Company: San Diego Gas & Electric (U 902 M)
Proceeding: 2019 General Rate Case
Application: A.17-10-007
Exhibit: SDG&E-24-R

REVISED

SDG&E

DIRECT TESTIMONY OF CHRISTOPHER R. OLMSTED

(INFORMATION TECHNOLOGY)

DECEMBER 2017

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

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SUMMARY

O&M	2016 ($000)	2019 ($000)	Change
Non-Shared	17,762	29,741	11,979
Shared	55,616	58,708	3,092
Total	73,378	88,449	15,071

Capital	2017 ($000)	2018 ($000)	2019 ($000)
IT	38,373	50,414	80,924
Business	81,193	79,957	58,853
Total	119,566	130,371	139,777

Summary of Requests

- Provide support services that directly contribute to San Diego Gas & Electric Company's (SDG&E) ability to provide secure, safe, and reliable service at reasonable rates for our customers while maintaining a safe work environment for our employees.
- Position the Information Technology (IT) Division (IT Division or IT) to meet the continued growth in business demand.
- Address operational incidents through O&M and capital expenditures.

REVISED SDG&E DIRECT TESTIMONY OF CHRISTOPHER R. OLMSTED
INFORMATION TECHNOLOGY

I. INTRODUCTION

A. Summary of Information Technology Costs and Activities

My testimony supports Test Year (TY) 2019 forecasts for operations and maintenance (O&M) costs for both non-shared and shared services and capital costs for the estimated years 2017, 2018, and TY 2019 associated with the Information Technology area for SDG&E.

The IT Division is responsible for many of the technology-related services and activities for SDG&E, Southern California Gas Company (SoCalGas), and Sempra Energy Corporate Center (Corporate Center). The services include supporting applications, hardware, and software, some of which are used for risk assessment and management across the company. Our business clients rely on IT to provide support for numerous areas to deliver safe and reliable service to our customers. The areas include, but are not limited to, asset management, work management and measurement, fuel and power, outage management, gas and electric facilities, transportation, procurement and settlement, financial management, accounting, customer field operations, meter reading, customer energy management, smart meter data management, routing, scheduling, dispatching, revenue cycle, customer assistance, and customer contact functions. This is accomplished through the IT Division's operation of company data centers that store and manage data, including those used for risk assessments and development of related mitigation plans, as well as foundational information security services to ensure security and privacy. The costs for these services and activities, excluding cybersecurity, are attributed to cost centers at SDG&E, which are described herein, as well as to cost centers at SoCalGas, which are described in my SoCalGas IT testimony (Exhibit (Ex.) SCG-26). Testimony related to cybersecurity services within IT is sponsored by Gavin Worden (Ex. SDG&E-25 and Ex. SCG-27).

Table CRO-1 below summarizes the overall costs for services and capital investments provided by the IT Division for both SDG&E and SoCalGas.

TABLE CRO-1

Test Year 2019 Summary of Total Costs (SCG & SDG&E)

IT - INFORMATION TECHNOLOGY			
Shown in Thousands of 2016 Dollars	**2016 Adjusted-Recorded**	**TY 2019 Estimated**	**Change**
SoCalGas	24,588	32,927	8,339
SDG&E	73,378	88,449	15,071
Total O&M	**97,966**	**121,376**	**23,410**

	2017	**2018**	**2019**
SoCalGas	122,653	148,498	176,169
SDG&E	119,566	130,371	139,777
Total Capital	**242,219**	**278,869**	**315,946**

B. Summary of Costs Related to the Fueling Our Future Initiative

As described by Randall Clark in Ex. SDG&E-03, SDG&E and SoCalGas kicked off the Fueling Our Future (FOF) initiative in May 2016 to identify and implement efficient operations improvements. The IT Division will undertake several FOF initiatives, which are detailed in Section II.C.2 herein. Table CRO-2 below provides a summary of the FOF cost efficiencies described in my testimony.

TABLE CRO-2

Summary of FOF Costs (000s)

INFORMATION TECHNOLOGY (In 2016 $)			
FOF O&M	**Estimated 2017**	**Estimated 2018**	**Estimated 2019**
FOF-Implementation	167	646	115
FOF-Ongoing/Benefits	(256)	(1,484)	(3,061)
Total O&M	**(89)**	**(838)**	**(2,946)**

FOF-Implementation	**Estimated 2017**	**Estimated 2018**	**Estimated 2019**
1IT003.000, IT Support NSS	167	646	115
Total	**167**	**646**	**115**

FOF-Ongoing/Benefits	**Estimated 2017**	**Estimated 2018**	**Estimated 2019**
1IT003.000, IT Support NSS	(256)	(1,484)	(3,061)
Total	**(256)**	**(1,484)**	**(3,061)**

C. Summary of Safety and Risk-Related Costs

Included in the capital costs supported in my testimony are business sponsored projects driven by activities described in SoCalGas and SDG&E's November 30, 2016 Risk Assessment Mitigation Phase (RAMP) Report.[1] The RAMP Report presented an assessment of the key safety risks of SoCalGas and SDG&E and proposed plans for mitigating those risks. As discussed in the Risk Management & Policy testimony of Diana Day and Jamie York (Exhibit SCG/SDG&E-02), the costs of risk-mitigation projects and programs were translated from that RAMP Report into the individual witness areas.

The forecasts for mitigation costs included in the RAMP Report are not for funding purposes, but rather to provide a range of estimated cost impacts for the TY 2019 GRC filing. Therefore, the final GRC representation of RAMP costs may differ from the ranges shown in the original RAMP Report. Table CRO-3 below provides a summary of the RAMP-related costs supported by my testimony.

TABLE CRO-3

Summary of Incremental RAMP-Related Costs

INFORMATION TECHNOLOGY (In 2016 $)			
RAMP Report Risk Chapter	**2017 Estimated Incremental (000s)**	**2018 Estimated Incremental (000s)**	**TY 2019 Estimated Incremental (000s)**
SDG&E-13 Records Management	20,422	26,129	21,657
Total	**20,422**	**26,129**	**21,657**

D. Summary of Aliso-Related Costs

In compliance with Decision (D.) 16-06-054, the testimony of witness Andrew Steinberg (Ex. SCG-12) describes the process undertaken so the TY 2019 forecasts do not include the additional costs from the Aliso Canyon Storage Facility gas leak incident (Aliso Incident), and demonstrates that the itemized recorded costs are removed from the historical information used by the impacted general rate case (GRC) witnesses.

[1] Please refer to the Risk Management & Policy testimony of Diana Day (Ex. SCG/SDG&E-02) for more details regarding the utilities' RAMP Report.

As a result of removing historical costs related to the Aliso Incident from IT adjusted recorded data, and in tandem with the forecasting method employed and described herein, additional costs of the Aliso Incident response are not included as a component of my TY 2019 funding request. Historical IT costs that are related to the Aliso Incident are removed as adjustments in my revised workpapers (Ex. SDG&E-24-WP-R) and also identified in Table CRO-4 below.

TABLE CRO-4

IT Historical Adjustments to Remove Aliso Incident Costs

IT - INFORMATION TECHNOLOGY			
Workpaper	**2015 Adjustment (000s)**	**2016 Adjustment (000s)**	**Total (000s)**
Total Non-Shared	**0**	**0**	**0**
2100-3071.000, SAP ACCOUNTING & FINANCIAL SYSTEMS	0	(14)	(14)
2100-3091.000, SOFTWARE DEV - DATABASE ADMINISTRATOR	0	(4)	(4)
Total Shared Services	**0**	**(18)**	**(18)**
Total O&M	**0**	**(18)**	**(18)**

E. Organization of Testimony

The costs presented in the remainder of my testimony are specific to IT costs charged to SDG&E cost centers. I sponsor the TY 2019 forecasts for O&M costs for both non-shared and shared services and capital costs for the estimated years 2017, 2018, and 2019. Table CRO-5 below summarizes my SDG&E IT-sponsored costs.

