

**BEFORE THE PUBLIC UTILITIES COMMISSION  
OF THE STATE OF CALIFORNIA**

Application of the California Energy	)	Application 12-11-001
Commission for Approval of Electric Program	)	(Filed November 1, 2012)
Investment Charge Proposed 2012 through	)	
2014 Triennial Investment Plan	)	
	)	
_____	)	Application 12-11-002
And Related Matters.	)	Application 12-11-003
	)	Application 12-11-004
	)	
	)	
_____	)	

**COMPLIANCE FILING OF SAN DIEGO GAS & ELECTRIC COMPANY'S  
(U 902 E) 2015 EPIC ANNUAL REPORT**

Stacy Van Goor  
8330 Century Park Court  
San Diego, California 92123  
Telephone: (858) 654-1534  
Facsimile: (619) 699-5027  
E-mail: svangoor@semprautilities.com

Assistant General Counsel for:  
SAN DIEGO GAS & ELECTRIC COMPANY

February 29, 2016

**BEFORE THE PUBLIC UTILITIES COMMISSION  
OF THE STATE OF CALIFORNIA**

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Commission for Approval of Electric Program	)	(Filed November 1, 2012)
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	)	Application 12-11-003
	)	Application 12-11-004
_____	)	

**COMPLIANCE FILING OF SAN DIEGO GAS & ELECTRIC COMPANY’S  
(U 902 E) 2013 EPIC ANNUAL REPORT**

Pursuant to Ordering Paragraph 16 of Decision (D.) 12-05-037 and in accordance with the Annual Report Outline provided in Attachment 5 of D.13-11-025, San Diego Gas & Electric Company (SDG&E) hereby submits its 2015 EPIC Annual Report (Report), provided hereto as Attachment A. In addition, SDG&E provides the excel file titled “SDG&E 2015 EPIC Project Status Report” in accordance with D.13-11-025 as Attachment B.<sup>1</sup> Together the two documents provide an overview of SDG&E’s EPIC activities during the 2015 calendar year and program financial information through December 31, 2015.

SDG&E and its fellow EPIC Administrators are required to each submit an annual report “detailing program activities.”<sup>2</sup> The annual reports are designed “to facilitate consistent reporting by the [EPIC] Administrators on their investment plans and project results.”<sup>3</sup> The reports, and their timing, are intended to inform stakeholders of the EPIC Plan’s

<sup>1</sup> The EPIC Administrators are required to provide with the annual report “electronically in spreadsheet format the information identified in Attachment 6 to report on projects described in Section 4.b of the EPIC annual report outline adopted by this decision.” D.13-11-025 at 63; Attachments 5 & 6.

<sup>2</sup> D.12-05-037 at 8.

<sup>3</sup> D.13-11-025 at 4-5, 62.

accomplishments when they meet with the EPIC administrators in March of the years in which investment plans will be considered.<sup>4</sup> In accordance with D.12-05-037, SDG&E serves this Report on “all parties in the most recent EPIC proceeding, and all parties to the most recent general rate cases for SDG&E, Pacific Gas and Electric, and Southern California Edison, and each successful and unsuccessful bidder for EPIC funding.

Dated at San Diego, California, this 29<sup>th</sup> day of February, 2016.

Respectfully submitted,

By: /s/ Stacy Van Goor

Stacy Van Goor  
8330 Century Park Court  
San Diego, California 92123  
Telephone: (858) 654-1534  
Facsimile: (619) 699-5027  
E-mail: svangoor@semprautilities.com

Assistant General Counsel for:  
SAN DIEGO GAS & ELECTRIC COMPANY

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<sup>4</sup> D.12-05-037 at 30-31.

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**ATTACHMENT A**

**SDG&E 2015 EPIC ANNUAL REPORT**

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**San Diego Gas & Electric Company**

**2015 EPIC Annual Report**

**February 29, 2016**

## 1. EXECUTIVE SUMMARY

Pursuant to Ordering Paragraph 16 of Decision (D.) 12-05-037 and in accordance with the Annual Report outline provided in Attachment 5 of D.13-11-025, San Diego Gas & Electric Company (SDG&E) hereby submits its 2015 EPIC Annual Report (Report). This Report provides an overview of SDG&E's EPIC activities during the 2015 calendar year.

As required by D.13-11-025, SDG&E is providing additional information about SDG&E's EPIC activities in Excel at Attachment B, "SDG&E 2015 EPIC Project Status Report."<sup>1</sup>

SDG&E proposed, and received approval for five programs that demonstrate smart grid system integration solutions in the first triennial application cycle (EPIC-1).<sup>2</sup> In addition SDG&E proposed, and received approval for five programs that demonstrate grid modernization and technology integration solutions, along with a sixth project in which SDG&E will participate in demonstration projects of industry RD&D consortia in the second triennial application cycle (EPIC-2).<sup>3</sup>

### a. Overview of Programs/Plan Highlights

In A.12-11-002, SDG&E requested Commission approval of five programs that demonstrate smart grid system integration solutions. In November 2013, SDG&E's Application and First Triennial EPIC Plan was approved in full, with minor modifications, by the Commission in D.13-11-025. The total SDG&E budget for the first triennial cycle is \$8,600k. Ten percent of this amount (\$860k) is allotted to program administration. The remainder (\$7,740k) is allotted to technical work in the Technology Demonstration and Deployment (TD&D) programs, which are limited to pre-commercial demonstrations.

In A.14-05-004, SDG&E requested Commission approval of the Second Triennial EPIC Plan which included five programs that have the potential to help modernize the electric grid to improve customer benefits, as well as a sixth project through which SDG&E will participate in industry RD&D consortia. In April, 2015, SDG&E's Application was approved in full, with minor modifications by the Commission in D.15-04-020. The total committed SDG&E budget for the second triennial cycle is \$8,679k. Ten percent of the total authorized budget of \$8,792 (\$879k) is allotted to program administration. The remainder of the committed budget (\$7,800) is allotted to technical work in TD&D programs, which are limited to pre-commercial demonstrations.

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<sup>1</sup> D.13-11-025 at 63.

<sup>2</sup> D.13-11-025.

<sup>3</sup> D.15-04-020.

