



## Section 2 - VISION

## 2 VISION

### 2.1 A SMART ENERGY FUTURE

SDG&E's vision for a smart energy future is driven both by public policies and by its customers who are currently adopting technologies such as rooftop solar and electric vehicles at rates higher than anywhere else in the nation. SDG&E's customers have also consistently shown support for more renewable generation projects, technologies and legislation. As a result, "Smart Utility," investments are already underway at SDG&E to ensure that it is meeting the unique demands that renewable energy, electric vehicles and rooftop solar are placing on the grid. Additionally, SDG&E envisions a smart energy future in which the rising cost of electricity is managed through new operational and customer-enabling technologies, while consumer privacy and grid security are protected to the greatest degree possible. SDG&E envisions building on its current Smart Grid platform to maintain the utility's high service reliability while supporting more sustainable energy utilization and a cost-effective Smart Grid roll-out.

To date, SDG&E has invested in new technologies and redesigned its business processes to maximize efficiency, reduce emissions, empower customers and maximize customer value. Examples of its efforts include a full-scale advanced metering infrastructure (AMI) deployment and its OpEx 20/20 program, which includes Smart Grid foundational projects such as a state-of-the-art outage management/distribution management system (OMS/DMS), geographic information system (GIS), condition-based maintenance (CBM) and transmission and distribution automation. Helping its customers to save on their energy usage and reduce the amount of electric and gas infrastructure needed through energy efficiency (EE) and demand response (DR) have also been key objectives of SDG&E.

This Smart Grid Deployment Plan builds on these initiatives to maximize its value and benefits as well as create new value and benefits through additional, targeted investments. SDG&E's Smart Grid vision is to work in collaboration with key

stakeholders to create the foundation for an innovative, connected and sustainable energy future in its service territory. One of the key objectives of SDG&E's current Smart Grid programs and vision going forward is to help customers maximize the value of their energy usage and generation.

SDG&E's customers are adopting environmentally-friendly technologies such as photovoltaic (PV) and wind generation as well as PEVs and are beginning to leverage customer-empowering smart meter technology such as Google PowerMeter in greater numbers every day. These exciting technologies bring the promise of extensive benefits to customers and society including reducing the impact of energy usage on the environment, reducing energy dependence on foreign sources, and further developing the ability to better understand and control energy usage and resiliency in the face of a natural or intentional attack on the grid. They also bring new challenges, such as maintaining power quality and avoiding outages as issues associated with the two-way energy flow that results from distributed generation, the intermittent power from solar and wind generation; and the unknown and potentially unpredictable load required by electric vehicle charging are addressed. These and other changes have triggered the start of a major transformation in the electric utility business--transforming the grid of the past into a smarter grid of the future increasingly needed today.

The state of California is also focused on Smart Grid investments that will help reduce emissions. Senate Bill (SB) 17 establishes the overall intent that Smart Grid deployments help achieve the following: the goals of Assembly Bill (AB) 32, the state's 33 percent renewable portfolio standard (RPS); as well as achieving California's distributed generation goals and demand response mandate; improved building and appliance efficiency standards; and implementation of the electric procurement loading order. SDG&E's vision is that utilities will provide the foundation that facilitates the achievement of many of the state's emission reduction goals. The specific means by which this Deployment Plan complies with SB 17 are set forth in detail in Section 2.6 of this Smart Grid Deployment Plan Vision.

SDG&E's vision is to work in collaboration with key stakeholders to create the foundation for an innovative, connected and sustainable energy future. In fact, a broad cross-section of stakeholders from across the service territory provided input to this filing, offering suggestions and recommendations to enhance this vision. SDG&E believes that the focus of its Smart Grid investments should be on maximizing benefits to customers. By leveraging digital and advanced technologies to create a smarter grid, customers will benefit from cost-effective solutions to these new challenges and gain synergies while reducing energy consumption and related emissions from these evolving technologies while also having confidence their privacy is protected. For example:

- Through automation technologies integrated with the Smart Grid, customers will be able to manage discretionary loads, such as home air conditioning and PEV charging in a manner that is the most compatible with local electric distribution needs. By 2020, the use of stationary and PEV batteries can be networked at home, at work, and at shopping malls to help the utility stabilize the grid during partially cloudy days or erratic wind conditions, potentially lowering the cost of PEV ownership, while increasing the amount of renewable energy integrated reliably into the grid;
- Customers will have tools that will help them manage their energy use and costs and make it easy for them to do so;
- Customers will have price sensitive appliances and devices that can be programmed to react to the changing cost of energy and modify behavior to lower energy bills according to customer preferences, such as delaying the refrigerator's defrost cycle to midnight when air conditioner use is low, as well as charging a PEV earlier or later in the in the evening to early morning hours when the wind is blowing more than expected, and even discharging energy from storage when the price is extremely high;

- Customers will be able to ride through electric outages by leveraging microgrid technologies to manage a combination of community energy storage, electric vehicle batteries, load following fuel cells, and distributed solar and wind generation. Eventually PEV batteries will supply energy, and home energy management systems and smart appliances and devices will be utilized to better match energy use to the supply available.
- Customers will be able to look to the Smart Grid for provision of real time prices, energy use information and to enable an array of billing options to enable them to manage energy use and costs.
- SDG&E will be able to provide higher levels of power quality, reduce outages, and reduce restoration time by implementing new technologies. SDG&E will implement Smart Grid capabilities that can provide customers differentiated levels of reliability and power quality that are tailored to meet their specific needs.

Smart Grid investments will provide a utility platform that creates a network of many different market participants throughout the grid, allowing electricity to be generated, stored, delivered and consumed in the most cost efficient and ecologically sound manner possible. This will empower power producers, foster innovation in equipment suppliers, and enable new trading partner relationships and new product markets (which may include things such as allowing customers with distributed generation and storage to participate in balancing, storage and/or ancillary service markets at the distribution service level), all of which will serve to increase efficiency and minimize cost and emissions associated with electricity consumption.

Many utilities across the nation are waiting to see what happens elsewhere before responding to these industry changes. For the San Diego region and SDG&E, however, waiting is not an option. SDG&E cannot wait because:

- Its customers and many stakeholders have shown consistent support for new renewable legislation, generation technologies, and projects--with some already being developed and more being planned in the San Diego region to meet the 33 percent renewable portfolio standard by 2020;
- Its customers have installed more megawatts of rooftop solar in San Diego than utility customers in any other U.S. city. By the end of 2011, over 13,000 – more than 1 percent – of SDG&E customers will have installed photovoltaic systems totaling over 100 MW of capacity;
- Its customers are already taking delivery of Nissan Leaf and Chevrolet Volt electric vehicles, with more Leafs being sold in San Diego than anywhere else in the country (and Ford, Mitsubishi, and BMW have also targeted the San Diego region for their PEV release in late 2011 – early 2012); and,
- Its customers already have access to interval usage data, with thousands signing up for Google PowerMeter. They are poised to leverage new energy management technology.

SDG&E can't wait for others to move forward, because its customers are already moving forward. Consistent with the views expressed by many of the utility's stakeholders, SDG&E envisions a future in which customers are empowered - - with accurate price signals, advanced enabling technologies, a well-designed market structure, and a Smart Grid that allows them to choose how they want to consume and generate their electricity and maximize their energy value based on their own preferences and priorities. Customers will be able to safely add increasing levels of intermittent distributed renewable generation and may even provide grid reliability services to the utility. The electricity grid will be able to accommodate increasing demand from PEVs. Accurate price signals may also encourage more economic decisions regarding charging such vehicles during off-peak and super off-peak hours when prices are low and there is sufficient system capacity and resources. SDG&E will achieve greater efficiencies by

moving to condition-based maintenance and implementing other efficiency improvements through the use of new technologies.