TABLE CRO-5

Test Year 2019 Summary of SDG&E IT Costs

IT - INFORMATION TECHNOLOGY			
Shown in Thousands of 2016 Dollars	**2016 Adjusted-Recorded**	**TY 2019 Estimated**	**Change**
Total Non-Shared	17,762	29,741	11,979
Total Shared Services (Incurred)	55,616	58,708	3,092
Total O&M	**73,378**	**88,449**	**15,071**

	2017	**2018**	**2019**
IT	38,373	50,414	80,924

Business	81,193	79,957	58,853
Total Capital	**119,566**	**130,371**	**139,777**

Some of the costs shown in Table CRO-5 serve only SDG&E, but in most cases, the costs are "shared" and thus serve SDG&E as well as SoCalGas and Corporate Center. Non-shared costs that are incurred and activities performed solely for the benefit of SDG&E are discussed in Section III. Section IV sets forth the shared costs and activities that benefit SDG&E, SoCalGas, and/or Corporate Center. Section V details SDG&E IT capital costs.

The IT Division is responsible for a variety of technology-related services and activities for SDG&E, SoCalGas, and Corporate Center. The O&M costs presented in my testimony have been categorized into three areas:

- Applications – Applications support the development, implementation, and maintenance of computer software utilized by customers, employees, and/or vendor partners.
- Infrastructure – IT Infrastructure supports the design, implementation, and operation of the Company's computing infrastructure, including both hardware (ranging from desktop computing systems and servers to storage systems) and software (including middleware, production control, operating systems, and other low-level software systems).
- IT Support – This category of costs includes labor and non-labor for cost centers that are not specifically aligned with the other IT areas described above. Examples would include officer costs, budget and planning activities, and our intern/associate program.

F. Forecast Methodology

The forecast methodology developed for IT costs is the base year (2016) recorded, plus adjustments. The primary reason for this approach is that history is not necessarily a good predictor of future needs. The pace of change in the technology industry continues to accelerate when compared to prior years. This is evidenced by growth in computing power at the hardware level as well as the number and diversity of applications at the software level. Factoring in emerging computing trends, such as cloud computing and the increasing commercialization of IT capabilities, required us to use current data and adjustments rather than relying on historical averages that do not include these types of trends in our computing environment. In addition, the

level of support provided by the IT Division continues to grow as capital projects are implemented because projects that drive benefits and efficiencies within business units often create increased workload within the IT Division that would not have been reflected in our historical costs.

Finally, using the base year, plus adjustments, methodology starts the IT Division at a lower requested dollar amount than if we had utilized 3-year, 4-year or 5-year averages (see Table CRO-6 below). Use of the base year, plus adjustments, methodology is consistent with SoCalGas' approach, as demonstrated in my SoCalGas IT testimony (Ex. SCG-26).

TABLE CRO-6[2]

IT Division (SoCalGas and SDG&E) Forecast Methodology Comparison (000's)

2016 Adjusted-Recorded	5-Year Average	4-Year Average	3-Year Average
97,976	103,266	100,556	98,910

G. IT System-Wide Outages

Another consideration for using a base-year costs plus adjustments methodology is the fact that disruptive events have the potential to change planning assumptions dramatically. In 2017, several significant system-wide IT outages impacted business operations. The frequency and duration of these events resulted in forecasts in 2018 and 2019 to be based on the events occurring in 2017 rather than historical patterns. Table CRO-7 below includes the most significant events in 2017 to date, which resulted in widespread impacts to the business for several hours at a time, the most significant being a multiple-day outage occurring on April 11, 2017.

TABLE CRO-7

IT Division (SoCalGas and SDG&E) System-Wide Outages (January 2017 – To Date)

Event Start	Duration (in minutes)	Description
February 6, 2017	2,772	Multiple virtual machine (VM) hosts outage related to storage and high central processing unit (CPU) use due to over provisioning

[2] The 5-year historical costs include both routine IT support as well as unique project work that may vary from year to year. All costs have been included within our historical averages and accurately reflect the scope of IT Division responsibilities.

Event Start	Duration (in minutes)	Description
March 29, 2017	2,524	Multiple applications running in VM environment down
April 7, 2017	4,563	Multiple applications running in VM environment down
April 11, 2017	49,164	Storage failure
May 9, 2017	11,590	Network outage
June 6, 2017	133	Network outage
June 12, 2017	182	Core network router down
June 29, 2017	2,835	Network outage

As a result of these outages, O&M and capital forecasts have taken into consideration the need to invest in infrastructure resources and equipment to provide a more reliable computing environment that our business clients have come to expect in order to meet their operational needs.

II. RISK ASSESSMENT MITIGATION PHASE AND SAFETY CULTURE

A. Risk Assessment Mitigation Phase

A portion of my requested capital funds are linked to mitigating the key safety risks that have been identified in the RAMP Report. These key risks were identified through the RAMP process described in the RAMP Report and are associated with activities presented in my testimony. These risks are summarized in the table below:

RAMP Risk Chapter Description

RAMP Risk	Description
RAMP Report Chapter SDG&E-13 Records Management	Relates to the potential public safety, property, reliability, regulatory, or financial impacts that result from the use of inaccurate or incomplete records.

While developing the GRC forecasts, SDG&E evaluated the scope, schedule and resource requirement, and synergies of RAMP-related projects and programs to determine costs already covered in the base year (2016) and the additional capital costs that are incremental increases expected in the following three years. A list of these projects along with the sponsoring witness are provided in the table below. RAMP-related costs and activity descriptions are further described in my revised capital workpapers.

Safety Related Risk Mitigation Capital Costs

In 2016 $ (000s)

INFORMATION TECHNOLOGY (In 2016 $)				
RAMP Report: SDG&E-13 Records Management	**2017 Estimated Incremental**	**2018 Estimated Incremental**	**TY 2019 Estimated Incremental**	**Exhibit Reference**
00813A, RAMP - INCREMENTAL T16045 CPD ENHANCEMENTS PHASE 3	8,957	888	0	SDG&E-14 Alan Colton
00813F, RAMP - INCREMENTAL T19011 Patrol Inspect Auto Corrective Maintenance Program (CMP)	646	0	0	SDG&E-14 Alan Colton
00831A, RAMP - INCREMENTAL T19003 DRMS (Demand Response Management System) Phase 3	0	612	643	SDGE&E-19 Lisa Davidson
00831H, RAMP - INCREMENTAL T15831 DEMAND RESPONSE MANAGEMENT SYSTEMS (DRMS)	517	0	0	SDGE&E-19 Lisa Davidson
00831M, RAMP - INCREMENTAL T19036 Enhanced Network Analytics	0	3,826	4,000	SDG&E-19 Jerry Stewart
00833B, RAMP - INCREMENTAL T16040 SORT EXTENSION	1,661	0	0	SDG&E-17 Gwen Marelli
00833D, RAMP - INCREMENTAL T19016 Modernizing Outage Reporting (MOR)	1,250	1,691	341	SDG&E-14 Alan Colton
00833F, RAMP - INCREMENTAL T15067 POWERWORKZ UPGRADE	1,236	0	931	SDG&E-14 Alan Colton
00833I, RAMP - INCREMENTAL T19022 Electric GIS 2017 Enhancements	0	2,555	0	SDG&E-14 Alan Colton
00833J, RAMP - INCREMENTAL T19023 CPD Enhancement Phase 4	0	9,954	9,954	SDG&E-14 Alan Colton
00833K, RAMP - INCREMENTAL T19024 Electric GIS 2018 Enhancements	0	0	1,041	SDG&E-14 Alan Colton
03851C, RAMP - INCREMENTAL T19033 FoF - Engineering Project Lifecycle	2,064	1,965	491	SDG&E-14 Alan Colton
03851E, RAMP - INCREMENTAL T19002 FoF - TSPI Phase 3	1,848	295	578	SDG&E-14 Alan Colton
14860A, RAMP - INCREMENTAL T14860 DISTRIBUTED ENERGY RESOURCE MGMT (DERMS)	2,243	3,627	3,678	SDG&E-13 Alan Dulgeroff