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**b. Status of Projects**

As discussed in further detail below, in 2015, SDG&E continued the execution of the three EPIC-1 projects that were previously started. Two of these projects have established teams comprised of SDG&E staff and a contractor for each. Tasks in the project plan are in progress. The third project has an internal team established, and negotiations are in progress with a contractor, who will complete the team. The fourth and fifth EPIC-1 projects had been on hold, pending a decision by the CPUC in response to SDG&E's Petition for Modification (PFM) filed in January, 2014. Based on Decision (D.) 16-01-010, SDG&E has released these two projects and committed the originally planned funding to them. The work on these projects will begin in 2016. The third project mentioned above has also been restored to the originally intended funding level. Part of its funds had also been on hold, pending the decision on the PFM. No deliverables are yet available for EPIC-1 projects. .

SDG&E released the first five of its EPIC-2 projects in 2015. Technical leads were assigned, and they are preparing the project implementation plans. Project team formation, including contracted portions of the projects will take place in 2016. The sixth EPIC-2 project on demonstrations through collaborative R&D consortia will be started in 2016.

Each of SDG&E's EPIC projects except Project 11 is performed by a project team comprised of SDG&E technical staff and a contractor. Project 11 is funded and performed through R&D consortia. SDG&E's updated portfolio for both EPIC-1 and EPIC-2 is provided in Table 1.

**Table 1. SDG&E's EPIC-1 and EPIC-2 Portfolio as of December 31, 2015**

<b>EPIC-1 Projects (2012 – 2014)</b>		
<b>EPIC Project</b>	<b>Project Commitments (\$ thousands)</b>	<b>Comments</b>
1. Demonstration of Grid Support Functions of Distributed Energy Resources	1,673	No change from original plan.
2. Smart Distribution Circuit Demonstrations	1,599	No change from original plan.
3. Distributed Control for Smart Grids	1,648	No change from original plan.
4. Smart Grid Architecture Demonstrations	1,410	No change from original plan.
5. Visualization and Situational Awareness Demonstrations	1,410	No change from original plan.
6. SDG&E Program Administration	860	No change from original plan.
<b>Total</b>	<b>\$8,600</b>	

<b>EPIC-2 Projects (2015 – 2017)</b>		
<b>EPIC Project</b>	<b>Project Commitments (\$ thousands)</b>	<b>Comments</b>
1. Modernization of Distribution System & Integration of Distributed Generation and Storage	1,700	No change from original plan.
2. Data Analytics in Support of Advanced Planning and System Operations	1,200	No change from original plan.
3. Monitoring, Communications, and Control Infrastructure for Power System Modernization	1,200	No change from original plan.
4. System Operations Development and Advancement	1,200	No change from original plan.
5. Integration of Customer Systems into Electric Utility Infrastructure	1,000	No change from original plan.
6. Collaborative Programs in RD&D Consortia	1,500	No change from original plan.
7. SDG&E Program Administration	879	No change from original plan.
<b>Total</b>	<b>\$8,679</b>	

## **EPIC-1 PROJECTS**

### **Project 1: Demonstration of Grid Support Functions of Distributed Energy Resources**

SDG&E selected Schweitzer Engineering Laboratory (SEL) as the prime contractor for this project in the third quarter of 2015. A kickoff meeting was held with the SDG&E subject matter experts (SMEs) to discuss the SEL project plan, schedule and deliverables. SEL has submitted the use cases for this project and they are in discussion with SDG&E regarding testing schedule and availability of the SDG&E Integrated Test Facility (ITF).

A project implementation plan, including approach, testing locations, internal staffing, procurement plans, and schedule was developed in parallel with the RFP and will be finalized when the use cases are finalized, including scheduled use of the ITF.

### **Project 2: Smart Distribution Circuit Demonstrations**

SDG&E awarded a prime contract for the Smart Distribution Circuit Demonstrations Project to Schweitzer Engineering Laboratories (SEL). Project kick-off and initiation meetings were held, and a comprehensive project implementation planning effort was undertaken to identify the team resource requirements, technical approach, testing locations, internal staffing, procurement plans, and schedule.

SDG&E is working with SEL to refine project metrics. Work on Phase 1 (Baseline Characterization and Requirements Definition) and Phase 2 (Modelling and Circuit Optimization) was underway at the conclusion of 2015.

### **Project 3: Distributed Control for Smart Grids**

An RFP for this project was sent to 12 contractors and 5 responded. The contractor will be selected in 2016, and a contract will be negotiated to add the contractor to the project team.

A project implementation plan, including approach, testing locations, internal staffing, procurement plans, and schedule was developed in parallel with the RFP and will be finalized with involvement from the contractor.

Based on D. 16-01-010, this project will not be changed and will be restored to the originally planned funding level.

#### Project 4: Smart Grid Architecture Demonstrations

This project had been suspended until SDG&E received a decision on its PFM filed in 2014. With the issuance of D. 16-01-010, SDG&E will release this project and launch it at the originally planned funding level in early 2016.

#### Project 5: Visualization and Situational Awareness Demonstrations

This project had been suspended until SDG&E received a decision on its PFM filed in 2014. With the issuance of D.16-01-010, SDG&E will release this project and launch it at the originally planned funding level in early 2016.

### **EPIC-2 PROJECTS**

#### Project 6: Modernization of Distribution System and Integration of Distributed Generation and Storage

In 2015, the Technical Lead for this project was assigned to the project. Input from internal stakeholders for development the project scope was obtained in an SDG&E internal project roadmapping session in October. The project plan will be completed and implemented in 2016.

#### Project 7: Data Analytics in Support of Advanced Planning and System Operations

The Technical Lead for this project was assigned in 2015. In 2015, the project Technical Lead was assigned to the project. Input from internal stakeholders for development the project scope was obtained in an SDG&E internal project roadmapping session in October. The project plan will be completed and implemented in 2016.

#### Project 8: Monitoring, Communication, and Control Infrastructure for Power System Modernization

A detailed project plan has been developed that provides the basis for ongoing project development, planning and tracking mechanism. An RFP will be released to procure a prime contractor for this project by the end of first quarter of 2016. The prime contractor selection is scheduled for the second quarter of 2016

#### Project 9: System Operations Development and Advancement

The Technical Lead for this project was assigned to the project. In 2015, the project Technical Lead was assigned to the project. Input from internal stakeholders for development the project scope was obtained in an SDG&E internal project roadmapping session in October. The project plan will be completed and implemented in 2016.

