Section 3 – DEPLOYMENT BASELINE

3 DEPLOYMENT BASELINE

3.1 INTRODUCTION

SDG&E sees Smart Grid as an evolution not a revolution; however, the pace of evolution is accelerating. SDG&E has historically been proactive in adopting new technologies. For example, SDG&E installed its first generation geographic information system (GIS) and outage management system (OMS) in the early 1980s. SDG&E has been deploying transmission, substation, and distribution line SCADA since the mid 1980s, has deployed high-temperature low sag conductors as well as synchrophasors on the bulk power system, and deployed a STATCOM (static VAr compensation) device at Talega substation to provide dynamic VAr support on the transmission system.

Consistent with its Smart Grid vision, SDG&E continues to make smart technology investments to meet state and federal policy requirements and drive value to customers, laying the foundation for an innovative, connected and sustainable energy future in its service territory. SDG&E also recognizes that maintaining consumer trust in the electrical grid as it modernizes into the Smart Grid will be essential, especially in enabling consumer choice while protecting consumer privacy through technologies like smart meters. Current investments have been evaluated and undertaken because they enable customer choice, control and convenience; provide improvement of the utility network's effectiveness and efficiency; or are clearly aligned to policy compliance. In addition, these investments have been made with an objective to allow for the utmost flexibility, so that future investments can address emerging requirements as they present themselves and capture new benefits where they exist.

SDG&E's "OpEx 20/20" program (Operational Excellence with a 20/20 vision, which encompasses the re-engineering of key operational business processes to support Smart Grid, along with new versions of key associated software systems) is a prime example of the utility's philosophy as it drives for benefits in managing its network today through enhanced outage management, network visibility, mobile workforce enablement, and

customer information presentment. Each of these areas is important to how SDG&E runs its business today, but also combine to provide a critical platform for the deployment of the smart technologies outlined in the SDG&E Smart Grid Deployment Plan Roadmap. For example, its Outage Management System/Distribution Management System (OMS/DMS) investment provides the foundation for managing the increasing number of smart controllable devices the SDG&E network will require. Its GIS investment provides an enterprise view of the network that will allow the utility to respond to shorter planning cycles driven by industry trends, and to be more efficient in its operations. SDG&E's investments in customer management and information presentment can be extended to support new types of information sought by customers in the future.

SDG&E's Advanced Metering Infrastructure (AMI) deployment was nearly complete by year-end 2010 with 1,820,000 electric and gas smart meters deployed. The San Diego region is also home to the highest penetration of electric vehicles in the U.S., and accordingly SDG&E's clean transportation and PEV programs are sufficiently advanced to support customers who are choosing these low-emission alternatives.

SDG&E also has a number of pilot and demonstration projects in-flight to assist its understanding of smart technologies. For example, its Borrego Springs Microgrid project is demonstrating a Smart Grid alternative service delivery model and technologies that SDG&E believes can support reliability and incorporate a wider group of energy generators (e.g., wind, solar, storage, etc.).

These investments and other existing major smart technology investments are discussed in more detail in this section. This section also includes a description of the current state of SDG&E's grid including transmission and distribution infrastructure, communications, and generation resources currently existing in SDG&E service territory. Lastly, it presents the security and privacy features of our existing Smart Grid investments.

3.2 CURRENT STATE OF SDG&E'S GRID

The key generation, transmission, and distribution characteristics of SDG&E's grid as of December 31, 2010 are described below. They are provided as context for the current and planned Smart Grid investments that are discussed in this deployment plan.

3.2.1 GENERATION

The generation fleet that is currently connected to SDG&E's grid is undergoing a transition. The plants that were built in the 1960s and 1970s are methodically being retired and replaced with new plants that are based on technologies that are better equipped to meet the needs of the grid going forward.

- The current mix of generation units connected to SDG&E's system that provide power to the grid are:
    - Combined Cycle Plants: 1,160 MW
    - Steam Plants: 960 MW
    - Simple Cycle Peaking Plants: 688 MW
    - Renewable Plants: 75 MW
    - Cogeneration (Combined Heat and Power) Plants: 157 MW

Since 2000, the generation fleet connected to SDG&E's grid has undergone the following changes:

- Two new combined cycle plants have added approximately 1,160 MW of new generation capacity. These units are about 1/3 more efficient than the generation fleet they are replacing. Combined Cycle plants have a heat rate of about 7,000 British thermal units/kilowatt hour (Btu/kWh) as compared to the older steam plants with heat rates in excess of 10,000 Btu/kWh.

- Ten new peaking units of about 50 MW each at seven different locations have added approximately 500 MW of new capacity. These units are capable of going from offline to full power in less than 10 minutes.

Several of the older vintage plants currently connected to the grid are expected to be retired soon. These include:

- The Encina Power Plant, a five unit, 960 MW plant that uses steam boiler technology; is expected to retire by 2017 due to increased restrictions in the state's policies regarding the use of once-through cooling technologies that rely on ocean water.

- The Cabrillo II Peaking Plants are 12 peaking units, each with a capacity about 16 MW, located at three different sites. These units are expected to retire at the end of 2013 when their land leases expire. These old inefficient units have extremely high heat rates (above 15,000 Btu/kWh) and have very limited operating hours (under 900 hours a year).

The remaining generation fleet connected to the SDG&E grid includes:

- 13 different renewable power facilities that provide about 75 MW (nameplate) to the grid. These facilities are mostly made up of biogas facilities and a wind project.

- Approximately 90 MW of small-scale solar, mostly made up of plants located on business and residential rooftops where the power is consumed at or near the location it is generated.

- Four large cogeneration facilities with a total capacity of 157 MW that provide most of their electrical power to the grid.

- Approximately 80 MW small scale generation combined heat and power facilities where the electrical output is mostly used by the business were the facility is located.