INFORMATION TECHNOLOGY (In 2016 $)				
RAMP Report: SDG&E-13 Records Management	**2017 Estimated Incremental**	**2018 Estimated Incremental**	**TY 2019 Estimated Incremental**	**Exhibit Reference**
Total	**20,422**	**25,413**	**21,657**	

The specific RAMP risk mitigation efforts shown in the table above were initiated by a need identified in other business units. Yet, these RAMP activities utilize information technology. Accordingly, these RAMP activities will be managed in part by IT and by the business unit that established its necessity. I present the costs of RAMP activities that have an IT component. The referenced witness listed in the table above discuss the mitigation, how it contributes to reducing the risk, and any alternatives that were considered to that project.

Because IT determines the cost for the requested technology service or application, an evaluation was made by IT to determine the portion, if any, that was already performed as part of historical activities (*i.e.*, embedded base costs) and the portion, if any, that was incremental to base year activities. As shown in the table above, all the IT-related RAMP capital projects were determined to be RAMP Incremental because they are either new systems or enhancements to existing services and applications.

While the starting point for consideration of the risk mitigation efforts and costs was the RAMP Report, the incremental costs of risk mitigation presented in my testimony may differ from those first identified in the RAMP Report due to further evaluation by IT or the referenced witness area.

B. Safety Culture

SDG&E is committed to providing safe and reliable service to its customers. Our safety-first culture focuses on public, customer, and employee safety, with this commitment embedded in every aspect of our work. Our safety culture efforts include developing a trained workforce, operating and maintaining energy infrastructure, and providing safe and reliable service. IT is dedicated to all aspects of providing safe and reliable energy delivery while protecting customer information and ensuring compliance with regulations. IT employees participate in all Company-mandated safety training and ensure the availability and operability of the technology that business clients rely on to run their operations.

As stated earlier in my testimony, the IT Division is responsible for many of the technology-related services and activities for SDG&E, SoCalGas, and Corporate Center. The

services include supporting applications, hardware, and software – some of which are used for risk assessment and management across the company. SDG&E's safety culture places a strong emphasis on customer, employee, and public safety. The IT Division works to fulfill that culture by providing the technology support required by operating and business units to safely and efficiently fulfill their objectives. As processes and operations become increasingly dependent on technology for efficiencies and safety, the IT Division's business clients rely on IT to provide support. SDG&E and SoCalGas' safety culture is evident in IT as it provides some of the means with which the operating and business units are able to improve their safety performance.

Examples of areas in SDG&E and SoCalGas with which IT works includes asset management, work management and measurement, fuel and power, outage management, gas and electric facilities, transportation, procurement and settlement, financial management, accounting, customer field operations, meter reading, customer energy management, smart meter data management, routing, scheduling, dispatching, revenue cycle, customer assistance and customer contact functions.

III. NON-SHARED COSTS

"Non-Shared Services" are activities that are performed by SDG&E solely for its own benefit. Corporate Center provides certain services to SDG&E, SoCalGas, and its other subsidiaries. For purposes of this GRC, SDG&E treats costs for services received from Corporate Center as non-shared services costs, consistent with any other outside vendor costs incurred by the utility. Table CRO-8 summarizes the total non-shared O&M forecasts for the listed cost categories.

TABLE CRO-8

SDG&E Non-Shared O&M – Summary of Costs

IT - INFORMATION TECHNOLOGY			
Shown in Thousands of 2016 Dollars			
Categories of Management	**2016 Adjusted-Recorded**	**TY 2019 Estimated**	**Change**
A. Applications	14,114	17,489	3,375
B. Infrastructure	3,650	15,198	11,548
C. IT Support	(2)	(2,946)	(2,944)
Total	**17,762**	**29,741**	**11,979**

A. Applications (Non-Shared)

1. Description of Costs and Underlying Activities

The non-shared SDG&E IT Applications costs represent labor and non-labor for systems where 100% of the activities directly support SDG&E. The types of systems supported in this area include, but are not limited to, customer field operations, work order management, smart meter data management, customer billing, service order routing, scheduling and dispatching, revenue cycle processing, and customer assistance and customer contact functions, including self-service capabilities via MyAccount. For example, the Service Order Routing Technology (SORT) system, an IT application, is a work order management system used only by SDG&E customer service field personnel. The SORT system schedules, routes, and dispatches work to SDG&E field personnel. The SORT system collects specifics on work performed at a customer's premise, which is recorded and returned to other SDG&E systems for status and reporting. Providing the right information in a timely manner helps ensure that SDG&E field employees are able to perform their duties and provide customer services in a safe and timely manner.

2. Cost Drivers

Table CRO-9 below lists the forecasted increases associated with non-shared O&M related to Applications.

TABLE CRO-9

Non-Shared O&M Cost Drivers – Applications (000's)

Cost Driver Descriptions	TY 2019 Estimated
A. Increased costs to support CISCO Wellness[3]	1,500
B. Incremental resources to support new functions/features implemented by capital projects	762
C. Backfill labor vacancies	674
D. Contract additions and escalations	439
Total	**3,375**

[3] CISCO Wellness is an initiative that was launched in early 2016 in response to a series of CISCO system-related challenges that were initially encountered in late 2015. This initiative includes a collection of system improvement activities, which consists of adding incremental support resources, improving manual processes, and implementing technical enhancements.

B. Infrastructure (Non-Shared)

1. Description of Costs and Underlying Activities

These non-shared SDG&E IT Infrastructure costs represent labor and non-labor for the infrastructure area where 100% of the activities are for SDG&E. These costs are typically related to providing service to SDG&E-only facilities (*e.g.*, construction and operations districts and customer contact centers) and include network engineering infrastructure support.

2. Cost Drivers

Table CRO-10 below lists the forecasted increases associated with non-shared O&M related to Infrastructure.

TABLE CRO-10

Non-Shared O&M Cost Drivers – Infrastructure (000's)

Cost Driver Descriptions	TY 2019 Estimated
A. Operational Data Center/Infrastructure enhancements	6,200
B. Incremental resources to support new functions/features implemented by capital projects	2,255
C. Office 365 annual subscription	1,937
D. Backfill employee vacancies	770
E. Additional mainframe capacity	205
F. Contract additions and escalations	181
Total	**11,548**

C. IT Support (Non-Shared)

1. Description of Costs and Underlying Activities

The costs in SDG&E non-shared IT Support cover costs and savings associated with IT's FOF initiatives.

