Meeting Date: 08/19/14

AGENDA REPORT

City of Santa Clara, California

Agenda Item # 7A-3

Santa Clara
All-America City
2001

Date: August 5, 2014

To: City Manager for Council Action

From: Director of Electric Utility

Subject: 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 and have the Council adopt the plan. The City's Electric Utility, Silicon Valley Power (SVP), has reviewed various technologies and their relative cost-effectiveness. With the exception of pumped hydroelectric power, very little commercially available energy storage is currently cost-effective. SVP is working to demonstrate the use of energy storage systems on the customer's side of the meter to assist customers with controlling their demand and provide other cost benefits. Programs may also be developed to assist customers in installing their own systems and to study how energy storage systems might be integrated into the utility. Staff will continue to monitor the development of energy storage technologies and the Energy Storage Procurement Plan will be reviewed in three years to determine whether technologies have become cost-effective.

ADVANTAGES AND DISADVANTAGES OF ISSUE:

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 most common sources of energy storage include hydroelectric facilities, rechargeable batteries, thermal energy storage and compressed air systems. By far the largest amount of energy storage in use world-wide is pumped hydro. Another commercially available system is Thermal Energy Storage (TES) units, which involve creating ice or cold water at times of off-peak energy use to create cooling at peak times.

Energy storage systems are of most value when the utility needs to provide electricity to customers during a large peak in usage (such as is created through air conditioning), where there is a need to smooth out generation delivery patterns from intermittent facilities, as in wind and solar, or when there is a need to extend facility service life for capital items in the distribution system. None of these situations is currently the case in Santa Clara. Due to the very flat load use pattern, full coverage of supply requirements and the fact that the distribution system has very few sections that require upgrade, installing large scale energy storage systems based on utility need cannot be justified at this time.

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

Category	Amount (kW) / Reason
Transmission	None – not cost effective
Distribution	None – not cost effective
Customer	30 kW – Green Charge Networks project at Tasman Drive Parking Structure

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. These might include future projects to evaluate Vehicle-Grid-Interface (VGI) options to utilize electric vehicle batteries as a storage option to support the distribution system or distributed solar projects combined with an energy storage component. As 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 Silicon Valley Power elected to implement rebates to assist customers in installing storage systems on their own facilities, such a program would have a cost to the City. The Council would review any program at that time to determine its appropriateness.

RECOMMENDATION:
That the Council 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
Director of Electric Utility

APPROVED

Julio J. Fuentes
City Manager

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

Energy Storage Procurement Plan
Silicon Valley Power
City of Santa Clara

JULY 2014

Executive Summary

The basic purpose of energy storage for an electric utility is to provide control over spikes and dips in both generation and load requirements, particularly when the portfolio includes a large amount of non-dispatchable renewable resources, such as wind and solar, or extreme usage peaks, such as when there are high summer temperatures leading to a need for air conditioning or substantial coincident electric vehicle fast charging loads. For Silicon Valley Power (SVP), consumption is relatively flat, with a system load factor of 74.4%, due to a temperate climate and a significant percentage of 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 was a need to provide control over swings in generation due to the non-dispatchability of wind and solar on the grid. In developing its energy storage procurement plan, SVP will measure the cost-effectiveness of energy storage by comparing it to the cost of procuring resources for peaking purposes. While in many locations this might include first looking at Energy Efficiency (EE), according to the State's Loading Order, in Santa Clara, there are few cost-effective EE options that provide significant peak savings, primarily due to climate. Thus, the resources with which energy storage will be compared include Demand Response, renewable sources or gas-fired peaking resources.

State Law (AB2514) requires publicly owned utilities (POUs) to evaluate energy storage as an element of their supply plans. AB2514 established a timeline for adoption of a policy by October 2012 and initiating the procurement of energy storage that is deemed cost-effective by the local governing board by October 2014. In addition, POUs are required to report on their implementation of AB2514.

SVP has also reviewed various assessments of different technologies and their relative cost-effectiveness, including an adaptation of a pro forma financial analysis of thermal energy storage applications at customer locations for POUs. Based on these studies, except for the possibility of pumped hydroelectric power, there is essentially no commercially available or viable energy storage that is cost-effective for SVP. There are also no identified sections of the distribution system where installation of energy storage would alleviate problems created by large amounts of solar electric generation or in order to delay the need to upgrade the local network.

SVP is piloting 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. 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. For SVP, these projects provide an opportunity to study different energy storage projects and their impacts on the utility system.

Some of SVP's customers have installed storage systems to provide bridging power for the rare occasion that SVP power goes down and they need to transition to their backup generators. These customers have installed batteries and/or flywheels so that there is no impact to the power quality or delivery at their facilities. It is also possible that some of SVP's customers may wish to install energy storage for a variety of environmental and other reasons not related to cost-effectiveness. The City of Santa Clara will need to develop appropriate guidelines for installation of energy storage on customers' premises and may provide assistance to them in making these installations.

