Application of San Diego Gas & Electric Company (U-902-E) for Adoption of an Advanced Metering Infrastructure Deployment Scenario and Associated Cost Recovery and Rate Design.

Application 05-03-015
Exhibit No.: ______________

CHAPTER 11

COMMUNICATION SYSTEM, ELECTRIC METERS AND PROGRAMMABLE CONTROLLABLE THERMOSTATS

JULY 14, 2006 AMENDMENT

Prepared Supplemental, Consolidating, Superseding and Replacement Testimony Of

PAUL PRUSCHKI

SAN DIEGO GAS & ELECTRIC COMPANY

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

July 14, 2006

TABLE OF CONTENTS

CHAPTER 11

COMMUNICATION SYSTEM, ELECTRIC METERS AND PROGRAMMABLE CONTROLLABLE THERMOSTATS

JULY 14, 2006 AMENDMENT

Prepared Supplemental, Consolidating,
Superseding and Replacement Testimony
of
PAUL PRUSCHKI
SAN DIEGO GAS & ELECTRIC COMPANY

I. INTRODUCTION

The purpose of this *amended* testimony is to refresh my March 28, 2006 testimony to include material information which will impact my (Chapter 11) testimony in which I present the estimated costs and benefits associated with the communication system, electric meters and programmable controllable thermostats (PCTs) that would be installed for an Advanced Metering Infrastructure (AMI) deployment. This amended testimony reflects the inclusion of a new cost analysis of PCTs and has been added to my testimony at Section III.C. and Section V.C. In addition, this testimony corrects the allocation of vendor network design, project management and training costs such that $9.5 million has been reallocated from O&M to Capital. Finally, errors were corrected primarily concerning the communication network redeployment costs, along with other corrections I identified below. This resulted in a decrease in combined Capital and O&M costs of $2.5 million. Other than the aforementioned changes, my testimony remains unchanged.

The specific cost categories that I discuss are the communication system, electric meter and PCT costs summarized in Table PP 11-1. The specific benefit category that I discuss is the electric meter purchase avoidance due to growth meter displacement identified in Table PP 11-2. The total capital communication and electric meter technologies direct dollar request is approximately $447 million and the associated Operations & Maintenance (O&M) (which includes the PCT costs) is approximately $87 million.

This testimony consolidates, supersedes, and replaces all previous direct and supplemental testimony filed by me or by any other SDG&E witness testifying in this docket, on the topics covered herein.

II. BACKGROUND

The purpose of this chapter is to describe the AMI communication system, electric meters and PCT technology used as a basis for estimating AMI equipment and deployment costs. More importantly, the AMI communication system and electric metering technology satisfies the functional requirements that will enable the benefits described in various chapters of this business case. Mr. Charles' testimony (Chapter 9) describes SDG&E's analysis of responses to SDG&E's AMI RFP and the development and selection of 'solution sets' that are used in evaluating and estimating the costs related to the AMI communication system and electric meter. For this July 14, 2006 amendment, costs related to PCTs were included for reasons described in Mr. Gaines' testimony (Chapter 5).

SDG&E is seeking an AMI technology that can satisfy the state's policy goals as described in Mr. Reguly's testimony (Chapter 8), as well as enable the benefits described in various chapters of SDG&E's AMI filing. Through the RFP process, SDG&E has determined that there are AMI technologies available from the marketplace that can deliver these functional requirements and the benefits included in the business case. SDG&E is currently conducting technology field tests that will continue over the next 12 months to validate the performance of selected technologies and to determine which will best meet the functional requirements at a competitive price.

III. BASE ASSUMPTIONS

A. Communication System

The AMI communication system costs are dependent on the technology required to satisfy the six policy goals as described in Mr. Reguly's testimony (Chapter 8). In addition to the six policy goals, SDG&E determined functional requirements from a rigorous business process design (BPD) review as described in Mr. Charles' testimony (Chapter 9). As a result of the BPD review sessions and guidance from the six policy goals, SDG&E generated the functional requirements that were then included in the RFP solicitations issued in October,

2005. As SDG&E evaluated the RFP responses, a key evaluation factor was the ability of the system or component proposed to meet the requirements and therefore enable the benefits identified in various chapters of SDG&E's AMI filing.