The grid itself will become more resistant and resilient to an ever-increasing number of threats, from cyber-attack to terrorism, and customers and providers alike will be confident that the infrastructure and information they depend on are secure. The Smart Grid will also empower electricity producers and other market participants by creating a network that allows for efficient coordination among many different market participants--from central station generation, capacity and ancillary service resources to distributed generation and demand response resources--and allows electricity to be generated, stored, delivered and consumed in the most cost efficient and ecologically sound manner possible.

SDG&E's vision for its Smart Grid Deployment Plan is intended to create a secure utility platform for the "Smart Customer" that empowers them with reliability, choice, control and convenience. This utility platform of the future is enabled by SDG&E's vision of a "Smart Utility" that is capable of coordinating energy resource operation across the grid, from central station generation and capacity resources sited on the transmission grid, to distributed energy and demand resources sited on the distribution system. Through its utilization and expansion of information delivery channels, SDG&E will provide customers with more timely and relevant information on their energy usage, market prices and system conditions and make them active participants in the Smart Grid of the future. Lastly, by creating a utility platform that ensures reliability and allows resources to respond to accurate and timely price signals and system event conditions, SDG&E will strengthen the efficiency, transparency and security of the grid to support its vision of a "Smart Market" for its customers and all grid stakeholders.

***"SDG&E can't wait for others to move forward, because its customers are already moving forward."***

SDG&E looks forward to working closely with its customers, stakeholders, the Commission, the California Independent System Operator (CAISO), and Federal Energy Regulatory Commission (FERC) to help achieve its Smart Grid Deployment Plan Vision.

## 2.2 SDG&E'S SMART GRID VISION

The electricity industry is facing unprecedented changes. Customers, increasingly concerned with their carbon footprint and rising energy costs, are installing distributed renewable generation resources in greater numbers every year. PEVs are being introduced early in the San Diego market to respond to a growing focus on what an individual can do to have less impact on the environment while reducing their monthly transportation fuel expenses. New technologies are allowing customers to become increasingly empowered to manage their energy usage to minimize electricity costs and air emissions (both greenhouse gases and criteria pollutants) associated with their electricity use.

In order to successfully navigate these changes in a way that maximizes the value of the services, SDG&E has adopted a vision on the basis of input from customers, key stakeholders, and employees. Its vision is set forth below:

*“San Diego Gas & Electric, in collaboration with key stakeholders, will create the foundation for an innovative, connected and sustainable energy future.”*

This is also SDG&E's vision for Smart Grid deployment. SDG&E will work with key stakeholders to deploy Smart Grid technologies that create an innovative, connected and sustainable energy future that provides value to its customers. It will do this by making Smart Grid investments to ensure safe and reliable electricity service as customers invest in renewable DG and PEVs, and allow SDG&E to effectively communicate with customers and their agents regarding their energy use. This “core technical platform” will increase the value of services SDG&E provides and empower customers to consider distributed energy resources (DER) alternatives, after-meter-



services, and/or a PEV, thereby creating a new innovative and improved customer experience. SDG&E's vision aligns with the vision set forth in the Electric Power Research Institute (EPRI) Public Interest Energy Research (PIER) program final project report entitled *California Utility Vision and Roadmap for the Smart Grid of Year 2020*.

In developing this Deployment Plan, SDG&E solicited input from its customers and stakeholders.<sup>1</sup> Three areas of interest stood out as the highest priorities in these discussions: customer behavior/education, demand response and rate design. These key themes and other areas of stakeholder interest are summarized in greater detail below and incorporated throughout this deployment plan:

- 1. Educate Customers on Energy Opportunities and Choices.** Education of customers and all stakeholders is paramount, and significant investment in customer communications and research on customer behavior should be high priorities. Customer behavior and preferences vary, thus the education and product and service offerings need to vary also. "One size does not fit all." Utilizing peer-to-peer education is an important strategy. Significant education will also be needed for SDG&E's workforce who will be integral in offering this education to customers. Educated customers make better choices and are more empowered to make value decisions on energy.

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<sup>1</sup> SDG&E solicited input from the following organizations as it developed this deployment plan:

- Environmental: Environmental Health Coalition; San Diego Audubon Society; San Diego Coastkeeper
- Academia: San Diego State University (SDSU) Center for Energy Studies; University of California, San Diego (UCSD) Division of Calit2; UCSD Office of Strategic Energy Initiatives
- Business Organizations: San Diego Regional Chamber of Commerce; San Diego, North County, East County economic development organizations
- Municipal Utilities/Governmental Organizations: City of San Diego; County of San Diego; City of Chula Vista; SANDAG Energy Working Group
- Ratepayer Advocates: Utility Consumers' Action Network (UCAN)
- Energy NGOs: University of San Diego (USD) School of Law Energy Policy Initiatives Center (EPIC); California Center for Sustainable Energy
- Large Customer/Corporate Interests: Sony; *Additional Large Communications Technology Company*
- Collaborative Organizations: UCSD Connect; Clean Tech San Diego
- Workforce Interests: San Diego Workforce Partnership

- 2. Facilitate Energy Efficiency and Demand Response.** Customer access to energy information, energy prices and emissions by time of day with enabling technologies that allow customers to control and maximize their energy value are critical. This is similar to the importance of communicating with customers in their chosen language; utilities have an obligation to provide and communicate customer specific usage and price information with the customer's chosen communication channel(s).
- 3. Offer Rate Options and Cost Choice.** Cost-based and time-differentiated rates in some form are critical and must be linked by customers to cost-savings to be effective.
- 4. Enable Plug-in Electric Vehicles (PEVs).** SDG&E's goal is to ensure the safe, reliable and efficient integration of PEV charging loads with the utility grid. Community planning is important in addressing the potential future "ramp up" of home and public/commercial PEV charging facilities. Cost-based time-differentiated PEV rates can be an effective way to encourage PEV charging during off-peak hours, and yield other system benefits that could result from a more efficient use of the grid today, and in the future potentially enable longer term PEV charging and electricity storage.
- 5. Enable and Integrate Energy Storage.** There is a consensus in the industry that electricity storage is a critical component in mitigating intermittency and integrating increased penetration of renewable distributed generation. Large-scale storage should be part of the strategy, as should vehicle-to-grid storage.
- 6. Expand Collaboration.** SDG&E, its vendors and suppliers, businesses, partners, community organizations, key stakeholders and academia should all work together to incorporate projects/concepts into Smart Grid deployment. Smart Grid functionality could have significant potential as a local economic driver.

- 7. Support Workforce Readiness.** A Smart Grid will demand a new workforce with specific skills at all levels. SDG&E, academia, business, and labor should work together to create and/or invest in the creation of a new, local “reservoir” of talent with these skills. In addition, there needs to be a proactive approach to working with unions in order to develop agreements that are forward-thinking and collaborative and support a flexible workforce that is able to meet the future needs of the Smart Grid. Current employees will need to develop new skills to adapt to technological and business process changes while HR systems will need to be aligned so that the workforce is flexible and consistent with Smart Grid needs.
- 8. Integrate Distributed Energy Resources (DER).** The Smart Grid must be able to integrate DER resources without adverse impacts on reliability. The Deployment Plan should address how Smart Grid technologies can facilitate development of combined heat and power (CHP) facilities.
- 9. Expand Technology Development.** Investment and collaboration, integration of new technologies to interface with the Smart Grid, as well as business and technology transition strategies are needed to ensure existing technologies are optimized.

