

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

Application of the California Energy  
Commission for Approval of Electric Program  
Investment Charge 2012 through  
2014 Triennial Investment Plan.

And Related Matters.

Application 12-11-001  
(Filed November 1, 2012)

Application 12-11-002  
Application 12-11-003  
Application 12-11-004

**COMPLIANCE FILING OF SAN DIEGO GAS & ELECTRIC COMPANY'S  
(U 902-E) 2016 ELECTRIC PROGRAM INVESTMENT CHARGE ANNUAL  
REPORT**

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February 28, 2017

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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 2016 Annual Report for its Electric Program Investment Charge (EPIC) Program (Report), provided hereto as Attachment A. In addition, SDG&E provides the excel file titled "SDG&E 2016 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 2016 calendar year and program financial information through December 31, 2016.<sup>2</sup>

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<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> SDG&E will provide a timely update regarding any contracts that have been executed between January 1, 2017 and the date of this filing (February 28, 2017) in accordance with Ordering Paragraph 25 of D.13-11-025.

SDG&E and its fellow EPIC Administrators are required to each submit an annual report “detailing program activities.”<sup>3</sup> The annual reports are designed “to facilitate consistent reporting by the [EPIC] Administrators on their investment plans and project results.”<sup>4</sup> The reports, and their timing, are intended to inform stakeholders of the EPIC Plan’s accomplishments when they meet with the EPIC administrators in March of the years in which investment plans will be considered.<sup>5</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 Company, and Southern California Edison Company], and each successful and unsuccessful applicant for an EPIC funding award” through December 31, 2016.<sup>6</sup>

Dated at San Diego, California, this 28<sup>th</sup> day of February, 2017.

Respectfully submitted,

*/s/ Emma D. Salustro*

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<sup>3</sup> D.12-05-037 at 8.

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

<sup>5</sup> D.12-05-037 at 30-31.

<sup>6</sup> *Id.* at OP16.

**ATTACHMENT A**  
**SDG&E 2016 EPIC ANNUAL REPORT**

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# **SDG&E 2016 EPIC ANNUAL REPORT**



**San Diego Gas & Electric Company  
2016 EPIC Annual Report**

**February 28, 2017**

## **I. 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 2016 EPIC Annual Report (Report). This Report provides an overview of SDG&E's EPIC activities during the 2016 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 2016 EPIC Project Status Report."<sup>7</sup>

SDG&E proposed, and received approval for five projects that demonstrate smart grid system integration solutions in the first triennial application cycle (EPIC-1).<sup>8</sup> In addition SDG&E proposed, and received approval for six projects that demonstrate grid modernization and technology integration solutions in the second triennial application cycle (EPIC-2).<sup>9</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

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<sup>7</sup> D.13-11-025 at 63.

<sup>8</sup> D.13-11-025.

<sup>9</sup> D.15-04-020.

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 and Second Triennial EPIC Plan 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.

### **B. Status of EPIC-1 and EPIC-2 Projects**

As discussed in further detail below, in 2016, SDG&E continued the execution of the three EPIC-1 projects that were previously started and launched the remaining two EPIC-1 projects following a decision by CPUC on a pending Petition for Modification (PFM) that had been filed in January 2014.<sup>10</sup> Full funding was also restored to a third EPIC-1 project that had been partially reduced in budget, pending the PFM decision. All five EPIC-1 projects are now in various stages of execution. Teams have been formed for all five projects and task work is in progress. No deliverables are yet available for EPIC-1 projects.

In 2016, SDG&E continued the work on the five EPIC-2 projects that had been released the prior year. Project teams have been formed and task work is in progress for all projects.

The sixth EPIC-2 project on demonstrations through collaborative R&D consortia was launched in 2016. Specific demonstration ideas were developed and presented to consortia for consideration. In 2017, those ideas deemed to be most likely to attract leveraged funding from other members of the consortia will be developed into plans to actually launch the projects and

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<sup>10</sup> D.16-01-010.

seek additional funding. The consortia staff members are expected to provide interactive support to SDG&E for contractor procurement and active management of the work.

**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, 2016**

<b>EPIC-1 Projects (2012 – 2014)</b>		
<b>EPIC Project</b>	<b>Project Commitments<sup>11</sup> (\$ thousands)</b>	<b>Comments</b>
1. Smart Grid Architecture Demonstrations	1,410	No change from original plan.
2. Visualization and Situational Awareness Demonstrations	1,410	No change from original plan.
3. Distributed Control for Smart Grids	1,648	No change from original plan.
4. Demonstration of Grid Support Functions of Distributed Energy Resources	1,673	No change from original plan.
5. Smart Distribution Circuits Demonstrations	1599	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,	1,200	No change from original

<sup>11</sup> Commitment means assigned for anticipated work on a project, including anticipated contractual commitments, equipment purchases, software licenses, associated technical work by the SDG&E project team, and other expenses directly associated with the project work.