## Project 10: Integration of Customer Systems into Electric Utility Infrastructure

The Technical Lead for this project was assigned to the project. In 2015, the project Technical Lead was assigned to the project. Input from internal stakeholders for development the project scope was obtained in an SDG&E internal project roadmapping session in October. The project plan will be completed and implemented in 2016.

## Project 11: Collaborative Programs in RD&D Consortia

Funds have been committed to this project and it will be launched in 2016. SDG&E will work with R&D collaborative consortia to identify high value, high priority demonstration projects that can be funded through the consortia.

## **2. INTRODUCTION AND OVERVIEW**

### **a. Background on EPIC**

EPIC was previously established by the Commission in D.11-12-035 to provide public interest investments in applied research and development, technology demonstration and deployment, market support, and market facilitation of clean energy technologies and approaches for the benefit of ratepayers of California investor-owned utilities (IOUs). D.12-05-037 established the purposes and governance structure for EPIC and D.13-11-025 clarified many of the program's regulatory requirements.

EPIC is designed to provide funding for electric utility research, development, and demonstration (RD&D). Specific funding allotments are made to four EPIC program administrators, including SDG&E.<sup>4</sup> The EPIC program is intended to run until 2020 and is comprised of three triennial program cycles.

### **b. EPIC Program Components**

The IOUs, including SDG&E, may only administer EPIC projects in the area of pre-commercial technology demonstration and deployment (TD&D). Post-commercial demonstrations and deployments are not allowed. Utility participation in the early stages of the research and development process, i.e., basic research for new utility-related technology, is also not allowed.

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<sup>4</sup> EPIC administrators are the California Energy Commission, San Diego Gas & Electric, Southern California Edison and Pacific Gas and Electric.

### **c. EPIC Program Regulatory Process**

Pursuant to D.12-05-037, SDG&E was required to submit an application seeking Commission approval of an EPIC plan every three years. SDG&E submitted its First Triennial (EPIC-1) Plan (A.12-11-002) on November 1, 2012 and received full Commission approval of the Plan in D.13-11-025. No hearings were held. SDG&E submitted its Second Triennial (EPIC-2) Plan (A. 14-05-004) on May 1, 2014 and received Commission approval of the Plan in D. 15-04-020. No hearings were held.

SDG&E and the other EPIC administrators are required to submit an annual report every February 28. This is the fourth annual report submitted by SDG&E for its EPIC program.

### **d. Coordination among EPIC Administrators**

The four EPIC administrators have regular teleconferences and ad-hoc face-to-face meetings as needed to coordinate EPIC activities.

### **e. Transparent and Public Process**

SDG&E is committed to conducting competitive procurements for those parts of the project work that require contracted services or major purchases of equipment or software. Development and issuance of Request for Proposals (RFP's) for two EPIC-1 projects was initiated in late 2014 and for a third EPIC-1 project in 2015. Competitive procurements for 7 additional EPIC projects are planned for 2016.

An SDG&E public EPIC web site has been established at <https://www.sdge.com/epic>. SDG&E and the other EPIC administrators are required to host at least two stakeholder meetings annually to discuss their EPIC programs, proposals and progress.<sup>5</sup> In 2015, SDG&E hosted, on behalf of itself and the other EPIC administrators, and participated in an EPIC stakeholders' workshop on August 18, 2015 and participated in a stakeholders' symposium on December 3, 2015. The focus of the workshop was on distributed energy resource (DER) integration and the symposium had three parallel tracks on three major topic areas addressed in the EPIC projects: energy efficiency, generation/integration, and data analytics/systems architecture.

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<sup>5</sup> D.12-05-037 at 74.

### 3. SDG&E's EPIC Budget & Related Costs

#### a. SDG&E Authorized Budget & Incurred Costs for First Triennial Cycle (2012 – 2014) and Second Triennial Cycle (2015 -2017)

**Table 2. SDG&E Budget and Incurred Costs for EPIC-1 and EPIC-2 as of December 31, 2015**

	EPIC Triennial 1 (2012 – 2014)		EPIC Triennial 2 (2015 – 2017)	
	Technology Demonstration & Deployment (in \$ thousands)	Program Administrative (in \$ thousands)	Technology Demonstration & Deployment (in \$ thousands)	Program Administrative (in \$ thousands)
SDG&E Authorized Budget	7,740	860	7,800	879
SDG&E Incurred Costs	444	166	16	96
SDG&E Disbursements to CEC	16,127	3,024	0	897
SDG&E Disbursements to Commission for Regulatory Oversight	N/A	273	N/A	75

#### b. Commitments/Encumbrances for TD&D Projects

SDG&E has committed \$7,740k of its TD&D budget for the EPIC-1 cycle to the five projects in the approved First Triennial Plan. This amount includes release of funds from the EPIC-1 cycle that had been held pending the issuance of D. 16-01-010 which provided clarification regarding PEVSP pilot funding.

As of December 31, 2015, SDG&E has encumbered \$1,447k of EPIC-1 funds for contracted activities, of which \$332k had been expended. SDG&E has spent \$112k on internal project work. The total expenditures through December 31, 2015 on TD&D project work is therefore \$444k (\$332k + \$112k). More detail is provided in Appendix B.

SDG&E has committed \$7,800k of its EPIC-2 TD&D budget to the six projects in the approved EPIC-2 plan. This constitutes full commitment of the approved EPIC-2 TD&D funds.

As of December 31, 2015, SDG&E has encumbered \$227k for EPIC-2 contracted activities, of which \$11k had been expended. SDG&E has spent \$5k on internal project work. The total expenditures through December 31, 2015 on TD&D project work is therefore \$16k (\$11k + \$5k). More detail is provided in Appendix B.

**c. Commitments/Encumbrances for Program Administration**

SDG&E has fully committed its program administration budget for both triennials (EPIC-1: \$860k, EPIC-2: \$879k). SDG&E has incurred a cumulative \$262k for overall program administration expenses through 2015, which includes both EPIC-1 and EPIC-2 costs. Of this amount, \$166k is attributed to EPIC-1 and \$96k is attributed to EPIC-2. All program administration has been performed in-house.

**d. Fund Shifting Above 5% between Program Areas**

SDG&E has done no fund shifting to date.

