ENERGY STORAGE INCENTIVE PROGRAMS

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SUMMARY AND KEY TAKEAWAYS

Energy storage is an increasingly cost-effective solution for electricity customers in a growing number of markets across the country, and this trend is expected to carry on as prices continue to fall. Yet regulatory frameworks and market rules in many parts of the country prevent customers from being able to provide or monetize the value their energy storage system can offer, impacting project investment decisions. Recent energy storage cost-benefit studies developed for Massachusetts, New York, and Nevada have revealed the potential value of energy storage systems to customers, utilities, and the electric system. Incentive programs can serve as a bridge on the path towards realizing this value, jumpstarting a state's storage market while the necessary reforms are finalized to enable customers to secure financial compensation for the value their storage systems provide. The benefits in soft cost reduction of incentivizing the near-term deployment of megawatts can far exceed the costs of an incentive program.

This report is intended to provide policymakers with a guide for developing effective incentive programs for the deployment of energy storage systems. While there are several types of incentives a state can pursue to encourage adoption of energy storage, this report on rebate programs. There are a few existing energy storage incentive programs across the United States that can serve as a resource to glean lessons learned for effective policy design. ESA's rubric for incentive program design can be summarized in the following key takeaways:

- Rebates carry the greatest potential to reach the widest number and type of customers, and deploy the greatest number of systems by providing a solution to upfront financing challenges.
- Program design complexity should be relative to amount of funding, time horizon of program implementation, and the maturity of the state's storage market.
- Incentive amount should be determined through a gap analysis that accounts for the state-specific average all-in installed costs and available revenue streams, rather than capping incentive as a percent of project cost.
- Incentive amounts should be based on the duration the system (dollar per watt hour) rather than installed watt—recognizing that the cost of an energy storage system differs by duration.
- Allocating funds for specific customer classes and applications that face greater hurdles is often appropriate.
- Program rules should require enough "skin in the game" to ensure that only serious projects are awarded funds so the program may yield the greatest deployment.

I. INTRODUCTION—THE PURPOSE

Energy storage carries the potential of deferring or avoiding costly distribution system upgrades, increasing power quality on distribution circuits, and increasing circuit and substation hosting capacity to meet the system demands posed by increasing proliferation of distributed energy resources (DERs), particularly non-dispatchable generation. Customer-sited energy storage systems also provide customers with the ability to better respond to tariff price signals and modify customer-sited generation to serve the needs of the grid, as well as to realize savings on their energy bills, enhance resilience and increase productivity.

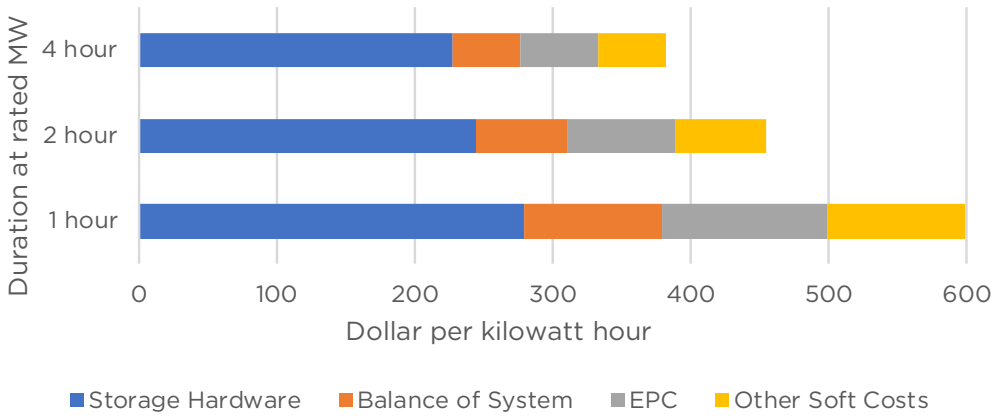
However, current market structures and policies lack properly permissive regulatory frameworks and clear mechanisms to identify and capture the full value of energy storage systems. Ultimately, system benefits and cost savings to customers can best be assured by removing regulatory barriers to energy storage participation in long term planning and markets; and by setting accurate price signals and mechanisms to compensate for the services that energy storage systems provide. This process for updating the rules and regulations to accurately capture the value of energy storage is a multi-year effort. Such a process if unique to each specific jurisdiction, but should consider the following elements: updating existing programs and wholesale market rules to incorporate energy storage as an eligible technology; review rate design to ensure price signals to customers align with cost of serving them; create greater transparency on the distribution grid to facilitate optimal siting decisions; update interconnection rules to reflect the unique behavior of energy storage; and facilitate a multiple-use application framework that allows customers to capture multiple value streams. In the interim, various policy initiatives can help spur the energy storage industry in order to realize the immediate benefits storage provides, even as markets and regulations are updated to better capture its true value. One such policy lever is an incentive program.