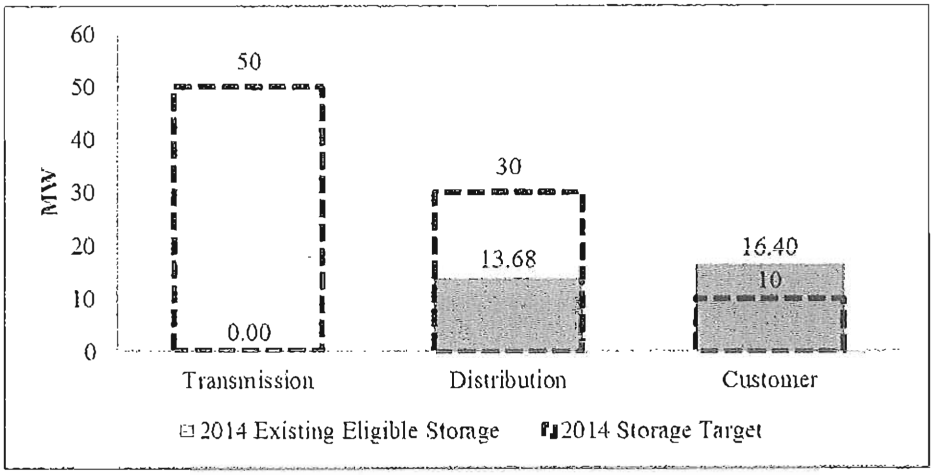
Legislative Requirement to Review Energy Storage

State Law (Assembly Bill or AB 2514; September 2010) obliges the California Public Utilities Commission (CPUC) to require investor owned utilities (IOUs) to develop cost-effective energy storage plans and procurement policies. To further this goal, the law required the CPUC to adopt energy storage procurement targets by October 1, 2013 for the state's IOUs. Notwithstanding that most forms of energy storage are not cost-effective at this time, the CPUC issued a ruling on June 10, 2013 proposing energy storage procurement targets for the IOUs on the basis that competitive solicitations are a better way to elicit cost-effective energy storage proposals. On October 17, 2013, the CPUC closed its Energy Storage Rulemaking and issued D.13-10-040, which created an Energy Storage Procurement Framework and Design Program, and established a target of 1,325 megawatts of energy storage to be procured by the three major IOUs by 2020. These energy storage installations must be placed into service no later than the end of 2024. IOUs were required to file procurement applications containing a proposal for their first energy storage procurement period by March 1, 2014.

All three of the large IOU's filed procurement plans with the CPUC in February 2014. These utilities plan to seek a variety of storage capabilities for transmission, distribution and customer areas of operation. All three utilities plan to achieve half or more of their energy storage goals through transmission-level projects in the Long Term Transmission Plan process. As an example, Southern California Edison's (SCE's) plan is shown below, as taken from the testimony in support of SCE's Energy Storage Procurement Plan, submitted to the CPUC on February 28, 2014.

Figure III-1

SCE's Fulfillment of the 2014 Storage Targets by Grid Domain



As Participating Transmission Owners (PTO's) with the CAISO, these IOU's will be able to collect return in a Transmission Revenue Requirement for approved and installed projects. This option is not available to SVP, which is not a PTO.

PG&E and SCE have stated an intention to meet the requirements to procure storage through the following means: a competitive Request for Offers (RFO) to be issued around the end of 2014, CPUC-approved programs including Self Generation Incentive, Permanent Load Shift, Demand Response and Electric Vehicle Pilots; CPUC proceedings for Long Term Procurement Plan, Renewables Portfolio Standard and Resource Adequacy; electric vehicle funding for grid storage; and other approved channels, including research. SDG&E plans on following the traditional procurement mechanisms mentioned above, but only intends to issue an RFO in 2014 for transmission and distribution business areas, as it believes the customer side storage requirements have been met through electric vehicle and solar photovoltaic programs.

D.13-10-040 further established a target for community choice aggregators and electric service providers to procure energy storage equal to 1 % of their annual 2020 peak load by 2020 with installation no later than 2024, consistent with the requirements for the utilities. With a one-year lag, AB 2514 requires the same determinations of governing boards of POUs, such as the City of Santa Clara's Silicon Valley Power (SVP), to open proceedings and make determinations by October 2014 comparable to those required of the CPUC.

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 is required to open an energy storage system procurement proceeding by March 1, 2012 and to adopt an energy storage procurement target by October 1, 2014, with the first target to be achieved by December 31, 2016 and the second by December 31, 2021. SVP must report to the CEC regarding individual progress toward meeting this goal. SVP opened the energy storage procurement proceeding on February 28, 2012. This report meets the requirement of adopting an energy storage procurement target by October 1, 2014.

Summary of Energy Storage Technologies

Energy storage systems absorb energy, store it for some period of time (and with some loss) and then release the energy. Energy storage can provide flexibility to the utility for times when there is a greater production of electricity than is needed, such as a winter night when windmills are operating at full capacity but few customers are requiring electricity. Energy storage then can deliver this electricity to the grid later when the demand is higher, and the options to generate electricity are more expensive. In addition, energy storage can provide support to "clean up" the fluctuations in the system, such as when renewable systems, such as wind or solar photovoltaic (PV), vary in production on a moment to moment basis due to atmospheric conditions. On the customer side, energy storage systems can be used to reduce peak demands or to provide backup to increase reliability for high-performance loads.

