Company: San Diego Gas & Electric Company (U 902 M)
Proceeding: 2019 General Rate Case
Application: A.17-10-___
Exhibit: SDG&E-13

SDG&E

DIRECT TESTIMONY OF ALAN M. DULGEROFF

(DISTRIBUTED ENERGY RESOURCES POLICY)

October 6, 2017

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

A Sempra Energy utility®

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SDG&E DIRECT TESTIMONY OF ALAM M. DULGEROFF (DISTRIBUTED ENERGY RESOURCES POLICY)

I. INTRODUCTION

A. Summary of Proposals

I sponsor San Diego Gas & Electric Company's (SDG&E) test year 2019 testimony regarding policy on the incorporation of Distributed Energy Resources (DER) into SDG&E's electric energy distribution network. DER are an increasing part of the energy mix in SDG&E's service territory. This increasing contribution, however, presents challenges associated with incorporating DER into the design and operation of the existing network.

B. Organization of Testimony

My testimony is short, consisting of a background discussion on DER, growth in the SDG&E service territory, and finally some of the impacts and concerns that DER pose as the adoption of DER becomes more widespread. In order to safely and reliably manage the increasing DER on its system, SDG&E will require new tools, systems, and infrastructure. For the near-term, some of these are described in the testimony of Alan F. Colton (Exhibit SDG&E-14). This description of the impacts and concerns for the distribution system supports Mr. Colton's request for certain materials that will enable SDG&E to support further DER integration into its distribution system. SDG&E's increasing familiarity with the tools and technologies that DER providers are expected to employ will also enable it to craft appropriate safety and operating procedures.

II. BACKGROUND

SDG&E believes the electric distribution system must evolve to meet the future needs of customers and society. Climate policy, technological advances, and customer choice are driving the widespread adoption of DER. Advanced metering, rate structures such as time-of-use billing (TOU), and new end-use technologies are key drivers to changes in energy consumption and production. These changes are presenting new challenges across SDG&E. For example, distribution system operators are no longer solely managing the safety and reliability of a system of limited energy producers and unidirectional and predictable flow from substations to customers, but now power flows from many sources at varying times of day and in different directions. Changing operational characteristics of SDG&E's distribution system include greater variability and composition of load and resources throughout the system, two-way power flows on distribution circuits, and more complex maintenance and emergency operations. These changes require corresponding modifications in the design and operation of the distribution system.

Consider the example of the use of fuses on the distribution system. Historically, the system was built to accommodate one-way power flow from the source to the end-users, such as residences, businesses, or industrial facilities. Distribution circuits emanating from substations are protected with a variety of sectionalizing devices so a fault on a single branch or segment of the circuit does not necessarily cause an outage on the rest of the circuit upstream. Often this is accomplished by inserting fuses at several locations along the length of the circuit. Those fuses are designed and selected so that they are 'timed,' meaning that not all fuses will open at the same time a circuit fault is detected. Fuses near the end of the circuit are faster and more sensitive, and fuses near the beginning of the circuit (closer to the substation) are slower and less sensitive. This scheme is intended to limit service interruption to the portion of the circuit with the actual fault. This, of course, is predicated on the traditional one-way power flow on that circuit. Introducing DER along that same circuit can result in power flows in both directions, limited fault current, undetected faults, and incompatibility with the original circuit protection scheme. This not only risks the integrity of the electric system and associated electrical equipment, but the safety of anyone in proximity or working on that circuit, from utility linemen to the general public. The introduction of DER along a distribution circuit must be carefully designed and managed to preserve the integrity of the system and safety of the public.

To support the changing grid and processes, SDG&E needs to make investments in resources, tools, sensors, systems, communications, and infrastructure. These will help SDG&E's distribution system to become a platform for distributed resources and devices to connect and interact more easily and reliably, and possibly support the development of new markets and services. In addition, these investments will promote universal service by reducing barriers to adoption of distributed technologies and enhancing consumer choice. Properly redesigned, the distribution system and operating procedures will more seamlessly facilitate DER integration in a manner that promotes fairness and equity for all customers, along with safe and reliable energy production and delivery.