**e. Uncommitted/Unencumbered Program Funds**

SDG&E does not have any approved program TD&D funds that are uncommitted as of December 31, 2015. There is a small difference (\$68.6k) between the \$7,868.6k that was authorized for EPIC-2 and the \$7,800 that is committed for TD&D. The difference exists because this amount was not included in the SDG&E application for EPIC-2. Therefore, SDG&E's approved budget in D.15-04-020 reflects the amount proposed in its application. This has led to a situation where SDG&E is approved to invest less than the amount allocated to it. D.15-04-020 instructed SDG&E that it will need to separately apply for release of these funds for commitment to a project.

**4. SDG&E EPIC PROJECTS**

**EPIC-1 Projects**

**Project 1: Demonstration of Grid Support Functions of Distributed Energy Resources (DER)**

- i. Investment Plan Period  
2012-2014 (EPIC-1)
- ii. Assignment to Value Chain  
Distribution

iii. Objective

The objective is to assess the viability of using DER to provide non-traditional functions, such as Volt/VAR regulation, fast-response peaking or emergency power, peak shaving and distribution system status information. These findings will be used to determine DER's appropriate roles in a mix of alternative solutions for distribution system voltage regulation, electrical loss reduction, and gains in safety and reliability. The results will aid utilities to decide which, if any, DER grid support functions in specific application situations warrant commercial pursuit.

iv. Scope

DER grid support functions will be tested in various application situations to assess their technical and economic viability and to determine interconnection and interoperability system requirements for control and dispatch of those DER functions that appear to be viable for commercial adoption (if any).

v. Deliverables

A key deliverable will be a comprehensive final report which will include;

- Descriptions of DER functions demonstrated, application situations, testing performed, and test results.
- Recommendations regarding which DER functions should be pursued commercially in power distribution systems.
- Roadmap for transfer of knowledge gained (on function viability and interoperability system requirements to support functions) to commercial practice and/or to standards working groups, as may be appropriate.
- Specifications for integration systems to encourage "plug and play" capabilities in the "smart inverters" (power conditioning systems) and other integration components.
- Transfer of relevant information to standards development organizations and other stakeholders.

Interim deliverables will include draft test plans and schedules and detailed test methodologies and analysis.

vi. Metrics

The measure of success for this project will be if it provides a basis for deciding which DER functions warrant commercial pursuit in smart grid development. Project metrics will also include the identification of suitable interoperability, interconnection systems and communication protocols that support the functions. The metrics will include a determination of what standards, rules and regulations are needed to

encourage the adoption of viable grid support functions and the dissemination of program results to standards writers and governmental entities engaged in drafting applicable industry standards and rules.

- vii. Schedule  
April 1, 2014 to July 31, 2017
- viii. EPIC Funds Encumbered  
\$664k
- ix. EPIC Funds Spent  
\$209k
- x. Partners (if applicable)  
n/a
- xi. Match Funding (if applicable)  
n/a
- xii. Match Funding Split (if applicable)  
n/a
- xiii. Funding Mechanism (if applicable)  
Combination of in-house work and pay-for-performance contracts. A prime contractor was selected by competitive procurement. Three bidders responded to the solicitation. All bids passed the initial screening criterion of being responsive to the request for proposal, and they were all evaluated and scored in accordance with the evaluation criteria. Schweitzer Engineering Laboratories (SEL) was selected for contract award. SEL was the highest scoring bidder.
- xiv. Treatment of Intellectual Property (if applicable)  
None to date.
- xv. Status Update  
SDG&E selected SEL as the prime contractor for this project in the second quarter of 2015. An agreement was executed in July 2015 and a kickoff meeting was held with SDG&E subject matter experts (SMEs) to discuss SEL's approach to pilot test grid

support DER functions to observe how well those support functions work in specific locational and operational situations, determine the value of grid support functions, and determine the requirements for interconnection, interoperability, and communication standards. The work is also intended to identify any gaps in meeting those requirements, and to determine operational requirements for control and dispatch of specific grid support functions in viable application situations.

SEL developed a set of use cases to accomplish the aforementioned tasks, which included diagrams of the proposed Real-Time Digital Simulator (RTDS) test setup and proposed schedule.

SDG&E will work with the selected prime contractor to perform the project work and to further refine project metrics. During project execution, the internal stakeholder review panel will continue to critique project work and results and to aid in tech transfer of the results into practical application.

## **Project 2: Smart Distribution Circuit Demonstrations**

- i. Investment Plan Period  
2012-2014 (EPIC-1)
- ii. Assignment to Value Chain  
Distribution
- iii. Objective  
The objective of this project is to perform pilot demonstrations of smart distribution circuit features and associated simulation work to identify best practices for integrating new and existing distribution equipment in these circuits. Simulations will take advantage of hardware-in-loop testing with a real-time digital simulator currently available at SDG&E. Using simulations to optimize one particular circuit, desired features will be tested in that circuit to assess their suitability for widespread commercial adoption.
- iv. Scope  
This project encompasses laboratory and field testing of alternative distribution circuit components and circuit designs and assesses the related distribution system operational implications. Tests are being staged and data will be taken. It will be necessary to stage “before and

after” simulations and tests to understand the prospective benefits of specific options that are under study. Data analysis will be performed, and recommendations will be made on best practices for robust distribution circuit practices in the future.

v. Deliverables

The project team will produce three reports containing project data, findings, and recommendations. The Hardware and Circuit evaluation Report (an interim report) will describe the available and existing hardware capabilities, the required hardware or simulations and any baseline data results and conclusions. The Circuit Simulation Report (an interim report) will provide the simulation model specifics, required control algorithms, optimal equipment placement, and any circuit improvements simulated (based on baseline data). The comprehensive Final Report will document all of the work and important project results.

vi. Metrics

The project team is developing metrics by which project results can be evaluated. In general, the ultimate measure of success will be having a benchmark smart distribution circuit design that helps advance smart grid development. The circuit design will be capable of assimilating a wide variety of smart devices and will have a protection system that allows this assimilation to be done without compromising reliability or safety. Project metrics will include meeting project milestones and completing deliverables. The findings will be published in relevant technical conferences and journals, as may be appropriate.

vii. Schedule

July 7, 2014 to July 31, 2017

viii. EPIC Funds Encumbered

\$743k

ix. EPIC Funds Spent

\$197k

x. Partners (if applicable)

n/a

xi. Match Funding (if applicable)

n/a

xii. Match Funding Split (if applicable)  
n/a

xiii. Funding Mechanism (if applicable)

Combination of in-house work and pay-for-performance contracts. A prime contractor was selected by competitive procurement. Six bidders responded to the solicitation. All bids passed the initial screening criterion of being responsive to the request for proposal, and they were all evaluated and scored in accordance with the evaluation criteria. Schweitzer Engineering Laboratories (SEL) was selected for contract award. SEL was the highest scoring bidder.

xiv. Treatment of Intellectual Property (if applicable)  
None to date.

xv. Status Update

SDG&E awarded a prime contract for the project to SEL during the second quarter of 2015. The SDG&E/SEL project team was formed, and it is managed by the SDG&E Technical Lead. The team launched the project task work during the third quarter and held a formal project initiation meeting in the early part of the fourth quarter of 2015.