2. Cost Drivers

Table CRO-11 below lists the forecasted reductions associated with non-shared O&M related to IT Support. The FOF implementation costs listed are forecasts for FOF that did not meet capital requirements. It is estimated that approximately 10% of the anticipated work will be charged to O&M activities. The on-going benefits reflect the savings IT expects to see as a result of FOF implementations. Examples include removing desktop phones, application rationalization (reducing and/or eliminating duplicate or low-value applications), establishing a vendor management office to optimize spending with third parties, reducing customization of purchased software, standardized infrastructure, and procurement and sourcing savings.

TABLE CRO-11

Non-Shared O&M Cost Drivers – IT Support (000's)

Cost Driver Descriptions	TY 2019 Estimated
A. FOF Implementation Costs	115
B. FOF On-going Benefits	(3,061)
Total	**(2,946)**

IV. SHARED COSTS

A. Introduction

As described in the testimony of James Vanderhye (Ex. SDG&E-32), shared services are activities performed by a utility shared services department (*i.e.*, functional area) for the benefit of: (i) SDG&E or SoCalGas, (ii) Sempra Energy Corporate Center, and/or (iii) any unregulated subsidiaries. The utility providing shared services allocates and bills incurred costs to the entity or entities receiving those services.

Table CRO-12 below summarizes the total shared O&M forecasts for the listed cost categories.

TABLE CRO-12

Shared O&M Summary of Costs

IT - INFORMATION TECHNOLOGY			
Shown in Thousands of 2016 Dollars Incurred Costs (100% Level)			
Categories of Management	**2016 Adjusted-Recorded**	**TY 2019 Estimated**	**Change**
A. Applications	15,045	16,253	1,206
B. Infrastructure	36,019	38,238	2,219
C. IT Support	4,551	4,218	(333)
Total Shared Services (Incurred)	**55,616**	**58,708**	**3,092**

I am sponsoring the forecasts on a total incurred basis (100% level), as well as the shared services allocation percentages related to those costs, which are provided in my shared services workpapers with a description explaining the activities being allocated. See Ex. SDG&E-24-WP-R. The dollar amounts allocated to affiliates are presented in Mr. Vanderhye's testimony (Ex. SDG&E-32).

B. Applications (Shared)

1. Description of Costs and Underlying Activities

The shared IT Application costs charged to SDG&E cost centers represent labor and non-labor for systems where activities performed are shared among SDG&E, SoCalGas and/or Corporate Center. They are comprised of a diverse portfolio of IT applications that require investments to manage ongoing requirements of our business users who rely on these systems to perform their daily tasks. The types of systems supported in this area include asset management, distribution work management, procurement, supply chain, and financial systems. In general, this diverse portfolio of existing IT applications requires frequent investments to satisfy the changing requirements of our business users who rely on these systems to perform their daily tasks. For example, Systems Applications and Products (SAP) is an application that is used across the Sempra Energy organization. SDG&E payrolled employees that provide support for SAP have their time allocated to SDG&E, SoCalGas, and Corporate Center based on the number of users of the SAP system for each company.

2. Cost Drivers

Table CRO-13 below lists the forecasted increases associated with shared O&M related to Applications.

TABLE CRO-13

Shared O&M Cost Drivers – Applications (000's)

Cost Driver Descriptions	TY 2019 Estimated
A. Contract additions and escalations	971
B. Backfill labor vacancies	235
Total	**1,206**

C. Infrastructure (Shared)

1. Description of Costs and Underlying Activities

The shared IT infrastructure costs charged to SDG&E cost centers represent labor and non-labor for infrastructure activities performed to benefit SDG&E, SoCalGas, and/or Corporate Center. Examples of these activities include operating the data centers around the clock (*e.g.*, servers, storage, routers), integrating with cloud service providers, manning the enterprise command center that monitors IT systems and services, supporting the phone system, and operating the IT help desk. Services include, but are not limited to, providing support for the

design, deployment, and support of hardware and software systems relating to distributed (*i.e.*, UNIX and Windows) and enterprise (*i.e.*, IBM Z/OS) class servers, disaster recovery, production management, data storage systems, service and help desk management, web-based applications middleware, and services infrastructure.

Although the majority of shared IT infrastructure costs are captured in SDG&E cost centers, there are also some shared IT infrastructure costs captured in SoCalGas cost centers, as described in my SoCalGas IT testimony (Ex. SCG-26).

2. Cost Drivers

Table CRO-14 below lists the forecasted increases associated with shared O&M related to Infrastructure.

TABLE CRO-14

Shared O&M Cost Drivers – Infrastructure (000's)

Cost Driver Descriptions	TY 2019 Estimated
A. Contract additions and escalations	2,280
B. Incremental resources to support new functions/features implemented by capital projects	234
C. Adjustments/corrections	(295)
Total	**2,219**

D. IT Support (Shared)

1. Description of Costs and Underlying Activities

The costs in shared IT Support charged to SDG&E cost centers cover labor and non-labor expenses recorded by the Vice President of IT and the IT Associate program, which is a three-year program for newly hired IT employees that provides them with rotational assignments within the IT Division.

2. Cost Drivers

Table CRO-15 below lists the forecasted decrease associated with shared O&M related to IT Support and hiring a new IT associate.

TABLE CRO-15

Shared O&M Cost Drivers – IT Support (000's)

Cost Driver Descriptions	TY 2019 Estimated
A. Transfer analytics contract costs to infrastructure cost center	(397)
B. Hire additional IT associate	64

Total	**(333)**

V. CAPITAL

A. Introduction

Table CRO-16 below summarizes the total SDG&E IT capital forecasts for 2017, 2018, and 2019. Table CRO-16 shows the full complement of IT projects being proposed by SDG&E in this filing. In other words, Table CRO-16 is composed of both business unit-sponsored IT capital projects, as well as IT Division-sponsored IT capital projects. The costs depicted in Table CRO-16 are the total costs to be incurred by the proposed capital projects and charged to SDG&E cost centers. They do not reflect adjustments that may result due to sharing of project costs across SoCalGas and Corporate Center, if appropriate.

Included in Table CRO-16 are projects sponsored by the business units that include IT technology solutions to meet business demand. The business justifications for the business-sponsored projects are included in the testimony of the associated business witnesses:

Accounting and Finance/Legal/ Regulatory Affairs/External Affairs	Hrna (Ex. SDG&E-31)
Customer Services - Field	Marelli (Ex. SDG&E-17)
Customer Services – Information & Technologies	Davidson (Ex. SDG&E-19)
Customer Services – Office Operations	Stewart (Ex. SDG&E-18)
Fleet Services	Herrera (Ex. SDG&E-21)
Electric and Fuel Procurement	Helm (Ex. SDG&E-12)
Gas System Integrity	Rivera (Ex. SDG&E-05)
Electric Distribution – Capital	Colton (Ex. SDG&E-14)

My revised workpapers contain the cost justifications for the IT portion of these business unit sponsored capital projects. I provide additional information about IT Division-sponsored IT capital projects below in Section IV.C. Table CRO-16 summarizes the total capital forecasts for 2017, 2018, and 2019.