A. DER Growth on SDG&E's Distribution System

There has been a significant increase in DER penetration in SDG&E's distribution system, primarily due to a large increase in solar photovoltaic (PV) installations. Deployment of such PV systems has been incentivized by the NEM tariff and state and federal tax credits and incentives. Lower cost materials and installations are now sustaining DER adoption, seen most frequently as "rooftop solar," in combination with state climate policy and technological advances. For these reasons, I expect growth in DER penetration will continue for the foreseeable future.

State energy policy, as reflected in the Renewable Portfolio Standard (RPS), requires that SDG&E along with the other investor-owned utilities (IOUs) procure 50% of energy from renewable sources by 2030.[1] Further emphasis on renewable energy supply will likely result in more utility-scale and distributed resources to meet state objectives.

SDG&E was the first California IOU to reach its Net Energy Metering (NEM) 1.0 cap, which occurred in 2016. At the end of 2010, SDG&E had approximately 11,700 DER installations throughout its system, installed at a rate of just over 3,000 per year. In 2016, SDG&E enabled 30,000 installations through a combination of a streamlined on-line interconnection process and innovative technology, such as the Renewable Meter Adaptor (RMA), a tenfold increase from 2010. By July, SDG&E realized over 110,000 DER interconnections. Those 110,000 installations represent approximately one in every thirteen households in SDG&E's service territory. The aggregate nameplate capacity of those DERs is approximately 750 MW, which surpasses SDG&E's Palomar Energy Center combined cycle power plant. Table AMD-1 below illustrates this growth in DER deployment.

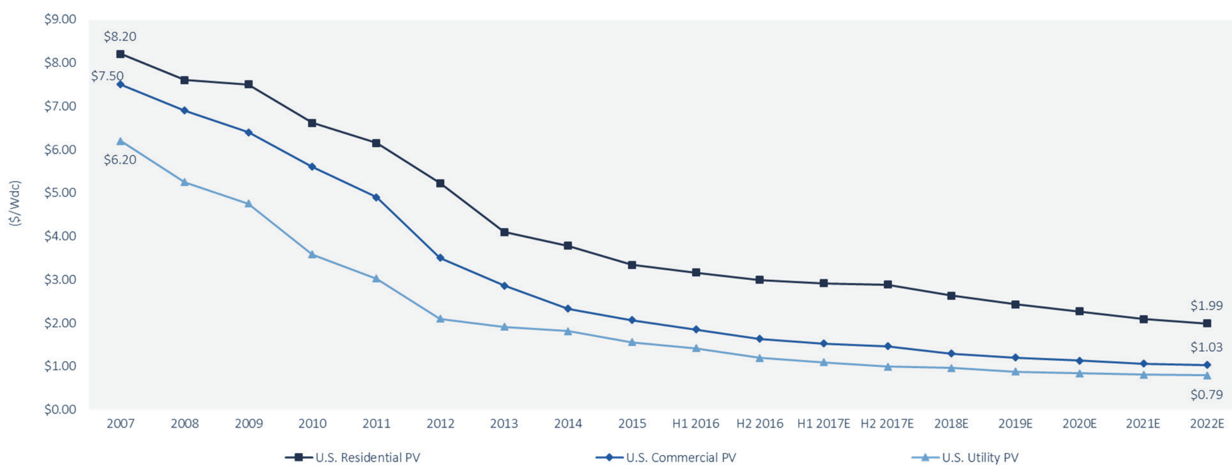
[1] California Public Utilities Code 399.15 (a) (2) (B), "…that require retail sellers to procure not less than 50 percent of retail sales of electricity products from eligible renewable energy resources."

Table AMD-1.
NEM Installations and Nameplate Capacity in SDG&E Service Territory

Year	Yearly Installations	Total Installations	Yearly kW	Total kW
2010	3,191	11,730	25,584	85,209
2011	3,990	15,720	34,611	119,819
2012	5,262	20,982	37,367	157,187
2013	10,916	31,898	67,177	224,364
2014	15,729	47,627	103,124	327,488
2015	27,207	74,834	168,709	496,197
2016	30,406	105,240	198,364	694,561

