and projects, including but not limited to our:

- "Sustainable Community Project" which provides utility capital for the integration of distributed energy resources located on customer premises into the SDG&E distribution system. This is related to the internal standards we have developed so as to ensure that distributed-generation applications are a fundamental element of the distribution-system-planning process. These guidelines were developed in concert with distributed-generation vendors and allows for both utility and third-party distributed resources to compete as "wire" alternatives. The project also incorporates broader "green building" concepts into the facilities and surrounding landscaping;

- "Smart Grid Program" which encompasses the efficient integration of a significant level of renewable resources so as to meet California's renewable portfolio standards, standards which are among the most aggressive in the nation and have to date precipitated the development of significant levels of new intermittent (or what the Commission describes in the Proposed Smart Grid Policy Statement as "variable") resources;

- "Operational Excellence 2020 Program" which encompasses the upgrading and/or replacement of some twenty enterprise systems to bring SDG&E's computing and operating systems to "state of the art" condition and assure interoperability where those systems interface and data exchanges occur. The program also includes advanced outage- and distribution-management systems, a condition-based maintenance system for substations, and a geospatial information system designed to support smart-grid applications;

- A Smart Meter Program and related Advanced Metering Infrastructure Initiative which involves the installation and integration of some 2.3 million "smart" gas and electric meters by the end of 2011;

- Comprehensive Demand Response Program, which beginning in the summer of 2009 will include the "Participating Load Pilot Program" which aims at providing demand response as a resource to the bulk-power markets operated by the California ISO. SDG&E has the overall goal of achieving a load impact of 265 megawatts for all of its demand-response programs in 2011;

- "Comprehensive Alternative-Fuel Vehicle Program" which not only provides investment incentives to potential owners and operators of vehicles using nontraditional fuels but also encompasses system upgrades that enable the use of "plug-in" hybrid electric vehicles to mitigate generation variability associated with intermittent resources and absorb "excess" generation during certain periods of the day or at key locations on the distribution system; and,

- Alternative service-delivery models, including the "Microgrid" concept which incorporates distributed energy resources into the smart grid and permits the "islanding" and local balancing of certain resources and loads in the event of outages. SDG&E has initiated this three-year proof-of-concept, utility-scale project incorporating many elements of a smart grid, including leveraging elements of the smart-meter and smart-substation projects SDG&E has also launched, and expects that the Microgrid project will reveal and demonstrate the potential pathway for a self-sustaining energy community. In recognition of the importance of this innovative program, SDG&E was awarded a $7.5 million grant from the Department of Energy and another $3 million grant from the California Energy Commission to demonstrate its Microgrid concept.

SoCalGas is also the owner of a proprietary technology that facilitates the use of existing gas-distribution lines as a conduit for housing optic-fiber cable bundles. This technology provides a safe, low-cost last-mile solution to interconnecting customer-end information and communications appliances and hardware to the national communications grid, obviating the need for high-cost and disruptive excavations of urban and suburban roadways and rights-of-way.

In summary, the Sempra Energy Utilities are well along the path of implementing smart-grid concepts, standards, integration techniques, programs and projects. Each of our plans and projects could be affected in some way by the Commission's policies and regulations related to the availability and regulation of broadband communications. It is our hope that the Commission's inquiries will result in the adoption of policies and regulations that encourage, enable and incentivize the implementation of smart-grid strategies and deployment of new technologies.

B. Comments of the Sempra Energy Utilities

The following comments follow the structure of the questions posed in the Commission's Public Notice.

1. Suitability of Communications Technologies.

As the Public Notice acknowledges, Smart Grid applications are being currently being deployed using a variety of public and private communications networks. In terms of the network specifications required for Smart Grid applications, the Sempra Energy Utilities generally have the following communications requirements:

- Selective fixed coverage (at least 1 kbps) to certain utility assets, such as transmission and distribution lines, suitable for communicating to battery-powered devices installed both above and below ground;
- Pervasive fixed coverage (at least 1 Mbps) for all utility assets and customer locations;
- Pervasive mobile coverage (at least 100 kbps) for all utility assets and customer locations;
- Selective broadband coverage (at least 10 Mbps) for major assets and locations;
- Communication service availability at least 99.99 percent and 99.999 percent where financially feasible;
- Communication latency of less than 100 msec for communications to locations where major assets are situated (*e.g.*, between utility data centers and substations);
- Communication services capacity that does not impose or implicate time-of-day limitations on application design and/or business functionality; and,
- Communication path accountability, *i.e.*, the ability of the provider to prove that each communications device and link in the path is properly managed, configured and secure pursuant to the critical infrastructure protection standards and regulations of the Federal Energy Regulatory Commission and the North American Electric Reliability Corporation.