TABLE CRO-16

Capital Expenditures Summary of Costs

INFORMATION TECHNOLOGY (In 2016 $)			
Categories of Management	**Estimated 2017 (000s)**	**Estimated 2018 (000s)**	**Estimated 2019 (000s)**
A. Controller, Reg Affrs, Legal	1,369	0	0
B. CS – Field	2,250	0	0
C. CS - Information & Technologies	20,583	21,109	1,818
D. CS - Office Operations	14,897	15,774	16,332
E. Fleet Services	2,168	4,514	7,632
F. IT	38,373	50,414	80,924
G. Procurement	3,005	426	0
H. Gas System Integrity	110	0	0
I. Electric Distribution	36,811	38,134	33,071
Total	**119,566**	**130,371**	**139,777**

B. Forecast Methodology

Before an IT capital project is funded and moves into development, it must go through SDG&E's capital project approval process, which has several distinct stages, as described below.

1. IT Division Capital Plan Development

The IT Division first prepares a capital plan, which is the sum of proposed plans of IT and business-sponsored projects that utilize the IT capital budget. The capital plan includes both ongoing projects and anticipated needs, and is usually developed in the fourth quarter of a fiscal year in preparation for upcoming years. At this stage, the composite capital plan consists of a long list of viable capital projects, each with the potential to beneficially impact IT capability and services. Supporting documentation is developed by way of concept documents and business cases to be utilized as part of the prioritization and approval process.

2. Concept Documents

Concept documents are high-level assessments developed for review during the capital planning process. The concept document contains typical project elements, such as cost estimates, business benefits, and project schedules. It also provides project teams the opportunity to document alternative options considered, as well as business risks and implications of not proceeding with the project. All of these elements are available for

consideration during project prioritization and approval. The Central Business Planning group then decides whether to approve funding as part of its prioritization and approval process.

3. Project Prioritization and Approval

The concept documents provided by project teams are utilized for prioritization purposes. Rankings are determined based on various factors including, but not limited to, regulatory requirements, critical service maintenance needs, and/or cost benefit analyses. The projects in the narrowed capital plan list are then prioritized by likely impact on IT capability and services. The annual capital budget allocation processes for SDG&E is administered by the Central Business Planning group on behalf of the Executive Finance Committee (EFC). Details of the capital planning process are presented in the testimony of SDG&E's Rate Base witness R. Craig Gentes (Ex. SDG&E-33).

4. Business Cases

Once funding is approved by the Central Business Planning group for a concept, a complete business case must be prepared and approved before work begins. Business cases are developed jointly by representative(s) from the sponsoring IT department, the sponsoring business department (when applicable), and the IT Project Management Office (IT PMO). Others may be added to the team as required.

- The sponsoring IT department is primarily responsible for defining the project scope, identifying the technical approach, and generating the basis of the estimate for the capital costs and ongoing O&M support costs.
- The business representatives are primarily responsible for confirming the business requirements, calculating the business benefits, and ensuring that the proposed solution meets the business objectives.
- The IT PMO ensures that the templates are completed correctly, that the budgets are calculated and characterized correctly, and that the proposed scope is consistent with policy.

A near final draft of the business case is provided to Information Security for review and comment.

5. Cost Sharing Mechanisms

A cost sharing mechanism must be determined for any project that will be utilized across SDG&E, SoCalGas, and/or Corporate Center. As part of the business case development, a

project team will include a recommendation of how costs will be shared for consideration during the capital approval process based on its assessment of project scope.

C. IT-Sponsored Capital Projects

The remainder of the IT capital costs I am requesting is for SDG&E IT-sponsored capital projects. Table CRO-17 below provides a summary of costs for the IT-sponsored capital projects. Summary descriptions of the projects are provided in the subsections below and details can be found in my revised capital workpapers for each project (Ex. SDG&E-24-CWP-R).

TABLE CRO-17

Capital Expenditures Summary of Costs – IT Projects Only

Shown in Thousands of 2016 Dollars				
Information Technology	**Work Paper (Ex. SDG&E-24-CWP-R)**	**Estimated 2017**	**Estimated 2018**	**Estimated 2019**
1. SDGE Private Network Refresh Phase 2	00818A	856	-	-
2. SDGE Transm Comm Reliability Improvement	00827A	10,324	-	-
3. SCADA Radio Replacement & Expansion	00827B	1,861	-	-
4. SDGE Out of Band Mgmt	00827C	372	-	-
5. ADMS Phase 3	00833C	1,102	133	-
6. SDG&E Data Warehouse and Hadoop Platform Upgrade	00833E	1,066	1,335	-
7. Electronic Bill Presentment and Payment (EBPP) for Sundry Billing and Customer Generation	00833G	-	1,591	-
8. 2018/2019 SDGE MDT Technology Obsolescence	00834D	-	1,268	1,237
9. LTE Communications Network	00834E	-	22,889	50,262
10. 2016/2017 SDGE MDT Technology Obsolescence	00834F	1,015	160	-
11. Downtown SCADA Communications Infrastructure Modernization	00834G	1,210	3,745	5,689
12. SDGE Enterprise Desktop Refresh	00834H	2,928	-	-
13. SQL Server 2016 Enterprise Environment	00834J	1,320	-	-

Shown in Thousands of 2016 Dollars				
Information Technology	**Work Paper (Ex. SDG&E-24-CWP-R)**	**Estimated 2017**	**Estimated 2018**	**Estimated 2019**
14. 2017 SDGE Mainframe Capacity Hardware Upgrade	00834K	-	2,273	4,575
15. SDGE Private Network Expansion and Refresh (Phase 3)	00834M	4,239	-	-
16. SDGE Private Network Expansion and Refresh (Phase 4)	00834N	-	3,674	-
17. Transmission Communications Reliability Enhancement - Phase II	00834O	6,769	12,711	14,631
18. NOC Modernization	00834P	4,258	-	-
19. SDGE Self Support Small Cap 2017 – 2019 (Routine)	00834Q	500	635	635
20. WAN Life Cycle Extension 2016	00834T	310	-	-
21. SDGE Private Network Expansion & Refresh (Phase 5)	00834U	-	-	3,895
22. SDGE Mainframe Capacity Upgrade and HW Tech Refresh	00834V	25	-	-
23. Smart GRID Endpoint Protection	15869A	218	-	-
Total		**38,373**	**50,414**	**80,924**

1. SDGE Private Network Refresh Phase 2

The forecast for the SDGE Private Network Refresh Phase 2 project for 2017, 2018, and 2019 is $856K, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year. The current microwave radio end-points are based largely on TDM-protocols (Time Division Multiplexing) limiting network redundancy and flexibility for TDM devices. At present, the legacy TDM network and many associate substation sites present a single point of failure given the lack of TDM network redundancy. This project will (1) upgrade nine existing SDG&E microwave radio backbone links to provide network redundancy, added capacity, and replace "End of Life" and "End of Support" devices, and (2) add four new links to provide redundancy and diversity for network resiliency. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 231).

2. SDGE Transmission Communication Reliability Improvement

The forecast for the SDGE Transmission Communication Reliability Improvement project for 2017, 2018, and 2019 is $10,324K, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year. The project will transform the existing TDM communication inter-site infrastructure (substation to substation and substation to head-end) of selected substations to redundant Internet Protocol/Multiprotocol Label Switching (IP/MPLS) infrastructure offering diverse communication paths, dynamic and intelligent rerouting, robust monitoring (24x7x365 network operations center (NOC)), and alerting and correlation capabilities. This will be done in three phases. In phase I, 10 of the 23 prioritized critical substations and three aggregation locations require the least amount of infrastructure upgrades. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 236).