The AMI communication system costs are based on actual pricing data received from the RFP responses in December, 2005, and the evaluation process described in Mr. Charles' testimony (Chapter 9). By evaluating multiple technologies, SDG&E was able to develop 'not-to-exceed' costs that were then included in the 'solution sets' described by Mr. Charles' testimony (Chapter 9). The solution sets are based on technology that is available from the marketplace. This testimony will not discuss any specific proprietary vendor technology, as SDG&E will be field testing multiple AMI technologies over the next 12 months. I will discuss a range of capabilities available today that meet SDG&E's functional requirements and that drive the 'not to exceed' costs included herein.

B. Electric Meters

The largest AMI cost component in SDG&E's business case is the purchase of electric meters with embedded AMI communication modules. The electric meters are categorized by their relative difference in cost and complexity. These categories are: single-phase meters for residential applications; network meters for residential multi-family applications; and poly-phase meters for commercial and industrial applications. These categories are used to calculate initial meter costs, meter maintenance costs, and incremental costs of meters required because of failures and customer growth. During the 2.5 year deployment described herein beginning in mid-2008, SDG&E will be replacing the entire meter population with solid-state meters rather than retrofitting existing electromechanical meters.

C. Programmable Controllable Thermostats (PCTs)

As discussed earlier, costs related to PCTs were included in this supplemental filing for reasons described in Mr. Gaines' testimony (Chapter 5). The original AMI Technology RFP (issued in October 2005) identified load control technologies (including PCTs) as an optional feature or product for RFP respondents. As such, vendors did not provide product or pricing information for that section. Once SDG&E decided to include PCTs, SDG&E contacted selected AMI vendors to determine their PCT product offerings and requested preliminary PCT pricing information. The PCTs that the vendors proposed are capable of two-way communications through the AMI communications network. The responses, along with prior experience from SDG&E's Smart Thermostat Program, were used to identify the costs included in this amended testimony.

PCTs are expected to be deployed between 2009 and 2013 at approximately 16,600 small and medium commercial and industrial (C&I) customer premises with a peak demand less than 200 kW. Because these premises typically have multiple PCTs per location, the actual PCT total will be approximately 57,000. Title 24 standards for PCTs are still in development and this business case does not propose a solution, but rather makes the assumption that the existing AMI communication network can be used for PCT communications.

IV. AMI TECHNOLOGY

The RFP process established that multiple technologies are available from the marketplace that can satisfy SDG&E's functional requirements. The technologies can be disaggregated at a high level into two separate categories: powerline carrier (PLC), and radio frequency (RF), often referred to as wireless. RF can be further broken down into two separate categories: licensed (the utility owns or leases the RF spectrum) and unlicensed (the utility does not own and shares the RF spectrum with other users). Powerline carrier, as the name suggests, communicates over the utilities existing powerlines. RF, on the other hand, communicates wirelessly over the air. It is important to note that the technologies referred to here apply to communication to/from an endpoint device (the meter, PCT, etc.) and a higher-level collection device. SDG&E refers to these components of the system as the local area network (LAN). As these technologies relate to AMI, there are pros and cons that depend on the specific application. These applications can relate to meter density per square mile or substation, and rural versus urban/suburban environments (morphology). An important point to note is that gas meters do not have available power, and for safety and maintenance reasons SDG&E will not run wires to the gas meter. As a result, SDG&E has required that the gas AMI module communicate wirelessly. At this point in time, SDG&E is technology neutral, and is evaluating multiple technologies. However, as stated earlier, the 'not to exceed' costs included in this chapter ensure that SDG&E's functional requirements are met, thereby ensuring that the benefits included will be realized.

Communication between collection devices and the head-end system is referred to by SDG&E as the wide area network (WAN). The head-end system typically resides in a utility's data center and is used to read the meters, perform other utility applications and monitor/manage the AMI communication system. Typical technologies used today for WAN communications are public wireless (CDMA, GSM) and landline telephone (PSTN).