SDG&E has developed this Deployment Plan on the basis of its vision and stakeholder input and consistent with the requirements of D.10-06-047. Pursuant to that decision, SDG&E’s Smart Grid Deployment plan describes SDG&E’s Smart Grid vision in the context of three high level concepts – “Smart Customer,” “Smart Market,” and “Smart Utility” below. SDG&E’s Deployment Plan will also continue to evolve as the priorities and expectations of its customers and stakeholders change.

## 2.3 “SMART CUSTOMER”

SDG&E’s vision of the “Smart Customer” is one who is empowered and able to make informed decisions about their energy usage and generation as a result of Smart Grid investments, allowing them to maximize their energy value.

Specifically, Smart Grid investments will create opportunities for the “Smart Customer” of the future to reduce energy cost and use, to reduce their carbon footprint, and to install and effectively utilize DG and after-meter technologies. Under SDG&E’s Smart Grid Deployment Plan Vision, the utility will collaborate with customers and energy service providers to provide customers with more choice on how and when they use energy based on improved information (including accurate price signals) and access to enabling technology.

SDG&E will create a utility foundation for an innovative, connected and sustainable energy future and work with customers and service providers to increase customer engagement with and adoption of new energy management technologies. From a “Smart Customer” perspective, this will give consumers the opportunity to capture the benefits of a wide range of existing and emerging energy technologies and associated energy management products and services that may, or may not, be provided by the utility. These energy products and technologies will empower customers to reduce energy use when energy prices and associated emissions are at their highest, and reduce their overall energy demand, all of which will reduce energy costs and related emissions.

Customers will be aware, informed and knowledgeable about their energy choices, and have the tools to act upon those choices. Customers will use, store, produce, and/or manage energy to meet their individual needs as well as the needs of the grid and energy markets with a clear understanding of its value. Technology, energy-related services, and energy markets will evolve as market participants/actors: (1) they will adopt new technologies that integrate readily accessible information with automated

systems that manage appliances and equipment; (2) they will install competitive distributed generation systems and networked and integrated PEV charging equipment; and, (3) they will optimize energy storage capabilities. In order to achieve these objectives, it will be necessary to ensure the availability of accurate and transparent cost-based rates and pricing and standardized/reliable information. This will enable utility and non-utility service providers to offer competitive products and services that will be valued by customers and 3rd party service providers. SDG&E will create a standardized platform for the transfer of customer usage information to third parties (with customer approval), thereby enabling customers to access third party services and reduce overall market transactions costs.

SDG&E recognizes that engaging with and proactively reaching out to customers is critical to the success of its smart meter deployment and Smart Grid utilization efficiency. Both demand side (customers) and supply side decisions (including self-provided supply) are more efficient if valued-added market information is available to market participants. The Commission and the State have clearly embarked on the path of deploying advanced metering technology (e.g., smart meters). Advanced metering technology is not only achieving operating efficiencies in meter reading, i.e., automating the meter reading process, but as recognized by many of SDG&E's stakeholders, including consumer advocacy groups, business interests, academia, non-governmental organizations, and corporate interests, the availability of more timely and granular (interval) energy usage information can and will change customer behavior.

The change in customer energy usage resulting from smart meters can be categorized into four impacts:

- Information feedback
- Demand response from short run price elasticity
- Energy efficiency or equipment investments including PEVs
- Distributed generation and storage investments

To achieve customer and environmental benefits associated with these impacts, investments are necessary to ensure the availability of energy usage data at the granular level. Customer-specific interval usage information must be presented in a timely, understandable and useful form. Customers must understand their rate structure and the impacts that may result from various dynamic rate options. Time-differentiated rates, in some form, are a critical component in the success of demand response and adoption of new energy management technologies.

### **Customer Education, Outreach and Information**

Unless customers understand the benefits that Smart Grid provides, believe those benefits are meaningful, and believe there is an easy and feasible way for them to participate, they will likely not engage. SDG&E's customer education, outreach and communications strategy will recognize and effectively respond to this challenge. SDG&E must continue to tailor specific customer messages and content to specific customer groups based on how they use energy, how they access information about energy, and how they make energy decisions. In addition, SDG&E will need to work with each segment to ensure two-way feedback/communication so customers have the information to make informed energy choices on demand response, energy efficiency investment measures and self-generation. Customer education and communications will need to include a full range of outreach, beginning with general energy awareness to specific, targeted, customer-selected options. By achieving the forgoing objectives, SDG&E will empower customers to better manage their energy usage and minimize emissions, consistent with the state's policy goals.

SDG&E is also planning to provide various applications for on-line presentment of energy usage, rate comparison analysis, near real-time information and month to date bill alerts, month-end bill projections and high bill analysis.

## **Maximizing Benefits of the Home Area Network and Other Customer Premise Technologies**

Customers will be empowered to participate in and respond to markets on the technical platform created for Home Area Networks (HAN) and other customer premise networks. The platform is comprised of several core components that include the Demand Response Control Application (DRCA), the network communication path into the home or building, the HAN or other devices at the customer's premises, the customer portal applications, and the back office integrations required to support those systems. "Behind-the-meter" services and applications accessed by the customer inside their premises, such as monitoring and management of devices connected to the HAN, could be expanded beyond third parties and extended to utilities, thereby giving customers more choices.

## **Accommodating Increased Plug-in Electric Vehicle (PEV) Penetration**

The "Smart Customer" may drive an electric or plug-in electric vehicle and SDG&E is prepared to accommodate their increased market adoption. After 2012, thousands to tens of thousands of PEVs are estimated to be owned by SDG&E's customers. With an estimated load of 3.3 kilowatt (kW) per vehicle (6.6 kW per vehicle after 2012) this equates to 45 megawatts (MW) of new load<sup>2</sup>, which if not managed and integrated properly, could have a significant impact on the local electric distribution system and potential generation needs. If SDG&E's service territory experiences rapid adoption of PEVs, the outlook for 2020 could be as much as 200,000+ vehicles in the greater San Diego region. Stakeholders in the municipal arena have expressed concern about the impact of the coming "wave" of PEVs.

One of many challenges associated with PEV growth rates will be the "clustering" of PEV ownership (i.e., two or more PEVs served by one neighborhood transformer). This could

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<sup>2</sup> SDG&E EOY2012 estimate

be particularly an issue in the older coastal areas of SDG&E's service territory. In most instances these coastal homes are smaller, do not have air conditioning and the number of customers connected per transformer is greater than neighborhoods with air conditioning load in the inland areas. A 3 kW charging load is comparable to large central air conditioning load that is added to the local distribution system. SDG&E is currently involved with an Electric Power Research Institute ("EPRI") project to further assess the impact of PEVs on the grid, as well as monitoring the PEV loads and charging patterns of PEV customers during the 2011 deployment. Proactively, SDG&E believes it is imperative to examine three areas of system activities: the need for existing facility upgrades, an effective use of smart (monitoring) transformers and understanding the loads generated from the use of public charging infrastructure in order address the coming PEV charging demands, and supporting PEV service providers to provide timely and adequate charging infrastructure.

Finally, under SDG&E's Smart Grid Deployment Plan Vision, SDG&E will enable and support the growth of electric transportation while ensuring the safe, reliable and efficient integration with the grid. SDG&E desires to create an excellent customer experience and build consumer confidence in clean electric transportation.

### **Customer Experience of the "Smart Utility" of the Future**

To ensure that the "Smart Customer" is empowered and informed, SDG&E envisions a customer service experience that meets their preferences and needs while protecting their privacy.