3. SCADA Radio Replacement & Expansion

The forecast for the Supervisory Control and Data Acquisition (SCADA) Radio Replacement & Expansion project for 2017, 2018, and 2019 is $1,861K, $0, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. This project's goals are:

1. Replace the aging SCADA radio equipment with newer technology with enhanced security features including communication encryption, endpoint authentication and authorization by the end of March 2017.
2. Transform the existing TDM infrastructure at SCADA master radio sites to fully redundant IP equipment by the end of March 2017.
3. Address issues with SCADA backend severs by the end of March 2017 ($200K).
4. Test and begin replacement of exiting RMS 900 Remote Terminal Units (RTUs) in critical sites with newer standard communication devices.
5. Expand backhaul links not covered by the Private Network Replacement project (PNR) to support the additional SCADA traffic by the end of March 2017.

The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 241).

4. SDGE Out-of-Band Management

The forecast for the SDGE Out-of-Band Management project for 2017, 2018, and 2019 is $372K, $0, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. The project will implement an out-of-band management solution for 412 locations across the SDG&E and SoCalGas service territories. The project scope will include procurement, deployment, and configuration of 700 out-of-band management devices. Providing this out-of-band management solution allows for network support personnel to remotely connect to all sites throughout the service territory regardless of the network state. This will enable faster response time and provide for continued coverage and support with limited resource availability. The specific details regarding this project are found in my revised capital workpapers (Ex. SDGE-24-CWP-R, p. 246).

5. Advanced Distribution Management System Phase 3

The forecast for the Advanced Distribution Management System (ADMS) Phase 3 project for 2017, 2018, and 2019 is $1,102K, $133K, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. The ADMS Phase 3 project will:

1. Upgrade and configure major net minecraft server (NMS) code lines (1.12 SP3, then 2.3).
2. Upgrade NMS and FocalPoint application server infrastructure including OS and WebLogic.
3. Upgrade FocalPoint application to version 6.6.5.
4. Configure NMS and FocalPoint software for new device classes.
5. Build a foundation for distributed energy resource management (DERMS) and NMS integration including As-Switched Model, DER Time to Live, and Dispatch Schedules into NMS.
6. Migrate to NMS native damage assessment tool and enable non-outage events.
7. Develop requirements and design for conducting damage assessment through NMS mobile application.
8. Implement NMS Volt-VAr optimization tools based on results from Volt-VAr working group.
9. Improve power flow solutions by incorporating transmission breaker status and phase angles.

The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 251).

6. SDG&E Data Warehouse and Hadoop Platform Upgrade

The forecast for the SDG&E Data Warehouse and Hadoop Platform Upgrade project for 2017, 2018, and 2019 is $1,066K, $1,335K, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. This project is a base project to ensure that all at-risk data warehouses (DW) (*i.e.*, Smart Meter DW, Customer DW, Engineering DW and Customer Contact Center DW) and extract, transform, load (ETL) environments can continue to operate at the base level to meet business requirements. The goal is to decommission all unsupported and at-risk environments by leveraging an Open Source ETL tool for data staging and transformation using Hadoop. The SQL Data Warehouse would still be used as the final business intelligence (BI) layer to offer a seamless transition for business users for their reporting needs. This project will deliver the design and development of one BI report directly against a high-volume data source in the Hadoop Data Lake. This project will also include the upgrade of the Hadoop environment to enable more security features within Hadoop. The specific details regarding this project are found in my revised capital workpapers (Ex. SDGE-24-CWP-R, p. 257).

7. Electronic Bill Presentment & Payment (EBPP) for Sundry Billing & Customer Generation

The forecast for the Electronic Bill Presentment & Payment (EBPP) for Sundry Billing & Customer Generation project for 2017, 2018, and 2019 is $0, $1,591K, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. Currently non-electric and gas billing (Sundry Billing) processes require that a paper invoice be mailed out and the payer can only send in a physical check to pay for the services being billed. This project proposes to purchase and deploy SAP's Biller Direct software. Biller Direct is an EBPP software that is tied directly to SAP's Accounts Receivables module. This software will provide the option to send the customer a notice of invoice availability via email and allow the customer to view and pay the invoice online via an automated clearing house (ACH) transaction through the Biller Direct portal. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 341).

8. 2018/2019 SDGE MDT Technology Obsolescence

The forecast for the 2018/2019 SDGE MDT Technology Obsolescence project for 2017, 2018, and 2019 is $0, $1,268K, and $1,237K, respectively. SDG&E plans to build and place this project in-service by the test year. This project is for the 2018 and 2019 replacement of Mobile Data Terminals (MDTs) utilized by SDG&E's Electric and Gas Transmission & Distribution field personnel. This is a base business requirement as the field personnel rely on this equipment to respond to storms, outages, etc., which can directly impact System Average Interruption Duration Index (SAIDI)/System Average Interruption Frequency Index (SAIFI). The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 347).

9. LTE Communications Network

The forecast for the Long-Term Evolution (LTE) Communications Network project for 2017, 2018, and 2019 is $0, $22,889K, and $50,262K, respectively. SDG&E plans to build and place this project in service by the test year. The existing wireless communications infrastructure has become increasingly inadequate to meet the demand for greater volumes of data at high speed and have proven to be difficult and costly to deploy and maintain. Expanding the existing systems can provide coverage over a larger area but cannot meet the demand for high volume low latency data and control. Additionally, the Federal Communications Commission's (FCC) grandfathered protection of the use of 3.65 GHz frequency licenses will expire in 2020, which increases the risk of wireless network instability around the Borrego substation. As more dedicated communications solutions are deployed, there is higher potential for instability of operational field area networks due the use of unlicensed frequencies. To address these issues, SDG&E will implement a private broadband wireless digital communications network. Further, this system will support our large-scale, near-term expansion of SCADA field devices and the Falling Conductor system throughout SDG&E's service territory. Additionally, it will provide connectivity for a variety of use cases forecasting tremendous growth over the next 20 years including Advanced SCADA, SmartMeter AMI backhaul, fault circuit indicators, smart transformers, Distributed Storage Monitoring & Control. All of these use cases are being expanded in an effort to increase SDG&E's electric power system reliability and reduce outage durations. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 265).

10. 2016/2017 SDGE MDT Technology Obsolescence

The forecast for the 2016/2017 SDGE MDT Technology Obsolescence project for 2017, 2018, and 2019 is $1,015K, $160K, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. This project is to replace MDT units supported by Enterprise System Solutions Field Hardware Support (FHS) and used by SDG&E Gas and Electric field and contract personnel. This project replaced approximately 235 units in 2016, and plans on replacing approximately 294 units in 2017. These units are used by various organizations throughout SDG&E. This replacement is being done in accordance with guidelines outlined in the MDT standards for MDT life cycle, due to the environment in which units are used on a daily basis, and because of their general condition at the end of four years. The technology will be evaluated to ensure users will be able to take full advantage of new features being developed in field applications such as Click Mobile and GIS Mobile. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 353).

11. Downtown SCADA Communications Infrastructure Modernization

The forecast for the Downtown SCADA Communications Infrastructure Modernization project for 2017, 2018, and 2019 is $1,210K, $3,745K, and $5,689K, respectively. SDG&E plans to build and place this project in-service by the test year. The downtown area where we service some of our largest high profile customers is in need of communications infrastructure upgrades. The current copper wires are more than twenty years old, suffer frequent interruptions, and will not support the transformation to IP SCADA communications and remote network management. Approximately 10 of the existing RTU will be replaced with IP capable units. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 271).