As stated in Mr. Reguly's testimony (Chapter 8), SDG&E continues its commitment to open architecture throughout the various information exchanges. With regard to the LAN portion of the AMI communication system, open architecture between endpoint devices and collectors is not readily available in the marketplace today and is technology dependent. On this subject, SDG&E agrees with the viewpoints expressed by DRA witness Ralph Abbott in his testimony regarding PG&E's Functionality Criteria, Technology, and Vendor Selection Issues provided on January 18, 2006 (at page 2-15, line 5) when he stated, "[t]here is essentially no interoperability among vendors at the meter module level." Mr. Abbott further states, "[b]ased upon my frequent and routine interactions with the leading AMI vendors, I believe that there is no serious likelihood that these vendors will adopt open communications interoperability standards at the meter module level within the next five years."

With regard to the WAN and head-end sections of the AMI communication system, SDG&E believes that the technologies being considered offer open architectures. In particular, the WAN has the option of using commercial wireless technologies (CDMA, GSM), ethernet, landline telephone (PSTN), and future offerings such as BPL, WiFi and WiMAX.

As described in Ms. Welch's testimony (Chapter 10), SDG&E required vendors to deliver an Information Technology System that can interface with any AMI Technology vendor's head-end system. By decoupling these systems, they can be developed, tested and deployed independently. It has been estimated that the Information Technology System will take approximately 18 months to develop, test and deploy. The AMI communication technologies that SDG&E will field test are available today and therefore do not need to be developed. Therefore, during the 18 months that the Information Technology System is being developed and tested, SDG&E will be concurrently conducting field tests of multiple AMI technologies to ensure that the best selection is made for the right application. Additionally, this will allow time for promising technologies to further develop. As Mr. Reguly describes in his testimony (Chapter 8), there may be a case for altering our plan to acquire the additional benefits an emerging technology may offer.

Taking the potential for emerging technologies a step further, SDG&E included requirements within the RFP that will allow SDG&E to take advantage of emerging technologies that are not commercially available during the deployment phase. SDG&E has achieved this by requiring that all AMI modules (within electric meters and PCTs) and network equipment be capable of remotely upgrading device firmware. This requires that the electric meter and PCT AMI modules and the AMI communications network be capable of two-way communications. Due to battery life constraints and lack of compelling benefits of two-way communications, the gas AMI modules will operate with one-way communications. SDG&E has also required that WAN devices have “plug and play” modules for backhaul. For example, should a BPL network be deployed, this would allow SDG&E to use the BPL network to transmit data to and from collection devices.

As Mr. Fong stated in Chapter 2, AMI is an important and foundational building block for SDG&E’s long term operating vision. This vision necessitates the deployment of technologies that will transform our electric system into a smart grid. With that said, it is important to SDG&E that technologies being considered for AMI are consistent with that vision. The technologies that SDG&E are considering are capable of providing the endpoint device data that will enable SDG&E to monitor and manage much of the electric system. As described in Mr. Lee’s testimony (Chapter 4), this data will enable much more accurate and timely load forecasting than is available today. Specific data that is required on a daily basis are hourly intervals for residential, 15 minute intervals for

C&I, bi-directional and net metering, and revenue integrity monitoring. Data transmission capabilities on a near real-time basis is required for power outage and restoration notification and detection.

SDG&E believes that the bandwidth requirements (data speed) for the LAN portion of the AMI communications network is sufficient for our metering and voltage management plans that require daily input. In other words, no quantifiable benefit has been identified that would require real-time data from every one of SDG&E's meters. Therefore, as SDG&E's electric system transforms into a smart grid in the future, SDG&E does not see the need to change out our meter LAN interfaces, thus changing out all of the meters.

V. SUMMARY OF COSTS & BENEFITS

A. Communication System

The communication system cost estimates are based on actual pricing data received from the RFP process as described in Mr. Charles' testimony (Chapter 9). This pricing data, together with the actual quantities and types of devices to be deployed in the SDG&E service territory and internal cost estimates for SDG&E labor and associated items was used to develop the communication system costs. Also incorporated into these costs are additional communication system devices due to growth meters and replacement communication system devices due to failures. Specifically, the failure rate required by the RFP is 0.75% for the first 15 years. The RFP goes on to specify an acceptable failure rate of 1.5% for an additional 6 years beyond the first 15 years. SDG&E's business case costs were modeled with an expected life of 17 years to avoid mass communication system device failures. In short, a replacement or re-deployment of all AMI-enabled electric meters and AMI communication components is built into the case 17 years after the initial deployment period (excluding those communication components and electric meters included due to growth or replaced due to failure during the intervening years). Costs are also included for replacement of these growth and replacement communication components and electric meters once they reach their expected end of life at the 17 year point following installation.