At present, the Sempra Energy Utilities have yet to find a single communications technology, solution or provider that can meet the communications requirements of the broad range of smart-grid components and applications we are deploying. As a result, energy utilities have historically built or acquired single-application communication systems (commonly and aptly called "silos"), although this approach is suboptimal in terms of enabling an integrated end-to-end smart grid comprised of diverse, interoperable technologies. Nevertheless, the Sempra Energy Utilities have developed a communications-system strategy that calls for the utilization of a "right-enough" communications solution meeting the requirements of individual smart-grid

applications, and subsequently binding discrete communications systems and networks together using a single control and security system. This system architecture, internally dubbed "GridComm", encompasses a series of radio-frequency networks that are integrated by a master "Control Service". This approach allows the continued use of legacy systems while we add new systems for new functions, technologies and services.

Of the radio-access technologies available today, we find OFDMA-based technologies, such as mobile WiMAX (802.16e), are well-suited to the provision of core communications functionality. These technologies provide good spectral efficiency, deployment flexibility in terms of frequency of operation, and supportable channel bandwidths. Equally important, they also have the required quality-of-service (QOS) mechanisms to support smart-grid communication needs.

With respect to the types of network technologies most commonly used in Smart Grid applications, there are a number of different communication technologies being proposed for smart-grid communications, including WiMAX-based solutions for wide-area network technologies, mesh technologies, cellular carrier services technologies, and satellite services. The cost of implementation and operational capabilities of these systems varies widely and is, in part, dependent on whether the utility must buy or lease spectrum within which to operate the network. For the Sempra Energy Utilities and the 24 million points of presence represented by our customers and their smart meters, this spectrum cost, whether leased or purchased, is obviously significant. That being said, our current architecture analysis favors the implementation of a wide-area private network augmented with broadband hot-zones. Having undertaken extensive technical and cost analyses of a number of solutions, it is highly likely the final solution set will be based on OFDMA technology. With due respect for the Commission's inquiry and interests, however, much of the information we have collected is proprietary in nature and cannot be shared in this public forum.

With respect to existing communications offerings, the Sempra Energy Utilities have found that existing carrier-operated networks are inadequate for the full range of the Smart Grid's needs. While the Sempra Energy Utilities will use carrier services for those uses or applications where these services are adequate and can be acquired at a favorable cost, there are fundamental problems with carrier-operated services relative to our high-level requirements.

The following table compares the general smart-grid network specifications identified earlier in these comments to the problems we have experienced with carrier networks:

Smart Grid Requirement	Commercial Carrier Service Issues
Pervasive fixed coverage (at least 1 Mbps) to all utility assets and customer locations	Moderate adequacy - carriers typically cover ninety-five to ninety-seven percent of utility assets and customer locations. Performance in rural locations varies considerably and service is frequently unavailable or unreliable, which is unacceptable for Smart Grid applications and system reliability.
Pervasive mobile coverage (at least 100 kbps) to all utility assets and customer locations	Moderate adequacy - carriers typically cover ninety-five to ninety-seven percent of utility assets and customer locations. Because the mobile utility field workforce often travels between network coverage areas, mobile service is only adequate with add-on session-management software costing millions of dollars in utility-oriented applications.
Selective broadband coverage (10 Mbps) to locations where major assets are situated	Unavailable and completely inadequate - no carrier option is currently available. Major carriers predict that Long-Term Evolution coverage will be available in the Sempra Energy Utilities service territory beginning in 2010. We estimate it will be five to seven years after initial offerings before 4G network coverage is equivalent to 3G network coverage available as of 2009.
Communication service availability at least 99.99 percent and 99.999 percent where financially feasible	Moderate adequacy – carrier data networks are increasingly available for use by energy utilities, however, those uses compete for capacity and performance with growing consumer use and traffic. 3G system providers do not offer quality-of-service guarantees or assign priorities to discrete uses or users, compromising the operation and/or reliability of smart-grid functionalities. Additionally, service recovery after adverse events, such as earthquakes or wildfires, may not be adequate to support utility-system repair requirements or to otherwise ensure the safety of repair crews.
Communication latency of less than 100 msec between utility communications centers and major assets	Poor adequacy – carriers do not provide latency guarantees on existing radio-frequency networks.
Communication path accountability – the ability to prove that each communications device and link in the path is properly managed, configured and secure under the terms of national standards and regulations related to critical infrastructure protection	Poor adequacy – 3G network providers either do not or cannot as a practical matter provide detailed path and operations information.