Incentives in the form of rebates, on-bill credits, grants, or tax advantages can provide a bridge to scalable deployment of energy storage to accomplish broader efficiency, resilience, and clean energy goals as system costs continue to decline and policies and markets evolve. Incentives should be designed to decline over time until storage values are more effectively recognized and monetized in existing regulatory and market framework, and should be provided in tandem with policy efforts to reform existing rules and regulations in a way that ensures a sustainable market in the future.

The all-in installed costs of energy storage systems are made up of hardware, balance of systems, and soft costs. Soft costs include siting, permitting, and interconnection, and tend to make up a larger portion of the all-in installed costs in nascent markets with little, if any, deployments of energy storage (see Figure 1). While system hardware costs are influenced by technology deployments on a national and global level and have been declining significantly in recent years, putting downward pressure on all-in installed costs, soft costs reductions can only be achieved with in state deployment. Incentive programs are an effective mechanism of targeting soft costs reduction for installations in the state, which can have significant benefits beyond behind-the-meter installations, especially for states that recognize the eventual need for gigawatts of energy storage as part of its energy and environmental objectives.

While there are several incentive types for customer-sited energy storage, state-level incentives in the form of a rebate tend to be most effective at overcoming the upfront financing challenges for behind-the-meter energy storage systems and result in lower transaction costs than state tax incentive programs. A properly designed rebate program carries the potential to drive deployment of energy storage to the greatest number of applications and the widest variety of customer classes by making the systems more cost effective through lowering the financial costs and administrative burden. However, the principles outlined in this white paper and many of the program design components it discusses are applicable to other incentive program designs as well.

Figure 1. ILLUSTRATIVE INSTALLED COSTS OF BATTERY STORAGE SYSTEM



Source: Based on developer input and NREL cost assumptions for standalone storage in "2018 U.S. Utility-Scale PhotovoltaicsPlus-Energy Storage System Costs Benchmark," November 2018.

While incentive programs are an effective way to stimulate the energy storage market, they must be complemented by efforts to update regulatory aspects such as interconnection standards, rate design, and other programs to ensure the programs achieve their intended outcome. Updated distribution interconnection standards that reflect the unique characteristics of energy storage systems will ensure a timely and affordable interconnection process and help drive down soft costs. Moreover, while incentives support a customer's upfront investment in an energy storage system, other elements are essential to justifying the long-term investment, such as rate designs that incorporate time-varying rates aligned with cost causation, utility programs that enable customer to provide grid services and compensate customers on their bills, along with clear signals of when to charging and discharging at times that are most beneficial to the grid and greenhouse gas reduction, and a multiple-use framework that enables distributed energy storage to participate in the wholesale market.

II. GUIDING PRINCIPLES OF INCENTIVE PROGRAM DESIGN

Energy storage incentive programs will undoubtedly vary from state to state, based on the regulatory context of the state and also the existing incentive programs and customer interest in deploying the technology. Therefore, ESA provides the following principles by which policymakers can develop an incentive program that suits their state's need.

- To provide the state with the greatest value, incentive amounts should reflect market maturity. Therefore, depending on the amount of funds available, an incentive may be reduced over time or market penetration levels, to reflect declines in softs costs (for example, interconnection and permitting) that come with increased experience deploying systems in that state.

- Program design that enables competition and a robust market helps ensure that customers have the most innovative and cost-effective products from which to choose. This should include all customer-sited energy storage technologies, whether electrochemical, thermal, mechanical or other.

- To enable energy storage operators to find the optimal mix of uses for each installation, programs should avoid specific requirements on operations of incentivized systems (for example, minimum cycling) and instead ensure price signals to energy storage customers are aligned with public policy objectives.

- To drive market deployment of particular applications or to end users such as residential customers and low-income communities who are likely to face greater hurdles in deployment, it may be appropriate to allocate some of the program funding to those specific categories.

