Peninsula Advanced Energy Community (PAEC)

Task 3.12: Final Report Summary of Successful Energy Storage Financing Programs

Prepared for
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Sovereign Energy Storage

Sovereign Energy provides utilities with intelligent and cost effective solutions for integrating renewables, improving system reliability and power quality, and lowering operating costs. Our success will accelerate the adoption and penetration of renewable energy, while modernizing and improving the stability of the grid.

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The Clean Coalition is a nonprofit organization whose mission is to accelerate the transition to renewable energy and a modern grid through technical, policy, and project development expertise.

The Clean Coalition drives policy innovation to remove barriers to procurement and interconnection of distributed energy resources (DER)—such as local renewables, advanced inverters, demand response, and energy storage—and we establish market mechanisms that realize the full potential of integrating these solutions. The Clean Coalition also collaborates with utilities and municipalities to create near-term deployment opportunities that prove the technical and financial viability of local renewables and other DER.

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I. Introduction

In this section, we will provide an overview of the revenue streams that support distributed energy storage projects and financing mechanisms that end-customers can utilize to get projects built. Sovereign Energy Storage (SES) has worked with active financiers and developers of distributed energy storage projects to collect this research and analysis data. The vast majority of systems installed to date have been financed based on incentive programs such as California's Self Generation Incentive Program (SGIP) or in places which have rolled back net metering tariffs (Hawaii). The business case for stand-alone storage has been thin at best, but as equipment and installation prices decline rapidly (10 – 20% annually) the market for stand-alone energy storage is expected to grow rapidly in the 2018 – 2020 time-frame.

Third party financing is key to moving the market forward. Integrators of behind the meter systems must have a third party ownership structure in place to get early customers comfortable with projects which would otherwise have long payback periods. Most current financing mechanisms are shared savings agreements, under which the system owner must bill the host customer for demand charge savings created by the battery. A more viable market currently emerging in California under Southern California Edison's (SCE) Resource Adequacy contracts, is for the projects to earn long term utility capacity payments. Investors are much more comfortable with projects that have a consistent utility revenue source rather than monthly billed payments from C&I customers.

In summary, distributed energy storage is in a nascent stage currently focused in California, but will be an area many energy investors move into in the short term due to decreasing project costs.

II. Distributed Energy Storage: Revenue Streams and Project Types

a. Peak Demand Management

- Peak demand management (or Demand Charge Management, DCM) is performed by lowering the metered demand for the highest 15-minute interval each month. As the battery operated to lower demand charges daily, revenue is created in terms of bill savings as a customer's demand is lowered.
- Example: if a customer has a peak of 1,000kW, and a 200kW battery successfully cuts the peak every month to 800kW, the revenue created from demand charge management is 200kW * the demand tariff (in PG&E E-19 territory the demand charge is $20/kW/month, so total revenue created is 200 kW * $20/kW = $4,000/Month).

b. PV + Storage to receive the Investment Tax Credit

- A storage system is eligible to receive the Federal Investment Tax Credit (ITC) if the system owner can prove that greater than 75% of the energy discharged by the battery was generated by electricity generated from the solar system. If 75% of the electricity discharged by the battery was generated from the solar system the storage system is eligible to receive a tax incentive equivalent to 75% of the solar ITC, which is currently 30% of the eligible capital cost (75% * 30% = 22.5%). If 100% of the electricity discharged by the battery was generated by the solar system, then the storage system is eligible for a tax incentive equivalent to the full ITC.
- When the system is in operation, the battery will draw charging energy from the PV system during morning peak production hours when the energy generated would otherwise be injected to the grid. The load will then draw energy stored from the battery instead of grid energy during evening peak times when the load is highest and the PV system is no longer producing energy. During hours when cloud cover is over the PV system and the load would spike and potentially trigger a monthly demand charge, the battery system will be reading the load to mitigate the occurrence of that event.

c. PV + Storage and the SGIP incentive (California Only)

- A storage system can receive both the ITC and an SGIP incentive, however under SGIP rules (see 2016 handbook 3.3.4) the customer (i.e. system owner) must pay for a minimum of 40% of the eligible project costs. Under this scenario, the ITC benefit would only be accretive to the project if the SGIP incentive level was below 60% of the project cost.
- Example: (see 2016 Incentive Levels) the 2016 Advanced Energy Storage incentive is $1.31/w. If the storage system eligible cost is $3/w, then

$1.31/w only covers 43% of project costs. To achieve the full 60% benefit available between ITC and SGIP, the additional 17% of project costs, or $0.49/w can be attained through filing for the ITC:

i. In practice, the project will receive the full ITC benefit of 30% (30% * $3/W = $0.9/w), and the SGIP rebate will be limited to ($1.80 - $0.90) = $0.90.[1] The ITC eligibility credit for Solar Photovoltaics includes storage paired with PV.