and Control Infrastructure for Power System Modernization		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>	

### **STATUS SUMMARIES OF EPIC-1 PROJECTS**

#### Project 1: Smart Grid Architecture Demonstrations

A detailed project plan has been developed that provides the basis for ongoing project development, planning and tracking. Work by the SDG&E project team started on assessment of architecture status and needs. A Request for Proposal (RFP) was released in third quarter of 2016, with contractor selection pending as of December 31, 2016. SDG&E will inform the Commission of any resulting prime contractor selection and contract execution in accordance with D.13-11-025.<sup>12</sup>

#### Project 2: Visualization and Situational Awareness Demonstrations

In 2016, the SDG&E project team developed much of the project plan, with the balance to be completed in early 2017. Work was started on identifying visualization capabilities to be demonstrated and requirements for the demonstration process.

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

SDG&E selected Quanta Technology, LLC as the prime contractor in the second quarter of 2016 to work with the internal SDG&E project team in performing the project work. A comprehensive project plan was written to identify the team resource requirements, technical

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<sup>12</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at Ordering Paragraph (OP) 25.

approach, testing location, internal staffing, procurement plans, and schedule. The project team held a meeting to review current SDG&E distribution system control practices and to assess the scalability and performance of alternative distributed control schemes with the participation of SDG&E stakeholders (who are potential end-users of the project results). The SDG&E/Quanta project team followed up with another working session to define the use cases and select which circuits to model to perform such tasks. System models are currently in development, and testing is scheduled to begin in SDG&E's Integration Test Facility (ITF) in the first quarter of 2017.

#### Project 4: Demonstration of Grid Support Functions of Distributed Energy Resources

SDG&E selected Schweitzer Engineering Laboratory (SEL) as the prime contractor for this project in 2015. The project is focused on pre-commercial demonstrations to assess the value of DER grid support functions in various alternative application situations. As of the end of 2016, the project team had developed a set of use cases, created a draft Functional Design Specification (FDS), a test plan, and a model for the circuit to be investigated. Software simulation of the developed use case scenarios began and was nearly completed by the end 2016.

#### Project 5: Smart Distribution Circuit Demonstrations

A comprehensive project plan was written to identify the team resource requirements, technical approach, testing locations, internal staffing, procurement plans, and schedule. The project team held a working session in the third quarter of 2016, which included a stakeholder review panel, to review the conclusion of Phase 1 of the project. This review included hardware evaluation, advanced distribution circuit and operational practices assessment, and baseline data requirements. Phase 2 of the project is underway and is focused on developing Real Time Digital Simulator (RTDS) models for use in the pre-commercial demonstration.

## **STATUS SUMMARIES OF EPIC-2 PROJECTS**

### **Project 1: Modernization of Distribution System and Integration of Distributed Generation and Storage**

In 2016, the project was focused on a pre-commercial demonstration of a substation communication network based on the IEC 61850 communication standards. Members of SDG&E's substations and protection sections were engaged in the project planning in both project team and project stakeholder (prospective user) roles. Intelligence was gathered on the status of the IEC standards and the vendor equipment options for the demonstration. The internal project team was more fully developed, and the needed contractor role was defined.

### **Project 2: Data Analytics in Support of Advanced Planning and System Operations**

A detailed project plan has been developed that provides the basis for ongoing project development, planning and tracking. Internal work started on database selection for ingestion into a data lake and on use case development. An RFP was released in July 2016, with a prime contractor selected as of November 2016. The contract was fully executed in early 2017.<sup>13</sup>

### **Project 3: Monitoring, Communication, and Control Infrastructure for Power System Modernization**

The project focus is on pre-commercial demonstration of an Open Field Messaging Bus (Open FMB). Internal work was started on assessing status and needs for Open FMB. This work included outreach to others working on Open FMB and literature review. An RFP was developed as per the project plan and released in July 2016, with a prime contractor selected as of November 2016. A contract has been fully executed in early 2017.<sup>14</sup>

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<sup>13</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

<sup>14</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

#### Project 4: System Operations Development and Advancement

In 2016, the internal project team was formed and the project plan was completed. The project focuses on the operation of distributed energy resources downstream of a distribution transformer. The integration approach to be demonstrated aims to control voltage and determine modifications to existing operations procedures that may be desirable. Work on remote end devices has been explored and controls at the transformer level are being worked out. Communication requirements, both upstream and downstream, have been determined. An RFP to add a contractor to the project team was issued in late 2016. Contractor selection and contract execution are expected in early 2017.<sup>15</sup>

#### Project 5: Integration of Customer Systems into Electric Utility Infrastructure

The internal project team was formed in 2016. The project plan was completed in 2016, and a scope of work was developed for contracting a portion of the project work. Contractor selection and contract execution are expected in early 2017.<sup>16</sup> The project approach will involve new uses of phasor measurement units on distribution systems to deal with the impacts of customer resources.