As indicated in the foregoing table, the breadth and duration of commercial carrier network outages render commercial services unsuitable for critical electricity equipment-control communications. Commercial-carrier wireless equipment failures and change-induced outages in the first half of 2009 have typically resulted in one to two hours of downtime for one hundred percent (100%) of affected devices, and an additional four to eight hours of disrupted communications for one (1) to five percent (5%) of those devices. The unreliability of carrier

networks during and after emergency events is also a serious issue due to the limited battery and backup generator resources located at carrier cell sites. Subsequent to the 2007 California wildfires, commercial carriers began deploying batteries and emergency generators to more of their cell sites, but typically with only an eight-hour battery life and/or limited generator fuel capacity. These matters raise significant concerns for energy utilities whose services are essential to their customers, particularly during widespread regional emergency conditions.

2. Availability of Communications Networks.

As indicated previously, the Sempra Energy Utilities agree with the Commission that the nation's energy utilities offer near-universal service, including in many geographies where no existing suitable communications networks currently exist (*e.g.*, for last-mile, aggregation point data backhaul, and utility control systems). This gap has serious implications for many smart-grid applications, whether related to the reliable operation of the utility's system or limiting the services that can be made available to a customer.

In terms of general access to communications networks, there is a marked difference between the network coverage, availability and performance offered in urban or suburban areas compared to remote or rural areas. Rural areas present the greatest challenge in terms of providing pervasive coverage to Smart Grid assets. Internal studies performed by the Sempra Energy Utilities show that coverage of grid assets by carrier services offerings falls to as low as fifty percent (50%) in the inland areas served by SDG&E. This leads us to believe that only by building a private network can we essentially achieve coverage of all but the most remote of our grid assets. With respect to coverage of our customers' premises, approximately one (1) to two percent (2%) of homes have no access to suitable communications networks for Smart Grid applications. Again, these are primarily customers in remote, rural areas where commercial cellular coverage is unavailable, intermittent or unreliable, and where carrier land-line services for Smart Grid purposes would be cost-prohibitive.

In addition to the service gaps and inconsistencies noted above, there are, as the Commission correctly suspects, other impediments preventing the use of carrier networks for Smart Grid communications. In most cases, the only communication networks available to homes are direct-subscriber lines, cable-television Internet services, or carrier-provided wireless 3G data services (*e.g.*, CDMA-, EDGE-, or HSPA-based services). In our opinion, direct-

subscriber and cable-television services are not viable channels for Smart Grid functions other than those related to certain home area network applications. As for carrier-provided wireless 3G services, we reiterate that these services are in several respects inadequate to meet the needs of smart-grid applications; as shown in the previous table, these inadequacies include unreliable, insufficient or otherwise poor coverage or availability, vulnerability to performance or service disruptions caused by competing uses, uncertain survivability or recovery of those services during and after adverse events, and the impracticality of meeting national regulatory standards related to critical infrastructure protection.

Smart Grid applications are wholly dependent upon the availability of reliable and secure communications to and from sensing, measurement and control devices installed on utility systems. In order for smart-grid applications to be enabled at these system devices and for these functions, suitable communications must first be in place. If they are not, a suitable network system or service must be extended or created to provide those communications, increasing the cost to deploy that application. Where "silo" networks or services must be extended or created, communications costs are increased significantly beyond those that can be provided by networks designed and deployed for use by multiple applications. This can be a major barrier to deploying smart-grid applications to those areas without communications coverage, as these increased costs may outweigh the customer or utility benefits provided by those applications. Consequently, the unavailability of a suitable broadband network has a significant impact on the cost of deploying smart-grid applications in remote or rural areas and poses a major barrier to extensive smart-grid deployment. As noted previously, commercial-wireline broadband is not available in many rural areas and cannot be deployed cost-effectively where provided for smart-grid purposes alone. Even where commercial-wireline broadband services are or could be made available, infrastructure costs are likely to be high due to the need for additional data-security and –integrity measures required by smart-grid applications.