d. PV + Storage + Demand Response

- PV + Storage projects can receive the ITC and participate in certain Demand Response markets. It is not possible for a specific asset to receive funding from multiple CPUC regulated programs, so rules differ across DR programs. In their recent energy storage DR RFOs, the CA IOUs have made it clear that equipment that receives incentives through the SGIP program is not eligible to participate in a bi-lateral utility DR program (no double dipping). To date, wholesale participation in the DRAM program in addition to participation in the SGIP program has been allowed.
- Generally, the utilities try to limit participation in multiple regulated programs, however the CPUC recognizes that since the battery can perform multiple functions in the market, dis-incentivizing that performance can have an adverse effect on rate payers. For example, the SGIP program is essentially a peak-demand reduction program, so if there is a separate regulated program that would incent participation in ancillary service or energy markets, in principle that should be allowed. The rules are not clear as of yet, and, developers should consult the local utility and CPUC staff before constructing projects with multiple regulated incentives anticipated.

e. Storage only + SGIP (California Only)

- Storage-only projects can perform peak demand management on site and can receive the SGIP incentive for up to 60% of eligible project costs, capped at an annual rate determined by the CPUC. California suppliers are eligible to receive an additional 20% of the incentive level, however they are still subject to the aggregate 60% cost cap. Systems under 30kW in nameplate capacity earn the full incentive upon commissioning, systems over 30kW earn 50% of the incentives upon commissioning, and the remaining 50% over the next 5 years through a Performance Based Incentive (PBI). The PBI is paid per kWh as metered from the battery; the system must perform 260 full cycles per year to receive the full PBI. See below table 1 of the 2016 SGIP incentive rates:

[1] DSIRE Federal Investment Tax Credit: http://programs.dsireusa.org/system/program/detail/658

Table 1: 2016 SGIP Incentive Rates

2016 Incentive Rates by Eligible Technologies

Technology Type	Incentive ($/W)
Renewable and Waste Energy Recovery	
Wind Turbine	$1.02
Waste Heat to Power	$1.02
Pressure Reduction Turbine	$1.02
Non-Renewable Conventional CHP	
Internal Combustion Engine - CHP	$0.42
Micro-turbine – CHP	$0.42
Gas Turbine – CHP	$0.42
Emerging Technologies	
Advanced Energy Storage	$1.31
Biogas Adder	$1.31
Fuel Cell – CHP or Electric Only	$1.49

[2]

f. Storage only + Demand Response + Demand Charge Management

- Storage only projects can perform both peak demand management on-site and perform Demand Response in bi-lateral utility programs. To successfully deliver DR, the battery must discharge against an active load, lowering the metered load for a specific interval period. In California, the demand response is measured according to a 10 day average baseline methodology. Under this methodology, each hour during the past 10 similar days prior to an event is averaged to establish an hourly baseline for those 10 days. The capacity of DR delivery is counted against this baseline.
- Energy storage projects can perform both DCM and DR, but the software must monitor and optimize the battery state of charge and baseline of the load, to ensure that when DR is called upon the site can achieve the full capacity possible.
- When battery systems are sized to perform the DR + DCM use cases, they must fully value both the pricing of each application, and the associated performance obligations and liquidated damages for non-performance to inform site level software to perform the highest value operation in every interval. Performance penalties must be fully valued in the initial site sizing analysis to inform proper sizing to loads.

[2] 2016 SGIP Handbook, http://www.cpuc.ca.gov/sgip/

III. Financing Arrangements

a. Customer Owned: Public Funds

As discussed in the preceding section, ITC is available to energy storage projects that accept greater that 75% of their charging energy from solar PV projects. To successfully capture the ITC control systems, the customer will need to carefully monitor and track solar charging and grid charging rates into the battery.

There is currently no Production Tax Credit available for energy storage. Since the wind production tax credit is measured on a per megawatt-hour of generation basis, any storage connected to a wind facility receiving the production tax credit will not be granted additional credits. A storage system will add value to a wind generation system if there is an advantage to shaping the periods during wind production, there is no value from a tax credit standpoint.

b. Property Assessed Clean Energy (PACE)

Property Assessed Clean Energy (PACE) is a mechanism under which property owners can receive bank financing for clean energy projects and repay the loan through payment of their property taxes. There are several financial institutions who are currently facilitating PACE financing, the largest is Renew Financial, which has facilitated over $1 Billion of PACE loans contributing to clean energy projects.

There are several rules required for a project before making a decision as to whether a project is eligible for PACE financing: 1) the current mortgage must not exceed 80% of property value, 2) the project size must not exceed 20% of the total property value.

