DOCKETED	
Docket Number:	20-MISC-01
Project Title:	2020 Miscellaneous Proceedings.
TN #:	233092
Document Title:	AB 2514 Silicon Valley Power City of Santa Clara 2017 Report
Description:	N/A
Filer:	Courtney Wagner
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	5/22/2020 1:52:58 PM
Docketed Date:	5/22/2020

City of Santa Clara
The Center of What's Possible

AGENDA ITEM#: 15.C

AGENDA REPORT

Meeting Date: November 7, 2017

To: City Manager for Council Action

From: Director of Electric Utility

Subject: Approve and Adopt an Energy Storage Procurement Plan to Evaluate Energy Storage as an Element of Electric Utility Power Supply Plans in Compliance with California Assembly Bill 2514

EXECUTIVE SUMMARY:

State Law, under Assembly Bill 2514 (AB2514), requires publicly owned utilities to evaluate the use of energy storage as an element of their power supply plans by preparing an Energy Storage Procurement Plan which is adopted by the utility's governing board. The plans must be submitted to the California Energy Commission (CEC) for review. The CEC is then required to submit a report to the Legislature on the progress of each publically owned utility.

The City's Electric Utility, Silicon Valley Power (SVP), continues to review various technologies and their relative cost-effectiveness. SVP, as a member of the Northern California Power Agency (NCPA), contracted with DNV GL to re-evaluate energy storage targets, energy storage technologies, as well as cost-effectiveness methodologies that can be used to make storage procurement decisions. DNV GL results helped in the development of SVP's Plan and procurement targets.

Energy storage systems absorb energy, store it for some period of time (at a loss) and then release it. Storage can provide flexibility to the utility for periods of time when supply and demand are not in balance, such as when there is a large amount of renewable generation. The broad range of storage technologies currently being reviewed have a wide range of performance, history of implementation, as well as cost and benefit qualities. The performance characteristics of these multiple technologies vary and differ vastly in configurations, efficiencies, as well as the number of discharge cycles they can perform. Finally, when sited at certain locations of the grid, the devices can often perform multiple functions to solve different electric system needs.

SVP currently has cost-effective means of achieving most of the performance characteristics provided by energy storage systems. SVP has a diversified generation portfolio that can be dispatched to economically provide those functions. For energy storage to be economic for SVP, it would most likely be in the event that there were multiple benefits provided within a battery storage deployment beyond simple demand shift. In the Energy Storage Procurement Plan, SVP has identified three potential use cases as an opportunity to deploy energy storage projects if those projects prove economically viable. SVP is continuing to pilot an energy storage project at the Tasman Drive Parking Structure through a California Energy Commission grant program to reduce customer-side peak demand charges due to high energy electric vehicle fast charging. Staff will continue to monitor the viability of

storage as part of the Integrated Resource Plan (IRP) analysis in 2018 and as market conditions evolve.

ADVANTAGES AND DISADVANTAGES OF ISSUE:
To stay in compliance with State Law AB2514 requires the Council to approve and adopt SVP's Energy Storage Procurement Plan. The Plan provides SVP with guidelines for exploring storage projects at transmission, distribution, and customer level benefits.

SVP has also been approached by other start-up energy storage companies that are interested in testing and evaluating their technology in cooperation with SVP. These projects provide an opportunity to study different energy storage projects, their impacts on the utility system and their cost effectiveness. Because SVP does not know if or when these opportunities might arise, these will not be incorporated into the energy storage procurement target. Staff will also study the potential for adding programs to assist customers in installing storage units at their locations to meet individual needs.

ECONOMIC/FISCAL IMPACT:
Adoption of the Energy Storage Procurement Plan would have no economic or fiscal impact on the City. However, if SVP moves forward with any of the described potential research-development projects or use case programs, SVP would incur costs. SVP would provide specific information and contract requirements, and the Council would review any program at that time to determine its appropriateness.

RECOMMENDATION:
That the Council approve and adopt an Energy Storage Procurement Plan to evaluate energy storage as an Element of Electric Utility Power Supply Plans in Compliance with California Assembly Bill 2514.