Some of the most common sources of energy storage include hydroelectric facilities, rechargeable batteries, thermal energy storage, and compressed air systems. By far the largest amount of energy storage in use world-wide is pumped hydro. This technology allows electricity to be stored when demand is otherwise low by flowing water from a lower altitude dam to one at a higher elevation. When electricity generation is needed, the water flows back to the lower elevation and generates power. While this is the most cost-effective storage option, it must be acknowledged that, as is the case with all energy storage technologies, there is an overall loss of energy efficiency caused by having to pump the water back up to the higher elevation. Other energy storage technologies available include compressed air, batteries of different chemistries and flywheels. Some of the most commercially available systems are Thermal Energy Storage (TES) units, which involve creating ice or cold water at times of off peak energy use. This ice or chilled water is used for air conditioning during peak times of the day.

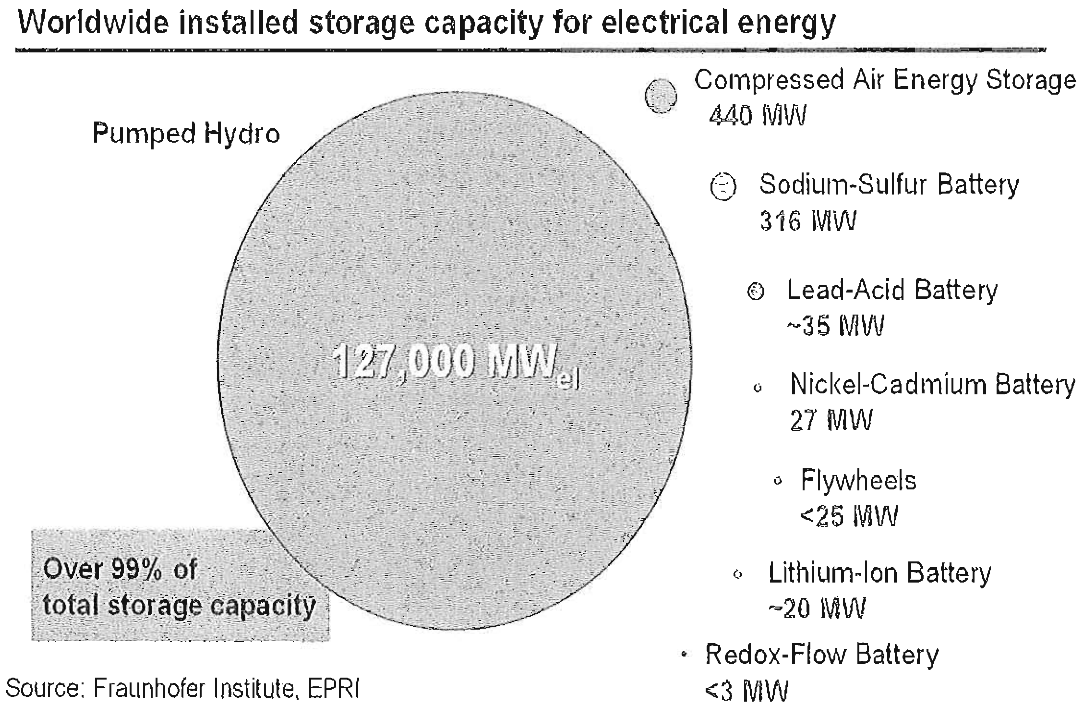
There is a large amount of information and analysis about energy storage technologies from both an objective and a sales' oriented point of view. The wide range of storage technologies currently being reviewed have a wide range of performance, history of implementation, as well as cost and benefit qualities. 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, for instance the TES discussed above, or to help balance out the generation produced from an on-site PV system with the needs of the building.

Two studies by the Electric Power Research Institute (EPRI) in 2010[1] and the National Renewable Energy Labs (NREL) in 2013[2] are some of the most well-reasoned and analyzed reports. The EPRI paper reviewed the available energy storage options, both in their potential to deliver different benefits to a utility and from a cost-effectiveness perspective. The more detailed NREL analysis looked at energy storage options for electric utilities and the potential benefits available from different sectors in transmission to distribution to customer-sited options.

The EPRI paper assessed existing energy storage technologies and those ready to be commercialized. The different technologies were compared on performance and capital costs criteria based on information received from vendors and system integrators. The paper provides an overview of energy storage applications and technology options, as well as the potential range of value of each type of storage system presented for different services. The most widely implemented technology is hydro pump storage, as shown in EPRI's summary pie chart below.

[1] *Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs and Benefits* (December 2010). Electric Power Research Institute. Principal Investigator: D. Rastler.
[2] *The Value of Energy Storage for Grid Applications* (May 2013). National Renewable Energy Laboratory. Denholm, JJ, Hummon, M, Jenkin T, Palchak, D., et al .

Figure 1; EPRI 2010 Report



The study also found that there is a wide range of costs to install and operate the differing energy storage technologies in different applications. When doing a cost-effectiveness analysis and determining where to site storage resources in a utility, the study found that it is best to look for those options that have multiple benefits in order to spread the costs over as many areas as possible, since upfront and ongoing operational and maintenance costs remain high for energy storage technologies in comparison to both traditional and renewable power purchases. Costs to install storage systems range wildly. In addition, in many instances there are very few real world installations to analyze, so the costs are highly variable and projected estimates are very suspect. The installation cost is estimated to range from $1,000 per installed kW of capacity to well over $5,000 per kW.