The development of a project implementation plan, including approach, testing locations, internal staffing, procurement plans, and schedule, is proceeding with involvement from the selected prime contractor.

SDG&E is working with SEL to perform the project work and to refine project metrics. Throughout the project execution, SDG&E's internal stakeholder review panel will continue to critique and refine project work and results as well as aid in technology transfer of the results into practical application.

Work on Phase 1 (Baseline Characterization and Requirements Definition) and Phase 2 (Modelling and Circuit Optimization) was underway at the conclusion of 2015.

### Project 3: Distributed Control for Smart Grids

- i. Investment Plan Period  
2012-2014 (EPIC-1)
- ii. Assignment to Value Chain  
Distribution
- iii. Objective  
The objective of this project is to test alternatives for communication and control across distribution system resources to ensure that devices operate in a complementary manner and ensure optimum distribution system performance, reliability, and stability. The project will test distributed control methods and approaches to control distribution circuit resources and integrate them as part of a unified control scheme with other higher-level control systems, such as the distribution management system (DMS). The project work will assess the scalability and performance of alternative control schemes.
- iv. Scope
  - a. **Phase 1** – Design and Development of Technical Solution: This phase will include investigation of the requirements and then proposing the design and development requirements for a comprehensive architecture for the Advanced Distribution Control System that spreads across the transmission operations, distribution operations, distribution substations, distribution feeders, and third party aggregators and retail customers. The design and development process includes the development and improvement of the functions, requirements, specifications, control interface, control algorithms, data models, data exchange, and security requirements of the Advanced Distribution Control System.
  - b. **Phase 2** – System Installation and laboratory testing at SDG&E's Integrated Test Facility (ITF): This phase will involve the installation of the test system, modeling and verification of RTDS circuit models, integration of smart technology hardware, development of control and operational schemes, development of the test plan for evaluation of the proposed Advanced Distribution Control System, and the execution of the test plan.
  - c. **Phase 3** – System Installation and field testing in SDG&E's power distribution system: This phase will include the field demonstration of the proposed Advanced Distribution Control System which should

gather and process the data and measurements from smart devices in an individual feeder or a larger distribution circuit region, coordinate and manage the operation of the controllable devices, and be compatible with higher level supervision at Advanced Distribution Management System (ADMS) level.

- v. Deliverables  
The project team will prepare and deliver a comprehensive final report on the work and results.
- vi. Metrics  
Metrics for this project will be based on comparing the performance of distribution system operations when various control schemes are in place with the performance of the same operations when the control schemes are not in place. The interaction of other distribution circuits on a common substation will also be compared. These performance metrics will include measures of power quality, electrical loss reductions, asset health maintenance, and adaptability to new device types in the distribution system.
- vii. Schedule  
January 12, 2015 to July 31, 2017
- viii. EPIC Funds Encumbered  
\$40k
- ix. EPIC Funds Spent  
\$38k
- x. Partners (if applicable)  
n/a
- xi. Match Funding (if applicable)  
n/a
- xii. Match Funding Split (if applicable)  
n/a
- xiii. Funding Mechanism (if applicable)  
Combination of in-house work and pay-for-performance contracts

xiv. Treatment of Intellectual Property (if applicable)

None to date.

xv. Status Update

Meetings were held with SDG&E SMEs to discuss the proposed architecture included in the scope of work to ensure there was no duplication of effort with other internal projects and to address gaps between the Distributed Control Project and other SDG&E projects. An RFP was released in the fourth quarter of 2015 to procure a prime contractor for this project. The RFP contained a detailed description of the work to be performed by the prime contractor. The RFP was sent to 12 contractors and 5 responded. A contractor will be selected in 2016.

A project implementation plan, including approach, testing locations, internal staffing, procurement plans, and schedule was developed in parallel with the RFP and will be finalized with involvement from the contractor.

SDG&E will work with the contractor to perform the project work and to further refine project metrics. During project execution, SDG&E's internal stakeholder review panel will continue to critique project work and results as well as aid in tech transfer of the results into practical application.

#### **Project 4: Smart Grid Architecture Demonstrations**

i. Investment Plan Period

2012-2014 (EPIC-1)

ii. Assignment to Value Chain

Distribution

iii. Objective

The specific objectives of the project are to: perform pilot demonstration of key candidate prototype building blocks of the SDG&E smart grid architecture to determine their suitability for adoption in the architecture; document the results and make recommendations of whether specific building blocks should be adopted; and, provide demonstration results to the SDG&E interdepartmental smart grid architecture team to support the implementation phase for any building blocks adopted.

iv. Scope

The distribution system architecture building blocks will be identified and prioritized for demonstration. The highest priority building blocks will be prioritized up to the limit of the project budget. A test plan will be written and performed. Wherever possible, the demonstrations will be performed at SDG&E's ITF. Trials of specific communication standards, such as IEC 61850, will be conducted to evaluate their prospective use in the architecture. Analyses will be performed, and recommendations will be made relative whether specific building blocks should be adopted.

v. Deliverables

Recommendations regarding which building blocks should be adopted. Test results to support implementation of the adopted smart grid architecture building blocks. Rationale for why specific standards or other architecture building blocks are recommended or not recommended. A comprehensive final report describing the work and results will be prepared on Project 4.

vi. Metrics

Networked distribution automation will enable more efficient and reliable distribution system operation than is possible with merely operating the system devices autonomously. Networking requires committing to a stable architecture for both the electrical infrastructure and the communication infrastructure. Therefore, the ultimate measure of success in this project will be completing and documenting demonstrations of candidate architecture building blocks to help SDG&E create knowledge that will contribute to development of its architecture for networked distribution automation. Specific project metrics will include whether the project team met milestones in the project plan and completed deliverables in the contract. In addition, findings will be published in relevant technical journals and conferences, as may be appropriate.