- To ensure the most effective disbursement of funds and the greatest deployment of energy storage, programs should be developed with enough obligations and requirements to minimize applications from projects that are unlikely to get built. programs should be developed with enough obligations and requirements to minimize applications from projects that are unlikely to get built.

III. RECOMMENDED PROGRAM DESIGN FOR REBATE PROGRAM

Rebate incentive program designs will vary depending on funding available, the incentive amount, the length of time the program is intended to run, and the maturity of the storage industry in that state. A rebate incentive program can range from simple and straightforward to one with step downs in price incentive levels for varying applications. Getting the structure right is imperative to ensure funds are used in a timely manner to stimulate the market.

FUNDING MECHANISM

Use rebates. A rebate program can facilitate the greatest deployment of energy storage by reducing up front financing and transaction costs and reaching the widest range of customers. Rebate programs provide immediate up-front financing to support a customer's investment. Unlike state tax incentives, a rebate is aligned with the investor's energy storage system cost regardless of what the investor's in-state tax appetite is. While on-bill financing addresses some of the upfront financing challenges in the same way that a rebate program does, it tends to result in less market depth and a more limited offering of products and services if only one or two companies or technologies are incorporated into the program.

Table 1. Incentive Types

Incentive Type	Definition	Benefits	Challenges
Cash Rebates/Grants	Rebates and grants act to offset the capital cost of a storage system	• Funding not used in a given year (low participation or failed projects) can be carried over to another year • Administratively simple • Overcomes up front financing hurdles, financing simplicity	
State Tax Incentive	Tax incentives in the form of a credit represents a rebate on your tax bill	• Does not require budget expenditure, since it is an expected loss of tax revenue	• Funding not used in a given year (low participation or failed projects) cannot be carried over to another year • Requires customer or TPO to have in-state tax appetite • Administratively more complex than rebate programs
On-Bill Credit	Allows the utility to incur the cost or work with 3rd party developer to fund cost of storage system, which is then repaid on the utility bill	• No upfront financial hurdles	• May limit competitive landscape / market depth

Make funds available on a first-come, first-serve basis. The most effective incentive program is one that is transparent and responsive to market penetration. A program based on a first-come, first-serve basis ensures that funding is aligned with project development timelines. This is particularly important for commercial and industrial projects, so that customers are not waiting half a year or longer to move forward with their project. Mechanisms can be developed to ensure a fair dispersal of funds if significant interest in the program results in oversubscription at program launch.

Link funding to installed capacity, not power rating. Unlike renewable energy resources, which are valued based on their energy production value, energy storage is valued by its energy capacity. The total costs of the energy storage system scale up as the energy capacity increases. Energy storage system prices differ based on the capacity of the storage device, meaning for example, that a 2-megawatt lithium-ion battery with a one-hour duration is cheaper than a 2-megawatt battery with a two-hour duration. As a result, an incentive amount based on how many megawatts are installed does not capture the difference in cost for the customer. Therefore, ESA recommends that policymakers allocate incentives based on the duration of the system at rated capacity (watt-hour) rather than the power rating (watt).

Smaller programs ($20 million or less) should make all incentives available from the outset. For programs with funds under $20 million where the market is nascent with little storage industry presence, the best approach is to provide the market with the total amount of funds over a short period of time, rather than spreading the funds over multiple years. There are several important reasons for this. First, such limited funds will only be able to spur the industry and drive learning and economies of scale if they have a larger impact over a shorter period of time. Second, companies must make significant upfront investments (i.e., hiring, etc) to begin or increase operations in a state with a nascent market, and companies are more likely to justify such investments if there will be robust interest supported in the first few years.

Larger programs (> $20 million) should include a reduction in incentives as installations increase. For programs with significantly larger available funds, such as the California Self-Generation Incentive Program (SGIP), it may be appropriate to allocate funding by reducing incentive amounts as installed capacity increases, using a series of steps. The design of the step down is imperative for program success. ESA recommends against step down based on the passage of time, as such an approach may either lag behind or get ahead of market maturation. A step down that is triggered by an installed capacity threshold, or market penetration, is responsive to market depth and maturity -- the more storage is installed, the greater the justification for reducing the incentive amount because of the cost reductions due to increased deployment of the resource. For example, the California SGIP program, under its new design, included five steps, and the incentive level declined once the step was completely subscribed.