Different energy storage options can provide benefits (or values) to a wide range of activities in the electric utility. At the transmission level storage can provide protection for the grid and manage the flow of thousands of megawatt hours per year versus battery back-up for photovoltaic systems that can provide support to a single home or utility feeder. As shown on Figure 2 below, some of the highest value benefits include the capability to defer large capital upgrades in transmission, at a substation or for distribution feeders. Technologies at the customer side, such as TES or battery back-up to on-site PV systems, have a much lower value, but could potentially be of use to a large number of individual customers, as shown in Figure 2 from the EPRI study below. Many of the technologies are still early in the commercialization cycle, so it is generally expected that costs to install and operate many of these systems should come down in the next five to ten years as production costs and operational experience increase.

Figure 2; EPRI 2010 Report

Comparison By Type of Benefit Available from Storage:
Value Dollar Value to Utility (Vertical Axis) With Potential Capacity Savings (Horizontal Axis)

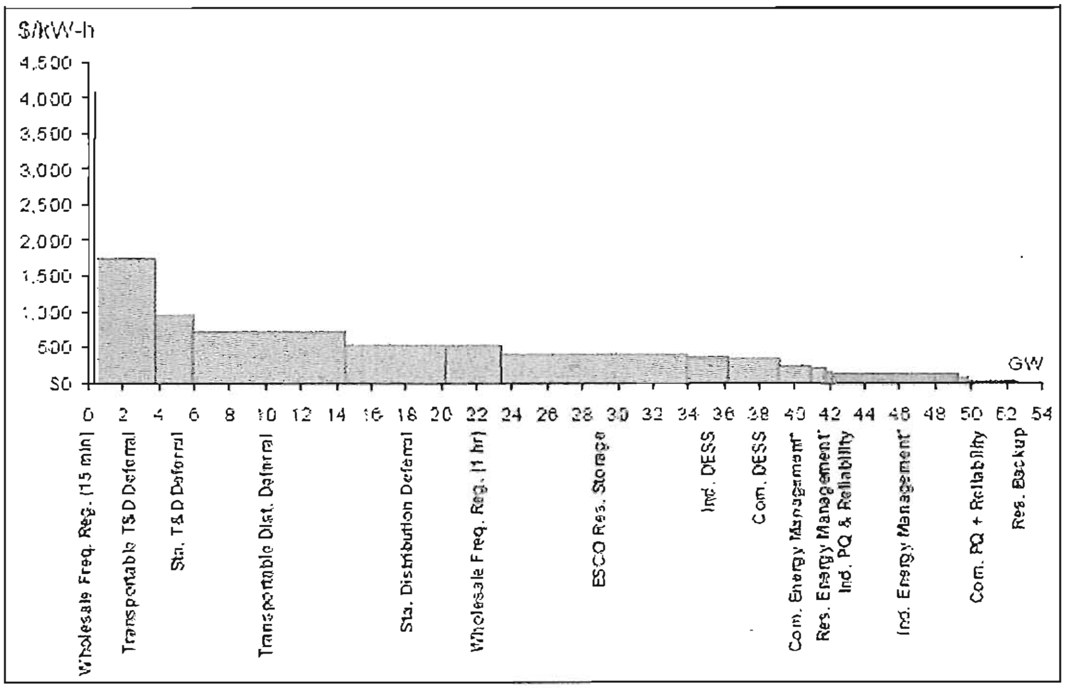


Figure 3-14
Estimated Target Market Size and Target Value Analysis

The NREL study analyzed the technologies with a commercial grid simulation tool to evaluate several operational benefits of electricity storage. Storage technologies were added to a utility system in the west, and the operational cost of generation was compared to the same system without the added storage. This operational value of storage was estimated for devices of various sizes, providing different services and with sensitivities to fuel price and other issues. There are three major areas where energy storage was tested to determine costs and benefits: the transmission system, the local distribution network (including neighborhoods) and local, customer-level battery power. Overall, the study found relatively little value for load-leveling to reduce peak energy usage at certain times of day but greater value when providing reserves to the transmission and generation system. The study also found that revenue received through storage technologies in a market setting at the local level is substantially less than the benefit provided to the system. This study demonstrated that energy storage has a number of challenges to overcome before it is commercially viable in many settings.

The essential conclusion of these studies is that pumped hydro is a mature, proven technology that can be cost-effective if suitable sites can be found. Compressed air energy storage shows promise in certain situations. Some battery technologies are coming close to cost-effectiveness on the scale required for at least some types of storage systems. Many applications are not yet commercially viable nor cost-effective in nearly all situations. Most of the systems do not have much (or any) time in the real working environment, so it is difficult to estimate costs to operate and maintain these systems at this point in time. Reliability is still a key factor for most of the energy storage technologies. On the other hand, while many customer-sited systems are not cost-effective at this time, some types of technologies may provide operational support, particularly when there are large distributed generation systems (PV) on a feeder or when deferring upgrades to a substation, distribution feeder or other large capital item.