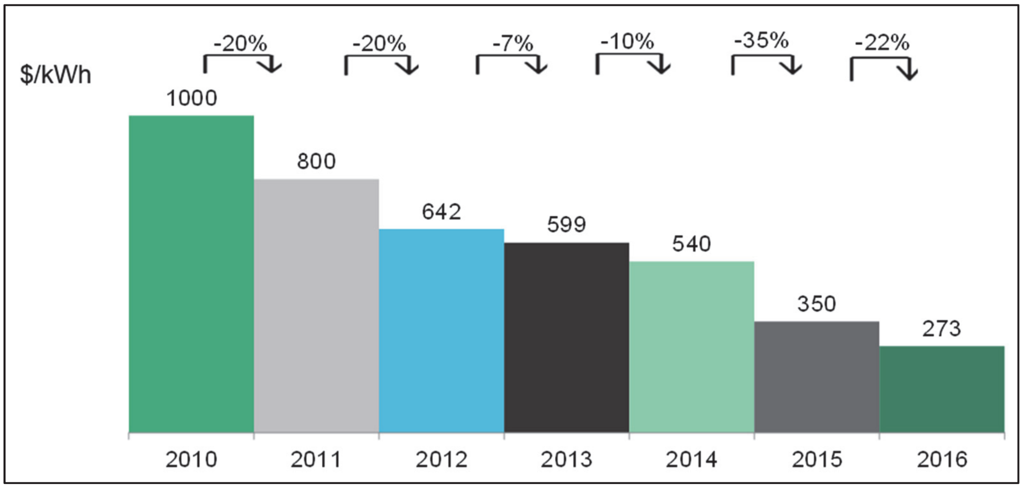
Figures AMD-1 and AMD-2 below depict historical and forecasted reductions in costs of PV installations and lithium-ion energy storage devices. As the costs to install such equipment decline, all else equal, the adoption of DER should continue.

Figure AMD-1.
Historical and Forecasted U.S. PV System Pricing by Market Segment[2]



[2] GTM Research PV System Pricing H1 2017, https://www.greentechmedia.com/research/report/pv-system-pricing-h1-2017

Figure AMD-2.
Lithium-Ion Battery Price Survey[3]



These key trends, policy, efficiency, and cost signal higher levels of DER penetration to be integrated by evolving the distribution system.

B. Operational Impacts of DER

Due to the increasing magnitude of DER, such as PV and energy storage today whose operating characteristics are less predictable than traditional baseload generation resources and loads, the distribution system can experience significant swings in voltage and load serving capacity. These impacts need to be addressed by Distribution Planners and Operators in order to maintain safe and reliable service levels.

Intermittent power production of PV systems impacts voltage on the distribution system. In addition, because SDG&E's system was designed and built to serve conventional customer loads, DER such as energy storage, when driven by other consumer and market factors, can be less predictable and more challenging to manage than traditional loads. Certain types of DERs can introduce constraints to serving load and impact reliability during grid operations, or alternatively, encounter grid hosting limitations.

III. HOSTING WIDESPREAD DER

SDG&E envisions the grid as a platform for clean, safe, and reliable energy for customers, including providing capacity for system-wide distributed technology adoption.

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[3] Bloomberg New Energy Finance lithium-ion battery price survey, 2010-2016, cells plus pack prices, https://about.bnef.com/blog/lithium-ion-battery-costs-squeezed-margins-new-business-models/

SDG&E currently leads the state by providing 43% of its energy from renewable sources. While much of this energy is supplied by central station resources interconnected to the transmission grid, SDG&E expects renewable energy to be increasingly interconnected to the distribution system. Planning the distribution system has become much more complicated,[4] and additional infrastructure will be required to support ever-increasing levels of DER growth. In addition, SDG&E has been a leader in safe and reliable service, receiving "Best in the West" in PA Consulting's Reliability One awards for 11 years.[5] Operating and market procedures to support the complexities of DER in the hundreds of thousands, if not designed and implemented effectively with new systems, could overwhelm grid managers and challenge their ability to maintain system reliability.

IV. DER PROVIDING DISTRIBUTION SERVICES

Proceedings active at the Commission are examining issues related to the quantification and validation of DER provision of distribution services. Specifically, the Distribution Resources Plan (DRP) and Integrated Distributed Energy Resources (IDER) proceedings[6] at the Commission are currently dealing with these issues. In recognizing the consensus recommendations of the Competitive Solicitation Framework Working Group (CSWFG) in the IDER proceeding, the Commission has identified four services that DER could provide to the distribution grid: distribution capacity, voltage regulation / VAr support, grid back-tie, and resiliency services via microgrids.[7] However, for SDG&E to maintain safety and reliability, the DER must provide performance guarantees.