Incentives should value first deployments more. Finally, ESA believes that for a state's energy storage market to realize significant growth in its storage industry and to benefit from economies of scale, the goal of the incentive program should be to install the same, if not more, megawatt-hours up front. That means that more funds should be provided at the onset of a program rather than equally among all steps.

RESERVING FUNDS FOR SUB-CATEGORIES

Considering the disparity in development timelines and project sizes, it may be appropriate to allocate some funds, at least initially, to ensure that funds are not immediately captured by one specific project type or customer class. Doing so will drive learning-by-doing across multiple business models and technologies, which will help establish a more diverse and robust energy storage industry.

Standalone storage may require set-aside incentives. ESA recommends that incentive programs reserve no less than 25% of funds for applicants installing standalone storage systems, rather than systems paired with solar photovoltaic (PV) or other generation systems. The federal Investment Tax Credit (ITC) for solar PV systems is also applicable to storage systems installed with solar PV systems, but not for standalone storage systems. The funds allocated to a program may be depleted quickly by customers also utilizing the federal ITC, if not controlled. Creating a storage-only allocation would encourage a diversity of storage applications and grid deployments. ESA recommends that this allocation of funds be reviewed after the end of the first year of an incentive program, to assess its effectiveness.

Residential customers may require specific incentives. ESA also recommends that an incentive program reserve no less than 25% of the funds for residential customers installing energy storage systems, and some subset of that for low income communities. There are a number of hurdles facing residential customers that merit a separate category allocated to that customer class. Since commercial and industrial projects tend to be larger in size, potentially a handful of projects could deplete the entire allocated credits of the program. Therefore, reserving credits at least in the first year or two of a program for residential customers will ensure they have an opportunity to participate in the program effectively. ESA recommends the allocation be reviewed at the end of the first year to determine subscription levels, and whether the credits should be returned to the broader program.

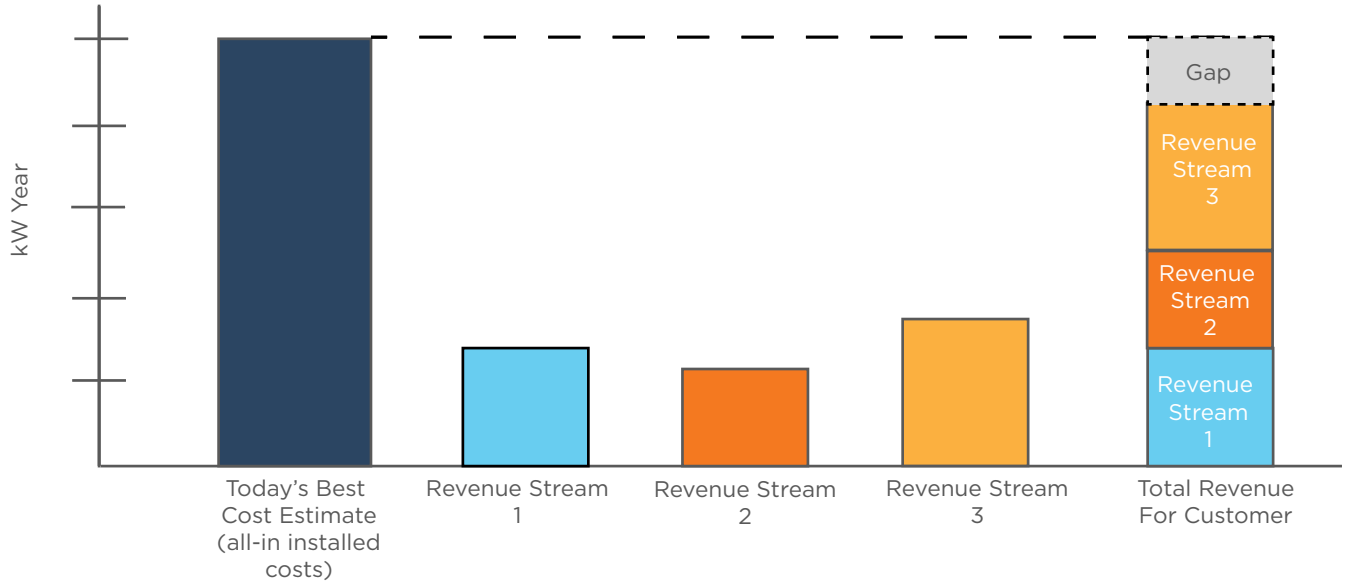
Figure 2. Stem's AI-driven Li-Ion storage system went live in 2017. Escondido Orange Glen High School, Escondido, California.