Potential for Cost-Effective Energy Storage in Santa Clara

AB2514's directive to POUs regarding energy storage procurement targets is fundamentally vague. According to the law, POUs must set a procurement target, but only "if appropriate." Further, all energy storage must be cost-effective. The law does not define how cost-effectiveness is to be determined.

"Cost-effective" is a relative term. Something is typically viewed as "cost-effective" when it is cheaper than a comparable alternative. However, cost-effectiveness could also be measured by someone's willingness to pay for something, even when nominally cheaper alternatives may be available. It should be noted that the California Independent System Operator (CAISO) currently charges for transmission on a strictly energy basis (per MWh) with no peak demand charge. Thus a benefit of peak shaving that energy storage could provide does not provide any monetary savings on transmission charges. Instead because energy storage requires more energy input than is recovered, depending on where it is located, a utility could end up paying more in transmission charges if it makes use of energy storage.

Energy Storage Options at the Transmission and Generation System Level

Energy storage systems, if properly set up with a good market design, can provide large benefits to utilities on the transmission and generation systems. The addition of energy storage can reduce costs through load leveling, which increases the use of lower cost generators while, at the same time, decreases the use of more expensive peaking generators. There are also the capacity benefits that energy storage can provide. Capacity is the capability of generation to produce power when and at the level needed. Since wind and solar cannot generate electricity at all times, their capacity factors are relatively low. Storage can increase the utility's capacity available to ensure power is delivered when customers require it, but renewable generators are off-line. The capacity benefit is important in storage cost-effectiveness. In fact, EPRI (2013) found that "the value of energy storage is largely dependent on it obtaining a capacity value, even if the device is providing higher-value reserve services" (page 34).

In addition to the potential for somewhat reduced costs in generation through using energy storage, if a utility could reduce the peak amount of power going over the transmission system it might, in theory, have reduced charges for peak demand. However, as mentioned above, currently the CAISO charges for transmission on a per megawatt hour (MWh) basis with no charges based on peak usage on a daily, weekly, monthly or annual time period. Without such demand charges associated with maximum transmission usage, the peak shaving benefit is not available. In fact, the additional load used by the storage device would cost the utility more in transmission charges.

This lack of a benefit in the transmission market design, and resulting cost for adding storage on the distribution system, eliminates the possibility that SVP could receive the highest potential benefit of installing a storage system. For these reasons, this potential benefit was not analyzed in the development of the Energy Storage Procurement Plan.

Distribution Network

Utilities can also potentially benefit from installing storage systems in the distribution system. If there are locations where a large capital upgrade is required to maintain service levels and the upgrade can be put off for five to 10 years through its installation, there can be cost-effective locations for energy storage. Also, if a utility has a large local generation facility (PV system) on a feeder without a significant amount of load, installing an appropriately sized storage system on the line can help to avoid operational problems that can occur when that PV system generates more electricity than is required to serve the customers on that feeder.

Due to long standing capital retrofit and upgrade programs, SVP does not currently have either of these situations. The utility has a standard practice to ensure that its system is not in jeopardy of overload at any time. There are also no feeders with outsized local generation systems. As SVP cannot gain significant benefits through installing energy storage in the distribution system at this point in time, this option was not analyzed. However, this could change in the future if a high concentration of electric vehicle fast chargers were installed that produced a high coincident peak load on a single feeder.

Customer Side Storage

SVP Pilot Project with Green Charge Networks

SVP is piloting 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.

Thermal Energy Storage (TES) Options

TES has been available for many years in various applications. Initially, thermal storage was used in large-scale, chiller based applications (e.g. 20+ tons) using water that was chilled or frozen during off-peak hours to provide cooling during the day. More recently, a thermal storage application has been developed for use with smaller scale, direct expansion, refrigerant-based air conditioners (DX AC) that are most common in homes and businesses. TES can be a cost-effective means of improving the cooling capacity in chillers and DX AC units and shifting on-peak demand to off-peak periods, particularly where there are wide variations between cool nights and hot days[3].

The Southern California Public Power Authority (SCPPA) has contracted with a specific vendor to provide this technology (Ice Bear) to a variety of commercial customers of the POUs in Southern California. SCPPA has created an integrated resource planning tool to evaluate the cost of this energy storage/peak load shifting resource against other supply- and demand-side resources for SCPPA members. This modeling tool was adapted to evaluate the potential application of Ice Bears in SVP territory by including revised inputs that reflect Santa Clara's more moderate climate and by using/including the local electric rates, as well as SVP-specific load/resource data and cost of service information. The model assumes a bulk buy of the systems, the issuance of debt by the utility to pay for the systems and a repayment of these initial loans over a 10 year period.

An avoided cost comparison and pro forma were run for SVP, first comparing TES against cost-effective peak load reducing energy efficiency programs, such as removing or replacing air conditioners. This was done because the State's Loading Order directs utilities to first look at adding cost-effective energy efficiency when procuring energy. Unfortunately, due to Santa Clara's mild climate and relatively flat total system load profile, there are few options available for cost-effective energy efficiency available for peak load reduction on any kind of scale. Therefore, the model is not viable against energy efficiency. The model was then run comparing TES against Demand Response Programs, renewable energy generation and generation of electricity from natural gas simple cycle plants. The last three models all show that TES has the potential to be cost-effective over the long term—well over 10 years—when compared to Demand Response and renewable energy, in particular.