To maintain the generation and load balance SDG&E adheres to CAISO and NERC reliability criteria. Under a one in ten year adverse load forecast scenario, the load and generation balance must be maintained even when the largest transmission line ("N-1"), and the largest single generation plant ("G-1"), are out of service. Thus, absent new major transmission lines, new local generation will need to be added as load increases.

Generation connected to the SDG&E grid consists of both utility owned generation and generation plants owned by independent energy producers. Because the transmission grid is subject to an open access tariff, generation resources connected to the grid do not need to be generation that is committed to serve SDG&E's load. Under an open access tariff, any generator that wants to connect to SDG&E's grid can do so long as it has the necessary studies completed and pays for any required system upgrades.

3.2.2 TRANSMISSION

The San Diego region's transmission infrastructure is typically described as being in an "electrical cul-de-sac" due to its location at the southernmost tip of California adjacent to the Pacific Ocean and the Mexican border, which geographically limits the transmission paths possible in the area. The one existing 500 kV transmission line, also known as the Southwest Powerlink (SWPL), connects the SDG&E grid to Arizona. The Imperial Valley Substation, situated on the one existing 500kV transmission path, is also an injection point for generation located in Mexico and proposed renewable generation in Imperial County.

SDG&E's electric transmission network is summarized as follows:

Transmission (500kV, 230kV, 138kV & 69 kV)

- 1,762 miles overhead
- 105 miles underground
- 14,142 structures
- 22 substations
- 201 tie-lines

The Sunrise Powerlink is now under construction and when completed (expected 2012) will add an additional 115 miles of 500 kV and 230 kV electric transmission lines.

Historically, SDG&E has been very proactive in applying technology to its system. SDG&E has utilized high-temperature low sag conductors for many years; several lines also have dynamic ratings, transmission engineering has also piloted some composite core conductors and approximately 95 percent of the transmission system is controlled via SCADA. Additionally, SDG&E installed a 300 MVAr STATCOM device at Talega substation to provide dynamic VAr support for the system. SDG&E has deployed a state-of-the art energy management system, EMS, which controls the SCADA devices and STATCOM device.

3.2.3 DISTRIBUTION

SDG&E's distribution grid is designed as a radial, open loop system. The primary voltages are 12 and 4 kV. Service transformers step down the voltage to the customer supply voltage at or near the customer point of delivery. SDG&E's distribution system contains both overhead and underground circuits with an exceptionally high proportion of the system underground. A summary of the distribution system is as follows:

Distribution (12 kV & 4 kV)

- 10,131 miles underground (60 percent)
- 6,658 miles overhead (40 percent)
- 219,482 wood poles
- 283 substations
- 997 circuits

SDG&E has Commission-regulated underground conversion programs and works jointly with the City of San Diego and other municipalities to underground a majority of the distribution lines within the jurisdiction of those municipalities. These programs convert overhead utilities to underground in accordance with boundaries established by the various jurisdictions within the SDG&E service territory.

SDG&E's Distribution Operations group relies heavily upon SCADA; over 70 percent of distribution circuits are controlled via SCADA. SDG&E already has seven self-healing circuits[5], both centralized and de-centralized, in operation. With its deployment of thousands of "field SCADA " devices since the early 90s, SDG&E is well positioned for a smooth transition into automatic power restoration capability (self-healing) system wide. SDG&E's cable technology management leadership includes: early adopter of conduit system in the 1960s, excellent failure records, low failure rate compared to industry, an innovative cable fault locating technique & training facility, and unique predictive modeling capabilities to proactively replace cable before failure and to improve reliability. SDG&E utilizes this state-of-the-art cable asset management system along with predictive reliability assessment tools to manage system reliability. Legacy mainframe computer applications are utilized for managing outages. SDG&E has also been installing pulse closing technology to improve operations. An extensive weather network gives SDG&E's staff meteorologist and distribution operators wide area

[5] A self-healing grid is one that automatically reconfigures via autonomous switching operations in response to a system fault improving the local reliability.

situational awareness, better preparing the utility for weather-related issues. These are just a few examples of SDG&E proactively applying technology to improve the distribution system's safe, reliable and efficient operation.

The *SDG&E Electric System Reliability Annual Report*[6] provides statistics for the following reliability indicators:

1. SAIDI (System Average Interruption Duration Index) - minutes of sustained outages per customer per year.

2. SAIFI (System Average Interruption Frequency Index) - number of sustained outages per customer per year.

3. MAIFI (Momentary Average Interruption Frequency Index) - number of momentary outages per customer per year.

4. SAIDET (System Average Interruption Duration Index Exceeding Threshold) - minutes of sustained outages per customer per year exceeding a defined annual threshold of 150 minutes.

5. ERT (Estimated Restoration Time) - sum of the weighted accuracy of each outage divided by the number of customers who experienced an outage. Weighted accuracy is determined by using the time in play and number of customers who received accurate estimates.

The reported results for 2010 are presented in the following table.

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6 ftp://ftp.cpuc.ca.gov/ElecReliabilityAnnualReports/2010/SDGE_2010%20Reliability%20Annual%20Report.pdf

Table 3-1: SDG&E Electric System Reliability 2010 Statistics

CRITERIA	SAIDI	SAIFI	MAIFI	SAIDET	ERT
Including CPUC Major Events (2010)	89.77	0.863	0.507	–	–
Excluding CPUC Major Events (2010)	67.74	0.543	0.428	35.82	54%
10-Year Average (2001-2010) Including CPUC Major Events	105.59	0.691	0.589	–	–
10-Year Average (2001-2010) Excluding CPUC Major Events	64.09	0.596	0.569	–	–

The historical reliability indices reported by SDG&E to the Commission are as follows:

Table 3-2: SDG&E Electric System Reliability Historical Indices

	All Forced Interruptions Included			CPUC Major Events Excluded				
Year	SAIDI	SAIFI	MAIFI	SAIDI	SAIFI	MAIFI	No. of Events	Event Cause(s)
2001	68.57	0.870	0.865	52.87	0.636	0.858	7	Fires (2), Load Curtailment (4), and Interruptions Due to Non-SDG&E Facilities (1)
2002	82.68	0.813	0.606	77.35	0.807	0.604	4	Fires (2), Interruptions Due to Non-SDG&E Facilities (2)
2003	298.45	0.860	0.869	76.14	0.717	0.845	2	Firestorm 2003 (1), Wind Storm Affecting >15% of Facilities (1)
2004	93.19	0.672	0.614	78.75	0.615	0.610	5	Fires (3), Interruptions Due to Non-SDG&E Facilities (1), December Storm (1)
2005	61.99	0.637	0.602	58.46	0.567	0.568	10	Fires (4), Interruptions Due to Non-SDG&E Facilities (4), Storms (2)
2006	52.83	0.545	0.494	52.65	0.541	0.494	9	Fires (6), Interruptions Due to Non-SDG&E Facilities (3)
2007	182.17	0.590	0.572	52.00	0.481	0.527	8	State of Emergency Declared (2), Interruptions Due to Non-SDG&E Facilities (2), Load Curtailment (1), Request to De-energize/ Restricted Access (3)
2008	59.17	0.517	0.380	58.92	0.515	0.378	9	Fires (2), Request to De-energize/ Restricted Access (7)
2009	67.06	0.542	0.380	66.01	0.538	0.380	4	Fires (1), Interruptions Due to Non-SDG&E Facilities (1), Request to De-energize/ Restricted Access (2)
2010	89.77	0.863	0.507	67.74	0.543	0.428	12	Storms (2), Interruptions Due to Non-SDG&E Facilities (6), Load Curtailment (1), Request to De-energize/ Restricted Access (3)

Table 3-3: SDG&E Historical System Reliability Data (using IEEE 1366 Exclusion Criteria)

SAN DIEGO GAS & ELECTRIC 2010 ELECTRIC SYSTEM RELIABILITY REPORT

HISTORICAL SYSTEM RELIABILITY DATA (USING IEEE 1366 EXCLUSION CRITERIA)

	All Forced Interruptions Included			Threshold Major Event Days Excluded *		
Year	SAIDI	SAIFI	MAIFI	SAIDI	SAIFI	MAIFI
2001	68.57	0.870	0.865	57.62	0.717	0.858
2002	82.68	0.813	0.606	70.71	0.621	0.588
2003	298.45	0.860	0.869	81.49	0.698	0.856
2004	93.19	0.672	0.614	78.83	0.619	0.610
2005	61.99	0.637	0.602	61.99	0.637	0.602
2006	52.83	0.545	0.494	52.83	0.545	0.494
2007	182.17	0.590	0.572	54.89	0.477	0.530
2008	59.17	0.517	0.380	59.17	0.517	0.380
2009	67.06	0.542	0.380	49.71	0.466	0.362
2010	89.77	0.863	0.507	63.36	0.520	0.441

* Per IEEE Standard 1366-2003 "2.5 beta method" for determining excludable days, days are excluded from a given year's metric if their SAIDI exceeds 2.5 times the standard deviation of daily SAIDI over the previous five year period.

SDG&E has been ranked by an independent utility consulting firm as having the "best" reliability in the western United States for five years in a row and earned the honor of "Best Reliability in the Nation" for 2009[7].

3.2.4 SUBSTATIONS

SDG&E has a total of three hundred and five substations. Twenty-two of these are transmission-only substations and only have 69 kV or higher voltages while the remaining distribution substations have primary voltages of 138 or 69 kV and secondary voltages of 12 or 4 kV. Ninety-five percent of the transmission circuit breakers are SCADA controlled.

[7] "PA Consulting Group recognizes North American Utilities for excellence in reliability and customer service at the 2010 ReliabilityOne™ and ServiceOne Awards," Nov. 18, 2010

New transmission-only substations in the last 10 years include the 230/69 kV Silvergate Substation, the 230kV Palomar Energy Substation to interconnect the SDG&E Palomar Energy Center power plant, and the 230kV Otay Mesa Substation which interconnects the Calpine Otay power plant. Other major transmission projects include a 500kV Miguel Substation retrofit with 500 kV Gas Insulated Substation and switchgear to reduce transmission congestion costs and a state-of-the-art static VAr compensation (STATCOM) device at the Talega Substation. The Sunrise Powerlink's 500 kV substation will be SDG&E's third 500 kV substation upon its completion in 2012.

SDG&E's standard 12 kV distribution feeders are fed via 138/12 kV or 69/12 kV substations. The newer distribution substations have a standard design that specifies termination structures, switchgear, transformer banks, surge protection, power factor correction capacitors (if needed), load tap changers (if needed), control, protection and metering. Approximately 86 percent of the 12 kV distribution feeders have SCADA control (660 out of 765).

Finally, SDG&E is phasing out its 4 kV substations that exclusively serve 4 kV feeders (i.e. 69/4 kV or 12/4 kV). None of the 4 kV substations have SCADA control because they are being strategically replaced with 12 kV feeders or 12/4 kV pad-mounted transformers.

SDG&E has adopted digital microprocessor relays in its substations since the mid 80s. These devices allow for smarter information & control of its grid, much earlier than most utilities. These technologies lay the foundation for future Smart Grid applications.

SDG&E is also installing condition based maintenance (CBM) to all transmission and distribution substations. This deployment is the largest and first of its kind in the United States. This program is part of the OPEX 20/20 program which will be discussed later.

3.2.5 DATA TRANSPORT

The SDG&E communication infrastructure consists of a private microwave system, a fiber optic network, a 900 MHz licensed radio system used for SCADA, as well as power-

line carrier (PLC), cellular, voice radio and copper lines. Communication systems are used for voice communication and data transport.