The communication system costs that have been included in the summary below are comprised of vendor fees; communication system hardware and software (head-end system); system design, installation and testing of collection devices; monthly attachment fees, backhaul (WAN) and unaccounted for energy (UFE) costs; company vehicles; installation, test and dispatching tools; and the additional internal labor to provide ongoing O&M.

To mitigate risk, SDG&E has also included vendor pricing for design, build, run, transfer (DBRT) activities. This risk mitigation action requires that the vendor meets all performance requirements and maintains full responsibility of the AMI communication system throughout the AMI deployment period plus six months. As a result, related communication system internal SDG&E O&M costs have been delayed until January 2011.

B. Electric Meter

The cost of an AMI electric meter includes the AMI communication module that is embedded "under the glass" of the meter and the cost for a new solid-state electric meter. As with the communication system devices, the electric meter cost estimates are based on actual pricing data received from the RFP process as described in Mr. Charles' testimony (Chapter 9). This pricing data, together with the actual quantities and types of meters in the SDG&E service territory, were used to develop the electric meter costs. Also incorporated into these costs are growth meters and replacement meters due to failures. Acceptable annual failure rates required by the RFP are 0.5% and 0.75% respectively for residential and commercial & industrial meters for the first 15 years. SDG&E will pay for the replacement costs. Beyond the acceptable failure rate, discounted costs have been included to cover the meter replacement. The acceptable failure rate doubles to 1.0% and 1.5% respectively, for an extended life of six years beyond the first 15 years. SDG&E's business case costs were modeled with an expected life of 17 years to avoid the impact of mass meter failures prior to replacement. As stated above, costs for a re-deployment of meters is also included in the 2025 – 2027 period, and replacement of failed and growth meters included in the period 2028-2038.

In order to mitigate what we see as a risk associated with fielding large numbers of new, solid state meters for our customers, SDG&E assumed an additional 0.5% risk.[1] To address this, SDG&E requested in the RFP that the vendors absorb this additional risk. The RFP responses failed to fully mitigate this risk.

SDG&E also required vendors to provide at least two separate meter vendors in their RFP response. This resulted in a marginal increase in meter cost, but should aid in mitigating meter supply issues and reduce exposure to large-scale meter failures (i.e.: flaws found with a particular lot or family of meters will be somewhat minimized due to this 'diversification' in the meter population).

C. Programmable Controllable Thermostats (PCTs)

The cost of a PCT includes the AMI communication module that is embedded in the PCT and the cost of a new PCT. As with the communication system devices, the PCT cost estimates are based on actual pricing data received from select vendors. Prior experience from SDG&E's Smart Thermostat Program was used to determine installation costs and failure rates. This cost data, together with the actual quantities of PCTs, was used to develop the PCT costs. Also incorporated into these costs are replacement PCTs due to failures. SDG&E's Smart Thermostat Program demonstrated an annual failure rate of 2.0%. Based on the California Energy Commission's (CEC) Public Interest Energy Research's (PIER) draft report on "Demand Responsive Control of Air Conditioning via Programmable Controllable Thermostats (PCTs)", dated February 14, 2006, SDG&E's business case costs were modeled with an expected life of 15 years. The PCTs are to be deployed between 2009 and 2013. Therefore, costs for a 're-deployment' of PCTs is included in the 2024 – 2028 period (excluding those PCTs replaced due to failure during the intervening years). Replacement of failed PCTs is included in the period 2029-2038.

[1] Based on current experience with poly-phase solid-state meters without AMI communications, SDG&E used an overall failure rate of 1.0% for all solid-state meters with AMI functionality.

Installation costs were used based on SDG&E's Smart Thermostat Program. This amounted to $75 for the first PCT at a customer location, and $25 for each additional PCT at the same location.