Today's technology, including the internet and smart phones, has changed how SDG&E's customers receive information and handle transactions. They have come to expect instant access to information and via multiple technology platforms. Thirty-eight (38) percent of SDG&E's customers have opted to view and pay their bill online using My Account, and they can already view their hourly energy data on Google PowerMeter. Later this year they will be able to see hourly data through My Account. Smart Meters



and access to energy consumption information will provide its customers the opportunity to have more control over their energy use. They will look to SDG&E to provide them with the tools to understand the information as well as solutions to save energy and money. Communicating this information in an easily-understandable and timely way is what customers will expect and soon come to demand. Customers want choice in communications channels: “text me” with outage info and updates, but “email me” about new programs. In order to meet the needs of its customers and establish the kind of relationship they want from their utility, SDG&E has a responsibility to be able to reach them through their preferred communication channel.

Customers’ concerns about the environment and their economic situations are also growing. Customers want help evaluating savings opportunities associated with replacing their appliances with more efficient ones. With dynamic pricing, customers want to know how they can use in-home displays and HANs to program appliances to go on and off to save money. They are also interested in evaluating investment opportunities like distributed generation, battery storage and electric vehicles and will look to SDG&E for information and insights. Through online channels, interactive web tools, and use of media/video; these often complex analyses and concepts can be more clearly presented, significantly increasing understanding, customer satisfaction and ultimately adoption and engagement in sustainable energy practices.

SDG&E’s investments in mobile applications and social media are necessary to provide the array of utility services (billing, bill payment, energy usage information, demand response programs, energy efficiency programs, low income assistance, etc.) to customers on their chosen communications channels. SDG&E must invest in technical infrastructure and supporting applications to integrate and communicate with its customers.

Empowering customers means providing them with information that raises their awareness so that they can make intelligent (smart) choices regarding their energy

usage. Such information must be delivered to the customer in a timely, transparent, relevant and reliable manner using the customer’s preferred channel. Customers will then be most likely to make decisions (behavior changes) regarding energy consumption. The “Smart Utility” will also need to maintain the ability to communicate with customers that do not use any new electronic media.

SDG&E’s “Smart Customer” vision is to be proactive and collaborative with its customers to deliver mutually beneficial outcomes. This means that SDG&E will continuously work with customers to understand their preferences and provide services via the channels that they value. SDG&E will continue to adapt to its customers’ changing expectations.

As the population in its service territory changes, SDG&E will continue to provide appropriate, multi-lingual customer service representatives and non-English printed material to better communicate with its customers.

## 2.4 “SMART MARKET”

Smart Grid investments will change the existing market by empowering customers to maximize the value of the energy and other services they receive from the grid and participate in demand response and potentially ancillary service markets in the future. With accurate price signals in retail rates, Smart Grid investments will allow markets for DER and PEVs to grow without imposing adverse impacts on customers without DER or PEVs. Smart Grid investments will also improve efficiency in grid operations and reduce costs for customers over time.

Under SDG&E’s vision of an innovative, connected and sustainable energy future, the “Smart Market” will enhance customer service and will provide customers with greater energy service choices, control and convenience. SDG&E will protect customers’ personally identifiable information in a secure environment. Customers will be able to choose alternative energy management and information services. Consistent with feedback from municipal, business-oriented, and consumer advocacy stakeholders,

SDG&E's Smart Grid will ensure that new market participants are able to enter markets and provide services that customers desire. Smart Grid investments will help SDG&E:

- Enhance overall value of identified products as part of the market;
- Improve overall efficiency and operation of DER on grid;
- Facilitate participation of DER into CAISO market (including a pilot program to demonstrate viability);
- Enable time-differentiated rates for storage, electric vehicles and small distributed generation;
- Integrate small distributed generation into the California Independent System Operator (CAISO) market; and,
- Enhance CAISO operational flexibility, while maintaining and/or improving SDG&E's grid reliability.

SDG&E will provide information and ensure the existence of a communication infrastructure that fully enables the capabilities and potential benefits of the "Smart Market." SDG&E will leverage open standards and interoperable architectures to enable existing and new participants to trade information, products and services in these markets.

SDG&E's vision for a "Smart Market" will require price signals that accurately reflect costs to provide utility services and avoid burdening one class of customer with costs that were incurred to serve another customer (cross-subsidization). This will also help promote rational, sustainable and economically efficient decision-making that will allow customers to minimize their energy costs and emissions.

Distributed renewable generation for residential net energy metered customers is a good example of the need for more accurate price signals to create a strategy that will lead to long-term support for, and continued investment in, distributed renewable energy in California. A residential net energy metering (NEM) customer is generally a home owner that has sufficiently high wealth or income or a high enough credit rating

to afford a PV system. When such a customer installs renewable generation, they use SDG&E like a battery – SDG&E stores the electricity the customer generates beyond their current demand, and returns that electricity to the customer when they need it. They also receive whatever electricity they still need from SDG&E under deeply discounted tier 1 and tier 2 rates. Under current rate design, SDG&E does not charge the NEM customer for the “battery,” or “reliability” service it provides. However, these costs are real. Under existing rules, customers that have not or cannot afford to install PV are forced to pay these costs. In order to ensure a long-term sustainable market for distributed renewable energy in California, NEM customers should pay the costs that are incurred to provide these services.<sup>3</sup>

SDG&E’s discussions with various customers and stakeholders have also led to an additional component of SDG&E’s vision for a “Smart Market”: as customer needs and desires evolve, it will be necessary for SDG&E to make low emission electricity commodity services available from the utility in various forms so *all* of SDG&E’s customers have the option of increased access to renewable energy at reasonable prices. All of California’s energy consumers should have the option to choose energy from renewable sources and to reduce their emissions.

## 2.5 “SMART UTILITY”

A “Smart Utility” understands what its customers want, need, and value. Under SDG&E’s vision for a “Smart Utility,” it will create the foundation for an innovative, connected and sustainable energy future in its service territory. Customers are expected to increasingly adopt automated energy management systems, install distributed energy resources, utilize energy storage capabilities, and charge electrical

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<sup>3</sup> One of the unintended consequences of this policy is that customers have no incentive to consider adopting energy storage as part of their system. Even if energy storage installed with a PV system could provide a more efficient solution for a customer than utility storage, it would not be adopted because PV customers can receive storage for free. For this reason, the inaccurate prices that result from NEM stand as an obstacle to the efficient adoption of storage technologies by PV customers.

vehicles. Customers have already told SDG&E that they want more service options. SDG&E will provide customer usage information, prices and critical event notifications through the customer's preferred communication channels. It will develop the distribution system and information technology infrastructure to enable and support growth in these customer alternative energy solutions.

To do this and accommodate California's RPS, Net Energy Metering and Low Carbon Fuel Standard requirements, SDG&E will need to improve its ability to integrate increased levels of renewable generation and electric vehicles into the distribution grid through various Smart Grid investments.

As a "Smart Utility," SDG&E will promote "Smart Markets" by enabling, facilitating, and/or creating reliable and transparent information services that are valued by customers and market participants. SDG&E will enable standard, consistent protocols across markets to provide secure transactions and protect customer information. It will create a platform that allows for efficient coordination between central station and distributed energy resources, managing energy demand based on accurate price signals to minimize costs and emissions. This Smart Grid platform will enable new markets, participants, products, and services. The platform will also allow for predictive capabilities for grid operators that will help minimize the impact of system disruptions to customers.

From a transmission perspective, SDG&E will implement projects designed to improve the speed with which the utility responds to issues on the transmission grid, provide the utility with additional information to allow it to proactively avoid potential issues and to allow it to make more efficient use of its resources. Many of these projects will be designed to improve the speed with which the utility is able to respond to system events.