A. Distribution Capacity Services

Distribution capacity services mitigate high loading conditions on the distribution system. This service could be provided by integrating DER and/or reducing energy demand downstream of a system constraint.

[4] Load forecasting and modeling is more complex with significant quantities of DER.

[5] *See* http://www.paconsulting.com/industries/energy-and-utilities/performance-improvement/reliabilityone/.

[6] R.14-08-013, et al., and R.14-10-003, respectively.

[7] Decision (D.) 16-12-036.

B. Voltage Regulation and VAr Support Services

Voltage regulation and reactive power (VAr) support services could be provided by DER to help maintain voltage on the distribution system, if needed. For example, a DER could adjust its real or reactive power output in order to help increase or decrease voltages. Load modifying resources could similarly support voltage regulation by reducing or increasing energy demand.

C. Grid Back-Tie Services

DER could provide grid back-tie services to help support utility operators in re-routing power during emergency switching or planned maintenance. For example, a DER could reduce the loading on a circuit segment to allow a tie switch to be operated with sufficient capacity to carry load from an adjacent circuit.

D. Resiliency Services

Resiliency services are envisioned to enable portions of the distribution system to "ride-through" or remain energized in the scope of a larger outage or emergency via microgrid concepts. For DERs to provide this service, there must be sufficient generating resources in place to meet customer demand, as well as control systems to maintain proper voltage and frequency. To avoid a brief outage when transitioning back to normal operation, the control system must also be capable of synchronizing with the rest of the grid.

V. CONCLUSION

In order for the distribution system and a distributed energy market to mature safely and effectively, the utility infrastructure must evolve, with investments needed in new sensors, communications, and systems. Customers served by SDG&E's distribution system had more than 110,000 DER installations as of July, and SDG&E projects more growth in the future. In my opinion, even if DER may once have been considered to be incidental facilities without material impacts on the planning and operation of the distribution system, that is no longer the case.

I have described some of the impacts and concerns that DER presents to the SDG&E distribution system in support of tools and related materials that Mr. Colton's testimony (Exhibit SDG&E-14) requests to further the integration of DER, increase SDG&E's experience with technologies anticipated from DER providers, and develop appropriate safety and operating procedures for a future distribution grid with increased quantities and types of DER.

Development of the operational architecture and hierarchy to ensure safe and reliable service as well as integration and operation of DERs, should come first. Markets that ensure cost effectiveness and equity for all ratepayers should be based on this reformed model. Infrastructure, systems, and processes should support and be driven by the revised architecture and market, and finalized and implemented after these critically important steps. In addition, testing, demonstrations, and pilots should also be completed to ensure that lessons learned are accurately identified and properly vetted before being used to inform decision makers.

This concludes my prepared direct testimony.

VI. WITNESS QUALIFICATIONS

My name is Alan M. Dulgeroff. My business address is 8316 Century Park Court, San Diego, California, 92123. I am employed by San Diego Gas and Electric as Director – Electric System Planning. I have been employed by SDG&E since 1993. In over 20 years of utility industry experience, I have held leadership and technical positions in 13 areas, including finance, human resources, information technology, and electric and gas transmission and distribution engineering, construction, operations, and maintenance. My present responsibilities include planning and engineering SDG&E's electric transmission and distribution systems.

I earned a Bachelor of Science in Electrical Engineering from San Diego State University. I am licensed in California as a Professional Engineer.

I have previously testified before the California Public Utilities Commission.

APPENDIX A

GLOSSARY OF TERMS

CSWFG	Competitive Solicitation Framework Working Group
DER	Distributed Energy Resources
DRP	Distribution Resources Plan
IDER	Integrated Distributed Energy Resources
IOUs	investor-owned utilities
NEM	Net Energy Metering
PV	photovoltaic
RMA	Renewable Meter Adaptor
RPS	Renewable Portfolio Standard
SDG&E	San Diego Gas & Electric Company
TOU	time-of-use
VAr	Voltage regulation and reactive power