3.3 SAN DIEGO SMART GRID STUDY

In 2005-2006, SDG&E partnered with the Utility Consumers' Action Network (UCAN) on a *San Diego Smart Grid Study Report* prepared for the Energy Policy Initiatives Center (EPIC) at the University of San Diego School of Law and produced by the SAIC Smart Grid Team.[8] The study was one of the first in the nation to apply the Smart Grid concepts developed by the U. S. Department of Energy (DOE) Modern Grid Initiative[9] (MGI) to a specific region. It provided a preliminary analysis to determine the technical feasibility and cost effectiveness of implementing Smart Grid technologies and strategies in the San Diego region. The objectives of the study were to (1) determine whether the future economic and regulatory climate in the San Diego region could accommodate or necessitate a Smart Grid, (2) determine the portfolio of technologies that could implement a Smart Grid, and (3) conduct a cost-benefit analysis to determine whether implementing a Smart Grid would be cost effective for the region.

This study provided SDG&E with a vision and early glimpse into the future of the Smart Grid. Applying the MGI, the study considered the application of advanced sensing, communication, and control technologies to generate and distribute electricity more effectively, economically and securely across the San Diego region from its source to consumer appliances and equipment.

The study ultimately provided a useful reference point and helped inform SDG&E's early efforts to develop its Smart Grid roadmap and vision.

[8] http://www.sandiego.edu/epic/research_reports/documents/061017_SDSmartGridStudyFINAL.pdf
[9] Information on the Modern Grid Initiative can be located at http://www.netl.doe.gov/smartgrid/

3.4 SMART TECHNOLOGY DEPLOYMENTS AND INVESTMENTS

3.4.1 OVERVIEW

SDG&E Smart Grid investments to date have helped prepare its network to deliver new and additional customer-valued capabilities as the utility strives for greater efficiency and effectiveness across its system. SDG&E has implemented an engineering data warehouse for more than 10 years to integrate various data sources to support better system planning, operations & maintenance. In addition, SDG&E has used its investments as a flexible foundation to prepare for the future and to allow sufficient room to respond to changing drivers and needs.

In order to empower customers, SDG&E has undertaken investments that provide customers with choice, convenience and control over their energy usage or that lay the groundwork for enhanced customer choice, convenience and control. Timely energy usage information and control of in-home appliances and equipment can be remotely enabled through the customers' smart meters and HANs. Its AMI deployment was 81 percent complete by the end of 2010 and is supporting six pilots testing HAN devices that provide customers with timely energy usage information and allow them to set alerts about their energy bills. Additionally, the grid automation investments SDG&E has made and continues to make across its network are also ensuring that the grid meets customers' service expectations while complying with the energy policy goals of the state. These investments also enable SDG&E to support additional products and services as market demand and policies emerge.

In maintaining and improving its network, SDG&E's OpEx 20/20 program is supporting the system through a series of investments that will allow SDG&E to manage its infrastructure more efficiently, increase operational effectiveness, and engage customers according to their preferences. SDG&E's OpEx 20/20 program also establishes the foundation for its Smart Grid investments with network visibility and

management capabilities that can be extended to include additional technologies as they are implemented.

SDG&E is also investing in pilots to understand and utilize technologies that it believes will play an important future role in allowing the grid to incorporate renewable resources, meet stakeholders' expectations and meet state energy policy goals. Additionally, pilots help SDG&E understand expected future costs and benefits of wider deployments.

3.4.2 MAJOR TECHNOLOGY DEPLOYMENTS

SDG&E has made significant progress deploying a range of technologies to meet state and federal policy requirements; maximize customer energy value; and help create the foundation for an innovative, connected and sustainable energy future in the San Diego region. These include SDG&E's automation, Smart Meter and Sustainable Communities programs. Its smart meter deployment is almost complete and the utility continues to invest in customer serving infrastructure and smart meter enabled programs and rates, such as dynamic pricing programs and information presentation. SDG&E's grid automation and control investments have developed its ability to manage grid performance and set the foundation for additional Smart Grid investments. Through the technologies applied in its Sustainable Communities Program, the San Diego region can see how energy efficiency technologies, green building and renewable energy can significantly reduce customers' environmental footprint.

3.4.2.1 AUTOMATION

SDG&E is improving its existing and extensive automation and control capabilities through strategies and investments designed to meet state and federal policy requirements and to maximize value to customers.

SDG&E's Distribution Automation Control strategy coordinates the switching of discrete devices such as capacitor banks, voltage regulators, and load tap changing transformers.

Objectives include maintaining bus voltages across the network within specified voltage limits, minimizing the number of transmission switching operations, increasing voltage control reserves by keeping the maximum number of devices offline, mitigating circular reactive power flows, and improving voltage security while striving to maintain a high-side bus power factor of 0.995.

By leveraging secure, reliable network communications capabilities; this technology deployment is a foundational element to SDG&E's Smart Grid Deployment Plan.

3.4.2.2 ADVANCED METERING INFRASTRUCTURE (AMI) DEPLOYMENT

SDG&E is deploying an Advanced Metering Infrastructure (AMI, also known as the Smart Meter program), throughout its San Diego and Orange County service territory to improve operational efficiencies, enable demand response for customers, and provide customers with information, understanding, and control over how they consume energy. The Smart Meter program will replace a projected 1.4 million electric meters and retrofit 900,000 gas modules and is scheduled for completion by the end of 2012. By the end of 2010, the Smart Meter program had installed 1,820,000 endpoints in its service territory including 1,095,000 electric and 725,000 gas smart meters. In addition, as part of the $572 million SDG&E Smart Meter Commission authorized funding[10], a ZigBee HAN communications module has been included in the electric smart meters. Furthermore, Smart Meter funding provided for the installation of approximately 36,000 programmable communicating thermostats (PCTs) in small business facilities. Additionally, a remote turn-on, turn-off device was required for all residential meter installations. This functionality is now being leveraged by Customer Call Center representatives and has provided customers an extremely quick turn-on or turn-off service when moving into new locations.