vii. Schedule

February 10, 2016 to August 31, 2017

viii. EPIC Funds Encumbered

\$0

ix. EPIC Funds Spent

\$0

- x. Partners (if applicable)  
n/a
- xi. Match Funding (if applicable)  
n/a
- xii. Match Funding Split (if applicable)  
n/a
- xiii. Funding Mechanism (if applicable)  
Combination of in-house work and pay-for-performance contracts
- xiv. Treatment of Intellectual Property (if applicable)  
None to date.
- xv. Status Update  
This project was put on hold, pending a decision by CPUC on SDG&E's PFM seeking clarification regarding PEVSP pilot funding. Based on guidance in D. 16-01-010, SDG&E will be using EPIC funds for Project 4 at the funding level originally planned. A project technical lead will be assigned and the project will be launched in early 2016.

### **Project 5: Visualization and Situational Awareness Demonstrations**

- i. Investment Plan Period  
2012-2014 (EPIC-1)
- ii. Assignment to Value Chain  
Distribution
- iii. Objective  
The objective of this demonstration project is to explore how data collected from sensors and devices can be processed, combined, and presented to system operators in a way that enhances grid monitoring and situational awareness. In particular, this program will look at low data currently unexploited and separately processed can be integrated and visually presented for strategic use by system operators. When transformed and presented in a visually integrated manner, this data can be invaluable for utilities to optimize grid operations as well as provide insights in the performance of the overall utility system. This visual framework also provides insights into customers' energy

consumption behavior to serve them more effectively foster energy conservation, and reduce peak demand. The demonstration of specific visualization and situational awareness concepts will be used to help SDG&E make choices on which options should be adopted into a future visualization and situational awareness system.

iv. Scope

The work will include requirements definition for the visualization and situational awareness based on where data could yield significant value, prototyping the data integration schemes, displays and algorithms, and implementing a testing plan. A roadmap will be developed for integrating project results deemed suitable for commercial adoption into SDG&E's power system.

v. Deliverables

Specifications for data processing and integration schemes, displays, and algorithms. Visualization and situational awareness solution designs. Demonstration results. Overall data visualization and situational awareness strategies and adoption roadmap. A comprehensive final project report describing the work and results will be prepared and delivered.

vi. Metrics

Specific project metrics will include the completion of the initial specification for a visualization and situational awareness system, the demonstration of a system display mock-up, and the specifications and recommendations for adoption by SDG&E. Other metrics will include achieving program milestones and deliverables. Findings will be published in relevant technical journals and conferences, as appropriate.

vii. Schedule

February 10, 2016 to August 31, 2017

viii. EPIC Funds Encumbered

\$0

ix. EPIC Funds Spent

\$0

- x. Partners (if applicable)  
n/a
- xi. Match Funding (if applicable)  
n/a
- xii. Match Funding Split (if applicable)  
n/a
- xiii. Funding Mechanism (if applicable)  
Combination of in-house work and pay-for-performance contracts
- xiv. Treatment of Intellectual Property (if applicable)  
None to date.
- xv. Status Update  
This project was put on hold, pending a decision by CPUC on SDG&E's PFM seeking clarification regarding PEVSP pilot funding. Based on guidance in D. 16-01-010, SDG&E will be using EPIC funds for Project 5 at the funding level originally planned. A project technical lead will be assigned and the project will be launched in early 2016.

## **EPIC-2 PROJECTS**

### **Project 6: Modernization of Distribution System and Integration of Distributed Generation and Storage**

- i. Investment Plan Period  
2015-2017 (EPIC-2)
- ii. Assignment to Value Chain  
Distribution
- iii. Objective  
This project will demonstrate distribution system infrastructure modernization solutions, including advances in distribution system design to enable use of new technologies, such as power electronic components, new protection systems, distributed generation and alternative storage technologies. The work will build on the current state of the art for these devices and any track record that is available from the industry. However, the demonstration work in this project will

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push forward to demonstrating complete integrated smart circuit solutions, versus the individual device focus of prior work.

iv. Scope

This project will encompass laboratory and field testing of modernized distribution circuit topologies which include components, subsystems and operational practices accommodating modern implementations of distributed generation, energy storage and controllable electronic devices. Methods to optimize the operation of both legacy and modern distribution system elements will be coordinated to achieve integrated and scalable solutions. Tests will be staged and data will be compiled. It will be necessary to conduct “before and after” simulations and tests to understand the prospective benefits of specific options and optimization goals that are under study. Data analysis will be performed, and recommendations will be made relative to which features should be adopted in ongoing modernization of the distribution system.

v. Deliverables

The project team comprised of SDG&E technical staff and the contractor will prepare and deliver a comprehensive final report on the work and results. Interim project deliverables will be identified in the project planning phase.

vi. Metrics

In general, metrics for this project will be based on comparing the performance of distribution system operations when various modernization solutions are in place with the performance of the same operations when they are not in place. These performance metrics will include measures of power quality, electrical loss reductions, asset health maintenance, and adaptability to new operational regimes in the distribution system. The SDG&E/contractor project team will develop a final list of metrics.

The ultimate measure of success in this project will be completing and documenting demonstrations of candidate modernization solutions to help SDG&E create knowledge that will contribute to ongoing modernization of its distribution system. Specific project metrics will include whether the project team met milestones in the project plan and competed deliverables in the contract. In addition, findings will be published in relevant technical journals and conferences, as appropriate.

- vii. Schedule  
January 4, 2016 to July 31, 2017
- viii. EPIC Funds Encumbered  
\$0
- ix. EPIC Funds Spent  
\$0
- x. Partners (if applicable)  
n/a
- xi. Match Funding (if applicable)  
n/a
- xii. Match Funding Split (if applicable)  
n/a
- xiii. Funding Mechanism (if applicable)  
Combination of in-house work and pay-for-performance contracts
- xiv. Treatment of Intellectual Property (if applicable)  
None to date.
- xv. Status Update  
The development of a project implementation plan, including definition of project tasks, identification of testing locations, identification of internal staffing needs, development of procurement plans, a breakdown of the project budget, and project schedule, will proceed in parallel with the RFP development in the first quarter of 2016.