#### Project 6: Collaborative Programs in RD&D Consortia

Project development on demonstrations through collaborative R&D consortia was launched in 2016. Specific demonstration ideas were developed and presented to consortia for consideration. In 2017, those ideas deemed to be most likely to attract leveraged funding from other members of the consortia will be developed into plans to actually launch the projects and seek additional

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<sup>15</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

<sup>16</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

funding. The consortia staff members are expected to provide support to SDG&E for contractor procurement and for active management of the work.

## **II. 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>17</sup> The EPIC program is intended to run until 2020 and is comprised of three triennial program cycles (i.e., EPIC-1, EPIC-2, EPIC-3).

### **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 and applied research for new utility-related technology, is also not allowed.

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<sup>17</sup> EPIC administrators are the California Energy Commission, San Diego Gas & Electric Company, Southern California Edison Company and Pacific Gas and Electric Company.

### **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 will submit its Third Triennial (EPIC-3) Plan on May 1, 2017. SDG&E and the other EPIC administrators are required to submit an annual report every February 28. This is the fifth 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 RFPs for two EPIC-1 projects was initiated in late 2014 and for a third EPIC-1 project in 2015. Competitive procurements for four additional EPIC projects were initiated in 2016 (including one for an EPIC-1 project and three for EPIC-2 projects).

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>18</sup> In 2016, SDG&E participated in the EPIC public stakeholder workshop (June 22) and the public symposium (December 1). SDG&E presented an overview of three of its projects at each of these events.

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<sup>18</sup> D.12-05-037 at 74.

### III. SDG&E'S EPIC BUDGET & RELATED COSTS

#### A. SDG&E Authorized Budget & Incurred Costs for EPIC-1 (2012 – 2014) and EPIC-2 (2015 -2017)

**Table 2. SDG&E Budget and Incurred Costs for EPIC-1 and EPIC-2 as of December 31, 2016 (in \$ thousands)**

	EPIC Triennial 1 (2012 – 2014)		EPIC Triennial 2 (2015 – 2017)	
	Technology Demonstration & Deployment	Program Administrative	Technology Demonstration & Deployment	Program Administrative
SDG&E Authorized Budget in CPUC-Approved Decisions <sup>19</sup>	7,740	860	7,800	879
SDG&E Incurred Costs <sup>20</sup> as of December 31, 2016	1,794	405	359	90
SDG&E Disbursements to CEC	16,127	3,024	18,879	1,794
SDG&E Disbursements to CPUC for Regulatory Oversight	N/A	273	N/A	150

<sup>19</sup> D.13-11-025 for EPIC-1 and D.15-04-020 for EPIC-2.

<sup>20</sup> Incurred costs means actual booked expenditures.

## **B. Commitments/Encumbrances<sup>21</sup> 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.

As of December 31, 2016, SDG&E has encumbered \$6245k of EPIC-1 funds for contracted activities and in-house work in collaboration with a contractor. As of December 31, 2016, SDG&E has expended \$1574k on contracted work. SDG&E has spent \$220k on internal project work. The total expenditures through December 31, 2016 on EPIC-1 TD&D project work is therefore \$1794k. More detail is provided in Appendix B.

SDG&E has committed \$7800k 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, 2016, SDG&E has encumbered \$2356k of EPIC-2 funds for contracted activities and in-house work in collaboration with a contractor. As of December 31, 2016, SDG&E has expended \$271k on contracted work. SDG&E has spent \$88k on internal project work. The total expenditures through December 31, 2016 on EPIC-2 TD&D project work is therefore \$359k. More detail is provided in Appendix B.

## **C. Commitments/Encumbrances for Program Administration**

As of December 31, 2016, SDG&E has fully committed its program administration budget for both triennials (EPIC-1: \$860k, EPIC-2: \$879k). SDG&E has spent a cumulative \$495k for overall program administration expenses through 2016, which includes both EPIC-1 and EPIC-2 costs. Of this amount, \$405k is attributed to EPIC-1 and \$90k is attributed to EPIC-2. All program administration has been performed in-house.

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<sup>21</sup> Encumbrances are funds that are specified for contracts (D.13-11-025 at 101; OP45) or for in-house work necessary in collaboration with a contractor (D.13-11-025 at 53). They differ from commitments in that commitments are the identification of blocks of funds to be assigned to projects, whereas encumbrances specify how the commitments will be used in the projects.

#### **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 \$7868.6k that was authorized for EPIC-2 and the \$7800 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.

D.15-04-020 instructed SDG&E that it will need to separately apply for release of these funds for commitment to a project.<sup>22</sup> SDG&E intends to file a separate application to use these funds in the near future.

### **IV. SDG&E EPIC-1 PROJECTS**

#### **Project 1: 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.

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<sup>22</sup> D.15-04-020 at 34-35.