DETERMINING INCENTIVE AMOUNT

The appropriate incentive amount needed to stimulate the energy storage market varies significantly between states and depends on several factors such as retail electricity prices, demand charges, and average all-in installation costs. Policymakers seek to determine an incentive amount that successfully jumpstart the market but does so at the least cost and most efficient way.

Use a gap analysis to quantify incentive level. Rather than cap incentives at a percent of total costs or look to other states to determine the appropriate incentive amounts, ESA recommends that policymakers looking to develop an incentive program undergo a gap analysis that provides state-specific information. A gap analysis can determine the closest approximation possible for what the gap is between the average all-in installed costs of the system, considering technology and application, and the current value stream opportunities for customers to support the economics of their storage system. If possible, there should be a separate gap assessment for each eligible storage technologies eligible for the incentive. New York State Energy Research & Development Authority (NYSERDA) has undergone a similar exercise that can serve as a best practices reference for policymakers looking to undertake a gap analysis.

Figure 3. ILLUSTRATIVE ENERGY STORAGE GAP ANALYSIS



Source: Illustrative example based on gap analysis described in New York Storage Roadmap, June 2018

Define incentives in monetary terms, not percentage terms. ESA urges policymakers to steer clear of incentives that are based on a percentage of the project costs, and instead provide a single incentive for all participants. A percentage-based rebate based on the total project costs discourages price declines and efficiency increases from project developers, and also requires the regulator or program administrator to investigate and verify the costs of every individual system. Rather, setting a conservative – yet realistic – dollar amount based on initial gap analysis for the incentive reduces program costs to ensure efficient use of funds.

APPLICANT REQUIREMENTS

The appropriate incentive amount needed to stimulate the energy storage market varies significantly between states and depends on several factors such as retail electricity prices, demand charges, and average all-in installation costs. Policymakers seek to determine an incentive amount that successfully jumpstart the market but does so at the least cost and most efficient way.

ESA recommends regulators require enough "skin in the game" for incentive awards to ensure that risky projects do not hold credits that could otherwise be used to successfully deploy storage technologies. California's SGIP design strikes an effective balance between enabling robust response and ensuring viable projects. ESA recommends the following obligations and requirements for any incentive program, based on the SGIP design:

- **Require a meaningful deposit.** A non-refundable deposit that is significant enough to ensure that only serious projects compete for an award. For example, SGIP includes a deposit worth 5% of requested incentive award amount. The application fee is refunded upon completion and verification of the installed SGIP project, and all forfeited application fees from projects that were not completed are allocated to the Program Administrator's credits for award.

- **Require proof of progress:** Requirement of demonstration of project milestones to make sure that the projects are progressing in a timely manner to maintain their awards. Regulators can develop a set of project milestones and the timelines required to meet them, including a signed contract for project purchase and commercial operation date.

PROMOTION OF MARKET DEPTH

As was noted earlier, one of the key principles of effective incentive program design is to facilitate a robust market for customers to get the most cost-effective and innovative solutions for their needs. Enabling competitive energy storage offers from multiple companies will help ensure more cost-effective incentive use. However, regulators must balance the market maturity with efforts to promote market depth.

After first year, review competitive landscape. A market with a nascent storage industry may only have one or two developers at first. In developing a program, policymakers should aim to stimulate the market and drive down costs by making the funds available on a first come, first serve basis. It may be appropriate to require that the regulator conduct a review at the end of the program's first year to determine whether a robust and competitive market is developing and consider whether there is a need for additional mechanisms to ensure a robust energy storage market is developed in the state.