John C Roukema

John C. Roukema
Chief Electric Utility Officer

APPROVED:

Deanna Santana

Deanna J. Santana
City Manager

Documents Related to this Report:
1) Energy Storage Procurement Plan for Silicon Valley Power, City of Santa Clara

C:\USERS\SLAUGHLIN\APPDATA\LOCAL\MICROSOFT\WINDOWS\TEMPORARY INTERNET FILES\CONTENT.OUTLOOK\HAKXFMNI\DS ENERGY STORAGE PROCUREMENT PLAN CAO17-1983 JCR.DOC

Energy Storage Procurement Plan
Silicon Valley Power
City of Santa Clara

October 2017

Executive Summary

State Law, under Assembly Bill 2514 (AB2514), requires publicly owned utilities to evaluate the use of energy storage as an element of their power supply plans by preparing an Energy Storage Procurement Plan and have the Council adopt the plan. The City's Electric Utility, Silicon Valley Power (SVP), continues to review various technologies and their relative cost-effectiveness. SVP, as a member of the Northern California Power Agency (NCPA), contracted with DNV GL to re-evaluate energy storage targets, energy storage technologies, as well as, cost-effectiveness methodologies that can be used to make storage procurement decisions.

Energy storage systems absorb energy, store it for some period of time (at a loss) and then release it. Storage can provide flexibility to the utility for periods of time when supply and demand are not in balance, such as when there is a large amount of renewable generation. Energy storage is comprised of a group of technologies that vary in stages of development: from traditional systems, such as pumped hydro that has been deployed for decades, to emerging systems such as Liquid Air Power and Storage (LAPS), adiabatic compressed air, to lithium ion batteries that has been expanding its portfolio of applications in recent years. In addition, the performance characteristics of these multiple technologies vary from power (short duration- such as; frequency regulation, voltage support, frequency excursion) to energy (long duration-such as; market arbitrage, capacity, demand management, spinning reserves, stand by, black start), and differ vastly in configurations, efficiencies, as well as the number of discharge cycles they can perform. Finally, when sited at certain locations of the grid, the devices can often perform multiple functions to solve different problems.

Even though battery prices are decreasing, most applications of battery storage are not cost effective at this time for SVP. SVP currently has cost-effective means of achieving most of the performance characteristics provided by energy storage systems. SVP has a diversified generation portfolio that can be dispatched to economically provide those functions. Additionally, unlike most utilities, SVP's consumption is relatively flat, with a system load factor of 75.8%, due to a temperate climate and a significant percentage of industrial and commercial customers who use the same amount of power at all hours of the day and night. Thus, as a general rule, for energy storage to be economic for SVP, it would most likely be in the event that there were multiple benefits provided within a battery storage deployment. Additional benefits are referred to as "stacking" or "value streams".

SVP has identified three potential use cases as an opportunity to deploy energy storage projects. Two Research and Development (R&D) pilot programs that may be beneficial to both SVP and the end use customer while providing multiple stacking benefits to make the projects economically viable. Through these R&D pilot projects, SVP is seeking to deploy a cost-effective energy storage business model that can be replicated in our service territory. SVP has also identified a Black Start Battery Hybrid project to support the greater Bay Area transmission system in case of system failure. SVP is continuing to pilot an energy storage project at the Tasman Drive Parking Structure through a California Energy Commission grant program to reduce customer-side peak demand charges due to high energy electric vehicle fast charging.

As SVP's load continues to add diversified resources to the generation portfolio does as well. In 2016 and 2017, SVP signed a series of power purchase agreements (PPAs) for a new solar project and new/repowered wind projects, all projects are estimated to begin production in 2020. As part of those PPAs, battery storage was evaluated and found not to be cost effective at that time. Staff will continue to monitor the viability of battery storage for those projects will be re-evaluated in 2019/2020 as part of the Integrated Resource Plan (IRP) and as market conditions change.

Legislative Requirement to Review Energy Storage

In 2013, AB 2514 codified Public Utilities Code Section 2836(b) requires the governing board of each local publicly owned electric utility to determine appropriate targets for the utility to procure viable and cost-effective energy storage systems to be achieved by December 31, 2016, and December 31, 2020, on or before October 1, 2014 as part of their supply plan. The statute also requires each governing board to reevaluate the determinations made pursuant to this subdivision not less than once every three years, with the first three-year period ending October 1, 2017.

The California Energy Commission (CEC) is required by AB 2514 to review the plans and reports submitted by POUs. This review should include consideration of the integration of technologically viable and cost-effective energy storage technologies with other programs, including demand side management and other means to result in the most efficient use of electricity generation and load management resources. The CEC must report to the Legislature regarding the progress made by each local POU serving end-use customers in meeting the requirements of AB 2514. The CEC staff and Commission have been clear that they value the importance of using energy storage to help in meeting the State's environmental goals and plan to act early to ensure energy storage procurement plans are implemented statewide.

In order to meet these requirements SVP must develop cost-effective energy storage options and adopt energy storage system procurement targets, if appropriate. SVP was required to open an energy storage system procurement proceeding by March 1, 2012 and adopted an energy storage procurement target by October 1, 2014, with the first report submitted to the CEC by December 31, 2016 and the second to be submitted by December 31, 2021. SVP must report to the CEC regarding individual progress toward meeting this goal. This report meets the requirement of adopting an energy storage procurement targets to be achieved by December 31, 2021.