[10] The CPUC opinion approving settlement on SDG&E's AMI project may be found at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/66766.pdf

AMI has established a two-way communications infrastructure, providing automated meter reading in place of manual meter reading, integrating customer information and billing systems, that measures interval energy use data in fifteen minute increments for commercial and hourly increments for residential customers, and enabling electric demand response and load control devices that will assist customers to reduce peak energy use.

Customer information presentation will soon be supported by the My Account web portal[11] which will provide hourly electric usage information the day following its collection. In addition, customers can already obtain alternative smart meter data presentment on an opt-in basis through Google's PowerMeter gadget (application)[12]. Furthermore, implementation of systems based on OpenADE[13] in 2011 is expected to accommodate "customer authorized" third party energy usage presentment providers. Near real-time customer energy usage information will be available through HAN compatible devices (in-home displays) and other HAN enabled equipment, appliances and information technologies.

While most of SDG&E's large commercial customers (>200 kW demand) already have automated meter reading solutions in place, this project will provide such metering capabilities for all residential and small and medium business customers.

Expected benefits of the Smart Meter program include:

- Improved customer service
- Outage management detection

[11] SDG&E's My Account website is http://myaccount.sdge.com. Online interval data presentation will be generally available to customers in 2Q2011.
[12] PowerMeter is a project from google.org, a philanthropic part of Google that develops technology projects. Information on PowerMeter and google.org can be found at http://www.google.com/powermeter/about/index.html
[13] OpenADE is the Open Automated Data Exchange task force within OpenSG, which defined requirements and initial service definitions prior to transitioning their work to the North American Energy Standards Board (NAESB), a standards development organization, where the work continues under the Energy Services Provider Interface task force. Additional information can be found at http://osgug.ucaiug.org/sgsystems/OpenADE/default.aspx and http://www.naesb.org/espi_task_force.asp.

- Reduced need to access customer property
- Energy information availability which is leading to customer energy awareness and associated behavioral changes that increase energy efficiency
- Enables dynamic pricing and demand response

Additional benefits accrue to society when residential and small business customers change their energy use patterns and take advantage of rebates for kilowatt hours saved during peak-usage periods. As customers shift their energy usage, more electricity becomes available, delaying the need for additional energy supply sources on peak-usage days.

3.4.2.3 SUSTAINABLE COMMUNITIES PROGRAM

The Sustainable Communities Program (SCP) integrates clean energy generation systems in sustainably designed, energy efficient buildings throughout SDG&E's service territory. The SCP was approved by the Commission in the SDG&E 2004 Cost of Service proceeding and again in the SDG&E 2008 General Rate Case. The SCP has been recognized by the Commission as an example of the *California Long Term Energy Efficiency Strategic Plan* goal of demand side management coordination and integration[14]. Its requirement that program participants' buildings be highly energy efficient and sustainably built results in showcase projects that demonstrate the integration of energy efficiency measures, green building practices and clean distributed energy.

3.4.3 MAJOR INFLIGHT PROJECTS

SDG&E's investments include key programs and projects that are in the implementation stage including the ongoing OpEx 20/20, Security Event and Incident Management, fiber

[14] http://www.cpuc.ca.gov/NR/rdonlyres/D4321448-208C-48F9-9F62-1BBB14A8D717/0/EEStrategicPlan.pdf

optic communications to substations, and other undertakings to support a connected and sustainable smart energy future for its service territory. These investments are targeted to improve SDG&E's ability to manage the system and provide customers with engagement they value.

SDG&E is also investing to understand nascent "smart" technologies and how their value can be maximized in programs like the Borrego Springs Microgrid demonstration. These programs and pilots can also be found in the accompanying Smart Grid Deployment Plan Roadmap.

3.4.3.1 OPEX 20/20

OpEx 20/20 is the program name for a portfolio of 20 enterprise-wide initiatives that focus on technology upgrades and process improvements to enhance the capabilities of front-line employees within Electric Operations, Gas Operations, back-office field and mapping support, Customer Service Field, and the Customer Contact Centers.

OpEx 20/20 (formerly called "Utility of the Future") enables SDG&E to continue to deliver Operational Excellence. "20/20" symbolizes a clear vision guiding the efforts over a 15-year program with initiatives that start and roll out at various times over several years.

OpEx 20/20 is providing new functionality to support decision making and greater visibility across the utility's operations and infrastructure and is allowing SDG&E to replace legacy software applications with commercial off-the-shelf products that cost less to maintain.

The advances in technology are enabling new, more efficient business processes and provide actionable information directly to employees.

Several of the new technologies listed below, such as Mobile Data Terminals (MDTs), are already in use at SDG&E[15].

With new technologies in place, many changes will occur.

- Expanding the use of **Mobile Data Terminals** with more functionality to more field crews and front-line field supervisors reduces paperwork and makes high-quality information readily available

- Building an enterprise **Geographic Information System (GIS)** consolidates foundational Smart Grid data into a single enterprise-wide repository and enables field employees to access or update electronic maps of the transmission and distribution systems through mobile devices

- Implementing new **Outage and Distribution Management Systems (OMS/DMS)** immediately pinpoints electric outages and help take corrective action to minimize customer impact and more quickly restore service to customers

- Adding **Forecasting, Scheduling and Dispatching Systems** improvements support SDG&E's ability to plan work and route crews more efficiently--reducing travel time and rescheduling changes automatically

- Implementing **Condition Based Maintenance** provides more effective use of large equipment, by proactively and automatically monitoring conditions that could impact reliability

- Offering **additional online services** for customers supports customer preference for these types of transactions

[15] The OpEx 20/20 programs include investments for both of Sempra Energy's regulated California utilities.

- **Single View of the Customer** enables understanding of an individual customer's activities across various programs and channels (such as the web, phone, and mail) so that it can provide improved service

3.4.3.2 MICROGRIDS

SDG&E's DOE funded and California Energy Commission (CEC) funded microgrid projects promote active customer participation to help support the community of Borrego Spring's energy needs and address standards, integration, and interoperability challenges for Smart Grid. Both microgrid projects are collocated in Borrego Springs, 100 miles northeast of the city of San Diego, with a population of 2,500 residents, and when complete, will form the largest U.S. microgrid in terms of capacity and the number of customers served.