- iv. **Scope**

The distribution system architecture building blocks will be created after reviewing the existing architecture, identifying next generation architecture principles, and evaluating standards and protocols for the various architectural constructs. The highest priority building blocks will be prioritized for demonstration 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, in a controlled environment that includes modeling and simulation of a typical distribution substation bus, feeders, and distributed energy resources (DER) on the circuits, 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**

A comprehensive final report describing the work and results of the project.
- 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 support SDG&E in its architecture development for networked distribution automation. Project tracking metrics are the milestones identified in the project plan. Technical metrics for the demonstration will be identified during project execution. In addition, key project results will be submitted for consideration for publication in relevant technical journals and conferences.
- vii. **Schedule**

February 10, 2016 to December 31, 2017
- viii. **EPIC Funds Encumbered as of December 31, 2016** \$498k
- ix. **EPIC Funds Spent as of December 31, 2016**  
\$75k
- 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)  
A combination of in-house work and pay-for-performance contracts will be used. A Request for Proposal (RFP) was released in third quarter of 2016, with contractor selection pending as of December 31, 2016. SDG&E will inform the Commission of any resulting prime contractor selection and contract execution in accordance with D.13-11-025.<sup>23</sup>
- xiv. Treatment of Intellectual Property (if applicable) None to date.
- xv. Status Update  
The internal project team was formed. A detailed project plan has been developed that provides the basis for ongoing project execution and tracking. The project plan includes the project technical scope, approach, resource requirements (internal staffing, external contractor procurement, and equipment), budget and schedule. The internal staff has been doing work on architecture status assessment and use case development. A Request for Proposal (RFP) was released in third quarter of 2016, with contractor selection pending as of December 31, 2016. SDG&E will inform the Commission of any resulting prime contractor selection and contract execution in accordance with D.13-11-025.<sup>24</sup> The SDG&E internal project team is working on internal technical tasks in preparing for the demonstration work. A stakeholder review panel (prospective users of project results) was formed to help guide the work.

## **Project 2: Visualization and Situational Awareness Demonstrations**

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

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<sup>23</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

<sup>24</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

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 project will look at how 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

A comprehensive final project report describing the work and results of the project.

vi. Metrics

The project tracking metrics will be the milestones in the project plan. Technical 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 regarding adoption by SDG&E.

Also, major project results will be submitted in technical papers and presentations for consideration by major technical conferences and publications.

vii. Schedule

February 10, 2016 to August 31, 2017

viii. EPIC Funds Encumbered as of December 31, 2016 \$1410k

ix. EPIC Funds Spent as of December 31, 2016  
\$71k

- 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)  
SDG&E EPIC funding used for work performed by the internal SDG&E project team.
- xiv. Treatment of Intellectual Property (if applicable) None to date.
- xv. Status Update  
The project plan was nearing completion at the end of 2016. Major tasks on the project plan include identifying issues and use-cases for pre-commercial demonstration, required equipment and software for selected use-cases. The project team held several meetings with potential stakeholders and end-users to assist in identifying the use cases for the pre-commercial demonstrations:
  - Visualization of Electric Transmission Outages.
  - Visualization of Electric Load Curtailment.
  - Self-Service Electric eGIS Reporting Interface.
  - Historical Play Back.
  - Real time system visualization dashboards based on Transmission and Distribution Supervisory Control and Data Acquisition (SCADA) and Advanced Metering Infrastructure (AMI) Data.
  - Incorporation of a representation of customer-owned energy resources.

### **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 requirements definition for the distributed control concepts to be demonstrated. The requirements definition will consider the functions, specifications, control interface, control algorithms, data models, data exchange, and security requirements for using distributed (less centralized) control in future electric utility power distribution systems. It will build on existing infrastructure in the SDG&E 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 hardware, development of control and operational schemes, development of the test plan for evaluation of the proposed distributed control concepts, and the execution of the test plan.

**Phase 3 – Data Collection and Analysis for the Pre-Commercial Demonstration:** This phase will include detailed analysis of the data collected, including functions of the proposed system, control methodologies of the system (including updates to existing strategies), results of testing and effect on the existing SDG&E control system, benefits, costs, challenges, and impact on the overall SDG&E distribution system and equipment, particularly with respect to operational situations.

v. Deliverables

A comprehensive final report will document the work and results of the project.

vi. Metrics

The project tracking metrics will be the milestones in the project plan. Technical metrics for this project will be based on comparing the performance of distribution system operations when various new control schemes are in place with the performance of the same operations when the control schemes are not in place. 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.

Also, major project results will be submitted as technical papers and presentations for consideration by major technical conferences and publications.