**Project 7: Data Analytics in Support of Advanced Planning and System Operations**

- i. Investment Plan Period  
2015-2017 (EPIC-2)
- ii. Assignment to Value Chain  
Distribution

iii. Objective

This project is designed to address the anticipated “data tsunami” associated with more widespread system monitoring and more widespread use of controllable devices in the power system. It will also help create better data management. It will demonstrate solutions for the data management issues and challenges expected to accompany the extensive amount of real-time and stored data being archived from field devices and identify the data mining procedures and the data-archiving methods, utilizing this data to improve power system operations. Solutions that are deemed to be best practices will be documented for use in improving the data management systems that support power system operations. The project results are expected to benefit SDG&E and other utilities.

iv. Scope

This demonstration project will determine the quantity and location of data-generating devices in the power system, the generation capabilities of these devices, and how the resulting data is being stored and archived. The project will determine how the data is being used to support the power system, such as predictive maintenance, voltage stability, condition-based maintenance, or post-event analysis. The project will identify and pilot new data analytic solutions to augment current practices.

v. Deliverables

The project team comprised of SDG&E technical staff and the contractor will prepare and deliver a comprehensive final report on the work and results. Interim project deliverables will be identified in the project planning phase.

vi. Metrics

In general, metrics for this project will be based on comparing the performance of distribution system operations when various new data analytic solutions are in place with the performance of the same operations when they are not in place. The SDG&E/contractor project team will develop a final list of metrics.

The ultimate measure of success in this project will be completing and documenting demonstrations of candidate data analytic solutions to help SDG&E create knowledge that will contribute to ongoing modernization of its distribution system. Specific project metrics will include whether the project team met milestones in the project plan and competed deliverables in the contract. In addition, findings will be

published in relevant technical journals and conferences, as appropriate.

- vii. Schedule  
October 16, 2015 to July 31, 2017
- viii. EPIC Funds Encumbered  
\$0
- ix. EPIC Funds Spent  
\$3k
- x. Partners (if applicable)  
n/a
- xi. Match Funding (if applicable)  
n/a
- xii. Match Funding Split (if applicable)  
n/a
- xiii. Funding Mechanism (if applicable)  
Combination of in-house work and pay-for-performance contracts
- xiv. Treatment of Intellectual Property (if applicable)  
None to date.
- xv. Status Update  
The development of a project implementation plan, including definition of project tasks, identification of testing locations, identification of internal staffing needs, development of procurement plans, a breakdown of the project budget, and project schedule, will proceed in parallel with the RFP development in the first quarter of 2016.

**Project 8: Monitoring, Communication, and Control Infrastructure for Power System Modernization**

- i. Investment Plan Period  
2015-2017 (EPIC-2)

- ii. Assignment to Value Chain  
Distribution
- iii. Objective  
The objective of this project is to demonstrate advanced monitoring, communication and control infrastructure needed to operate an increasing complex (smarter) power system infrastructure. In other words, to test system controls to “sort” data and use what is helpful and useful.
- iv. Scope  
To achieve this objective an Open Field Message Bus (OpenFMB) demonstration shall be undertaken that demonstrates interoperability through secure, peer-to-peer control and communication between multiple distribution system equipment based on existing standards. The demonstration will occur in a lab and/or in the field.
- v. Deliverables  
The project team comprised of SDG&E technical staff and the contractor will prepare and deliver a comprehensive final report on the work and results. Interim project deliverables will be identified in the project planning phase.
- vi. Metrics  
This project will demonstrate interoperable solutions for inclusion in the evolving advanced distribution system infrastructure. Once subsystem gaps in the evolving infrastructure have been identified and characteristics of the subsystems have been defined, subsystem performance and integration into the overall architecture will be demonstrated. Detailed metrics will be developed by the SDG&E/contractor team.
- vii. Schedule  
November 1, 2015 to July 31, 2017
- viii. EPIC Funds Encumbered  
\$163k
- ix. EPIC Funds Spent  
\$11k

- x. Partners (if applicable)  
n/a
- xi. Match Funding (if applicable)  
n/a
- xii. Match Funding Split (if applicable)  
n/a
- xiii. Funding Mechanism (if applicable)  
Combination of in-house work and pay-for-performance contracts
- xiv. Treatment of Intellectual Property (if applicable)  
None to date.
- xv. Status Update  
A detailed project plan has been developed that provides the basis for ongoing project development, planning and tracking mechanism. The project plan includes project technical scope, approach, resource requirements (internal staffing, external contractor procurement, and equipment), budget and schedule. An RFP will be released to procure a prime contractor for this project in the first quarter of 2016. The prime contractor selection is scheduled for the second quarter of 2016.

### **Project 9: System Operations Development and Advancement**

- i. Investment Plan Period  
2015-2017 (EPIC-2)
- ii. Assignment to Value Chain  
Distribution
- iii. Objective  
The objective of this project is to support continued modernization of SDG&E's power system via demonstrations of improved capabilities in system operations. The project will demonstrate a systematic process for the realignment of operating practices with advances in technology, software and standards used in the power system. The realignment is broad, and will address system integration issues, training programs, worker skill sets, and workforce readiness.

iv. Scope

The work scope has been drafted and is in the process of being finalized. The draft work scope outlines a distributed, autonomous, and scalable architecture, which includes robust communication architecture, and hardware and software platform for aggregating and dispatching coordinated net-load resources (the difference between the load and Distributed Energy Resources (DER)) in localized regions of a grid). The architecture includes a concept of Localized Residential Aggregation and Monitoring (LRAMs) and Regional Aggregation, Monitoring & Circuit Optimizer (RAMCOs) for control and aggregation of customer owned distributed generation and controllable loads on distribution systems. The project work will be performed by a team comprised of SDG&E technical staff and a contractor that will be competitively procured.

v. Deliverables

The SDG&E/contractor technical team will prepare and deliver a comprehensive final report on the work and results.