A microgrid is a group of energy generators (e.g., wind, solar, portable generation, battery storage) and customer loads within a clearly defined area that can be controlled to act as single controllable entity with respect to the larger electric grid. A microgrid may have the ability to connect and disconnect from the grid ("island") in response to system disturbances, enabling it to "ride through" outages by temporarily supporting the microgrid's energy needs.

As the San Diego region's population and development growth continues further inland to the east, the peak to average MW capacity profile will continue to increase. This will likely increase reliability issues, making distributed energy resource (DER)-based microgrids a necessary part of the grid design process where cost-effective reliability is the priority. SDG&E's microgrid projects are using proven technologies, including renewable and distributed generation, battery storage, automated switching technology and smart meter data that will be, for the first time, deployed holistically on a utility grid. A large part of the funding is through grants SDG&E received through the DOE and CEC for a Smart Grid Demonstration of Renewable Distribution Systems Integration. The

remaining funds come from SDG&E and its 10 partners who are developing this microgrid demonstration.

3.4.3.3 SECURITY EVENT & INCIDENT MANAGEMENT (SEIM) TECHNOLOGY

This initiative enhances SDG&E's cyber security capabilities with a more advanced solution to manage security events and incidents. It includes the design and implementation of a SEIM service that supports current production and regulatory requirements and is a foundation for future enhancements that will support strategic utility programs like Smart Grid. The SEIM service streamlines and enhances security event and incident monitoring, management, trend analysis, alert reporting and escalation processes.

Benefits of SEIM technology include:

- Greater ability to monitor security events across SDG&E's systems
- Provides the foundation for a single, consolidated security monitoring interface, helping to avoid costs of multiple solution management tools
- Avoids costs of per user/device product licenses
- Simplifies security incident and event decision workflow
- Increases capability to design and deploy connections between multiple log source devices and the SEIM
- Increases capability to design and deploy event correlation procedures from multiple log sources
- Centralizes management and view of security incidents and events
- Enhances and extends compliance with NERC/CIP, SOX, and Sempra business continuity/disaster recovery objectives
- Improves system performance based on dual-site workload load balancing to meet incident and event volume growth

3.4.3.4 FIBER OPTIC COMMUNICATION SYSTEM TO SUBSTATIONS

This project builds out a fiber optic network to all transmission substations, including installation in the Sunrise Powerlink line corridor. The fiber optic network will replace aging and less reliable communications to substations that will enable advanced protection and monitoring. In the future, it may provide backhaul capabilities for other Smart Grid communications and distribution operations.

3.4.3.5 LOW POWER WIDE AREA COMMUNICATIONS NETWORK

This project builds out the low-speed, low power wireless network and backhaul connectivity to enable electric T&D to deploy and monitor fault circuit indicators (FCIs), and to perform required daily manual monitoring of aviation lights. The project will support existing and new aviation lights, fault circuit indicators for High Risk Fire Areas (HRFA), and other FCIs.

Benefits include:

- Enhanced situational awareness for T&D multi-phase circuits
- Overhead FCI cost savings, reduced response times in HFRA
- Enhanced fire safety
- Elimination of costly manual inspection of 530 existing and future aviation lights.

3.4.3.6 SMART ISOLATION AND RECLOSING TECHNOLOGY

This project applies off-the-shelf limited discharge energy technology on the distribution system. Sensor-equipped devices reduce the energy let-through when reclosing into a distribution line which switched off due to a fault. Benefits include enhanced safety, reduced equipment stress, improved power quality and reliability. Protective device coordination is also enhanced, and the technology provides system automation at locations presently operated manually.

3.4.4 INVENTORY OF OTHER SMART GRID INVESTMENTS

In addition to the deployments and in-flight investments described in this section, SDG&E has a number of baseline projects designed to support its Smart Grid planning.

3.4.4.1 INTEGRATION OF INTERMITTENT RENEWABLES TRANSMISSION PLANNING STUDY

SDG&E is undertaking a Transmission Planning Study to determine the impact of increased levels of intermittent renewables attached to its transmission and distribution systems. The study will identify potential issues and inform mitigation strategies.

3.4.4.2 DEMONSTRATION OF COMPOSITE CORE CONDUCTOR INSTALLATION

This project is a demonstration of composite core conductor installations. These technologies may provide increased power transfer capacity, and thus decreased needs for new transmission. It may also reduce environmental impacts.

3.4.4.3 TRACKING AND MONITORING OF EV CHARGING FACILITIES

SDG&E has implemented a new process and control system that is integrated with GIS capabilities to track electric vehicle charging installations within the SDG&E service territory and to monitor performance. This effort is intended to ensure that the electric distribution system is capable of accommodating new customer loads due to electric vehicle charging. This process and control system includes vehicle registration and identification provided by the vehicle manufacturer and ECOtality, the electric vehicle infrastructure installer under the DOE funded electric vehicle project in San Diego.

Service orders issued to operating districts require evaluation of electric distribution infrastructure for capacity, graphical mapping of the location of the new customer load, and installing monitoring equipment on associated distribution transformers. The consumption patterns and loading of the associated distribution equipment will be monitored to assess the impact and quickly identify any facility overloads or voltage

problems and take corrective action. This information will also be useful for assisting planning studies to model future impacts.

3.4.4.4 IMPLEMENTATION OF SYNCHROPHASORS

In 2007, SDG&E successfully completed a project to integrate synchrophasor data into the operation of the State Estimator application on the Energy Management System. This CEC-funded project was the first utility implementation demonstrating the ability to use synchrophasors for state estimation in a working EMS. In 2009, SDG&E integrated synchrophasor data into a SCADA application which provided real-time phase angle measurements between two 500 kV substations, allowing for faster system restoration following 500 kV line outages. In 2010, SDG&E initiated a project to install synchrophasors at all major transmission substations for use at the transmission level. This project is expected to be completed by 2013. The project will include real time collection of synchrophasor data and a visualization and operator interface system to aid in real time operations of the system.