12. SDGE Enterprise Desktop Refresh

The forecast for the SDGE Enterprise Desktop Refresh project for 2017, 2018, and 2019 is $2,928K, $0, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. Previous hardware standards for memory, CPU, etc. have proven to be inadequate for many users, as computing resource requirements to run advanced applications such as GIS and Click have surpassed the capabilities of the existing workstation hardware. This has resulted in significant work efficiency impacts, particularly to employees in operations and engineering roles. Business units have been purchasing new/replacement desktop hardware out of O&M at

the rate of 150 units/month over past 6 months. The last enterprise system refresh was 2011-2014 and over 50% of the machines acquired in that timeframe will be out of warranty by the end of 2017. IT support groups have been receiving an increasing number of calls to provide repair and/or replace assistance for degraded service on machines in the environment. This project will resolve these issues. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 278).

13. SQL Server 2016 Enterprise Environment

The forecast for the SQL Server 2016 Enterprise Environment project for 2017, 2018, and 2019 is $1,320K, $0, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. The Sempra SQL shared database servers support over 1,500 databases for key business areas such as Finance, Emergency Services, Customer Programs, Electric and Fuel Procurement, Gas Operations, Smart Meter Operations, Regulatory Affairs, MyInfo and IT Services. Some of these areas have requirements that are regulatory mandates. The hardware components for SQL 2012 shared database servers are five years old and are scheduled to fall out of support, and with increasing demand, this will strain the current infrastructure and make it vulnerable to failure. The software components for SQL 2005 shared database servers have already gone out of support, and do not support security initiatives for handling encryption-at-rest. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 283).

14. 2017 SDGE Mainframe Capacity Hardware Upgrade

The forecast for the 2017 SDGE Mainframe Capacity Hardware Upgrade project for 2017, 2018, and 2019 is $0, $2,273K, and $4,575K, respectively. The monthly Mainframe Capacity Management reports show continued mainframe growth, with SDG&E being the primary consumer, seeing 30% growth in capacity over the last 7 months. The SDG&E workload was not anticipated and was primarily the result of net new data mining being performed by the Customer Operations team. Regulatory requirements and limitations of the CISCO application were the primary reasons for the data mining. In addition, since October of 2015, CISCO has experienced chronic application program processing errors, which on several occasions has resulted in the CISCO Finance SLA (Service Level Agreement) being missed (including a miss for the entire 2016 year). Processing errors have occurred for numerous reasons, but are primarily related to data issues (OC4, OC7 and User errors for invalid data). At

times the errors in jobs are rerun two to six times before successfully completing. The delays associated with the reruns result in the batch workload extending into daytime call center processing, maximizing processor usage for extended periods of time, and requiring the development environment to be limited on their assigned processor usage, extending the time for development jobs to complete, thereby impacting project schedules. Based on current capacity and performance reports, coupled with our understanding that SDG&E growth is expected to climb, we anticipate needing to run at full capacity 100% of the time commencing November 2017. Between now and November 2017, even with running at full capacity, the risk is still high for missing the CISCO SLA due to the chronic CISCO application processing errors. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 288)

15. SDGE Private Network Expansion and Refresh (Phase 3)

The forecast for the SDGE Private Network Expansion and Refresh (Phase 3) project for 2017, 2018, and 2019 is $4,239K, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year. The SDG&E network has a number of microwave communication infrastructure with aging hardware that were initially installed for a TDM-based environment; some of these links are also at capacity while others suffer from continued performance issues. In addition, it has become increasingly difficult to obtain replacement parts. Advancing field technologies require the deployment of new IP microwave radios with MPLS and Synchronous Ethernet capabilities (not currently supported by legacy microwave infrastructure). In addition to the existing legacy links above, the Encina smokestack, currently a communications hub for SDG&E and the major microwave route for all North County sites is scheduled for demolition in January 2018 putting a number of microwave links in jeopardy and in need of migration. This upgrade aims to:

1. Replace end-of-life microwave hardware, install IP-based technology; expand the microwave coverage to increase efficiency and eliminate network points of failure; add security features and increase capacity to existing links for future growth on the corporate and substation networks.
2. Migrate key sites currently on leased-line circuits to private microwaves to increase security and reliability and reduce O&M expenditures.

3. Migrate Encina microwave radio and equipment to a new location ahead of the Encina smokestack demolition scheduled for 2018.

The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 294)

16. SDGE Private Network Expansion and Refresh (Phase 4)

The forecast for the SDGE Private Network Expansion and Refresh (Phase 4) project for 2017, 2018, and 2019 is $0, $3,674K, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. The SDG&E network has a number of microwave communication infrastructures with aging hardware that were initially installed for a TDM-based environment; some of these links are also at capacity while others suffer from continued performance issues. In addition, it has become increasingly difficult to obtain replacement parts. Advancing field technologies require the deployment of new IP microwave radios with MPLS and Synchronous Ethernet capabilities (not currently supported by legacy microwave infrastructure). In addition to the existing legacy links above, the Encina smokestack, currently a communications hub for SDG&E and the major microwave route for all North County sites is scheduled for demolition in January 2018 putting a number of microwave links in jeopardy and in need of migration. This phase 4 aims to:

1. Replace remaining end-of-life microwave hardware, install IP-based technology; expand the microwave coverage to increase efficiency and eliminate network points of failure. also, add security features and increase capacity to existing links for future growth on the corporate and substation networks.
2. Migrate key sites currently on leased-line circuits to private microwaves to increase security and reliability and reduce O&M expenditures.
3. Migrate Encina microwave radio and equipment to a new location ahead of the Encina smokestack demolition scheduled for 2018.

The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 299)

17. Transmission Communications Reliability Enhancement - Phase II

The forecast for the Transmission Communications Reliability Enhancement - Phase II project for 2017, 2018, and 2019 is $6,769K, $12,711K, and $14,631K, respectively. SDG&E

plans to build and place this project in service by the test year. SDGE has experienced failures of legacy TDM equipment resulting in several long duration communication outages at critical substations. The TDM network is a complicated system of technologies that has limited remote monitoring and failover capabilities resulting in delayed service restoration as on-site investigation, troubleshooting, and restoration is required. Over the last decade, telecommunications have been undergoing an industry-wide transformation from TDM-centric infrastructure to IP/MPLS network services. Support of legacy TDM network devices and interface equipment is becoming increasingly difficult to maintain due to lack of vendor support.

Phase II (all remaining Electric Transmission and Distribution substations) of the initial phase of the Transmission Communications Reliability Improvements project will standardize the network communications equipment and monitoring by replacing the existing older network communication inter-site and intra-site infrastructure. The project will further address single points of failure in the network by providing diverse communication paths, dynamic and intelligent rerouting, robust monitoring (24x7x365 NOC), and alerting and correlation capabilities. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 304)

18. NOC Modernization

The forecast for the NOC Modernization project for 2017, 2018, and 2019 is $4,258K, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year. In the last few years, the IT organization has added a number of new services, applications, network upgrades and circuits, and users. These services doubled the demand for the NOC and staff to meet the service level agreements and service level objectives for its business and IT customers. IBM has recently completed an operational readiness review for NOC and concluded that for the NOC to keep up with the current and future demand of clients, applications, and services, it needs to consolidate and upgrade its fragmented tools, reengineer its legacy processes and structures, provide a single dashboard for monitoring and alerting, speed automations of tasks, and dramatically modernize its existing legacy environment. The NOC modernization project will prepare the NOC and its staff to exceed client expectations for existing and future workloads with IT and operational technology (OT) network convergence including new services and upgrades. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 311).