For example: if you want to finance a $1 Million dollar storage project, the total value of the property must be over $5 Million dollars, and the existing mortgage on the property must not exceed $4 Million dollars. If these conditions are met, it is possible to finance the project using pace. Pace financing can cover up to the full value of the project and the interest rate will be anywhere from 6% - 8%. The term of the loan will match the project life.

If there is a change in the ownership of the property during the project life, the new property owner will take over as the repayment of that loan in their property taxes.

c. Incentives Payments

The most well-established and successful state funding opportunity for energy storage is the SGIP program (discussed in detail above). Under the SGIP program energy storage can receive grant funding through a CPUC regulated framework. Systems below 30 kW will receive the entire incentive in an up-front payment upon commissioning. Systems larger

than 30 kW will receive half of the incentive up-front and the remaining incentive over 5 years through a performance-based incentive. In the 2017 SGIP auction the proposed incentive levels will be paid on a $/kWh installed capacity basis per the following table:[3]

Table 2: 2017 SGIP Proposed Incentive Levels ($/kWh) Installed Capacity Basis

3.1.2 ***Energy Storage Incentive Rates***

Upon program opening, total energy storage incentive funds are divided equally across five steps. Energy storage incentives decline by $.05/Wh between incentive steps, according to the following schedule:

Table 3.1.2 Energy Storage Incentives per Watt-hour (Wh)

	Step 1	Step 2	Step 3	Step 4	Step 5
Energy Storage	**$/Wh**	**$/Wh**	**$/Wh**	**$/Wh**	**$/Wh**
Large Storage (>10 kW)	$0.50	$0.45	$0.40	$0.35	$0.30
Large Storage Claiming ITC	$0.36	$0.31	$0.26	$0.21	$0.16
Residential Storage (<=10 kW)	$0.50	$0.45	$0.40	$0.35	$0.30

Other state grant funding is available, but not specifically for energy storage projects, and it is evaluated on a per-application basis. One such program is the New York State Energy Research and Development Authority (NYSERDA) NY Prize program. NY Prize helps communities reduce costs, promote clean energy, and build reliability and resiliency into the electric grid. NY Prize is a part of a statewide endeavor to modernize New York State's electric grid, spurring innovation and community partnerships with utilities, local governments, and private sector. Their mission is to enable the technological, operational, and business models that will help communities reduce costs, promote clean energy, and build reliability and resiliency into the grid.[4] Under the NY Prize Program will be rolled out in 3 stages; Stage 1 (Feasibility) awarded $100,000 for 83 feasibility studies across New York State in 2015. Stage 2 (Design), held up to $8MM for design work based on successful execution of feasibility studies. Stage 3 includes an undisclosed funding amount for project build-out and will be awarded in January 2018. For a full list of feasibility studies visit the NY Prize website https://www.nyserda.ny.gov/All-Programs/Programs/NY-Prize. It is important to note that the NYSERDA NY Prize program is in an early stage and the total amount of funding which will be made available to storage projects is unclear at this point.

[3] Proposed 2017 SGIP Handbook

[4] NY Prize Website, https://www.nyserda.ny.gov/All-Programs/Programs/NY-Prize

d. Available Equity and Debt Financing

There are many equity financing products currently available for distributed energy storage. For example, Advanced Microgrid Solutions (AMS) closed a $200M from Macquarie[5], and Stem has over $350M in project financing commitments after an additional $100M from Starwood Energy Group[6]. Very few customers are buying energy storage system cash due to the technology and business model risk; without a third party financed offer, very little energy would be deployed in California or any other state.

Each OEM is in the market with a financial arrangement for third party ownership. Projects collect revenues utilizing the applications outlined in the first part of this section. Typically, the end-customer will commit a specific percentage of overall project revenue or demand charge savings revenue to the third party system owner in the transaction[7]. The system owner will then guarantee that the customer will achieve a specific revenue target. With end-customer contracts, this guarantee will emanate either in the form of a specific kilo-watt reduction per month or per year, or it can be an actual amount of cash savings generated from system performance.

As an example: if a third-party owner installs a 200 kW, 400 kWh system at a given site, they will make an assessment of the expected monthly peak reduction which will accrue from the system, and will provide a guaranteed peak reduction which they have a high confidence of being able to effectively perform. If the system owner provides a guaranteed demand reduction of 100 kW, and the utility's demand charge is $20/kW/Month, then the effective guarantee will be for (100 kW *$20/kW/Month) $2,000 for that given month.

The revenue sharing mechanism will change depending on the market and the revenue streams that the project will be accessing. Typically, all revenues are shared (demand savings and demand response) at a fixed annual percentage, with the site host receiving between 50-10% of the benefits (30% as the industry average/standard). In some cases, retail customers prefer guaranteed revenue from the project, so project financiers will pay rent to the end-customer for space utilized by the project, and will turn around and bill the customer for all savings generated by the project. Billing for savings has yet to be proved as a reliable revenue source by banks.