3.5 CUSTOMER DATA PRIVACY AND SECURITY

3.5.1 CUSTOMER DATA COLLECTION, SHARING, AND RETENTION

What data is SDG&E now collecting? For what purpose is the data being collected? With whom will SDG&E currently share the data? How long will SDG&E currently keep the data?

In order to conduct business, SDG&E collects and utilizes a broad range of customer information (e.g., customer contact information, energy usage information, program enrollment and participation information). The amount and types of information collected have evolved over the years. For example, manual, monthly register meter reads were once the norm but are now being replaced with automated, remote reading of interval data (hourly for residential, 15 minute for commercial) multiple times per day via SDG&E's Smart Meter system.

SDG&E collects customer information beginning with the account set-up / service establishment process during which personal information is collected to establish and verify the identity of the customer of record along with premise information to ensure the correct linkage between the customer, meter and account (newly established). This information is necessary to enable effective customer service for billing and outage notification and for customer communication, outreach and education purposes. SDG&E customers' primary or preferred language is also collected and, in the case of businesses, information regarding responsible officers of the company and other business specific information can be collected. Information necessary to run a credit check and to help determine the credit risk associated with the account is also collected in order to determine if a meter deposit will be required and premise ownership and landlord information is collected in order to enable such things as 'revert to owner' services (in which service is not interrupted upon move out, but rather transferred back to the owner's name in order to facilitate property showing and follow-on rental). Additionally, information necessary to determine eligibility for medical baseline or life support status is collected.

Once the account is established, various data is collected during the normal course of utility transactions such as energy usage information, billing and payment information and program enrollment information. This can include the collection of household income information to determine eligibility for various utility programs, such as the California Alternate Rates for Energy or CARE program, demand response programs (such as the Summer Saver or air conditioning cycling program) and energy efficiency programs. In some cases when an in-home energy survey is conducted, very detailed information about a customer's premises is collected including types and numbers of appliances and lighting, for example. Information is also maintained regarding vegetation management associated with SDG&E's system with tree trimming information which can sometimes be associated with customer premises.

SDG&E retains information collected as necessary to efficiently and effectively fulfill its obligation to serve its customers.

SDG&E shares customer information with third parties in the conduct of its business. This includes contractors acting on the utility's behalf (e.g., fulfilling Energy Efficiency program enrollment, CARE recruitment, etc.) and third parties whom customers have designated to receive information (such as Commission-certified Energy Service Providers, for example). Third parties with whom SDG&E has a direct business relationship are bound by strict contractual terms and conditions including non-disclosure requirements and usage limitations, as appropriate, and that allow for proper remedies if third party actions so warrant.

3.5.2 DATA ACCURACY AND RELIABILITY

What confidence does SDG&E have that its data is accurate and reliable enough for the purposes for which it was being used?

SDG&E's practices and procedures regarding data gathering, maintenance and storage are aimed at ensuring the integrity of that data to fulfill the purpose for which it was gathered. Over time and when new systems or rules are put in place, these practices and procedures evolve and SDG&E strives for constant and incremental improvement. During the account set up process or other processes, personally identifiable information is provided and verified by the customer. Customer personally identifiable information (PII) or other less sensitive information that is required to complete a utility and / or customer transaction (e.g., billing, field order) includes such data as service address, billing address and other contact information. At the time the order is completed, the proper service address and other premise or customer data is validated against the utility data base to ensure accuracy.

Customer usage data (for billing purposes) is collected via the smart meter. The accuracy of the smart meter has been verified through the smart meter testing and

installation process. The customer usage data collected via the smart meter communications system may not be complete if a smart meter fails to transmit data through the AMI network. Typically, the missing data will be collected in a subsequent read attempt. Collected data is processed through the validation, estimating and editing (VEE) process. The accuracy of monthly read data (monthly usage billed on the tiered structure) must pass several comparison tests with the manual read as a validation test.

In addition to PII and usage data, other processes that rely on customer data generally have checks and balances included (such as multiple employees involved), and when possible, a single source of the data is utilized in order to ensure accuracy.

3.5.3 PROTECTION AGAINST DATA LOSS OR MISUSE

How does SDG&E protect the data against loss or misuse?

SDG&E employs a robust information security program that focuses on the three core competencies that operate together to protect against data loss or misuse: Governance, Engineering, and Operations.

The Security Governance organization is tasked with company security policy and policy compliance, which includes the drafting and maintenance of policy artifacts, and assures that the company is in compliance with all required legal and regulatory cyber security requirements; security awareness, which ensures every employee understands and executes their role in protecting company information; security strategy and architecture, which oversees the future direction of security controls across the company; and the security program office, which leads projects that implement new security controls. The Governance organization also maintains security contractual language that is used during negotiations with third parties to ensure that if the relationship calls for the sharing of company information, the information is adequately protected.

The Security Engineering organization is responsible for developing and maintaining company security standards and requirements, and ensuring that every new project adheres to each of these.

Finally, the Security Operations organization is responsible for monitoring company networks and systems for potential cyber threats and vulnerabilities, ensuring that vulnerabilities are quickly remediated, and if threats materialize, they are contained quickly so the damage caused is minimized.

3.5.4 SHARING CUSTOMER INFORMATION AND ENERGY DATA

With whom does SDG&E share customer information and energy data currently? With whom does SDG&E reasonably foresee sharing data in the future?

The question "With whom does the utility share customer information and energy data currently?" is addressed in section 3.5.1.