19. SDGE Self Support Small Cap 2017 – 2019 (Routine)

The forecast for the SDGE Self Support Small Cap 2017 - 2019 project for 2017, 2018, and 2019 is $500K, $635K, and $635K, respectively. SDG&E plans to build and place this project in-service by the test year. This project funding request is to cover multiple SDG&E Small Cap projects for 2017 - 2019 covering routine business customer operational issues, safety, network improvements, Information Security, faster service delivery, collaboration, and innovation. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 316)

20. WAN Life Cycle Extension 2016

The forecast for the Wide Area Network (WAN) Life Cycle Extension 2016 project for 2017, 2018, and 2019 is $310K, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year. This project is being developed to perform a lifecycle extension of the WAN. Planned for 2016 are eight (8) core WAN locations (Monterey Park, Rancho Bernardo, Century Park, One Wilshire, Mission, Metro, Miramar, and Gas Company Tower) for a total of 16 core devices, replacing end-of-life/end-of-sale core components for each device while maximizing the existing asset. This project is focused on lifecycle extension only to maintain vendor supportability, system reliability, and the ability to continue to meet evolving client requirements. This project will not implement new architectures or network services. The specific details regarding this project are found in my capital revised workpapers (Ex. SDG&E-24-CWP-R, p. 321)

21. SDGE Private Network Expansion & Refresh (Phase 5)

The forecast for the SDGE Private Network Expansion & Refresh (Phase 5) project for 2017, 2018, and 2019 is $0, $0, and $3,895K, respectively. SDG&E plans to build and place this project in-service by the test year. The SDG&E network has a number of microwave communication infrastructures with aging hardware that were initially installed for a TDM-based environment; some of these links are also at capacity while others suffer from continued performance issues. In addition, it has become increasingly difficult to obtain replacement parts. Advancing field technologies require the deployment of new IP microwave radios with MPLS and synchronous ethernet capabilities (not currently supported by legacy microwave infrastructure. This upgrade aims to:

1. Replace end-of-life microwave hardware, install IP-based technology; expand the microwave coverage to increase efficiency and eliminate network points of failure; also, add security features and increase capacity to existing links for future growth on the corporate and substation networks.
2. Migrate key sites currently on leased-line circuits to private microwaves to increase security and reliability and reduce O&M expenditures.

The specific details regarding this project are found in my capital revised workpapers (Ex. SDGE-24-CWP-R, p. 326).

22. SDGE Mainframe Capacity Upgrade and HW Tech Refresh

The forecast for the SDGE Mainframe Capacity Upgrade and hardware (HW) Tech Refresh project for 2017, 2018, and 2019 is $25K, $0, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. This project will replace the mainframe hardware with an upgraded configuration that will satisfy current mainframe capacity demands.

The upgraded hardware will utilize much faster 10GB network technology. Both production and disaster recovery mainframe hardware will be upgraded to current, more efficient, and fully supported technology. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 331)

23. Smart Grid Endpoint Protection

The forecast for the Smart Grid Endpoint Protection project for 2017, 2018, and 2019 is $218K, $0, and $0, respectively. SDG&E plans to build and place this project in-service by the test year. This project will test and deploy SDG&E's endpoint protection technologies to identified Smart Grid servers and workstations in the data centers, controls centers, substations, and field environments. The specific details regarding this project are found in my revised capital workpapers (Ex. SDG&E-24-CWP-R, p. 336)

VI. CONCLUSION

This concludes my prepared direct testimony.

VII. WITNESS QUALIFICATIONS

My name is Christopher R. Olmsted. My business address is 555 W. Fifth Street, Los Angeles, CA 90013. I am employed by SoCalGas as the Director of Application Services. In this role, I am responsible for the development and maintenance of application solutions related to customer lines of business at SoCalGas.

I have been a member of the IT department since 1995. I have held several positions during my career, all of which have focused on customer applications. The majority of my time has been spent working with SoCalGas' Customer Information System (CIS). I held various roles of increasing responsibility over the years, resulting in my assignment as Manager of the CIS in 2002. In 2008 I joined the team that developed the business case for SoCalGas' Advanced Meter initiative. I assumed responsibility for the IT aspects of the project after California Public Utilities Commission approval and remained on the team until being assigned to my current role in 2012.

Prior to joining SoCalGas, I was employed as a consultant with Andersen Consulting (1989 – 1995). My main focus during this time was the development and implementation of an open standards shop floor application for the manufacturing environment. The last two years at Andersen I was as a senior consultant/manager on CIS implementations at SoCalGas and SDG&E.

I received a Bachelor of Science degree in Computer Information Systems from California Polytechnic State University at San Luis Obispo in 1989.

I have previously testified before the California Public Utilities Commission.

APPENDIX A – GLOSSARY OF TERMS

ACH: Automated Clearing House
ADMS: Advanced Distribution Management System
BI: Business Intelligence
CPU: Central Processing Unit
CPUC: California Public Utilities Commission
DERMS: Distributed Energy Resource Management
DW: Data Warehouses
EBPP: Electronic Bill Presentment & Payment
EFC: Executive Finance Committee
ETL: Extract, Transform, Load
FHS: Field Hardware Support
FCC: Federal Communications Commission
FOF: Fueling Our Future
GRC: General Rate Case
HW: Hardware
IT: Information Technology
IT PMO: Information Technology Project Management Office
IP/MPLS: Internet Protocol/Multiprotocol Label Switching
LTE: Long-Term Evolution
MDT: Mobile Data Terminals
NMS: Net Minecraft Server
NOC: Network Operations Center
O&M: Operations and Maintenance
OT: Operational Technology
PNR: Private Network Replacement
RTU: Remote Terminal Units
SAIDI: System Average Interruption Duration Index
SAIFI: System Average Interruption Frequency Index
SAP: Systems Applications and Products
SCADA: Supervisory Control and Data Acquisition
SDG&E: San Diego Gas & Electric Company
SLA: Service-Level Agreements
SoCalGas: Southern California Gas Company
SORT: Service Order Routing Technology
TDM: Time Division Multiplexing
TY: Test Year
VM: Virtual Machine

WAN: Wide Area Network

SDG&E 2019 GRC Testimony Revision Log –December 2017

Exhibit	Witness	Page	Line	Revision Detail
SDGE-24	Olmsted, Chris	Throughout	n/a	Replaced Ex. SDG&E-24-WP with Ex. SDG&E-24-WP-R and replaced Ex. SDG&E-24-CWP with Ex. SDG&E-24-CWP-R. And inserted "revised" when referring to workpapers. This is to reflect revisions to both O&M and Capital workpapers.
SDGE-24	Olmsted, Chris	CRO-3	16	Changed RAMP Table CRO-3 "2018 Estimated Incremental (000s)" amount from 25,413 to 26,129
SDGE-24	Olmsted, Chris	CRO-13	13	Changed Table CRO-12, TY 2019 Estimated Column: Moved $64k" from Applications to the IT Support category. Applications updated from 16,317 to 16,253. IT Support updated from 4,154 to 4,218.
SDGE-24	Olmsted, Chris	CRO-13	13	Changed Table CRO-12, Change Column: Applications updated from 1,272 to 1,206. IT Support updated from (397) to (333).
SDGE-24	Olmsted, Chris	CRO-14	19	Changed Table CRO-13: Removed "Hire additional IT associate, $64k". Updated Total to 1,206.
SDGE-24	Olmsted, Chris	CRO-15	21	Added text to "2. Cost Drivers:" Added "and hiring a new IT associate."
SDGE-24	Olmsted, Chris	CRO-15	23	Changed Table CRO-15: Added "Hire additional IT associate, $64k." Updated Total to (333).