STATEMENT OF
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ENERGY AND ENVIRONMENT SUBCOMMITTEE
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Thank you Mr. Chairman and distinguished members of the Subcommittee for the opportunity to share Southern California Edison's smart grid strategy and activities to enable Federal and California climate and energy policies over the next decade.

My name is Paul De Martini, I am the Vice President for Advanced Technology for Southern California Edison. My responsibilities include Smart Grid and Electric Transportation strategy, policy and technology research, development and demonstration. Southern California Edison (Edison) is a subsidiary of Edison International and one of the nation's largest electric utilities, serving a population of nearly 14 million via 4.9 million customer accounts in a 50,000-square-mile service area within Central, Coastal and Southern California. Edison is a recognized global leader in the development and implementation of a smarter electric grid. This leadership is based on solid research and development capabilities and existing and current capital deployments in advanced technology to create a smarter grid.

Edison Smart Grid Strategy

The United States has arrived at a critical juncture in its energy future. The current stakes for addressing climate change, energy independence and infrastructure security could not be higher. Federal and state policymakers alike have recognized the need for a smarter, more robust electricity infrastructure if we as a country are to rely on greater amounts of renewable generation, use electricity as a fuel for vehicles, enable consumers to become active participants in the energy supply chain, and ensure the continued reliability and vitality of our nation's energy economy.

Edison is in the process of modernizing and expanding its electric power delivery systems. In doing so, it is critical that Edison deploy technologies that enable it to provide service in a manner consistent with present and future customer needs, while accommodating changes in market participation. Edison's vision of a smart grid is to develop and deploy a more reliable, secure, economic, efficient, safe and environmentally-friendly electric system. This smart grid will incorporate high-tech digital devices throughout the transmission, substation and distribution systems and integrate advanced intelligence to provide the information necessary to both optimize electric services and empower customers to make informed energy decisions.

Consistent with the 2007 EISA and the U.S. Department of Energy's and National Energy Technology Laboratory's Vision for the Modern Grid, Edison's smart grid will enable the increase of intermittent and renewable resources (such as wind and solar power) and spark greater use of Plug-in Electric Vehicles (PEVs) by increasing system flexibility; reduce greenhouse gas emissions; avoid the economic losses associated with catastrophic failures and wide-area blackouts; foster energy conservation, energy efficiency and demand response capabilities by providing customers with better energy use information and choices; reduce operating costs and improve reliability and safety by providing real-time information for system monitoring and

system automation; improve maintenance and operations practices on the electrical grid; and facilitate the development of a "Clean Tech" economy, which is expected to include the creation of new jobs. We believe a true smart grid can help America achieve a more secure energy future and meaningful greenhouse gas reductions.

Additionally, Edison believes that many aspects of our smart grid vision will need to be operational by the year 2020 to enable California's ambitious policy goals, such as the AB 32 green house gas reductions, zero net energy homes, California Solar Initiative, smart metering infrastructure, California's renewable portfolio standard, low carbon fuel standard, and wide-spread consumer adoption of plug-in electric vehicles.

To accomplish this objective, Edison's overall smart grid strategy encompasses six areas that address a broad set of requirements:

- Renewable and Distributed Energy Resources Integration
- Grid Control & Asset Optimization
- Workforce Effectiveness
- Smart Metering
- Energy-Smart Customer Solutions
- Secure Telecommunications & Computing Systems

Smart Grid Research, Development & Deployment

Edison seeks to discover, evaluate, and adopt energy and information technologies to implement our smart grid strategy. It is important to keep in context that California is the nation's leader in many of these areas and as such, several components of a smart grid are already in development within Edison's service territory. For example, Edison has already achieved significant results in energy efficiency, demand response, and renewable energy, and is a recognized national and international leader in these three areas. Other aspects of a future smart grid are under development, but their future implementation will enable Edison to meet increased renewable energy goals, further reduce greenhouse gas emissions, and improve system reliability and safety.

Existing Smart Grid System

Edison has made significant investments over the past decade in the deployment of transmission system measurement and control technology, distribution and substation automation, and smart meters for our large commercial and industrial customers. Edison has been a leading developer of wide area measurement and control technologies for over 15 years. Edison's pioneering efforts in the area of synchronized phasor measurement systems allows operators and engineers the ability to monitor the grid at critical points every 1/30th of a second. This is a significant improvement in our ability to assess and respond to the dynamic operating characteristics of the grid that can help avoid widespread electric system collapse. Synchrophasors as compared to SCADA systems is analogous to MRI as compared to X-ray. Edison's synchrophasor efforts were awarded the 2007 T&D Automation Project of the Year award from Utility Automation & Engineering T&D magazine.

Edison has one of the largest deployments of substation and distribution automation in the industry with over half of its 900 substations equipped with automation technology, including state-of-the-art microprocessor-based systems. Edison has also equipped over a third of its 4,300 distribution circuits and most of its nearly 10,000 capacitor banks with automation equipment that operates using wireless networks. Edison's automation strategy allows for both remote

control/monitoring and autonomous control of critical grid components, which helps protect the system during abnormal conditions and maintain reliability.