3. Spectrum.

The Sempra Energy Utilities submit that Smart Grid systems are currently being deployed using a variety of communications technologies, including public and private wireless networks, using licensed and unlicensed spectrum. The Sempra Energy Utilities have an abiding preference to use licensed spectrum for any communications involving grid monitoring and for

grid-control systems in particular. Licensed spectrum provides the most suitable operating environment in which to support core, mission-critical communications since it is always available, fully controlled and protected from interference. There have been two notable exceptions to the use of licensed spectrum for these functions. First, the Sempra Energy Utilities use an unlicensed 900 MHz radio-frequency system for advanced metering "last mile to the meter" connections, including the transmittal of meter-shutoff signals. Second, we are considering the use of lightly licensed 3.65 GHz WiMAX as part of our broadband hot-zone network to support some applications on the SDG&E electric-transmission and –distribution systems for both system monitoring and control. While these exceptions exist, it remains the case that we would prefer to use licensed spectrum if it were made available at reasonable cost.

In terms of our use of unlicensed spectrum, the Sempra Energy Utilities prefer to use unlicensed spectrum only for applications that do not represent critical grid-control functions. In these instances, unlicensed spectrum offers the key advantage of being free of acquisition fees. This advantage does not provide sufficient reason, however, for the Sempra Energy Utilities to adopt it for the transport of critical operations signals and communications. Of the unlicensed bands available today, the lightly licensed 3.65 to 3.70 GHz band that allows non-exclusive use is of most interest to the Sempra Energy Utilities for smart-grid communications and many manufacturers are making equipment using this spectrum available. We also envision making use of the 2.4/5.8 GHz ISM bands for Wi-Fi access points for basic non-mission critical wireless communications to portable applications and nomadic users in certain hot-spot locations.

With respect to interference problems we have encountered using unlicensed spectrum, the Sempra Energy Utilities do not have sufficient deployments of smart-grid communications technologies using these frequencies to determine if interference is, or will become, a major or widespread issue. In certain areas, however, Wi-Fi throughputs are severely limited by elevated noise floors from surrounding non-utility users, a concern we are currently monitoring and evaluating. Due to our limited experience, we have yet to experiment with or focus upon any specific techniques that would address interference problems adequately, however, we currently anticipate that Contention Based Protocols (CBP) and other techniques implemented in the upper half of the lightly-licensed 3.65 GHz band offer potentially adequate solutions. In addition, we are collaborating with On-Ramp Wireless in a research-and-development project as part of our

smart-grid program to determine whether a digital-signal processing technique can overcome interference in unlicensed spectral bands.

The spectral bands currently used by the Sempra Energy Utilities are not expected to be sufficient to meet the communications needs of our planned comprehensive smart-grid strategy, architecture and functionalities. The Sempra Energy Utilities expect either to acquire additional spectrum, at potentially considerable additional cost to the programs and services we plan to implement, or to gain access to new spectrum through Government action. In this regard, the Sempra Energy Utilities strongly encourage the Commission to take such actions in developing its broadband communications policies so as to speed the broad and earliest deployment of the fullest range of smart-grid technologies and assure the greatest exploitation of their benefits on a national level. As noted by Congress in the Broadband Data Communications Act and the Commission in its prior releases related to its responsibilities under the Act, there is a strong national interest in making broadband communications available to every citizen and every location. By making provision for the nation's energy utilities to utilize some portion of the broadband spectrum as part of its national broadband communications polity, the Commission can leverage our ubiquitous reach as a distribution channel to assure that this occurs at least for the functionalities and benefits represented by many smart-grid services and technologies.

Analysis of the traffic we expect to carry over our Smart Grid communications network leads us to believe we need, at a minimum, access to at least 2 MHz of licensed spectrum and, ideally, at least 5 MHz of licensed spectrum to support our pervasive wide-area requirements. In addition, further spectrum would then be required to support broadband hot-zones. Due to expected spectrum lease or purchase costs, we expect the spectrum utilized for these broadband hot-zones will be lightly-licensed or unlicensed, most likely at 3.65 GHz. Our internal studies have shown that frequency bands at or below 2.5 GHz, and ideally frequency bands that are sub-1 GHz, are best suited to meeting the challenge of providing wide-area, pervasive coverage across our service territory in areas that have challenging non-line-of-sight propagation characteristics.

