

Matter Number 16-00681, In the Matter of the Clean Energy Fund
Investment Plan

Clean Energy Fund Investment Plan: Energy Storage Chapter

Portfolio: Market Development

Submitted by:

The New York State Energy Research and Development Authority

Revised May 7, 2021

Clean Energy Fund Investment Plan: Energy Storage Chapter		
Revision Date	Description of Changes	Revision on Page(s)
August 1, 2016	Original Issue	Original Issue
June 23, 2017	Tables 1, 2, 4, and 5 have been updated to reflect a shift in timing of budget and benefits.	Multiple
November 1, 2017	Updated the baseline values in Table 3 to reflect latest data available.	15
September 6, 2018	Addition of Solar Plus Energy Storage Initiative	Multiple
April 19, 2019	Edits to reflect alignment with the PSC Energy Storage Order (18-E-0130) issued December 13, 2018. Emphasis on specific soft cost reduction activities clarified and removed Value Stacking Pilot program from future investment plan activities given the new incentive funding available under the PSC Storage Order. Reallocated remaining funding to anticipated soft cost activities. All benefits, activities, outcomes and impacts will be captured in the Annual State of Storage Report. As part of the Annual Investment Plan & Performance Report (IPPR) process, NYSERDA has updated budget and benefit values to align with actuals for past years and adjusted budget and benefit forecasts for future years, as appropriate, based on experience to date. Budget and benefit tables have been moved to Appendix B of this chapter. Updated rounding convention has been applied to budget and benefit tables. As noted above, benefits for these programs will no longer be reported in Appendix B. Output/outcome tables have also been removed as noted above.	Multiple
September 13, 2019	Restoring some benefits, outputs and outcomes that were removed in April 19, 2019 filing.	Multiple
October 2, 2019	Adding an additional outcome to the Solar Plus Energy Storage Initiative	31
June 1, 2020	As part of the Annual Investment Plan & Performance Report (IPPR) process, NYSERDA has updated budget and benefit values to align with actuals for past years and adjusted budget and benefit forecasts for future years, as appropriate, based on experience to date.	Multiple within the plan. Appendix A, B, & C
May 7, 2021	As part of the Annual Investment Plan & Performance Report (IPPR) process, NYSERDA has updated budget and benefit values to align with actuals for past years and adjusted budget and benefit forecasts for future years, as appropriate, based on experience to date. The investment plans have been updated to provide a bridge between committed and acquired planning. Committed budget and benefits summaries have been added to plan text, while Appendix B has been updated to reflect expenditure & acquired benefits plans.	Appendix B 14-15, 23, Appendix B

11 Energy Storage

Energy storage will play a critical role in achieving the State’s peak reduction, renewable generation and greenhouse gas reduction objectives. Storage will shift renewable energy to times of day that better match the needs of electric customer, grid values or avoid carbon emissions. Storage can reduce the intermittency of solar and wind energy, helping these resources to be more flexible in meeting electrical demand. In many applications, storage could avoid the need for new electric system infrastructure, increase system efficiency and resiliency, and reduce the need for infrequently used peaking fossil fuel plants. Storage can also integrate with demand response and energy efficiency measures within buildings to achieve greater energy savings without sacrificing occupant comfort and often provide a degree of back-up power. Finally, energy storage can also redefine the transportation system as seen with electric vehicles.

New York is at the beginning stages of deploying storage to meet aggressive storage targets of deploying 1,500 MW of advanced energy storage by 2025 and 3,000 MW by 2030. In June 2018, Department of Public Service (DPS) and NYSERDA staff released the New York State Energy Storage Roadmap which includes a series of recommended actions intended to achieve the Governor’s 1,500 MW target. The Roadmap’s recommended policy, regulatory and programmatic actions were developed in conjunction with numerous stakeholders to enable, support and accelerate New York’s transition to its desired end-state vision for energy storage, which includes full use of distributed energy resources (DERs) including storage to meet system needs; dispatchability and dynamic price signals; flexibility in enabling intermittent renewable resources like solar and wind to be used when needed most; and a thriving energy storage sector. On December 13, 2018 the New York Public Service Commission (PSC) issued an Energy Storage Order that adopted many of the Roadmap recommendations and authorized an additional \$310 million in collected, unallocated funding for market acceleration bridge incentives.