Depending on the specific data elements, customer PII and usage data will be shared with the customer. The customer is able to access their specific account information (including PII) via SDG&E's My Account. The customer must have an established My Account log-in ID and password. Customer usage data will be available to customer authorized third parties given the customer's explicit consent. Customer authorized third parties could be information service providers, energy service providers, energy management services and other third party home area devices (including in-home displays). SDG&E agents who act on behalf of SDG&E may also have access to customer data depending on services contracted by SDG&E (e.g., energy efficiency services, low-income program outreach and enrollment). SDG&E will also contract with various software vendors that provide on-line presentment, energy bill management and analytical tools that require access to customer data. These third party vendors will be under contract/licensed by SDG&E with appropriate non-disclosure agreements regarding customer related data.

3.5.5 THIRD PARTY DATA USAGE PURPOSE

What does SDG&E anticipate is or will be the purpose for which the third party will use the data?

The primary purpose for customer authorized third-party access to their usage data is to help the customer better understand and control their energy usage.

3.5.6 INFORMATION SECURITY AND PRIVACY FOR SHARED DATA

What measures are or will be employed by SDG&E to protect the security and privacy of information shared with other entities?

The primary measures by which SDG&E protects the security and privacy of information shared with other entities are via the contractual terms and conditions included in the contracts between SDG&E and the entities that receive this information. SDG&E structures its agreements with third parties with the goal of protecting customers' information. The utility's standard confidentiality language includes the following provisions designed to protect customers' information:

- SDG&E uses a broad definition of "Confidential Information" to protect a wide range of information related to customers;
- SDG&E limits vendors' use of such Confidential Information to be solely for purposes of performing services under its agreements (i.e., vendors cannot use Confidential Information for their own benefit or commercial purposes);
- SDG&E requires vendors to use reasonable security procedures and practices to protect Confidential Information from unauthorized access, destruction, use, modification or disclosure. For third parties, onsite security evaluations may be performed to ensure appropriate security controls are in place, except in some cases where current certifications (e.g. ISO 27001) performed by accredited firms exist;

- SDG&E requires vendors to deliver or destroy any Confidential Information upon request ; and

- SDG&E specifies that confidentiality provisions related to customer Confidential Information remain in effect for perpetuity.

3.5.7 LIMITATIONS AND RESTRICTIONS ON THIRD-PARTY DATA

What limitations and restrictions will SDG&E place on third-party use and retention of data and on downstream sharing?

SDG&E has limited contractual controls, enforcement authority or imposed penalties on customer authorized third parties. If the customer directs (via explicit consent) SDG&E to provide their specific customer usage data to a third party, then direct contractual relationship and potential business transactions are between the customer's third party and the customer. SDG&E has limited authority to interfere with the customer's third-party relationship, including the third-party use of the customer usage data and potential sharing downstream. At best, SDG&E can terminate transfer of customer usage data to a third party if that third party is deemed a "bad actor".

Each vendor SDG&E utilizes is required to have their agents, representatives, subcontractors and suppliers familiar with, and abide by, the customer confidentiality provisions in its agreements as more fully described in the response to question 3.5.6 above. Generally speaking, these customer confidentiality provisions prohibit the use or sharing of customers' Confidential Information for any purpose other than performing services for SDG&E under its agreements. Additionally, these provisions include requirements to protect customer information using reasonable security measures and allow SDG&E to seek the return or destruction of any Confidential Information.

3.5.8 ENFORCEMENT OF LIMITATIONS AND RESTRICTIONS

How will SDG&E enforce those limitations and restrictions?

In the case of SDG&E's contractual third parties, limitations, restrictions, conditions and defined damages can be specified in the specific contract terms and conditions. Per response to 3.5.7, SDG&E has limited authority with regard to customer authorized third parties. SDG&E will require customer authorized third parties adhere to specific data transfer protocols (i.e., OpenADE/NAESB ESPI standards, SEP) to ensure security encryption, customer verification and device compatibility.

3.5.9 INDIVIDUALS' ACCESS TO THEIR DATA

How do individuals have access to the data about themselves?

Customer's personally identifiable information (PII) can be accessed by the customer through their My Account log-in ID, by calling SDG&E's customer contact center, or by visiting one of SDG&E's branch offices.

3.5.10 AUDIT, OVERSIGHT, AND ENFORCEMENT MECHANISMS

What audit, oversight and enforcement mechanisms does SDG&E have in place to ensure that the utility is following its own rules?

As a California utility, SDG&E is subject to multiple checks and balances to ensure it is in compliance with its internal policies and procedures. SDG&E has put in place several mechanisms to provide governance, oversight and enforcement of security and privacy controls. For example, SDG&E uses both internal and external mechanisms to provide oversight over security and privacy controls.

Internally, these include a System Development Lifecycle Methodology that injects security and privacy requirements early in a project to ensure the project will comply with internal policies as well regulatory requirements. This methodology is also used to

test planned components for security vulnerabilities in new infrastructure to verify that security and privacy requirements have been met.

SDG&E security and privacy controls are also regularly reviewed by a corporate internal audit department that reports to Sempra Energy's Board of Directors. This internal audit organization uses the company's security policy, requirements and industry standards to verify the state of security and privacy controls and makes recommendations to improve when necessary.

Externally, SDG&E uses independent third party auditors and professional security control testing organizations to enhance its perspective of how well its security and privacy controls are meeting expectations.

Finally, SDG&E is regularly audited by industry governance organizations, such as the North American Electric Reliability Corporation (NERC), to ensure compliance with specific security controls.

3.6 CONCLUSION

SDG&E's current investments and practices have been undertaken because they are clearly aligned to policy compliance, providing customer-valued capabilities, and maintaining SDG&E's network efficiency. They are intended to support SDG&E's vision for Smart Grid, while maintaining sufficient flexibility to respond to emerging requirements. SDG&E has been working for some time to build the "Utility of the Future." The enhancements it has made will ensure that it continues to attain the highest reputation for reliability while looking out for its customers' best interests, including the privacy of customers' personally identifiable information.