- vii. Schedule  
January 12, 2015 to July 31, 2017
- viii. EPIC Funds Encumbered as of December 31, 2016 \$1648k
- ix. EPIC Funds Spent as of December 31, 2016  
\$550k
- 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)  
SDG&E EPIC funds will be applied to a combination of in-house work and a pay-for-performance contract. A prime contractor was selected by competitive procurement in the second quarter of 2016. Five 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. Quanta Technology, LLC was selected for the contract award. Quanta was the highest scoring bidder.
- xiv. Treatment of Intellectual Property (if applicable) None to date.
- xv. Status Update  
  
In second quarter of 2016, SDG&E selected Quanta Technology, LLC as the prime contractor for this project, and a contract was executed. A kickoff meeting was held with the internal SDG&E project team, SDG&E stakeholders (i.e., prospective users of project results, and the contractor) to discuss the approach for the project, which is aimed at filling the gaps in the current distribution system control practices by adding distributed control features. The project approach also aims to assess the scalability and performance on the developed distributed control system against distribution optimization objectives, such as efficiency,

voltage and frequency stability, reliability, power quality, asset health maintenance, and operating costs.

The project plan was developed and consists of three major phases. A internal working session was held to review the results of Phase 1. This review included hardware evaluation, advanced distribution circuit and operational practices assessment, and baseline data.

Phase 2 of the project is underway, currently developing Real Time Digital Simulator (RTDS) models, for use in the demonstration work. There is ongoing interaction between team members, with set bi-monthly meetings, and as technical questions arise, on as-needed basis. Working documents are carefully reviewed to keep work on track.

#### **Project 4: 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  
The key deliverable will be a comprehensive final report on the work and results of the project, which will include:

- Descriptions of DER functions demonstrated, application situations, testing performed, and test and analysis results.
- Recommendations regarding which DER functions should be pursued commercially in power distribution systems and in which applications.
- Recommendations for tech transfer of knowledge gained (on function viability and interoperability system requirements to support functions) into commercial practice and/or to standards working groups, as may be appropriate.
- Recommendations for integration systems to encourage “plug and play” capabilities in the inverters (power conditioning systems) and other integration components.

vi. Metrics

The project tracking metrics will be the milestones in the project plan. Technical metrics for the pre-commercial demonstration will be determined during the demonstration planning phase. One measure of success for this project will be whether it provides a basis for deciding which DER functions warrant commercial pursuit in future distribution system 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 which standards are preferred to support the adoption of viable grid support functions.

vii. Schedule

April 1, 2014 to December 31, 2017

viii. EPIC Funds Encumbered as of December 31, 2016 \$1115K

ix. EPIC Funds Spent as of December 31, 2016  
\$624K

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)  
 EPIC funding of an internal SDG&E project team working with a pay-for-performance prime contractor. 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 the contract award. SEL was the highest scoring bidder.
  
- xiv. Treatment of Intellectual Property (if applicable) None to date.
  
- xv. Status Update  
 In 2016, the project team developed a set of use cases for the demonstration, which included diagrams for the proposed Real-Time Digital Simulator (RTDS) test setup. The project team created a draft Functional Design Specification (FDS).  
 The project team developed circuit models for the RTDS. A test plan was also created. Software simulation for the developed test scenarios began and was nearly completed by the end of 2016. The pre-commercial demonstration at SDG&E's ITF is anticipated to start in March 2017.  
 The SDG&E internal team and contractor team are in regular contact. SDG&E technical staff also visited the contractor's facility for direct interaction with the contractor. A formal progress review was held at SDG&E in October 2016, engaging the SDG&E internal project team, SDG&E stakeholders (i.e., prospective users of the results) and the contractor.  
  
 The internal stakeholder review panel will continue to critique project work and results as the project continues to unfold.

**Project 5: 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 testing of alternative distribution circuit components and circuit designs and assesses the related distribution system operational implications. Tests will be 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

A comprehensive final report will document the work and results of the project.

vi. Metrics

The project tracking metrics will be the milestones in the project plan. Technical metrics will be developed to guide the actual demonstration work. In general, the ultimate measure of success will be having a benchmark future distribution circuit design concept that helps advance future distribution system development. The circuit design will be capable of assimilating a wide variety of existing and emerging device types and will have a protection system that allows this assimilation to be done without compromising reliability or safety.

Also, project results will be submitted as technical papers and presentations for consideration by major technical conferences and publications.

vii. Schedule

July 7, 2014 to July 31, 2017

viii. EPIC Funds Encumbered as of December 31, 2016 \$1599k

ix. EPIC Funds Spent as of December 31, 2016

\$473k

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)

SDG&E EPIC funds will be applied to supporting a team of internal technical staff and a pay-for-performance contractor. 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 the contract award. SEL was the highest scoring bidder.

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

xv. Status Update

In the first quarter of 2016, the project team finalized the Functional Design Specification document. The project team held an internal working session in the third quarter of 2016, which included the stakeholder review panel (prospective users of the results) to review the results of Phase 1 of the project. This included hardware evaluation, advanced distribution circuit and operational practices assessment, and baseline data.