NYSERDA’s energy storage market development strategy targets key barriers limiting energy storage adoption in three sectors: customer-sited (behind-the-meter systems), distribution system, and bulk system, and grid impacts from electrifying the transportation system. The first initiative described in the Energy Storage chapter, entitled Reducing Barriers to Deploying Distributed Energy Storage, addresses barriers in these three sectors and the ability to use these systems to meet transmission and distribution system needs. This work to reduce barriers focuses on permitting and siting, customer and site acquisition, technical consulting, and increasing customer and financier confidence through developing safe deployment and siting technologies and processes, providing developer facing support and education, and providing potential customers and energy storage users with tools that support market replication. The budget, benefit, and participant values for this initiative were updated in June 2017 and again in April 2019 to extend the timing of work under this initiative to 2025 to coincide with the storage incentives authorized under the PSC Energy Storage Order.

The second initiative of the Energy Storage chapter, Solar Plus Energy Storage, is a first step in NYSERDA’s solar plus energy storage market development strategy as recommended in the New York State Energy Storage Roadmap. This initiative works in conjunction with the first initiative to

address soft cost barriers, as well as enabling industry and utilities to address interconnection, metering and compensation mechanisms associated with paired combination systems sooner than otherwise would have occurred. Both initiatives are part of NYSERDA's coordinated intervention strategies to develop and deploy energy storage products and remove market barriers to their adoption. This energy storage market support is closely related to new Value of Distributed Energy Resource tariffs in that it improves the value of distributed renewable energy by shifting the energy output to more valuable times of day.

In addition to the two initiatives described in this chapter, NYSERDA also has an initiative entitled Energy Storage Technology and Product Development in the Renewables Optimization Chapter, which supports product development and initial field testing to reduce total system cost and increase performance. Insights gained from the activities included in this chapter will also be incorporated into the solicitations used to support that product development work.

11.1 Reducing Barriers to Deploying Distributed Energy Storage

11.1.1 Overview

<p>Present Situation</p>	<ul style="list-style-type: none"> • Energy storage will help achieve New York’s long-term renewable and greenhouse gas reduction goals by integrating intermittent renewables, increasing utilization of electric system assets, and reducing the need for fossil fuel peaker plants.¹ In particular, leveraging dispatchable behind-the-meter and distributed resources to meet customer need and those of the electric system is integral to a Reforming the Energy Vision (REV) future. • The market is ripe for driving scale as hardware costs are declining, customer interest in energy storage is growing, and the importance of this solution in achieving the State’s renewable energy, greenhouse gas, and REV objectives is increasingly recognized. • However today, the typical distributed storage resource is underutilized in serving multiple system needs, has high installed costs relative to the hardware costs, and often has an unacceptable return on investment. This initiative will address these challenges to deploy and validate optimized distributed storage solutions under REV. • While still a nascent market, since 2012, employment in New York’s energy storage sector has grown 30% to approximately 3,900 employees and global annual revenues from New York companies have increased 50% to \$900 million. A recent study projected that by 2030 this sector could employ 25,000 in New York State and comprise \$8 billion in annual revenues.² Distributed energy storage is still very much in the early stages of deployment in New York with approximately 60 MW of rated power installed, including the 20 MW Beacon flywheel facility for frequency regulation, and 40 MWs of thermal and electrochemical storage providing customer and grid services. • Three main stall points are preventing wide-scale adoption of distributed energy storage³ in New York. While these barriers affect all forms of energy storage to different extents, the impact is especially significant on electrochemical systems such as advanced batteries which, due to their features, are especially well suited for many distributed storage functions. <ul style="list-style-type: none"> ○ <u>Soft costs</u>: including permitting, customer acquisition, design, interconnection, and financing, can comprise 25% or more of the total installed cost of an energy storage system. While battery costs are declining by 10% or more annually,⁴ these soft costs are largely driven by local conditions. ○ <u>Uncertainty</u>: since the number of distributed storage installations is still small, customers, investors and utilities are uncertain regarding performance, perceived safety risks, and financial models. In addition, uncertainty in future tariff structures adds difficulty in projecting long-term project revenues. ○ <u>Return on investment limitations</u>: while an energy storage system’s flexibility (fast response, precise load management, repeatable load curtailment, generation shifting) allow it to perform multiple functions due to unproven
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¹ For example, the *Renewable Electricity Futures Study* prepared by NREL in 2014 identified the need for 2.2 GW to 2.6 GW of energy storage in New York State at 50% renewable penetration, and up to 5.9 GW at 80% renewable generation.