The most stressing latency requirements for smart-grid functionality exist in wide-area measurement and control systems using synchrophasor instrumentation. Those applications require less-than-100 msec round-trip communication latency from endpoint to data center. Other latency-sensitive applications include isochronous applications, *e.g.*, voice and video

communications. With respect to the maximum latency limits for communications to and from different nodes of these smart-grid applications, existing carrier-provided wireless 3G services cannot deliver this level of latency on a reliable basis. While it is technically possible for announced 4G services – WiMAX and Long-Term Evolution – to deliver this level of performance, the Sempra Energy Utilities are reluctant to design and build our smart grid architecture based on assumptions and promises that may not come to fruition. It is our expectation that communications carriers will build their 4G services and networks primarily around the needs and revenue opportunities represented by 300 million prospective consumer-subscribers rather than the more demanding communications needs of the local energy utility and its smart grid. On the other hand, private networks can and will be built with customized performance for latency, availability, coverage, capacity, and security. These private networks are also the utilities' best option for the survivability and recoverability of communications services during and after adverse events, when customers and communities have the most urgent need for the restoration of utility services. Thus, the Sempra Energy Utilities are planning to build a proprietary communications network using the equivalent cost of 3G- and 4G-carrier services as a "price benchmark" – our goal is to build and operate a custom communications system for the same long-term cost that we might pay to a 3G- or 4G-carrier services, with the added benefit of assuring that our distinct and necessary requirements are met at levels of performance commensurate with best practices in the utility sector. The Sempra Energy Utilities understand that most large energy utilities are following this same path for the same reasons.

With respect to the major security challenges and the relative merits and deficiencies of private utility networks versus alternative solutions provided by commercial network providers, the Sempra Energy Utilities submit that carrier-provided Internet-based virtual private networks are vulnerable to the "best effort" underlying nature of the publicly available Internet. Private networks, on the other hand, enable utility-controlled virtual networks, including MPLS-based VRFs, to benefit from higher quality and higher classes of service, improved traffic engineering, and increased security. While commercial solutions provide cost-efficient solutions as compared to private utility networks, most commercial carriers have yet to adopt industry-standard and acceptable security practices meeting an energy utility's needs.

With respect to coordinating the potential allocation of spectrum to smart-grid communications with other countries, there are both potential benefits and technical

requirements that should be taken into account. The American electricity grid is interconnected with the electricity systems in Canada and Mexico and grid operations are coordinated across the international borders. An intricate system of operational requirements, longstanding agreements and industry practices facilitate the unity of the North American grid. A key implication of these circumstances for the Sempra Energy Utilities is that, at a minimum, operations-sensitive communications and usage using radio-frequency networks would need to be coordinated for transmitters along the international borders of the United States and Mexico.

With respect to spectrum allocation, there are no specific requirements associated with smart-grid communications at present that require or rule out any specific band, duplexing schemes, channel width, or any other requirements or constraints. The existing and announced spectral efficiency techniques used in operations-sensitive communications links are expected to be satisfactory for the purposes of smart-grid applications. As noted previously, our internal studies have shown that frequency bands at or below 2.5 GHz and, ideally, frequency bands below 1 GHz, are best suited to meeting the challenge of providing pervasive wide area coverage across our service territory, particularly in areas that have challenging non line-of-sight propagation characteristics. Further, licensed spectrum bearing exclusivity privileges provides the most suitable operating environment within which to establish these critical communications networks. For other communications needs, such as our broadband hot-zone layer, a much wider range of frequency bands can be utilized, including licensed, lightly-licensed and unlicensed spectrum up to 5.8 GHz.

While both FDD and TDD spectrum are suitable for Smart Grid support, TDD spectrum generally offers more flexibility and higher spectral efficiencies since downlink and uplink allocations can be dynamically allocated to meet the traffic requirement. A WiMAX-based solution has the appropriate control and configuration mechanisms to achieve these needs. For pervasive wide-area coverage, we believe the minimum requirement is for a 2 MHz block of either FDD or TDD spectrum. That being said, a 5 MHz or 10 MHz spectrum block would allow energy utilities to utilize WiMAX profile-defined channel bandwidths and to take advantage of the availability of equipment being produced by a number of manufacturers. This would bring economies of scale to both RAN and end-point solutions.