Third party financiers will then work with debt providers to negotiate debt terms across a portfolio of projects. These debt terms will be based on the bank's comfort with the technology and view on the economics of the overall portfolio over the life of the projects.

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[5] https://www.greentechmedia.com/articles/read/Advanced-Microgrid-Solutions-Gets-200M-From-Macquarie-to-Finance-Aggregate

[6] http://www.stem.com/stem-project-finance-capacity-now-exceeds-350-million-with-new-commitment-from-starwood-energy-for-up-to-100-million/

[7] http://www.decentralized-energy.com/articles/2017/02/innovative-financing-drives-distributed-energy-storage-deployment.html

Debt financing is raised on a portfolio level. The details of debt 'back leverage' for behind the meter energy storage projects have not been made public to date.

e. Equipment Leases

There are multiple lease products available for distributed energy storage systems. The most popular lease product has been an equipment lease provided by Stem, Inc. for their small commercial projects. This is a simple lease under which the end-customer pays a low monthly payment over the project life. The payments are not contingent on Stem, Inc. providing any savings. Stem, Inc. will in some cases provide a performance guarantee for peak kW reduction produced by the system. In this particular equipment lease, Stem, Inc. retains the right to dispatch the units for grid services.

f. Long Term Contracts

Long term contracts from utilities are the best way to finance distributed energy storage systems due to the creditworthiness of the off taker (the utility) and long term nature of the contracts. These contracts enable third party equity financing providers to subsidize the residential or commercial credit with investment grade utility credit. SCE's 2013 Local Capacity RFO procurement provided landmark long-term contracts for distributed energy storage.[8] 165MW of distributed energy storage projects were procured by SCE under this RFO. Project developers attracted large investors such as Macquarie Capital and NRG to purchase these contracts in turn, leveraging their low cost of capital. See below summary of project awarded:

Table 3: SCE 2013 Local Capacity RFO Procurement Project Awards

Seller	Resource Type	MWs
Ice Energy Holdings, Inc.	Thermal Storage (EE)	25.8 MW
Advanced Microgrid Solutions	Battery Storage (DR)	50.0 MW
Stem, Inc.	Battery Storage (DR)	85.0 MW

g. Utility Owned

There has yet to be a fully deployed utility-owned distributed energy storage program deployed. This model has been widely discussed but not executed. The closest proxy program is Tucson Electric Power (TEP) Residential Solar Program.[9] Under this program the utility owns residential solar systems installed on TEP customer roofs. These projects

[8] https://www.greentechmedia.com/articles/read/breaking-sce-announces-winners-of-energy-storage-contracts

[9] https://www.tep.com/residential-solar/

export solar to the utility under a net-metering tariff. TEP provides customers with a fixed monthly bill credit, not associated with solar generation at the site. The equipment expense is then rate-based by TEP.

h. Hybrid Ownership

Beginning during the summer of 2016, ConEd and Sunpower partnered on a pilot program to offer solar power and battery storage to 300 home-owners. According to a press release: *"The aggregation of hundreds of homes with solar power and battery storage will provide the utility with a cost-effective and innovative "virtual power plant," providing participating homeowners with a backup system in case of an outage while also supplementing the traditional energy delivery model to improve grid resiliency, reliability and sustainability."*[10]

In total, the program will involve 1.8MW of solar power, and 1.8MW, 4MWh of storage. Under the program, participants will enter an equipment lease with Sunpower for the solar equipment, and pay an annual monthly resiliency payment to ConEd for use of the battery system (owned and rate-based by ConEd). ConEd will dispatch the battery systems as an aggregated unit into ConEd and NYISO demand response and ancillary services programs.

IV. Conclusion & Next Steps

Energy storage finance is in its infancy. Most projects, at today's equipment prices, require grants or other financial incentives to meet investor return expectations. However, equipment prices are declining rapidly, enabling new business models, and opening new markets. Energy storage developers should closely monitor the myriad of proceedings at the California Public Utilities Commission (CPUC) related to Distributed Energy Resources (DER). Changes in interconnection procedures, locational value, participation in Demand Response (DR) or the CAISO wholesale markets, will have significant impacts on the financeabilty of behind the meter energy storage systems.

Finally, developers and policy makers should consider ownership ramifications of behind the meter energy storage systems. There is an important question that needs to be addressed: should projects be owned exclusively by customers, third parties, utilities, or a combination? The answer to that question will likely be determined by the electric grid services the projects provide.

[10] https://www.coned.com/en/about-con-edison/media/news/20160613/virtual-power-plant