Possible interim deliverables, pending project plan finalization, are:

- a. Communication system and architecture that will be used for project
- b. Smart transformer and RAMCO measurement and data hand off
- c. RAMCO ramping and dispatch algorithm
- d. RAMCO & Volt-VAr optimization (VVO) measurement and data hand off
- e. Large-scale real-time digital simulator (RTDS) circuit modeling, using hardware in the loop with RAMCO and VVO
- f. Field data gathering (10 RAMCO)
- g. RTDS and field data analysis

vi. Metrics

The metrics will be developed based on tasks and milestones in the final work scope.

vii. Schedule

November 11, 2015 to July 31, 2017

viii. EPIC Funds Encumbered

\$32k

- ix. EPIC Funds Spent  
\$1k
- x. Partners (if applicable)  
n/a
- xi. Match Funding (if applicable)  
n/a
- xii. Match Funding Split (if applicable)  
n/a
- xiii. Funding Mechanism (if applicable)  
Combination of in-house work and pay-for-performance contracts
- xiv. Treatment of Intellectual Property (if applicable)  
None to date.
- xv. Status Update  
The development of a project implementation plan, including definition of project tasks, identification of testing locations, identification of internal staffing needs, development of procurement plans, a breakdown of the project budget, and project schedule, will proceed in parallel with the RFP development in the first quarter of 2016.

**Project 10: Integration of Customer Systems into Electric Utility Infrastructure**

- i. Investment Plan Period  
2015-2017 (EPIC-2)
- ii. Assignment to Value Chain  
Distribution
- iii. Objective  
The project will address the evolving gateway between customers and utilities. Specifically, it will demonstrate the safe and reliable interoperability of customer systems with the distribution and transmission system and CAISO operations to improve grid operations and thereby increase ratepayer satisfaction and benefits.

- iv. Scope  
Alternative solutions for successful customer interoperability with utility systems will be identified. Requirements for integration of these solutions with utility systems will be specified. Promising interoperability systems will be demonstrated to create a knowledge base to support decisions on prospective commercial deployment of the systems. The work will be performed by a team comprised of SDG&E technical staff and a competitively-procured contractor.
  
- v. Deliverables  
An RFP is expected to be issued by end of the first quarter of 2016 to select a prime contractor. The SDG&E/contractor project team will perform the work and prepare interim deliverables and a comprehensive project report on the work and the results.
  
- vi. Metrics  
Metrics for this project will be based on comparing the performance of power system operations when various interoperability solutions are in place with the performance of the same operations when they are not in place. The SDG&E/contractor project team will develop a final list of metrics.  
  
The ultimate measure of success in this project will be completing and documenting demonstrations of candidate interoperability solutions to help SDG&E create knowledge that will support decisions regarding commercial adoption. Specific project metrics will include whether the SDG&E/contractor project team met milestones in the project plan. In addition, findings will be published in relevant technical journals and conferences, as may be appropriate.
  
- vii. Schedule  
October 16, 2015 to July 31, 2017
  
- viii. EPIC Funds Encumbered  
\$32k
  
- ix. EPIC Funds Spent  
\$1k
  
- x. Partners (if applicable)  
n/a

- xi. Match Funding (if applicable)  
n/a
- xii. Match Funding Split (if applicable)  
n/a
- xiii. Funding Mechanism (if applicable)  
Combination of in-house work and pay-for-performance contracts
- xiv. Treatment of Intellectual Property (if applicable)  
None to date.
- xv. Status Update  
The development of a project implementation plan, including definition of project tasks, identification of testing locations, identification of internal staffing needs, development of procurement plans, a breakdown of the project budget, and project schedule, will proceed in parallel with the RFP development in the first quarter of 2016.

#### **Project 11: Collaborative Programs in RD&D Consortia**

- i. Investment Plan Period  
2015-2017 (EPIC-2)
- ii. Assignment to Value Chain  
Distribution
- iii. Objective  
The objective of this project is to accomplish highly leveraged demonstration work through collaborative projects in industry R&D consortia. The leveraging includes both financial leveraging via co-sponsorship with other members of the consortia and intelligence leveraging by better informing the project content in EPIC activities with the knowledge of relevant activities occurring in a worldwide sense.
- iv. Scope  
By working through international R&D consortia, a much larger pool of knowledge coming from worldwide demonstrations related to the various project areas of the EPIC program will be captured than would be achievable in the few smaller demonstrations that are funded by

SDG&E's EPIC budget alone. The participation in the collaborative demonstrations leverages funding and helps SDG&E stay current on international developments that may impact EPIC project work.

- v. Deliverables  
Deliverables will be determined by the project specifications of the collaborative projects that SDG&E selects for funding.
- vi. Metrics  
Metrics will be determined by the project specifications of the collaborative projects that SDG&E selects for funding.
- vii. Schedule  
March 1, 2016 to December 31, 2017
- viii. EPIC Funds Encumbered  
\$0
- ix. EPIC Funds Spent  
\$0
- x. Partners (if applicable)  
n/a
- xi. Match Funding (if applicable)  
n/a
- xii. Match Funding Split (if applicable)  
n/a
- xiii. Funding Mechanism (if applicable)  
Co-funded share of collaborative consortia projects that are selected.
- xiv. Treatment of Intellectual Property (if applicable)  
None to date.
- xv. Status Update  
This project will be activated in 2016.

## **5. CONCLUSION**

### **a. Key Results for 2015 for SDG&E EPIC Projects**

SDG&E has released 10 of 11 projects in its CPUC-approved EPIC-1 and EPIC-2 applications. Internal teams have been formed for the first three EPIC-1 projects. RFPs have been completed for these projects, resulting in adding contractors to the teams for the first two projects, and negotiations with a contractor for the third project. Tasks in the project plans are in progress for the first two EPIC-1 projects. The third project has been restored to its full funding level, after receiving D. 16-01-010. The fourth and fifth EPIC-1 projects have also been released for funding at the originally planned levels.

SDG&E has committed all funds for five of its CPUC-approved EPIC-2 projects. Project implementation plans are being written for these projects, with input from internal SDG&E stakeholders.

No project final reports have yet been completed for delivery to CPUC.

### **b. Next Steps for SDG&E's EPIC Program**

For the ten EPIC-1 and EPIC-2 projects that have been launched, work will continue in 2016 on completion of any outstanding implementation plans and performance of tasks in the plans. The technical leads launch the early project work, build the project teams, and all team members (internal and contractor) participate in the performance of project tasks. The eleventh project on funding demonstrations through collaborative R&D consortia will be launched in the first quarter of 2016.

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**ATTACHMENT B**

**SDG&E 2015 EPIC PROJECT STATUS (Excel File)**