Phase 2 of the project is underway, currently developing Real Time Digital Simulator (RTDS) models for use in the demonstration. SDG&E project team members visited the main offices of SEL to review and assist in the model development. There is ongoing interaction between team members, with set bi-monthly meetings, and as technical questions arise, on as-needed basis. All working documents are carefully reviewed to keep the work on track.

## V. SDG&E EPIC-2 PROJECTS

### **Project 1: 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.

iv. Scope

This project has been focused on the pre-commercial demonstration of the international standard, IEC 61850, in a substation network. Investigating the application and usefulness of IEC 61850 will help SDG&E to assess the benefits and challenges of implementing this standard in substations. This pre-commercial demonstration will also investigate the interoperability of multiple vendor products.

This project will create knowledge to help SDG&E assess whether IEC 61850 should be adopted commercially and what the adoption requirements and processes would be. The knowledge may help other utilities with similar decision processes.

v. Deliverables

A comprehensive final report on the work and results of the project.

vi. Metrics

The project tracking metrics will be the milestones in the project plan. Technical metrics will be developed for the demonstration work during project execution. These technical metrics will consider how the results of each test scenario compared to the expected/predicted outcome.

In addition, project results will be submitted for consideration for publication and/or presentation in technical conferences and journals, as appropriate.

vii. Schedule

January 4, 2016 to December 31, 2017

viii. EPIC Funds Encumbered as of December 31, 2016 \$424K

ix. EPIC Funds Spent as of December 31, 2016  
\$93K

- 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)  
A combination of in-house work and pay-per-performance will be used.
- xiv. Treatment of Intellectual Property (if applicable) None to date.
- xv. Status Update

Members of SDG&E’s substations and protection sections were engaged in the project planning in both project-team and project-stakeholder roles. Options for performing the demonstration were explored, including at an actual substation or in a laboratory. Due to cost and risk considerations, it was decided to perform the demonstration in a laboratory using a substation mock-up. Intelligence was gathered on the status of the IEC standards and the vendor equipment options for the demonstration. The internal project team was more fully developed, and plans for contractor selection were initiated. The project plan writing was started and will be completed in early 2017.

The internal stakeholder review panel will continue critiquing project work and results on a regular basis and will aid in tech transfer of the results to the end users.

A project overview was presented at the annual public EPIC Symposium on December 1, 2016, in Sacramento, CA.

**Project 2: 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 can be used to support the power system operations, such as predictive maintenance, voltage stability, condition-based maintenance, or post-event analysis. The project will identify and perform advanced analytics for the most common types of distribution system asset failures. The project will undertake a demonstration to integrate multiple data sources into a data lake, create algorithms to perform predictive/prescriptive analytics, and create visualizations for future user engagement. The pre-commercial demonstration system will be used to demonstrate specific use cases from the roster of use cases developed by SDG&E’s Electric Distribution Engineering (EDE) team.

v. Deliverables

A comprehensive final report on the work and results of the project.

vi. Metrics

Project tracking metrics will be the milestones in the project plan. Technical metrics to steer the use case demonstration work will be developed during the project execution. In general, technical metrics for this project will be based on determining the extent of improvement in system operations, if successful use cases were to be adopted into routine practice by SDG&E. The SDG&E/contractor project team will develop a final list of technical metrics.

In addition, key results will be submitted for consideration for publication in relevant technical journals and conferences.

vii. Schedule

October 16, 2015 to December 31, 2017

- viii. EPIC Funds Encumbered as of December 31, 2016 \$701k
- ix. EPIC Funds Spent as of December 31, 2016  
\$62k
- 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 Request for Proposal (RFP) was released in third quarter of 2016, with contractor selection pending as of December 31, 2016. SDG&E will inform the Commission of any resulting prime contractor selection and contract execution in accordance with D.13-11-025.<sup>25</sup>
- xiv. Treatment of Intellectual Property (if applicable) None to date.
- xv. Status Update

The internal project team was formed. A detailed project plan has been developed that provides the basis for ongoing project execution and tracking. The project plan includes the project technical scope, approach, resource requirements (internal staffing, external contractor procurement, and equipment), budget and schedule. The internal staff has been doing work on identification of data bases to be ingested into a data lake, use case selection, analytic algorithm development and future-user visualization specification. Internal staff initiated data preparation mechanisms prior to ingesting data into the data lake. A Request for Proposal (RFP) was released in third quarter of 2016, with contractor selection pending as of December 31, 2016. SDG&E will inform the Commission of any resulting prime contractor selection and contract execution in accordance with D.13-11-025.<sup>26</sup>. The SDG&E internal project team has been working on internal technical

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<sup>25</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

<sup>26</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

tasks in preparing for the demonstration work. A stakeholder review panel (prospective users of project results) was formed to help guide the work.