If spectrum were to be allocated by the Commission for smart-grid applications, smart-grid deployments and operations would be simplified dramatically and significantly allay

concerns related to risks associated with technological obsolescence. Energy utilities must consider spectrum suitability to applications, availability of endpoint and transmitter radios, total cost (including spectrum cost), and many other complex factors as we consider the requirements of and specifications for smart-grid communications solutions. The existing options are complex and fraught with some risk, particularly uncertainty risks related to changes in carrier offerings and government-managed spectrum. By proactively allocating spectrum in a manner consistent with the vision for the smart grid articulated by Congress, the Federal Energy Regulatory Commission, and the Department of Energy, the Commission can address and resolve these risks, creating a rich, sustained, economically positive ecosystem of suppliers for a known radio-frequency solution in the energy-utility sector.

4. Real-time Data.

As a result of our smart meter deployment, customers of the Sempra Energy Utilities will have next-day consumption and pricing data available via the Internet or through our customer contact centers. Same-day or real-time consumption data will also be available to the customer via the ZigBee HAN chip installed in the electric meter at each customer location. Consumption data would be provided via the utility's secure customer portal, "My Account", or, with the customer's active consent, through secure third-party applications such as Google's PowerMeter. Providing this data through the utility website, where a comprehensive menu of other energy- and service-related information will also be accessible, gives Sempra Energy Utilities customers a "one-stop shop" for their energy information. Because some customers may prefer using a third-party site or portal that also provides other information important to them such as stock-market information, weather, and news, and other applications that can be personalized for their needs, the Sempra Energy Utilities will engage alliance partners to deliver our information through their systems. Customers accessing information via third-party websites would be assigned unique customer identities and passwords to protect their information. We have, as indicated previously, engaged Google to provide a data-delivery channel to our common customer-users in a recently launched pilot program. By offering customers access to consumption and pricing data through our proprietary site or through other channels already popular among Internet users, customers will have more options that better meet their needs, demands, habits, and preferences.

The Sempra Energy Utilities are working with UCA's[7] Open Home Area Network, Automated Data Exchange, Automated Demand Response, and end-to-end security working groups to help promote open standards and full interoperability, while ensuring the security of customer data. The Sempra Energy Utilities, as is the case with the entire utility industry, will require that third parties agree contractually to protect customer data at the same level and under the same terms as is required of them by state and federal regulations.

With respect to the uses of real-time consumption and pricing data that have been shown most effective at reducing peak load and total consumption, numerous pricing studies using time-dependent rates have been conducted on residential and commercial customers. These studies indicate a wide variation of response among customers, from a low of no response to highs exceeding fifty percent (50%) load reductions during peak periods. The average response is typically in the range of between ten (10) to fifteen percent (15%) load reductions. Most of these studies have not utilized real-time pricing but typically include day-ahead notification of elevated peak-period pricing.

With respect to the potential benefits that might come from providing consumers more granular consumption data, numerous studies indicate that in-home displays and on-line presentment result in energy savings of between three (3) and eighteen percent (18%). The Sempra Energy Utilities believe that additional studies are needed to determine which feedback methods (*e.g*., permanent in-home displays, loaned in-home displays, direct links to in-home computers, pushed data using web portals, direct mail presentment, *etc*.) are the most effective within discrete market and customer segments.

With respect to opening real-time consumption data to consumers and the energy management devices and applications they choose to connect, the Sempra Energy Utilities believe that providing more real-time consumption and pricing information, when offered in conjunction with technology enabling in-home energy management systems or when tied to specific appliances, will provide the customer greater control and choice over how and when they choose to "buy" electricity. Ultimately, this will also facilitate greater customer convenience and satisfaction. At a system level, involving the customer in these choices and

[7] The UCA International Users Group is a not-for-profit corporation consisting of utility user and supplier companies that is dedicated to promoting the integration and interoperability of electric, gas and water utility functions.

self-management option will ultimately result in greater efficiency, reduced consumption and higher levels of demand response during peak-pricing periods, lowering overall costs to all consumers.