After the energy crisis in California, it was recognized that providing energy use and pricing information to customers would allow them to make informed decisions about energy consumption that could mitigate wholesale market constraints. As part of a state initiative, Edison deployed smart meters to all of its largest commercial and industrial customers to provide timely energy information and online energy analysis tools to help them manage their energy costs. These customers with peak demand of 200kW or greater consume about 60% of the energy delivered on our grid. Edison's new smart meter program is designed to extend this capability to our small commercial and residential customers.

Current Smart Grid Projects

Edison is currently poised to take our grid to the next level over the next four years with another round of investments. In 2008, the California Public Utilities Commission (CPUC) approved our deployment of our Edison SmartConnect™ meters to five million residential and small commercial customers beginning this year and proceeding through 2012. Earlier this year, the CPUC approved Edison's 2009 general rate case that included about $270 million in smart grid investments related to advanced electric grid measurement and control systems that enable, in part, the integration of large-scale and distributed renewable generation and improve the overall operation of the electric grid. Also, Edison will expand synchrophasor technology to all of Edison's bulk transmission system – the largest deployment in the United States. Combined, these projects bring Edison's planned level of smart grid capital investment to about $1.5 billion over the next four years. This investment will provide important foundational elements, but more technology investment over the coming decade will be required to meet Federal and California climate, renewable and energy policy objectives and to realize additional operational efficiencies.

RD&D Overview

In the electric utility industry, Edison has a unique and comparatively large research, development and demonstration (RD&D) effort to support the achievement of our 2020 objectives. The current RD&D strategy is focused on three key themes:

1. **Integration and managing complex systems**
   - Renewable integration modeling and analysis
   - Telecommunications
   - Computing systems and data management
   - Interoperability standards development
   - Cyber-security
2. **Game-changing energy technology**
   - Energy storage
   - Superconductivity applications
   - Electric transportation
   - Self-healing distribution automation
   - Consumer end-use technology
3. **People and processes**
   - Customer adoption of energy smart technology
   - 21st Century electric utility workforce
   - Robotics, unmanned aerial vehicles, mobile workforce automation
   - Safety equipment

A significant level of complexity will be introduced to the electric grid over the next decade. Edison is working with leading research universities such as Caltech, MIT, Stanford, University of Southern California and Carnegie Mellon to better understand "system of systems" complexity, designing computing systems models and event scenarios to understand the nature of the future electric grid. Edison is also working with aerospace-defense and information technology firms to identify opportunities to adapt telecommunications, cyber-security and data management technologies.

Several game-changing energy technologies are expected to become commercially and economically viable over the next decade, including various forms of energy storage, high-temperature superconducting equipment, various forms of electric transportation, advanced self-healing distribution automation equipment and energy smart consumer devices/appliances. Edison is working with several national research labs, EPRI and manufacturers on the development of products from prototype testing to field demonstrations through commercial introduction on Edison's system. One example is the live demonstration of second generation distribution circuit automation on a Department of Energy (DOE) co-funded project called Avanti that also includes the world's first high temperature superconducting fault current limiter. Another is the work Edison is conducting at our Electric Vehicle Technology Center (EVTC), where we work closely with auto manufacturers on electric-drive systems and battery manufacturers on emerging mobile and stationary storage applications. Edison was honored to have President Obama visit our EVTC facility earlier this year.

In the area of people and processes, Edison is looking ahead to evaluate the consumer, organizational and workforce impacts of introducing a vast range of new technologies, customer programs and related operational process changes. Edison has engaged a consortium of universities to conduct research on the "Energy Workforce of the 21st Century" and has conducted consumer research to better understand technology adoption behavior with leading design firms like IDEO.

Edison is actively pursuing stimulus funds for two smart grid demonstrations and development of electric transportation. For smart grid, Edison will seek matching funds for both utility-scale energy storage utilizing automotive grade batteries and a regional smart grid demonstration that includes the development of a secure energy network for the smart grid. Edison participated in three electric transportation proposals currently under evaluation with the DOE. One was related to the development of plug-in electric vehicles with GM, The second proposal was for plug-in hybrid utility bucket trucks with Ford and Eaton and the third expands public charging infrastructure with Ford, the California Air Resources Board and other stakeholders in Southern California.

Interoperability Standards and Cyber-security

Edison recognizes that advancing smart grid interoperability and security through standards adoption fosters innovation and accelerates robust, secure and reliable technology deployments. This is achieved by lowering the barriers to entry for vendors; accelerating secure and interoperable product time to market; and ultimately lowering costs for consumers. Unfortunately, realizing the benefits of standardization requires more than just selection of a standard. Full realization of the benefits will require a shared government, utility and product supplier focus on a common set of smart grid functions, and a standards lifecycle framework supporting those functions. The goal of this standards lifecycle framework is to align policy, standards development, product development and procurement actions to create a self-sustaining smart grid market. A successfully operating, self-sustaining smart grid product market is defined

by public policy supported by standards that are rapidly adopted by product suppliers seeking certification, and driven by utility procurement agents only buying products certified to those standards.