### **Project 3: 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 increasingly complex 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, the project will undertake a demonstration to evaluate an Open Field Message Bus (OpenFMB) with respect to SDG&E’s existing architecture and vision for the future. The project will demonstrate interoperability through secure, peer-to-peer control and communication between multiple distribution system equipment types based on existing standards. The approach will include development of a test system for use in a pre-commercial demonstration to evaluate and demonstrate OpenFMB in a controlled environment within SDG&E’s laboratory. The pre-commercial test system will also be used to demonstrate specific uses cases to be developed as part of this project.
- v. Deliverables  
A comprehensive final report on the work and results of the project.
- vi. Metrics

Project tracking metrics will be the milestones in the project plan. Technical metrics to steer the use case demonstration work will be developed during the project execution. In general, technical metrics for this project will be based on determining the value of OpenFMB, if it were to be adopted into routine use by SDG&E. The SDG&E/contractor project team will develop a final list of technical metrics.

In addition, key results will be submitted for consideration for publication or presentation in technical journals and conferences.

- vii. Schedule  
November 1, 2015 to December 31, 2017
  - xvi. EPIC Funds Encumbered as of December 31, 2016 \$459k
- viii. EPIC Funds Spent as of December 31, 2016  
\$83k
- ix. Partners (if applicable)  
n/a
- x. Match Funding (if applicable)  
n/a
- xi. Match Funding Split (if applicable)  
n/a
- xii. Funding Mechanism (if applicable)  
SDG&E EPIC funds applied to a combination of in-house work and a pay-for-performance contract. A Request for Proposal (RFP) was released in third quarter of 2016, with contractor selection pending as of December 31, 2016. SDG&E will inform the Commission of any resulting prime contractor selection and contract execution in accordance with D.13-11-025.<sup>27</sup>.
- xiii. Treatment of Intellectual Property (if applicable) None to date.
- xiv. Status Update

The internal project team was formed. A detailed project plan has been developed that provides the basis for ongoing project execution and tracking. The project plan includes the project technical scope, approach, resource requirements (internal staffing, external contractor procurement, and equipment), budget and schedule. The internal staff has been assessing prior work by others on OpenFMB, use case development, and coordination with SDG&E's laboratory manager to prepare for demonstration. A Request for Proposal (RFP) was released in third quarter of 2016, with contractor selection pending as of

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<sup>27</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

December 31, 2016. SDG&E will inform the Commission of any resulting prime contractor selection and contract execution in accordance with D.13-11-025.<sup>28</sup> The SDG&E internal project team has been working on internal technical tasks in preparing for the demonstration work. Initial review of the demonstration setup was undertaken to evaluate the availability and requirement of equipment that could be used for the pre-commercial demonstration. SDG&E internal stakeholders reviewed a list of use cases and potential demonstration scenarios. A stakeholder review panel (prospective users of project results) was formed to help guide the work.

#### **Project 4: 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  
This project has been focused on a distributed, autonomous, and scalable architecture, which includes robust communication architecture and a hardware and software platform for aggregating and dispatching coordinated net-load resources (the difference between the load and power from Distributed Energy Resources (DER) in localized regions of the distribution system). 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 is being performed by a team comprised of SDG&E technical staff and a contractor that is being competitively procured.

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<sup>28</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

- v. Deliverables  
A comprehensive final report on the work and results of the project.
- vi. Metrics  
The project tracking metrics will be the milestones in the project plan. Technical metrics will be developed for the demonstration work during project execution. Examples of possible metrics are: completion of test system setup plan, successful setup of the test system, completion of plan for moving test system to SDG&E lab and preparing it for demonstration work, contractor and SDG&E internal team trained for the pre-commercial demonstration phase. Additional metrics are to be written as part of the test plan.
- vii. Schedule  
November 11, 2015 to December 31, 2017
- viii. EPIC Funds Encumbered  
\$390k
- ix. EPIC Funds Spent  
\$72k
- 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)  
A combination of in-house work and pay-for-performance contracts will be used. An RFP was released in third quarter of 2016, with contractor selection pending as of December 31, 2016. SDG&E will inform the Commission of any resulting prime contractor selection and contract execution in accordance with D.13-11-025.<sup>29</sup>
- xiv. Treatment of Intellectual Property (if applicable) None to date.

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<sup>29</sup> SDG&E will provide information about contracts executed in early 2017 within 90 days of their execution pursuant to D.13-11-025 at OP 25.

xv. Status Update

In 2016, an internal project team was formed. A project 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 was completed. An RFP to add a contractor to the project team was issued in late 2016. The contractor selection and contract negotiation will be completed in the first quarter of 2017. The internal team met with other departments to obtain needed information and address potential problems. Included was a meeting with the IT group to consider alternative network approaches and determine how much effort would be needed for the chosen network approach.