Demand Response Comparison:

This analysis showed that procuring energy storage under the program mentioned above has a payback period of between 13 and 18 years, depending on the quantity of TES installed, when compared to implementing a Demand Response program. While a Demand Response program would be relatively less expensive to implement than a large capital TES installation program at customer locations, the benefits are comparatively less significant at SVP than at other utilities in the state, primarily because of Santa Clara's overall flat usage pattern and high load factor profile.

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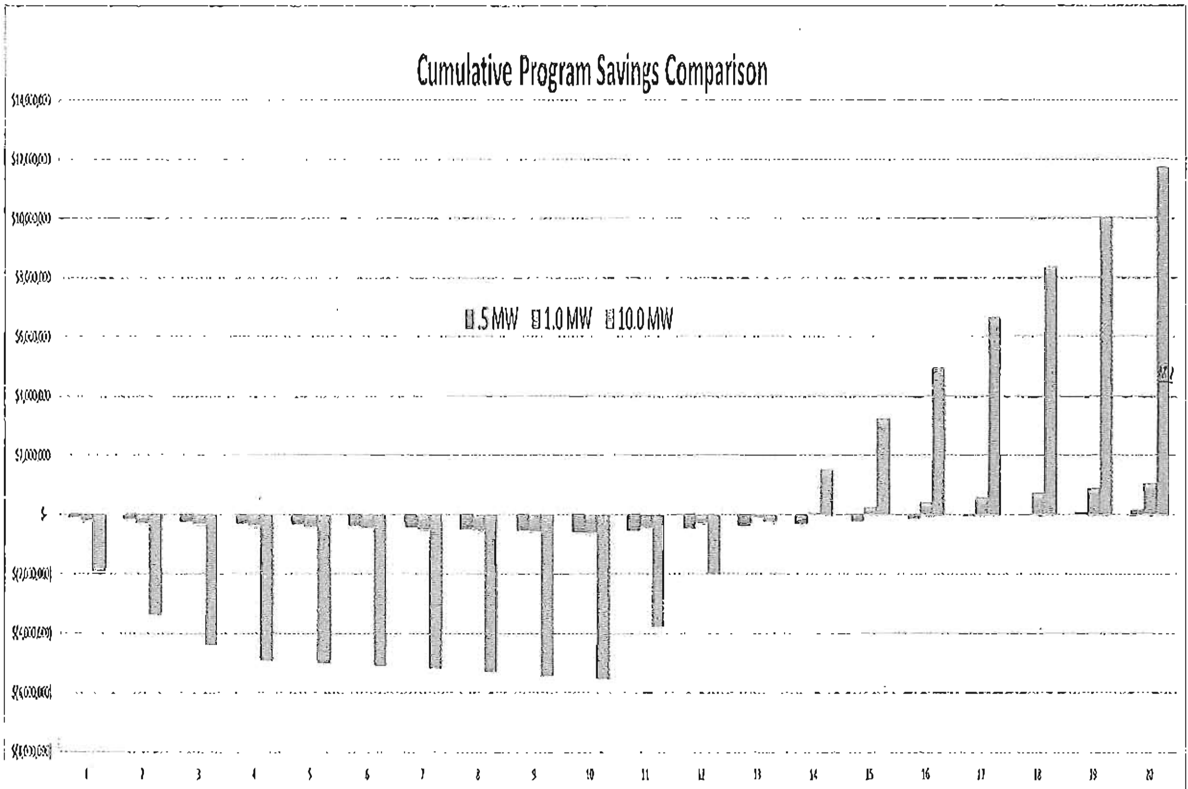
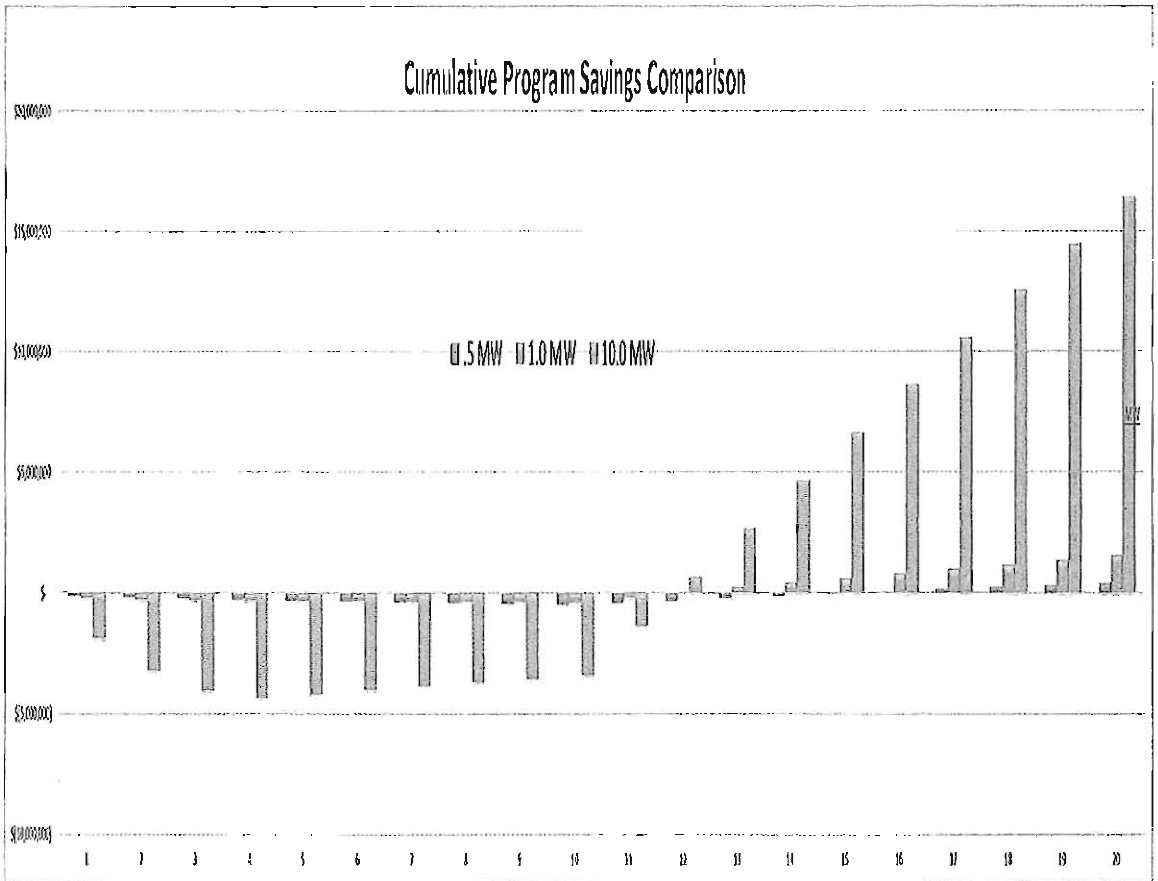
[3]A built in assumption of these systems is that electric system on-peak demand coincides with the period of highest air conditioning need. If, in fact, on-peak demand occurs in winter or during evening hours, this may not be the case for that particular electric distribution system.