Energy Storage Use Cases

It is not unique for a statute to require utilities to procure emerging energy technologies as long as they are cost-effective. In 2006, SB 1 required utilities to procure cost-effective solar. Compared to storage, evaluating the costs and benefits of solar was more straightforward: there is a predominant technology, the generation profile is comparable, and the cost can simply be quantified and compared with each other based on a straight forward dollar per Watt metric. Unlike solar, assessing the cost-effectiveness of storage presents a unique set of challenges.

When it comes to evaluating the cost-effectiveness energy storage there are a wide range of energy storage technologies that can be deployed depending on the use case. While an energy storage system may be optimized for a particular use case, other value streams/stacking benefits or offerings can enhance the revenue if it can operate given those parameters. The wide range of storage technologies currently being reviewed have a wide range of performance, history of implementation, as well as cost and benefit qualities. Energy storage systems can be connected to the transmission grid to balance out variable generation, particularly from some renewable resources, with load requirements. Storage systems can also be placed on a customer facility to help reduce usage and rates by shifting consumption away from peak periods, or to help balance out the generation produced from an on-site PV system with the needs of the building.

The following list in Table 1 provides definitions, collated from number of public sources, for the most commonly cited energy storage applications, some of which were covered in more detail earlier in this plan:

Table 1: Energy Storage Application Segments – SVP will explore potential benefits in bold below in the different use cases

Transmission	Distribution	Customer – Behind-the-meter
Provide frequency regulation services	Defer system upgrades	**Customer bill management: Time-of use(TOU) energy and demand charge management**
Provide spin / non-spin reserves	**Improve distribution system operation (Voltage Support/VAR Support)**	**Maintain power quality**
Provide ramping	Mitigate outages	**Provide uninterruptible power supply**
Provide Black Start		
Avoid renewable curtailment and/or minimum load issues		
Shift energy		
Provide capacity		
Smooth intermittent resource output		

"Firm" renewable output		
Improve transmission system operation (short duration performance, inertia, system reliability		
Avoid congestion fees		

Recommendation for an SVP Storage Procurement Plan

SVP is proposing to explore three potential projects/use cases to be deployed before January 1, 2021, if found to be cost effective. A transmission battery storage application - a black start battery hybrid project. Two potential Research and Development (R&D) projects. One, with a Class A commercial customer to explore a battery storage deployment that may provide multiple benefits or dual value streams to both the utility system and the end customer. Two, a R&D project that is a hybrid distribution and customer-end-use project/solution with a large data center that could maximize different value streams and incremental benefits to SVP's distribution system and the customer.

To satisfy SVP's obligations under state law, SVP proposes the following energy storage procurement targets at this time:

Category	Amount (kW) / Use Case
Transmission	• 2.5MW Black Start Battery Hybrid Project at a Generation Facility in Santa Clara. SVP is proposing to use a Battery Energy Storage System (BESS) to provide black start capabilities. SVP has submitted a proposal to the California Independent System Operator (CAISO) to be part of the network of generators that brings the electric grid back on-line after a system failure also known as Black Start.
Distribution	• 50 MW Research and Development (R&D) project with a new data center development to explore multiple value streams/stackable benefits to the customer and the utility. Potential benefits; demand response, frequency support, ancillary services, a non-wires solution to potential system constraints
Customer	• Developing a .75-1.5MW Commercial R&D program for Commercial Customers to benefit both utility (demand response) and customer deployment (peak shaving) and potentially other multi-purpose uses • Continuing a 30 kW – Green Charge Networks project at Tasman Drive Parking Structure

Also, some customers may have motivations to install locally-sited storage systems for back-up, to reduce demand charges, to be able to more effectively use electricity generated by on-site PV systems, or for a variety of environmental and other reasons not related to cost-effectiveness. For these customers, SVP will provide assistance in researching, procuring and operating battery-backups for PV systems. Installation of these systems may help customers keep their rates down and enhance their sustainability footprint. The City of Santa Clara is working on the appropriate guidelines for installation of energy storage on customers' premises and may consider developing a residential storage program in the future.

Energy Storage Opportunity at the Transmission and Generation System Level

Black Start Capability

Black Start is the procedure to recover from a shutdown of the bulk transmission system which has resulted in major loss of power supply. The black start process involves the starting of individual, isolated power stations (using on-site power that is not dependent on the bulk system to operate, such as a diesel genset) that can then serve to restore power to the ISO balancing authority area following a system outage. A black-start unit provides energy to help other units restart and provide a reference frequency for synchronization. CAISO obtains black start services from generating units under interim black start agreements or reliability must-run contracts.