SDG&E will implement the tools necessary to create a self-healing and resilient system through the use of real-time information to more efficiently utilize its distribution and

transmission assets, the expansion of communicating and remotely controllable field devices, and the support of projects which will protect the utility from the elements. For example, synchrophasors will provide real-time data about the system's status and will ultimately be used for system control and restoration.

SDG&E will also be able to implement Smart Grid capabilities that enable new products and services that provide customers with differentiated levels of reliability and power quality that are tailored to meet their specific needs.

SDG&E's "Smart Utility" vision includes the provision of balancing, storage, reliability and integration services to customers which reflects the value of the service the utility provides and the infrastructure investment that supports it, particularly for distributed generation customers.

To support SDG&E's larger vision for Smart Grid, the company must also consider what role security will play in this new paradigm. SDG&E envisions that by 2020 all Smart Grid participants, from customers to service providers, to regulators, to utilities, must be able to rely on the availability of the system; trust the integrity of the information produced by the system; and be confident that sensitive information is secure from unauthorized access or disclosure. SDG&E's Smart Grid must be resistant to physical and cyber security threats, as well as resilient to attack and natural disasters. It must be aligned with industry standards and best practices. Because resources are finite, it must be built on a security program that uses well-established risk management methodologies to maximize its security investments.

To realize this vision, security programs and infrastructure must make Smart Grid participants aware of the following: the utility must have greater visibility into the system state, as well as events taking place on the system; customers must understand their own role in better protecting their privacy; each system stakeholder must have

more information to help the utility reduce the overall risk of the Smart Grid with an emphasis on creating a culture of security<sup>4</sup>. Security management functions must converge with central governance by the utility. This management must be open and federated for company-to-third-party interoperability. Company security processes, such as incident response, must be integrated. For system resistance and resilience, centrally managed security policies will disperse, being driven into localized islands or communities of infrastructure to allow the system to continue to protect itself in the event it becomes isolated from the whole.

SDG&E's Smart Grid Deployment Vision for security will benefit customers by ensuring a trusted and reliable infrastructure that will enable them to better manage their energy usage and will provide them a broader choice of energy opportunities that fit their lifestyle, whether it is saving money or choosing from a wider selection of sustainable energy generators.

Being resistant to physical and cyber attack is a key theme of SDG&E's Smart Grid Deployment Plan Vision. It is essential that the Smart Grid be designed around industry best practices and standards. It is important to develop a risk management-based security program that enables business risk owners to apply resources where the Smart Grid needs them most, based on known threats, vulnerabilities and impacts to the Smart Grid. It is also imperative that the utility enhance its situational awareness capabilities to identify and respond more quickly to physical or cyber events that could be precursors to a larger security incident.

Security will not only be embedded in SDG&E's Smart Grid's operational processes and technologies, but also in the people that participate in the generation, transmission, distribution and consumption of energy, including utilities, third parties and customers. These risk owners within SDG&E will continue to include physical and cyber security

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<sup>4</sup> Aligns with the Energy Sector Control System Working Group's "[Roadmap to Secure Energy Delivery Systems.](#)"

risks in their decisions. Utility employees, third parties and customers are informed and understand the shared obligation to protect every individual's privacy as well as the Smart Grid itself.

Smart Grid will act as an important and powerful economic driver for the region, as it serves as a platform that can be a focal point for new, innovative products and services, thereby giving rise to the growth and development of new and existing businesses. By introducing experienced, qualified and certified Diverse Business Enterprise (DBE) suppliers and helping new potential DBE providers expand their technical capabilities and capacity, SDG&E will leverage Smart Grid to ensure the continued growth of opportunities for DBEs.

A "Smart Utility" will require a smart workforce. As stakeholders in academia have recommended, SDG&E plans to develop a labor pool in partnership with universities, colleges, and trade schools that is trained and prepared to install, integrate, and manage smart technologies for the utility and third parties. This will lead to a workforce that is motivated, enabled, and competent to meet the needs of all the domains and functions of the Smart Grid initiative, maintain systems that support and create a workforce that is flexible and able to adapt to both immediate needs as well as needs 5-10 years in the future, and ensure that all supporting HR systems are aligned and consistent with the strategies of the Smart Grid initiative.

SDG&E has a strong commitment to ensure its workforce reflects the labor markets it serves. Therefore, as with all of its recruitment strategies, SDG&E will ensure the outreach for all employment opportunities related to Smart Grid is inclusive to all communities.

## 2.6 IMPLEMENTING THE POLICIES OF SB 17

In D.10-06-047, the Commission requires utilities to explain how their Smart Grid Deployment Plan Vision will further the following policies embraced in SB 17:



- a. Create a self-healing and resilient grid;
- b. Empower consumers to actively participate in operations of the grid;
- c. Resist attack;
- d. Provide higher quality of power and avoid outages, saving money;
- e. Accommodate all generation and storage options;
- f. Enable electricity markets to flourish;
- g. Run the grid more efficiently;
- h. Enable penetration of intermittent power generation sources;
- i. Create a platform for deployment of a wide range of energy technologies and management services;
- j. Enable and support the sale of demand response, energy efficiency, distributed generation, and storage into wholesale energy markets as a resource, on equal footing with traditional generation resources; and,
- k. Significantly reduce the total environmental footprint of the current electric generation and delivery system in California.

SDG&E's plans for implementing these policies in 2015 and 2020 are summarized below.

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#### A. CREATE A SELF-HEALING AND RESILIENT GRID

SDG&E's Smart Grid vision includes implementing the tools necessary to create a self-healing and resilient system through the use of real-time information to more efficiently utilize its distribution and transmission assets, the expansion of communicating and remotely controllable field devices, and the support of projects which will protect the utility from the elements. Synchrophasors will provide real-time data about the system status and will ultimately be used for system control and restoration. These applications at substation systems will utilize algorithms to make decisions at the transmission and distribution level. This will allow isolated fault detection and remove operator or human intervention that tends to increase restoration times. Automated decisions will reduce outage durations and increase reliability.

Under SDG&E's vision, SDG&E will implement increased self-healing properties and resiliency on its distribution system under the following implementation roadmap:

**By 2015**

- Automatic fault detection, isolation, and service restoration capabilities are being enabled, requiring minimal human intervention and leading to improvement in outage reporting measurements.
- PEV growth is supported and encouraged through the application of new technologies to manage customer load and facilitate electric vehicle charging to minimize impacts to the grid.
- The network is designed and provisioned with alternate communication coverage should a critical node fail. Grid communication protocols and placement of wireless aggregation radio sites support intelligent automated failover.

**By 2020**

- Supply side network reliability management and predictive capabilities are in place.
- SDG&E is enabling differing levels of reliability, depending on customer needs for self sufficiency, with corresponding tariffs (particularly for C&I customers).
- Redundant network services are deployed to targeted areas to ensure continued availability for critical applications.
- Full self-healing infrastructure allows for proactive repair of the system before events become customer impacting incidents.

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**B. EMPOWER CONSUMERS TO ACTIVELY PARTICIPATE IN OPERATIONS OF THE GRID**

It is SDG&E's vision to provide customers with near-real time signals via price and/event triggers to balance supply and demand. Customers may elect to participate in programs

with event triggers that manage and control customer end-use load. Utilities, the CAISO and/or third parties will provide capacity payments or incentives, or markets for energy or ancillary services that will be available for customer participation (same day and near real-time programs) as described in the prior “Smart Market” description. Pricing will reflect the value of capacity to the utility and society (value of service). Programs will provide customers with capacity payments or other incentives for capacity. SDG&E will facilitate and empower consumers to actively participate in grid operations by providing more information about the grid’s operational condition and associated energy pricing. The utility will develop systems that will enable dynamic optimization of grid operations and resources, including appropriate consideration for asset management and utilization. All customer and grid systems monitoring, controls and information transmission will adhere to cyber security standards; and customer privacy will continue to be protected according to best practices.