Renewable Energy Comparison:

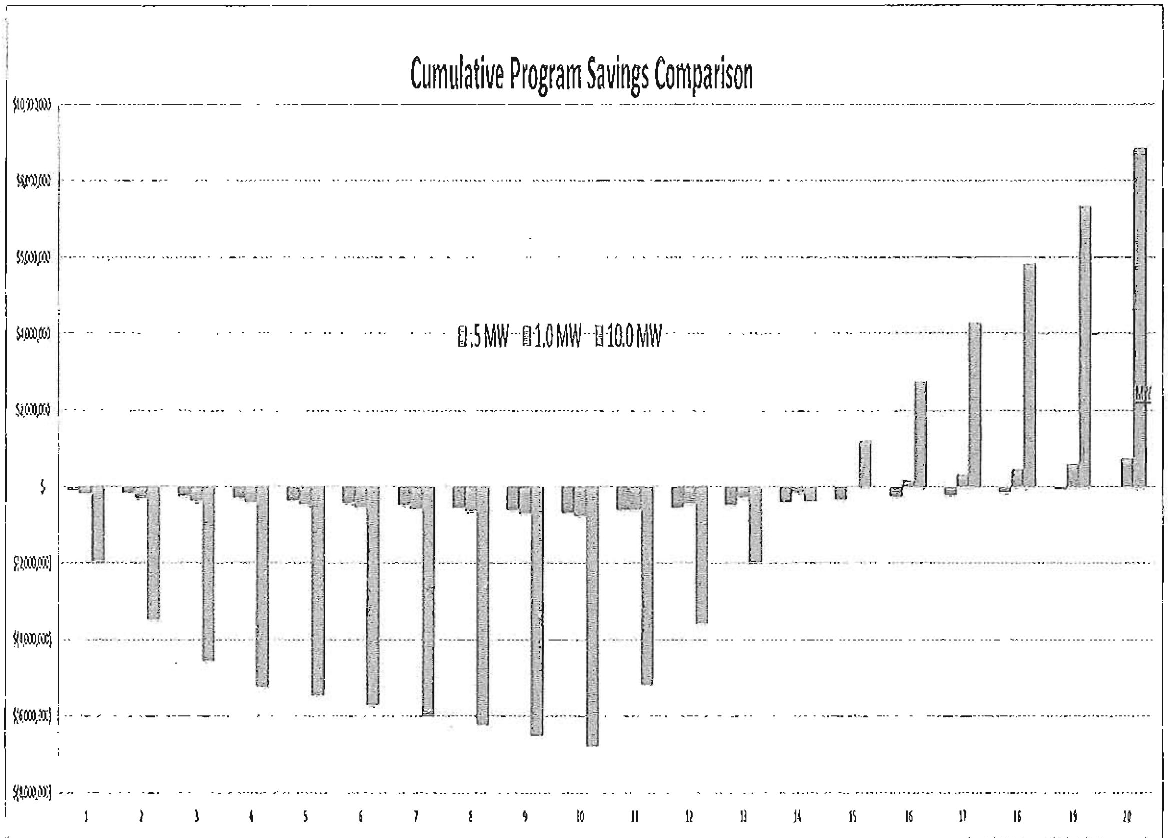
The second preferred resource in the State's Energy Loading Order is electricity generated from renewable resources, such as geothermal, wind or PV facilities. Due to the fact that the market for renewable resources in California is currently dominated by wind and PV systems, the proposed TES program was compared to these technologies. The comparison of installing some TES at customer locations against purchasing renewable energy shows that TES would pay back somewhere between 11 and 15 years when compared to PV and 10 and 12 years when compared to wind, assuming the cost to procure that energy remains similar to what is assumed in the model. Installing customer-side TES would reduce the need to procure and transport electricity and manage the differences between when the renewable energy can be generated and when it is needed by customers, thus, over time, a customer-side TES system could pay back costs.