Energy storage systems can also provide an active reserve of power and energy within the grid and can be used to energize transmission and distribution lines, as well as provide station power to bring power plants on line after a large failure of the grid. Storage can provide startup power to larger power plants, if the storage system is suitably sited and there is a clear transmission path to the power plant from the storage system's location.

The Proposal

In response to California ISO market notice dated June 15, 2017 SVP submitted a proposal for Black Start and System Restoration Phase 2. Silicon Valley Power is proposing to provide black start capability using a Battery Energy Storage System (BESS) combined with a simple cycle gas turbine located at the Silicon Valley Power's existing Gianera Generating Station. The Gianera Generating Station consists of two GE Frame 5 simple cycle gas turbines utilizing dual fuel capability: natural gas and diesel fuel. On a loss of natural gas the facility can start up and provide almost using its fuel reserves contained 100,000 gallon diesel tank. The BESS will be capable of supplying 2.5 MW of electrical power for 12 minutes. According to Silicon Valley Powers estimates Silicon Valley Power the BESS is capable of supplying enough electrical power to start the gas turbine on a complete loss of electrical power.

This BESS system is expandable to support additional stacking benefits. SVP plans to expand the BESS to qualify for and provide ancillary services (spinning reserve). Additionally, SVP plans to expand the BESS to provide other energy storage services.

Cost-Effectiveness

Silicon Valley Power is submitted this proposal on the basic assumption that it is economically feasible and technically feasible to qualify the unit to provide the additional functions (spinning reserve, energy storage). Economically feasible means Silicon Valley Power subjectively determines in good faith, using its own analysis, that the project's economic benefits will outweigh its burdens. Technically feasible means Silicon Valley Power subjectively determines, in good faith, using its own analysis that all engineering, permitting, construction and other technical requirements can be met in the timeframe required to achieve the benefits of the additional functions.

Energy Storage Opportunity at the Distribution Level

Distribution R&D project

SVP is negotiating a 50 MW Research and Development project with a new data center development where SVP would control the dispatch of a BESS to maximize system SVP operating conditions and/or the CAISO market opportunities.

SVP staff will evaluate the potential of multiple stacking benefits that a deployment of this size could bring to the market. Benefits include but are not limited but are not limited to[1]:

- Ancillary Services -Provide spin / non-spin reserves
  Operation of an electric grid requires reserve capacity that can be called upon when some portion of the online supply resources become unavailable unexpectedly. Generally, reserves are sized to be at least as large as the single largest supply resource (e.g., the single largest generation unit) serving the system and reserve capacity is equivalent to 15% to 20% of the normal electric supply capacity. Spinning Reserve refers to generation capacity that is online (and synchronized to the grid system) but unloaded and that can respond within 10 minutes when needed to compensate for generation or transmission outages. Non-Spinning Reserve refers to generation capacity that may be offline or that comprises a block of curtailable and/or interruptible loads and that can be ramped to the required level (and synchronized to the grid system) within 10 minutes.

- Provide ramping
  Conventional generation-based load following resources will increase output to follow demand up as system load increases and decreases output to follow demand down as system load decreases. To enable ramping service, a generation unit must be operated at partial load, which is inefficient and requires more fuel per MWh, resulting in increased emissions per MWh relative to the generation unit operated at its design output level. Varying the output of generators will also increase fuel use and air emissions, as well as the need for more generator maintenance and thus higher variable operations and maintenance (O&M) costs. Storage is a well-suited alternative resource to provide ramping because it can operate at partial output levels with relatively modest performance penalties and respond very quickly when output modulation is needed for load following.

---

[1] DNV KEMA Cost Effectiveness Methodologies Report 2017

- Shift energy
  At the transmission and distribution level, electric energy time-shift involves purchasing inexpensive electric energy, available during periods when prices or system marginal costs are low, to charge the storage system so that the stored energy can be discharged or sold at a later time when the prices or costs are high. Alternatively, storage can provide similar time-shift service by storing excess energy production, which would otherwise be curtailed, from renewable sources such as wind PV1 Operationally, this application is similar to avoiding curtailing excess energy as energy shifting on the transmission scale is performed during periods of over-generation.