D. Operation and Maintenance Costs (O&M)

The following are the O&M costs based on a full AMI deployment.

1. Communication System Costs

SDG&E estimated the following costs:

a. Incremental costs to existing O&M due to AMI functionality in the meter and the communications infrastructure (labor, tools, equipment vehicles).

b. Attachment costs for collection devices (e.g., rent or lease charges by cities or other third parties not owned by utility).

c. Dispatching and O&M of field employees associated with LAN/WAN and infrastructure equipment.

d. Backhaul cost of public network connections (WAN Common Carrier costs - Verizon, AT&T, etc.). Backhaul from collection devices to the utility's back office system is anticipated to be via a public network. This will also require frame relay circuits between the public carrier and SDG&E.

e. Electric power consumed by LAN/WAN equipment was based on data supplied by the vendors on typical usage for collection devices.

2. Electric Meter Costs

a. Meter Engineering Labor:

Due to the large volume of new solid state meters that will be deployed, additional SDG&E meter engineering resources will be required. These employees will support field metering personnel and communications support staff in conducting product failure analysis, evaluation and testing of firmware upgrades, coordinate programming changes and follow up with the vendors to ensure product support for the life of the meters.

b. Battery Replacement Costs:

SDG&E anticipates that the poly-phase meters will have backup batteries within the meter to maintain time when power outages occur depending upon the technology chosen. These batteries are expected to have a 10-15 year life. Costs for the replacement batteries were derived from the current costs for backup batteries in commercial meters and were replaced in the tenth year after installation. Costs were included for all installed poly-phase commercial meters (growth and deployment).

c. Power Consumption:

Any AMI solution installed under the meter cover will result in increased un-metered power consumption and thus additional load on the electric utility grid. SDG&E completed an analysis of measurements from devices currently under test and noted a continuous non-transmitting power consumption increase. Vendors also provided the watt loss power consumption increase for the communication solution in response to questions raised during the RFP process. When combined with the differential cost of watt loss between solid-state meters and mechanical meters and the number of metering devices deployed, a total cost for additional energy consumption is calculated and also included in the costs covered in this chapter.

3. Programmable Controllable Thermostat (PCT) Costs

a. The PCTs will use the AMI communications network and will not add any incremental communications costs.

E. System Operation Benefits

1. Growth Meter Displacement

Once the initial deployment of AMI begins in mid 2008, new solid state AMI-enabled meters will be installed for all future customer growth. Therefore, SDG&E will avoid the capital expenditures associated with the purchase of electromechanical meters for new customer growth. Costs savings are included based upon the type of meter that SDG&E expects to install for the various customer classes (Residential, Multi-family and Commercial). These benefits are captured specifically in Table PP 11-2.

2. Avoided TOU Meter Replacement Costs

SDG&E currently is undertaking the replacement of obsolete meters or older TOU meters with limited calendar functions with newer solid-state metering equipment. This project was intended to run through 2010 with a replacement rate of approximately 5000 meters per year and was approved in the General Rate Case (GRC). As AMI is deployed between 2008 and 2010, these older TOU meters would be replaced with new AMI capable meters negating the need to change out meters on the TOU Calendar Replacement Project. Savings result from reduced equipment costs. These benefits are captured specifically in Table PP 11-2.

VI. AMI COSTS IMPACTS BY FUNCTIONAL AREA- BY CAPITAL, BY O&M

Table PP 11-1
Communication System, Electric Meters and PCTs
Direct Dollars (Dollars in Thousands)