To realize this goal, Edison has been active over the past five years in several DOE sponsored efforts, including the GridWise Architecture Council to define use cases, user requirements, and reference designs. Over the past year, we have been increasingly active with the National Institute of Science and Technology's efforts to identify and recommend standards for the smart grid. Edison's long standing participation with several industry and standards organizations provided an opportunity to work more closely with both DOE and NIST on the development of standards in several areas, including customer access to energy information and a set of smart grid cyber-security specifications and profiles. For example, Edison is one of a dozen utilities that contributed funding to the smart meter security effort with DOE last year and is currently co-funding a broader smart grid effort in collaboration with DOE and NIST. Also, Edison along with several other utilities has been championing the development of an open standard and secure interface for customer access through a web services provider to customer related energy information on utility computing systems. NIST is leading an effort to coordinate the development of such a standard and Edison is actively supporting the effort.

Integration of new technologies with existing technology

Edison defines "interoperability" as a characteristic that permits seamless communication and exchange of information between diverse, disparate systems. The national and utility grids will need interoperability of key future smart grid technology components to support a robust, flexible, and secure energy infrastructure. Edison's vision for a smart grid has long been premised on the idea of "interoperability from the generator to the customer, and everywhere in between." This is important for stimulating vendor competition, fostering innovation, and realizing lower costs. Edison also supports criteria that, where appropriate, call for future smart grid deployments and enhancements to be interoperable with existing capital investments. The challenge is developing a systems architecture and roadmap that provides a graceful transition from the existing systems to the future state. For example, Edison has invested heavily in substation and distribution automation, and believes it is prudent to leverage this existing infrastructure for future smart grid enhancements as much as possible. Computing systems and telecommunications have evolved over the past twenty-five years to the mostly plug and play state that we know today – Edison expects the smart grid to similarly evolve over the next two decades given the typically long asset lives and the need to balance large capital costs with consumer rate impacts.

Smart grid benefits & Consumer adoption

Smart grid benefits can be generalized into three categories; utility operational benefits, customer energy savings benefits and societal benefits. In terms of utility operational benefits, many of the smart grid technologies involve automation of existing business practices that create substantial reductions in labor. For example, Edison's residential smart metering program created benefits that exceeded costs by about 110% on a net present value basis, with nearly 60% of the benefits derived from reduction in labor and related costs due to the elimination of the meter reading function. Other operational savings result from operational efficiencies in financial transaction management and field operations. The other 50% of the smart metering benefits come from energy procurement cost savings as a result of enabled demand response programs and reduction in residential energy consumption due to energy information.

Consumers will have a new range of energy management services and programs available from utilities and third parties that are enabled by smart metering, energy storage, energy smart appliances and plug-in electric vehicles. In a survey of research studies by Oxford University, and subsequently validated in limited field trials in the industry, consumers are expected to save on average between 5-15% on their monthly electric bills if they actively participate in dynamic pricing and energy conservation related programs. Consumer benefits also include improved customer experience from automated services like turning the electric service on when moving in to a house or apartment. Over 20% of Edison's 4.9 million customers move each year so this is a significant improvement. Customers will also experience improved service reliability and faster outage response as the smart grid is deployed.

A substantial portion of smart grid benefits are societal in nature and include national and state priorities, such as achieving energy independence, reducing greenhouse gas emissions, and increasing grid security, safety, and reliability. These benefits are often difficult to quantify, they may vary widely in their justification of various smart grid technologies, and they are multi-tiered in terms of who benefits from them. Benefits may relate to Edison customers, California residents in general, or society at large. These benefits should be considered by policymakers within the context of a complete portfolio of smart grid technologies, as the benefits may not accrue to any one project, but the integrated system which would necessarily be deployed over an extended time horizon.

Consumer adoption of new pricing, energy conservation and demand response programs will be one of the largest behavioral change management initiatives undertaken in public policy. However, based on Edison's research, we believe our customers are ready to change how much and when they use electricity. Edison has conducted persona based customer research over the past five years and the majority of our customers now are actively looking for a way to either reduce their energy costs to manage their monthly budget or reduce their energy use to reduce their carbon footprint. Consumers do not want to be wasteful and recognize that the smart use of energy will save them money and help make a positive difference for the environment.

One key is to provide customers information that is actionable. This is one of the values of a smart meter system especially combined with dynamic pricing. Another key is make the process simple and use technology to automate the customer's desired outcome. For example, to enable a customer who wants to manage to a monthly budget amount for electricity, Edison is creating a daily electric budget manager that notifies the customer if their usage will likely exceed the target budget in advance through online, text messages or cell phone application. Edison is also working with many product and service providers to create this type of automation. Edison recognizes that we have a once in a lifetime opportunity to engage and educate our small commercial and residential customers when we replace all our approximately five million meters over the next three plus years.

Conclusion

The electricity infrastructure delivering power from a variety of generating sources to our homes, businesses and communities is not suitable for today's needs. The challenges that face our nation's energy future simply cannot be met by our aging electric grid. Growing renewable energy capacity requirements, global climate change provisions, and the pressing need for more energy self-determination on behalf of customers all require a smarter, more intelligent grid. Edison is making significant investments in both capital infrastructure and smart grid R&D to accelerate our ability to support the future.