- Provide capacity
  Capacity refers to the making power and energy available to given an electric market to serve current and future demand. Resource adequacy capacity requirements ensure sufficient resources are available in the CASIO market for safe and reliable operation of the grid in real time. Resource adequacy capacity is also designed to provide appropriate incentives for the siting and construction of new resources needed for reliability in the future. For a given capacity resource, the net qualifying capacity is the qualifying capacity of a resource adjusted, as applicable, based on: (1) testing and verification; (2) application of performance criteria; and (3) deliverability restrictions. Flexible capacity is defined as the quantity of resource capacity as specified by CAISO to meet maximum three hour ramping and contingency reserves. Depending on the circumstances in a given electric supply system, energy storage can be used as an alternative to buying new central station generation capacity and/or purchasing capacity in the wholesale electricity marketplace.

  The storage system could perform in utility or ISO capacity dispatch programs such as Demand Response, Local Capacity Resource (LCR), or Forward Capacity Market (FCM). Under these programs, the storage system would be notified ahead of time of the volume and duration of capacity required and the price of that service. Capacity dispatch may involve storage discharging (equivalent to load reduction) during peak or congested hours of the day such as early or late evening.

- Improve distribution system operation (Voltage Support/VAR Support)
  Utilities regulate voltage within specified ANSI standard limits by installing and operating tap changing transformers and voltage regulators at the distribution substation and by switching feeder capacitors downstream to follow load changes. This need is pronounced on long, radial lines with high loading or on feeders with high penetration of intermittent residential PV systems which may be causing unacceptable voltage deviations for neighboring customers. Placing distributed storage closer to load can improve network voltage profile, mitigate fluctuations, and reduce network power losses. Though this may be valuable to SVP system operations it may harder to implement if competing with market opportunities. Staff will determine if this value can be stacked with others for maximum benefit.

- Provide uninterruptible power supply
  Even momentary outages or power quality events can result in large-scale customer financial losses when sensitive electronic or process equipment loads are present. The electric supply to these pieces of equipment can be backed up to an uninterruptible power supply which can seamlessly switch from the utility power supply to energy storage backup when a power quality event or momentary outage occurs. For long-term outages, the UPS enables ride-through

capability ensuring continuous supply of power to critical loads while other conventional back-up generation is brought on-line. This value is realized and valued by the end-use customer and is part of their business continuity strategy.

Target: 50MW Energy Capacity – Duration TBD

Goal: Creating a Battery Storage design that can be replicated to other Data Centers

Cost-Effectiveness:
Utility: To be determined -depends on the value extracted stacking benefits and the CAISO marketplace
Customer: Provide additional revenue stream and/or cost recovery mechanism

Deployment Target Date: 2019

Energy Storage Opportunity on Customer Sided Storage

Solar + Storage Pilot

The primary benefit for cost-effective deployment of behind-the-meter use cases is customer bill reduction through the reduction of demand charges that are applicable to some commercial and industrial customers, also known as "peak shaving." In addition to customer bill savings, energy storage could potentially provide capacity dispatch revenue from the utility as part of a Demand Response program. The storage system would be notified ahead of time of the volume and duration of capacity required and the price of that service. Capacity dispatch may involve storage discharging (equivalent to load reduction) during peak or congested hours of the day such as early or late evening.

SVP is working with a vendor who currently deploys Solar + Storage on large Class-A office buildings. SVP is proposing a R&D project to determine the cost-effectiveness of deploying smaller scale storage systems and co-optimized the benefits that the storage operation can provide. This also allows the utility to test the accuracy of customer control systems and the integration of battery storage into a defined operational strategy.

Proposed Size: .50 MW – 1.5MW

Goal: Reduce customer and utility peak through demand response management. Creating a win/win scenario for both the utility and end use customer without impacts to other rate payers.

Cost-effectiveness:
Utility: To be determined.
Customer: the deployment is dependent on the California Self Generation Incentive Program (SGIP) and the Federal Investment Tax Credit (FITC), applicable to energy storage and PV and potentially SVP's determined grid value.

Deployment Target Date: 2018/2019

Continuing Project -SVP Pilot Project with Green Charge Networks

SVP is continuing to pilot an energy storage project at the Tasman Drive Parking Structure through a California Energy Commission grant program to reduce customer-side peak demand charges due to high energy electric vehicle fast charging. The City's Streets Department is SVP's customer at this parking structure. Green Charge Networks, a Santa Clara based energy storage company, approached SVP to install a 30 kilowatt (kW) "GreenStation" battery energy storage system along with an electric vehicle DC fast charger station at this location. The cost of the energy storage system, the DC fast charger and the installation is covered by a California Energy Commission grant program, resulting in no costs to Santa Clara or SVP. The GreenStation is installed behind-the-meter and dampens the demand spikes that occur when the DC fast charging station is used. This helps the Streets Department avoid higher electricity bills due to the increased demand charges that would otherwise occur from use of the DC fast charging station.