						Average Annual		
Costs	Total	2007	2008	2009	2010	2011-2024	2025-2027	2028-2038
Capital								
Total Comm System Capital Costs	82,795	0	8,991.8	8,031.6	8,412.3	1239.7	5,153.2	2231.3
Total Electric Meter Capital Costs	364,007	0	29,578.9	49,741.9	50,223.2	3,345.6	37,700.9	6,774.6
Total Capital Costs	*446,801*	*0*	*38,570.7*	*57,773.5*	*58,635.4*	*4,585.3*	*42,854.1*	*9,005.9*
O&M								
Total Comm System O&M Costs	50,738	0	163.2	639.9	866.0	1,687.8	1,747.9	1,836.0
Total Electric Meter O&M Costs	11,695	0	69.9	99.0	122.5	401.1	138.9	488.3
Total PCT O&M Costs	24,857	0	0	787.6	2,119.3	726.6	2,465.6	398.4
Total O&M Costs	*87,290*	*0*	*233.1*	*1,526.4*	*3,107.7*	*2,815.5*	*4,352.3*	*2,722.6*
Total Costs	**534,091**	**0**	**38,804**	**59,300**	**61,743**	**7,401**	**47,206**	**11,729**

VII. AMI BENEFITS IMPACTS BY FUNCTIONAL AREA- BY CAPITAL, BY O&M

Table PP 11-2
Communication System and Electric Meters
Direct Dollars (Dollars in Thousands)

						Average Annual		
Benefits	Total	2007	2008	2009	2010	2011-2024	2025-2027	2028-2038
Capital								
Total Elec Meter Avoided/Deferred Capital Benefits	38,310	844.5	1,738.6	1,751.9	1,765.4	1,031.1	1,167.9	1,297.3
Total Capital Benefits	*38,310*	*844.5*	*1,738.6*	*1,751.9*	*1,765.4*	*1,031.1*	*1,167.9*	*1,297.3*
Total Benefits	**38,310**	**844**	**1,739**	**1,752**	**1,765**	**1,031**	**1,168**	**1,297**

VIII. AMI RISK MITIGATION

As the largest capital cost category in the business case, any changes to the price we pay per electric meter will have a material financial impact. Risks in this chapter include the meter failure rate (includes battery failures as well), escalation of meter costs, and the assumption that 100% of meters will be read reliably by AMI. Each of these risks will be addressed below.

The meter failure rates, discussed in more detail earlier in this chapter, reflect a conservative assumption about the useful life of these assets. These meters have undergone or will undergo extensive tests including: accelerated life tests, field tests in SDG&E service territory, and sample testing before shipment. SDG&E has also included costs for a limited warranty.

In addition to the pricing provided in the RFP responses, the price of the electric meter includes some risk mitigation. SDG&E increased the cost per meter to include the option to have two meter manufacturers (both meter manufacturers would use the same AMI communication technology.)

AMI DBRT activities were mentioned earlier in this chapter. Essentially, the AMI technology vendor will be contractually responsible for the performance of the AMI communication infrastructure through deployment. SDG&E will establish service level agreements with significant rewards and penalties. After all meters have been deployed, and the network is operating within the service levels for a period of six months, the maintenance of the network will transfer to SDG&E. Viable RFP respondents included these performance requirements in their RFP bids.

IX. CONCLUSION

My testimony has discussed both the costs and benefits related to deploying an AMI communication system. The most significant contribution to the overall project costs comes from the purchase and installation of solid state meters with embedded AMI modules and associated network communications infrastructure. Based on the 'not to exceed' costs included in this chapter we are confident that a system can be procured that will provide the functionality described in Mr. Reguly's testimony (Chapter 8) and therefore enable the benefits described throughout other chapters in SDG&E's AMI filing.

My testimony also discussed at a high level the various technologies available for AMI. Through the RFP process, SDG&E determined that there were technologies available from the marketplace that could provide the functionality, and therefore the benefits, necessary to meet our requirements. SDG&E will be field-testing various technologies to determine which technologies best meet the functional requirements based on meter density and morphology.

This concludes my testimony.

X. QUALIFICATIONS OF PAUL PRUSCHKI

My name is Paul Pruschki and I am employed by San Diego Gas & Electric Company (SDG&E). My business address is 8326 Century Park Court, CP62C, San Diego, CA 92123.

My present position is Measurement Data Communications Manager in the Network Engineering & Operations Department of SDG&E. I have been employed by SDG&E since 2003. Previous positions relevant to my testimony include Technical Project Manager (2000-2003), RF Manager (1997-1999) and RF Engineer (1992-1997).

I received a B.S. in Electrical Engineering from Rensselaer Polytechnic Institute. I have not previously testified before the California Public Utilities Commission.