Natural Gas Large Simple Cycle (100MW or greater) Comparison:

The last procurement step on the State's Load Order is to purchase cost-effective, lower carbon intensive resources, such as electricity generated at natural gas facilities. Comparing the development of a customer-located TES program electricity generated by natural gas powered simple cycle units shows a payback that is slightly longer than the previous two models—between 14 years to over 20, depending on the size of the TES program. The payback of this model is longer, because the electricity procurement costs are lower. In addition, since electricity can be generated whenever needed by a natural gas plant, the potential value to a TES program when compared to this type of electricity is relatively less. This payback period is close to the expected useful life of the TES units[4]. For these reasons, a utility-sponsored TES program when compared to traditionally generated electricity would typically not be implemented purely on cost-effective grounds.

[4]For example, Ice Bear indicates that it expects a mean-time-between-failure of 16 years assuming proper annual maintenance.



Except for the pump storage method mentioned earlier in this paper, other energy storage technologies are currently less commercialized and not cost-effective as compared to the Ice Bear TES solution. Due to its high level of maintenance and current loading requirements of the distribution system, staff has found no areas where it would currently be useful from an operational level to install an energy storage device to delay a major capital upgrade. There are systems, such as the TES analyzed above, that could be cost-effective for customers to install on-site. In order to assist these customers in analyzing and potentially installing these systems, SVP will plan to analyze the cost-effectiveness of a program to provide such help and compare it with energy efficiency programs when developing the annual Demand Side Management program plan. If such a program is developed, the assistance to customers could be either through help procuring TES systems through a rebate or group purchase or through help in the operation of these units and integration with the utility system. In addition, SVP will continue to analyze storage technologies and their cost-effectiveness in the next procurement cycle. At that point in time, there will likely be additional systems that have become commercially viable and could provide a cost-effective service to the utility and its customers. To the extent that the resource coverage, usage patterns and/or upgrade needs in the distribution system change, SVP will place a priority on the review and potential procurement of energy storage systems at that point in time. Also, to the extent that more commercially tested, cost-effective utility-based storage opportunities develop as a result of IOU activities, SVP's approach to energy storage in the meantime will be reviewed and could be revisited.

Recommendation for an SVP Storage Procurement Plan

Energy storage systems are particularly of value in situations where the utility needs to provide electricity to customers during a large peak in usage (such as is created through residential or commercial air conditioning or coincident electric vehicle charging), where there is a need to smooth out generation delivery patterns from intermittent facilities, such as wind and solar, or when there is a need to extend service life and put off updating portions of the distribution system that are close to capacity. Due to the very flat load use pattern, full coverage of resource adequacy needs and the fact that the distribution system is in good repair with very few sections that require upgrade, installing large scale energy storage systems based on utility need cannot be justified at this time. To satisfy SVP's obligations under state law, SVP proposes the following energy storage procurement targets at this time:

Category	**Amount (kW) / Reason**
Transmission	None – not cost effective
Distribution	None – not cost effective
Customer	30 kW – Green Charge Networks project at Tasman Drive Parking Structure

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. For SVP, these projects provide an opportunity to study different energy storage projects, their impacts on the utility system, and their cost effectiveness. These might include future projects to evaluate Vehicle-Grid-Interface (VGI) options to utilize electric vehicle batteries as a storage option to support the distribution system or distributed solar projects combined with an energy storage component. As SVP does not know if or when these opportunities might arise, these will not be incorporated into the energy storage procurement target.

It is also possible that some of SVP's customers may wish to install energy storage for a variety of environmental and other reasons not related to cost-effectiveness. Some of SVP's customers have installed storage systems to provide bridging power for the rare occasion that SVP power goes down and they need to transition to their backup generators. These customers have installed batteries and/or flywheels so that there is no impact to the power quality or delivery at their facilities. Some customers may have motivations to install locally-sited storage systems for back-up, to reduce demand charges or to be able to more effectively use electricity generated by on-site PV systems. For these customers, it may be useful for SVP to provide assistance in researching, procuring and operating battery-backups for PV systems or TES, such as the Ice Bears procured by SCPPA. Installation of these systems may help customers keep their rates down and enhance their sustainability footprint. Assisting customers through rebates or other assistance will be further analyzed as a way to assist them and add to SVP's experience with energy storage systems.