PROJECT TIMELINE REQUIREMENTS

Policymakers should impose project timing requirements to make sure that the program credits are made available to customers who intend on installing storage and that reservations are not held for projects that are unlikely to be developed. However, policymakers in states with an emerging storage markets will face some difficultly estimating appropriate timeline requirements for project development milestones because of the limited experience with storage installations in that particular state. Time frames vary significantly across the country based on location and size of installation, local jurisdictional rules, the type of building, the type of storage technology, and whether the storage device is located inside or outside of the building. The process from purchase of the system to the in-service date can vary significantly as a result of non-technical processes, such as permitting and interconnection, especially for some instances on new construction projects. In California and other states, earlier storage installations for commercial and industrial customers experienced delays caused largely by lack of familiarity on the part of counties and utilities, which caused challenges in executing permitting and interconnection of storage. Until a particular state's storage market gains experience with permitting and interconnection, it is difficult to definitively determine appropriate timeframes.

ESA recommends that programs require projects to provide evidence of their development milestones. Those milestones should include a requirement that a timeline for executing a signed contract for a project following the incentive award. Considering the time required to negotiate a contract and the fact that some customers may only execute a contract contingent upon receiving the incentive, a 180-day requirement is appropriate. The last project milestone—proof of completion—must also reflect project development timelines. ESA recommends an 18-month project completion requirement as the shortest feasible requirement, which is still an aggressive timeline. Policymakers may choose to revisit project development timelines after a period of time, to evaluate whether those timelines were appropriate.

CUSTOMER ELIGIBILITY REQUIREMENTS

Limit incentives to one award per installation address. ESA recommends that regulators establish a limit of one incentive per installation address (the time period depends on the program design and may range from per year or per incentive step), rather than place limits by customer or customer address. By focusing on the installation address, policymakers can protect against abuse of the program, while ensuring the development of a robust storage market in their state with the greatest variety of customers and end use applications. The eligibility criteria should not constrain a customer who has multiple sites across a state, such as a business, from deploying storage across their several separate facilities. Using the address of physical installation, rather than customer address or identity, is the best approach for limiting abuse of incentive awards.

Third-party owned financing is a critical ingredient for a robust program. It is critical that eligibility criteria for the incentive encourages multiple ownership structures, including third-party ownership of storage systems installed at various residential and business properties. Limiting incentives to customer-owned systems can stifle the program's success. For example, the current eligibility requirements for the Maryland energy storage state tax incentive program only allow customers who own their system to apply for the tax incentive, and this is one of the reasons the program was not fully subscribed in 2018.

TIMING OF FUNDING

ESA recommends a program design that disburses the award only after a storage project is verified as in-service. Customers need certainty about their eligibility for the incentive before securing a contract with a developer and building their storage system, and as such, it is appropriate and necessary for programs to award the incentive early in the project development timeline and in advance of project completion. However, as with other incentive programs around the country, transfer of incentive funds should come only after the project is commercially operational, which ensures that systems are in fact deployed. This provides the needed clarity for customers while at the same time protects the funds from projects that never materialize.

IV. CONCLUSION

Before embarking on developing an effective program design, policymakers should consider existing policies in place, availability of funds, and the level of maturity of the storage industry in the state. If developed effectively, an incentive program for energy storage systems can stimulate the energy storage market, even as longer-term rate and regulatory and market reforms are undertaken to create mechanisms to capture and compensate storage systems for the value that energy storage systems can provide ratepayers, utilities and the grid. Ultimately, the long-term policy objective should be aimed at driving down soft costs, creating a robust in-state market, and ensuring the price signals and programs are aligned with public policy objectives.

V. APPENDIX

The table below provides an overview of the main components of existing incentive programs and programs under development in the United States.

Table 2. Overview of Existing Incentive Programs

Program Element	CA SGIP	NV SB 145	MA SMART storage adder	NJ RES	NY Sun Storage Adder	MD Tax Incentive
Funding levels	$830M through 2025 for storage	$10M ($5M for <100 kW; $5M for 100 kW - 1 MW)	Uncapped incentive per cusomer	$14M earmarked for 2019	$40M for storage adder*	$750,000/year through 2022; unused funds cannot be rolled over to next year
Incentive mechanism	First come, first serve; declining incentive	First come, first serve; declining incentive	First come, first serve	Auction	First come, first serve	First come, first serve
Eligible technologies & eligibility requirements	Preference for co-located with renewable distributed generation	All storage technologies, requires project to be co-located with solar	Requires project to be co-located with solar	Requires project to be co-located with solar	Requires project to be co-located with solar	All storage technologies
Customer class	Residential and non-residential	Residential and non-residential	Residential and non-residential	Non-residential	Residential and non-residential	Residential and non-residential

* $350M earmarked for storage “bridge” incentives, currently under development.