SDG&E’s vision for empowering customers through Smart Grid deployment is set forth in greater detail below.

**By 2015**

- SDG&E and third parties are providing HAN and other customer premise network capabilities, providing customers real-time feedback on power consumption and energy pricing.
- Standardized/reliable customer specific interval usage information and time-differentiated price signals are available and transparent, enabling customers to make informed and cost-based energy use decisions.
- SDG&E is providing options for customers to control and prioritize control of their loads to accommodate distributed renewables and efficiently integrate PEV loads.
- HANs and other customer premise devices are improving price-based and event-based demand response through automation. HAN and other customer premise

devices act as low-cost interfaces with automated applications for demand bidding and other DR program participation.

- SDG&E is implementing two-way communications between utility field networks and customer premise networks to enable customers to participate actively and securely in demand response, electric vehicle home charging, and retail wind and solar energy programs.
- SDG&E has extended grid communications to the distribution system, enabling distributed generation customers who provide energy back to the grid to report and view near real-time status of usage, rates, and system status.

### **By 2020**

- HAN and other customer premise communications continue to be extended into multi-tenant buildings (i.e., apartment buildings, high-rise, and premises physically removed from the meter location).
- Energy management systems capabilities are being embedded into most electronic devices such that direct communication via the Internet is an option for customers and manufacturers of appliances and other equipment. Utilities or other third parties can transmit to and receive signals from such devices.
- SDG&E is providing options and tariffs for customers to sell generation using distributed energy resources, dynamic market pricing, “electric vehicle to grid” applications, or energy storage discharge to optimize overall system efficiency and costs.
- Integrated systems are enabling a holistic approach to data management of customer information, GIS and other data that will lead to further innovation and cost-effective energy use decisions.

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### C. RESIST ATTACK

Being resistant to physical and cyber attack is a key theme of SDG&E’s Smart Grid Deployment Plan Vision. It is essential that the Smart Grid be designed around industry

best practices and standards. It is important to develop a risk management-based security program that enables business risk owners to apply resources where the Smart Grid needs it most, based on known threats, vulnerabilities and impacts to the Smart Grid. It is also imperative that the utility enhance its situational awareness capabilities to identify and respond more quickly to physical or cyber events that could be precursors to a larger security incident. SDG&E realizes that it cannot achieve its security goals alone. Raising the awareness of every actor and participant, including utility employees, third parties, consumers, and even regulators of a Smart Grid will be imperative to ensuring everyone understands their shared obligation to protect the Smart Grid.

SDG&E's vision is to converge security management and customer privacy capabilities across its risk owners and set enterprise-wide policies that can be collectively acted on by a wide variety of disaggregated defense mechanisms through the use of intelligent automation. This convergence allows the utility to establish inter-connected security capabilities such as incident response or key management, which work together within the utility and interoperate with third parties that have need-to-know or need-to-share security information with the utility. Finally, by disaggregating security control capabilities, such as video surveillance, malware prevention, event logging or intrusion prevention, SDG&E recognizes that even small portions of Smart Grid archipelagos need to be able to better protect themselves if they are disconnected from the larger whole for periods of time with response times improved to better support a real-time environment.

All SDG&E projects will be done in a manner that is designed to resist attack. For example, SDG&E envisions that its transmission system will involve increased transfers of data, remote or automated control and increased interactions with customers, generators, the CAISO and other market participants. SDG&E will proceed only when the security of the system will not be compromised.

SDG&E will also strive to ensure that the electric system, IT systems, smart meters and new Smart Grid technology deployments are designed to resist attack from outside sources so that service reliability is not jeopardized. This will be accomplished as follows:

**By 2015**

- SDG&E continues to ensure that all Smart Grid technologies applied to the electric distribution system are designed with control and communication systems that are highly resistant to outside intrusion or other unauthorized uses.
- Equipment manufacturers are using internal component designs that have hardware enabled detection for outside intrusions to enable isolation of affected equipment.
- End-point security enforcement and centralized security policy management are increasing system security inside and outside data and control centers.
- Smart Grid network security continues to improve, further protecting against unauthorized access and incorporating responsive intrusion detection and prevention measures.
- Communications networks are architected, configured, operated, monitored, and audited consistent with evolving regulatory policy and security best practices.

**By 2020**

- SDG&E continues to work with technology providers to develop new control systems that can automatically detect an attack and reconfigure to resist attack.
- Enhanced security, accountability and auditing capabilities in private and public clouds are enabled, lowering the overall costs of data storage and computation while improving the system's resistance to attacks.

- Smart Grid applications provide detailed logging of events enabling transactions to be traced from end to end and correlated with other events or messages for improved security, problem resolution, and performance monitoring.

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#### D. PROVIDE HIGHER QUALITY OF POWER AND AVOID OUTAGES

SDG&E will provide higher levels of power quality, reduce outages, and reduce restoration time by implementing new technologies. These will provide dynamic voltage regulation to increase power quality as well as automated fault location and switching during forced or unplanned outage conditions. Under SDG&E's vision, SDG&E will implement Smart Grid capabilities that enable new product and services that provide customers differentiated levels of reliability and power quality that are tailored to meet their specific needs. Automated demand response methods will also be used to balance local system conditions, and smart meters will provide "last gasp" alarms which will assist in real-time identification of local outages.

Improved measurement, control, protection, management, and optimization of the grid will allow SDG&E to avoid outages by anticipating potential problems and responding before they become an issue, or by quickly adjusting the transmission and distribution system to minimize any potential outages. The increased data about the conditions of the system will allow SDG&E and the CAISO to provide a higher quality of power by more quickly recognizing when the power quality is deviating from ideal and adjusting the transmission system to correct issues at an earlier time period. The initial steps in this process will focus on increased measurement and recording through new systems, followed by putting that data to use in control and protection projects.

Under SDG&E's Smart Grid Deployment Plan Vision, power quality issues will be more easily identified through the use of detailed, widespread, and dependable data collected throughout the system. Outages will be more clearly defined through the use of smart meters and other sensors, and lessened or avoided by the expansion of remotely controllable field switches and self-healing practices.

Cost-based rates, dynamic pricing and demand response will also enable new products and services to help customers manage their energy usage. Third party information service providers, demand response aggregators, and alternative energy management service providers will provide value-added services given transparent and timely price signals.

SDG&E's vision for providing higher quality of power and to avoid outages is set forth in greater detail below.

### **By 2015**

- SDG&E, along with the CAISO, continues to develop and deploy solutions that mitigate intermittency caused by high penetration of renewable generation.
- Automatic fault detection, isolation, and service restoration capabilities are being enabled, requiring minimal human intervention and leading to improvement in outage reporting measurements.
- PEVs are being integrated in larger numbers, without impacting distribution service reliability.
- Proactive outage communication, fewer and shorter outages, higher customer satisfaction, and fewer complaints are achieved through application of new communications, sensor, and control technologies.

### **By 2020**

- Distributed generation, energy storage, and demand response are being managed for use as virtual power plants and other applications.
- Fully integrated data systems are enabling a holistic approach to data management improving overall utility situational awareness regarding the state of the grid.



- SDG&E is installing advanced voltage regulation equipment to improve power quality.
- SDG&E continues to work with the industry to develop interfaces with customer loads to allow dynamic control and regulation.