5. Home Area Networks.

The Sempra Energy Utilities are designing their Home Area Network (HAN) program to include a broad range of devices that assist customers in understanding and, ultimately, managing their energy usage and costs. We have commenced an ambitious territory-wide installation involving millions of smart meters and are therefore focusing on HAN devices capable of fully communicating with smart meters. More specifically, SDG&E is evaluating HAN devices that permit customers and/or the utility to enable load control using the energy information transmittable to and/or produced by the customer meter. As examples, SDG&E is planning to deploy programmable thermostats with communications capability and load-control switches for energy-intensive end-uses such as air conditioners, electric water heaters and pool pumps. For the purposes of providing usage and price information, SDG&E will be deploying in-home display technologies, end-use meters for appliances and plug loads, meters for other commodities such as natural gas and water, and meters for distributed photovoltaic-generation systems. In the future, SDG&E may also incorporate additional devices that can be interconnected with smart meters; these additional devices may include premise-wide energy-management systems, plug-in vehicle charging and discharging controls, and controls for distributed energy resources other than photovoltaic technologies.

SDG&E's smart meters include a ZigBee radio for communications with its gas meter modules and for communications with HAN devices within a customer's home and throughout the customer's premises. Data shared between smart meters and HAN devices are currently defined by the ZigBee Alliance's Smart Energy Profile. Current work by the ZigBee Alliance and HomePlug Alliance on a new version of the Smart Energy Profile is expected to extend the functionalities enabled by and the range of data exchanged between smart meters and HAN devices so as to achieve the full vision of the "smart home".

In terms of connectivity to and compatibility with the Internet, the Sempra Energy Utilities envision that the same HAN devices that interact with smart meter sets will also be connected to the Internet. Thus, in addition to information technologies, the Sempra Energy

Utilities foresee that home-, building- and industrial-automation devices will be connected to the Internet and other widely available communications systems. The Sempra Energy Utilities' Premise Energy Management System is being designed as the platform providing the interconnection between the smart-meter network and a customer's LAN/Internet network. Under this vision, interoperable device networking will expand into diverse areas including consumer electronics, traditional computer electronics, personal healthcare, and utility asset monitoring and automation. The data shared between these devices and the utility will likely be similar to the data shared with the smart meter.

The role of broadband in the development and deployment of HAN applications is complex and not yet fully determined. Nevertheless, the Sempra Energy Utilities believe that, because broadband networks can provide the greatest bandwidth and lowest latency, broadband communications concomitantly allows us to plan for and implement the most extensive range of HAN applications. The data streams facilitating the management of energy usage and customer costs, however, may not require considerable bandwidth (*e.g.*, it only takes one byte of data to turn a light or off). The market will determine which devices need full Internet connectivity and which devices need simpler protocols and lower cost communications systems – the more sophisticated and comprehensive the HAN applications that customers want and adopt, the higher the probability that the Internet and broadband networks will be utilized to facilitate the applications bundled into an energy utility's HAN platform and placed at a customer's premises. The Sempra Energy Utilities would encourage the Commission to familiarize itself with, and perhaps even participate in, the development of interoperability and related technical standards now being actively pursued by the Federal Energy Regulatory Commission and the National Institute of Standards and Technology for smart-grid applications, equipment and technologies.[8] Additionally, the energy-utility industry has been working on standards and conventions for smart-grid and HAN applications for more than a decade and the work of the OpenSG group and the work published in the Utility AMI 2008 Home Area Network System Requirements Specification is commended to the Commission for its review and the communications needs of the energy utilities and integrated, interoperable HAN applications.

[8] See Federal Energy Regulatory Commission, *Re Smart Grid Policy,* Docket No. PL09-4-000, prompted by and in re Title XIII of the Energy Independence and Security Act of 2007.

C. Summary and Recommendations

The Sempra Energy Utilities are encouraged that the Commission will take smart-grid into account in developing its national broadband communications policies and regulations. By doing so, the Commission will be accommodating the national interests that will be served by the deployment of smart-grid technologies and functionalities and we therefore strongly encourage the Commission to consider the development of regulations and incentives in the context of its present inquiries that will contribute to the rapid and broad implementation of the fullest range of smart-grid technologies. By coordinating the two distinct but interdependent technology paths represented by broadband communications and smart-grid technologies, the Commission can leverage the potential offered by each so as to maximize the benefits and advantages they can provide. In particular, the proactive and appropriate allocation of spectrum in a manner consistent with the vision for the smart grid articulated by Congress, the Federal Energy Regulatory Commission and the Department of Energy can address and resolve communications uncertainties and issues currently faced by energy utilities as they consider the design and deployment of smart-grid applications and equipment, today, creating a rich, sustained, economically positive ecosystem of suppliers for a known radio-frequency solution in the energy-utility sector.

Respectfully submitted,

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October 2, 2009
San Diego, California