**Project 5: 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 contractor.

v. Deliverables

A comprehensive final report on the work and the results of the project.

vi. Metrics

Project tracking metrics will include whether the SDG&E/contractor project team met milestones in the project plan. Technical metrics for the demonstration work will be identified during performance of the demonstration. 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

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 create knowledge that will support SDG&E decisions regarding commercial adoption.

In addition, key results will be submitted for consideration for publication or presentation in relevant technical journals and conferences.

- vii. Schedule  
October 16, 2015 to July 31, 2017
- viii. EPIC Funds Encumbered  
\$305k
- ix. EPIC Funds Spent  
\$48k
- 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)  
SDG&E EPIC funding applied to the internal project team work and a pay-for-performance contract.
- xiv. Treatment of Intellectual Property (if applicable) None to date.
- xv. Status Update  
In 2016, alternatives for the project focus were examined, and the preferred focus was chosen. The focus is on using data from phasor measurement units on the distribution system to deal with operating issues associated with highly variable customer loads and DER. A project team was formed. A project plan, including definition of project tasks, identification of testing locations, identification of internal staffing needs, a breakdown of the project budget, and project schedule,

has been completed. The internal team has been identifying the data requirements. The circuits to be modeled have been identified. Three of four RTDS circuit models have been completed. The fourth circuit is currently being evaluated to confirm whether it is suitable for the demonstration work. A contractor will be added to the project team in 2017.

### **Project 6: 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  
The project team will work through RD&D consortia to organize pre-commercial demonstration projects and seek collaborative funding for the projects.
- v. Deliverables  
Deliverables will be determined by the 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)  
SDG&E EPIC funds applied to an internal team and collaborative consortia to define, set up, and execute collaborative pre-commercial demonstration projects.
- xiv. Treatment of Intellectual Property (if applicable) None to date.
- xv. Status Update  
Project development for demonstrations through collaborative R&D consortia was launched in 2016. Specific demonstration ideas were developed and presented to consortia for consideration. In 2017, those ideas deemed to be most likely to attract leveraged funding from other members of the consortia will be developed into plans to actually launch the projects and seek additional funding. The consortia staff members are expected to provide support for competitively procuring contractors and for active management of the work.

## VI. CONCLUSION

### A. Key Results for 2016 for SDG&E EPIC Projects

As of December 31, 2016, SDG&E has committed all funds for its eleven CPUC-approved EPIC-1 and EPIC-2 projects. SDG&E has begun ten of these projects. Project implementation plans have been or are being written for the projects. As of December 31, 2016, internal teams have been formed for these projects, and contracts have been executed for three projects.

Vendor selection is underway for six more projects. One of SDG&E's EPIC-1 projects is being performed entirely in-house, as was indicated in SDG&E's EPIC-1 application filing. The

EPIC-2 project on collaborative demonstrations through R&D consortia will be launched in 2017.

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

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

For all EPIC-1 and EPIC-2 projects, work will continue in 2017 on completion of any outstanding project plans and on performance of tasks in the plans. In the project execution process, the Project Technical Lead launches the early project work and builds the project team, and all team members (internal and contractor) participate in the performance of project tasks.

Specifically, for each project the following are the next steps:

- EPIC-1, Project 1: Develop the architectural framework for future distribution system, identify architectural features to be demonstrated, and perform the demonstration.
- EPIC-1, Project 2: Devise and demonstrate advanced features relative to the existing visualization and situational awareness capabilities in system operations.
- EPIC 1, Project 3: Demonstrate distributed control features that could enhance SDG&E distribution system operations.
- EPIC 1, Project 4: Demonstrate grid support functions of distributed energy resources to assess their viability for commercial adoption.
- EPIC 1, Project 5: Demonstrate integrated distribution circuits with advanced devices and other features to determine best practices.
- EPIC 2, Project 1: Set up and complete pre-commercial demonstration of IEC 61850 communications standards for substations.
- EPIC 2, Project 2: Set up data lake and apply data analytics to assessing distribution system asset condition.
- EPIC 2, Project 3: Perform pre-commercial demonstration of open field messaging bus.
- EPIC 2, Project 4: Demonstrate a system for aggregating and dispatching net-load resources in localized regions of the distribution system.
- EPIC 2, Project 5: Demonstrate improved capabilities for integrating customer systems (load and generation) into a distribution system to reduce adverse impacts on system operations.
- EPIC 2, Project 6: Set-up and execute pre-commercial demonstrations of high strategic value through collaborative activities within R&D consortia.

For these EPIC projects, \$7160k have been awarded (or are in the process of being awarded in early 2017) to contractors. SDG&E will provide the CPUC with notice of contract executions within 90 days of each occurrence.

## **ATTACHMENT B**

**SDG&E 2016 EPIC PROJECT STATUS (Excel File)**