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## E. ACCOMMODATE ALL COST-EFFECTIVE GENERATION AND ENERGY STORAGE OPTIONS

SDG&E will strive to accommodate all cost-effective generation and energy storage options by implementing new Smart Grid technology which will address voltage regulation, power quality issues and other impacts caused by new variable energy resources. The following outlines SDG&E’s vision for implementing these capabilities.

### **By 2015**

- Open systems and standards exist to facilitate a “plug and play” approach to the integration of various DER sources, energy management systems, and services.
- SDG&E’s system integration platform provides improved interoperability among different systems.
- Smart Grid communications are enabled along distribution lines connecting DER and energy storage providers, enabling timely and secure information exchange with distributed renewable energy providers, energy storage partners, and the CAISO markets.

By 2020, PEVs and DER products and services will reach mainstream, supported by regulatory mechanisms. Third parties will help customers with making supply and storage decisions. All electronic devices will be networked with energy management capabilities such that customers can maintain comfort, control, and choices with a net-zero energy home and businesses. SDG&E’s vision is to enable these capabilities as follows.

## **By 2020**

- SDG&E continues to develop control and communication systems to facilitate aggregation of energy storage and distributed energy resources, including “vehicle to grid” applications.
- SDG&E continues to develop forecasting capabilities for energy storage capacity and distributed energy resources.
- SDG&E is providing customers with opportunities to actively participate in the market using open standards and commercial-off-the-shelf (COTS)/in-house applications by leveraging time series data and event correlations, as well as meter data brought together using system integrations.
- Next generation wireless communication technologies enable greater geographic coverage and higher data capacity for monitoring and managing an increasing number of Smart Grid field area network devices.

## **F. Enable Electricity Markets to Flourish**

Under SDG&E’s Smart Grid Deployment Plan Vision, customers will have access to energy and ancillary service markets at the CAISO and SDG&E will work with the CAISO and other market participants to ensure that new markets are developed, or existing markets are improved to provide for services or energy needed for the continued operation of the grid. Third parties will continue to develop value-added services to meet customer and market needs, and SDG&E will provide the platform. SDG&E’s customers’ energy-related decisions will be integrated with other parts of their lives -- e.g., mobile devices, PEV charging at the mall. It is even possible that aggregation of energy demand and renewable generation resources develop. SDG&E provides the core technical platform on which these services can be provided. In addition to various Smart Grid investments, this transition will also require a transition to accurate price signals, so efficient markets emerge and customer decisions can be made that minimize energy costs and emissions, without unfairly benefitting customers that have

alternatives such as rooftop solar at the expense of those that do not. It is also important to SDG&E that all market segments have access to distributed energy systems, including underserved communities.

SDG&E will facilitate its customers' participation in DR rates and programs. Automated Demand Response (Auto DR), Residential Automated Control Technologies (RACT) and other automated technologies will receive dispatched triggers or prices and will be able to initiate localized responses to balance or control local grid conditions.

SDG&E will continue to support and implement technologies that adhere to industry open standards for interoperability and integration. These system-compatible technologies will provide energy management services and systems and controls functionality that are integrated with the HAN and SDG&E support systems.

More specifically, SDG&E's vision is to encourage, promote, and assist electricity markets to flourish through application of new technology and communication systems as follows:

**By 2015**

- SDG&E and third parties are enabling greater customer choice through HANs and other customer premise networks.
- SDG&E's system integration platform provides improved and more cost-effective interoperability among different systems.
- SDG&E is implementing identity federation to ease customer access to different applications and third party applications with a single identity.
- SDG&E continues to deploy flexible web and mobile application platforms providing easy information access for customers via different channels: portal, mobile access, etc.

- SDG&E is providing customers with a choice of user interfaces (e.g. portal, client, smart device) and notifications services (SMS text, Facebook, Twitter, etc.) that allow them to manage access, and view pricing information.
- Distributed energy resources are able to participate in CAISO markets, enabling improved utilization of all energy resources within the CAISO operating area.

### **By 2020**

- SDG&E's Distributed Energy Resource Management System (DERMS) is fully functional and interfacing with customer loads and resources, supporting the planning and utilization of all distributed energy resources.
- The market continues to efficiently integrate the aggregation of distributed resources, including electric vehicle to Grid applications, and energy storage.
- Price signals reflect efficient markets and the utility role moves toward that of a market facilitator.
- Energy management systems capabilities are being embedded into most electronic devices such that direct communications via the Internet is an option for customers and manufacturers of appliances and other equipment. Utilities or other third parties can transmit to and receive signals from such devices providing capabilities for finer grained management of distribution resources and loads.

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### G. RUN THE GRID MORE EFFICIENTLY

SDG&E's vision will be implementing several projects that will lead to a more efficient grid. A major theme within this will be the use of dynamic ratings in order to optimize the utilization of its assets. This will be especially helpful as SDG&E finishes a phase identification process to optimize capacity.

The expansion of remotely controllable isolation devices and other wireless technologies monitoring the grid will provide a detailed representation of SDG&E's real-

time operations from which educated and effective decisions can be made. To ensure its field force is as efficient as possible, workforce enablement projects have been put in place to digitize SDG&E's crews and start to have a faster, more environmentally friendly system which will be connected through computers and wireless communications.

Improved data on the conditions in various parts of the grid will allow SDG&E and the CAISO to optimize power flows on the grid and minimize losses, leading to a more efficient grid. Time-of-use rates will modify customer energy usage patterns. Asset life and operating capacity begin to be optimized via real-time information and analytics and maintenance costs will be reduced via better information that begins to enable resource optimization.

As the grid becomes more observable, SDG&E will need to meet the requirements to support advanced grid control and business operations.

SDG&E's vision for ensuring that the electric system efficiency is improved through optimization of design of equipment, implementation, and optimization of control as follows:

**By 2015**

- Improved voltage regulation of the distribution system through energy storage, automated capacitor switching, and other devices is resulting in lower system losses.
- Robust grid communications are enabling near real-time and real-time access to information required to more efficiently operate the grid.
- SDG&E continues to improve asset tracking and management through more comprehensive asset synchronization.

- SDG&E continues to enhance near real-time analytic services for control room analysis (via time-series based or alternative analytic tools) to enable predictive analysis, geospatial analysis.
- “Smart Charging” applications are enabling the integration of greater numbers of PEVs while helping to maximize distribution system efficiencies.
- SDG&E continues to integrate capabilities for field crews, including exploration into alternative tools (e.g., heads up displays, energized line notification, manuals on demand, goggles, wearable computing gear), and provides improved computational resources for field crews at the point of work.
- Community colleges, trade schools, and universities have Smart Grid based curricula that provide utilities with a Smart Grid-ready recruiting pool.

### **By 2020**

- Optimization of renewable resource dispatch is leading to more efficient use of resources and lower system losses.
- Ancillary service markets are allowing use of distribution-level resources to support the transmission system, resulting in better load dispatch and lower system losses.
- Capital expenditures are deferred or reduced through better planning information and utilization of distributed resources.
- SDG&E is leveraging time series data and event correlations to provide predictive capabilities that improve management of individual assets and system operating performance and health.
- SDG&E is partnering with educators to provide onsite university level training for Smart Grid subjects.

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## H. ENABLE PENETRATION OF INTERMITTENT POWER GENERATION SOURCES

SDG&E's vision includes enabling high penetration of intermittent renewable resources by using advanced technologies in energy storage (utility, customer and third-party owned), providing advanced control of and management of these intermittent renewable resources, and solid state voltage regulation as follows:

### **By 2015**

- SDG&E is architecting and enabling network connectivity and/or network interface points to enable secure and timely information exchange for intermittent power generators to participate in energy information services and events.
- Installation and provisioning of cost-effective energy storage, either utility, customer, or third-party owned, is helping to resolve voltage regulation, voltage flicker, and intermittency of renewable resources.
- Residential distributed generation output has metering and control options enabled by HANs.
- SDG&E is continuing to expand extranet connectivity for secure third party integrations to the utility and Smart Grid applications.

### **By 2020**

- Advanced inverter controls (for both distributed and central station renewables) are smoothing intermittency associated with solar and wind resources.

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## I. CREATE A PLATFORM FOR DEPLOYMENT OF A WIDE RANGE OF ENERGY TECHNOLOGIES AND MANAGEMENT SERVICES

SDG&E's vision is to provide an infrastructure for the electricity grid that allows for the utility, customers and third parties to install a wide range of energy technologies and system management services. These will enable a wide range of energy technologies to

be incorporated into the grid without adversely affecting, and indeed actually assisting, in the reliable operation of the grid. SDG&E's vision of this platform includes:

**By 2015**

- SDG&E's communication platforms for distribution Smart Grid devices allow future expansion and enable new technologies and services to integrate into the network.
- SDG&E continues to provide open access for applications/services with common data standards for both internal and external information exchanges.
- SDG&E's secure wired and wireless networks enable deployment of a wide range of energy technology devices and services, with layered RF networks enabling communication solution flexibility.
- SDG&E's HAN and other customer premise communications capabilities facilitate the continued integration of new energy management devices including end-use control automation.
- SDG&E continues to conduct RD&D with other parties to help bring more smart-grid related technologies to the market.

**By 2020**

- New Smart Grid distribution sensing and control devices are being integrated to improve distribution system scheduling, management, and operational support.
- Synchrophasor data is being used to assess the condition of the grid and respond to changes before they become problems. This functionality will potentially enable and/or require new products and services in the CAISO markets, especially the ancillary services market.
- Next generation wireless communications technologies and techniques are improving to support the increased volume of vaulted and underground distribution electric infrastructure.



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J. ENABLE AND SUPPORT THE SALE OF DEMAND RESPONSE, ENERGY EFFICIENCY, DISTRIBUTED GENERATION, AND STORAGE INTO WHOLESALE ENERGY MARKETS AS A RESOURCE, ON EQUAL FOOTING WITH TRADITIONAL GENERATION RESOURCES

SDG&E will work with the CAISO to ensure that those resources that can, and want to, can participate in the CAISO wholesale energy and ancillary service markets. Under its Smart Grid Deployment Plan Vision, SDG&E plans to make automated technology available to customers and facilitate third-party provisioning of technology that can dispatch demand response, DG and storage on an individual customer basis or as an aggregator. Wholesale energy markets and wholesale prices will be translated into retail prices for customers in a transparent and timely manner. As SDG&E empowers its customers to become more involved in their energy usage, SDG&E envisions a new grid with complex systems allowing demand response programs that help both the utility and the customer, energy efficiency practices that become the norm and not just for those who are “green,” the further expansion of distributed energy, and the introduction of energy storage to support the system.

SDG&E will provide customers with their own customer specific information on energy usage and dynamic pricing which will enable:

- Energy conservation because of the information feedback impact;
- Energy efficiency investment measures (equipment, appliances, others);
- Demand response; and,
- Distributed generation and storage investments for an on-premise energy source and market availability of stored energy (customers can sell into market at a price if combined with automated demand response).

SDG&E will support the sale of demand response, energy efficiency, and distributed energy storage and generation into wholesale energy markets as is described in greater detail below.

### **By 2015**

- Energy awareness provided by HANs and other customer premise networks, integrated with smart appliances and other communicating devices, is allowing customers to better conserve energy and more intelligently target their EE investments.
- HAN and other customer premise automation technologies like PCTs, load control devices, and smart appliances are allowing for improved DR response from individual customers, driving down the cost to participate and allowing smaller and smaller loads to economically participate in DR.

### **By 2020**

- Price-driven demand response capabilities are continuing to improve, enabling more efficient use of resources and market integration for demand response, energy efficiency, distributed generation, and energy storage.
- Widely adopted NIST standards are creating a ubiquitous market of plug-and-play networked devices in homes and businesses.

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## K. SIGNIFICANTLY REDUCE THE TOTAL ENVIRONMENTAL FOOTPRINT OF THE CURRENT ELECTRIC GENERATION AND DELIVERY SYSTEM AS WELL AS VEHICLE EMISSIONS IN CALIFORNIA

SDG&E's Smart Grid Deployment Plan, in combination with other programs, will reduce SDG&E's total environmental footprint. Its Smart Grid Deployment Plan Vision includes enabling the promotion of economic investments in energy efficiency investment measures (equipment, appliances, others), demand response with dynamic price signals, enabling the use of distributed generation and storage as on-premise energy source and/or provider of services to the market. SDG&E will pursue this in conjunction with information and communications with its customers to enable and maximize conservation impacts.

Implementation of SDG&E’s Smart Grid Deployment Plan Vision will also improve the efficiency of the current system, allow for the more efficient interconnection of and utilization of intermittent resources such as wind and solar projects, and foster new and innovative ways to reduce GHGs. As the system becomes more efficient, the energy lost during transmission will be reduced, thereby resulting in less overall losses and less energy need to be generated to meet demand.

The efforts SDG&E will make to ensure that all types of generation and storage can connect and that the grid is able to accommodate the increased intermittency that will accompany the vast expansion of renewable resources are specifically designed to help reduce the environmental footprint of electricity in California. Further, by allowing the grid to be operated more efficiently (for example with less system losses) and by carefully planning what additions are needed the environmental impact of the transmission system itself will also be reduced.

SDG&E strives to be a leader in reducing the environmental footprint. SDG&E’s vision will help accomplish this objective through its support for enabling renewable resources and the adoption of

***“...conservation impacts create the cleanest electricity available, that which is never generated.”***

PEVs. By enabling the growth of renewable energy resources and the safe, reliable and efficient integration of PEV loads with the grid, SDG&E will make a significant contribution to efforts to lessen the amount of fossil fuels burned, drive down the need for new power plant construction, reduce the dependency on the oil market, and create an overall awareness for the environment throughout the company and its customers.

SDG&E’s Smart Grid Deployment Plan Vision recognizes that conservation impacts create the cleanest electricity available, that which is never generated. Because demand response allows the electricity grid to avoid using inefficient peaking generation, it also can have a material impact in reducing total GHG emissions. SDG&E’s

vision for reducing the overall environmental footprint of the electric system and vehicle emissions is outlined below:

**By 2015**

- SDG&E, customers, and other third parties continue to install energy storage to enable more efficient use of renewable resources and to reduce overall base load generation requirements.
- SDG&E is relieving congestion by utilizing dynamic line ratings and synchrophasor data to more efficiently operate the grid.
- SDG&E is deploying highly energy efficient data center infrastructure through virtualization and server consolidation, including active power management for server and storage systems.
- SDG&E and its stakeholders continue to build capabilities to track emission reductions associated with PEV charging, in compliance with the California Air Resources Board Low Carbon Fuel Standard.

**By 2020**

- The ability to aggregate energy storage and distributed resources is leading to more efficient dispatching of resources.
- Data storage and computing systems are leveraging ultra low power technologies.
- SDG&E is enabling automatic server workload migration capabilities, based on availability, cost, and source (fossil fuel, solar, wind generated) of power.
- SDG&E's information systems and applications are being deployed on infrastructure with lower energy usage.