² Data obtained from *The Energy Storage Industry in New York: Recent Growth and Projections, 2015 Update*, June 2016 DRAFT and prepared by Industrial Economics, Inc. Final study to be published soon.

³ Distributed energy storage refers to energy storage systems in the kW to multi-MW range that are located behind and in-front-of a customer’s meter within the distribution and transmission system, but does not include bulk storage resources such as pumped hydro.

	<p>use cases, performance uncertainty, and market rules such as minimum system sizing in the wholesale markets, few systems in New York State provide more than one or two services limiting the ability to earn revenue.</p>
<p>Intervention Strategy</p>	<ul style="list-style-type: none"> • This initiative will primarily target building owners and operators, permitting agencies, and vendors to address the identified stall points and includes elements that build upon NYSERDA’s reputation as a source of objective and credible information: <ol style="list-style-type: none"> 1. Address permitting and siting concerns that prevent energy storage system deployment. This includes battery safety questions, developing permitting and siting guides, training permitting agencies and first responders, providing technical assistance and access to subject matter experts, and addressing other siting concerns such as tax issues and land use. 2. Provide developer facing support and education through educational materials to understand and leverage tariffs and market rules, models to evaluate NYS tariffs in project economics, and resources to identify locations where storage can maximize value. 3. Provide potential customers and energy storage users with tools that support market replication through fact sheets, case studies, and access to independent educational resources. • For a visual representation of this strategy, please reference the flow chart entitled “Logic Model: Reducing Barriers to Installing Distributed Energy Storage,” which can be found in Appendix A.
<p>Goals</p>	<ul style="list-style-type: none"> • Reduce total soft costs by up to \$50 per kWh for a distribution/bulk storage system and up to \$150 per kWh for a customer sited system by 2025 compared to 2017-18 costs. These soft cost reductions are inclusive of all use cases and include permitting, interconnection, customer acquisition, as well as engineering and construction costs. <ul style="list-style-type: none"> ○ Specifically, soft costs related to permitting, customer acquisition, and interconnection could be reduced 50 percent to 75 percent below 2017-2018 levels by 2025 for customer sited systems. ○ Engineering and construction costs could decline by 40 percent or more for customer sited systems as installations become more easily replicable over this timeframe. ○ Most recent developer survey data from 2017-18 from the limited number of projects deployed in New York State showed average total installed cost of approximately \$840/kWh including \$385/kWh for total soft costs including engineering/construction costs in customer sited systems in Con Edison’s service territory. • Half of all distributed energy storage installations in the market in five years provide value to two or more parties (customer, distribution utility, load serving entity, New York Independent System Operator (NYISO)). • Expand customer choice by increasing the number of experienced vendors selling energy storage solutions in New York State, and increase vendor capabilities and business models through data sharing, case studies, and best practices.

<p>State Energy Plan/Clean Energy Standard Link</p>	<ul style="list-style-type: none"> • Energy storage will play a critical role in reaching the State’s renewable generation and greenhouse gas reduction objectives and in reducing peak electric demand. • Distributed energy storage will firm intermittent renewables avoiding the need for new fossil fuel peaker plants, permit greater customer load control, and reduce electric bills. • Leveraging distributed storage systems to address multiple system needs will create a more cost-effective electric system and reduce ratepayer cost for traditional utility infrastructure. • The proposed strategies will help inform new test tariffs proposed by utilities for locational-based marginal price plus distribution value (LBMP+D), which would reflect the delivered price of electricity at a specific time of day and location. • This soft cost reduction strategy is integral to the PSC’s Energy Storage Order objectives.
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11.1.2 Target Market Characterization

<p>Target Market Segment(s)</p>	<p>The initial target markets will be demand metered customer installations and distribution and bulk power sector locations where grid benefits are the strongest. Within the customer segment, priorities include interval-metered customers in the multifamily, commercial, industrial and educational sectors with low load profiles (high peak loads for short periods). Interval-metered customers are those with the highest amounts of electricity use, typically measured in 15 minute or less intervals, which allows customers to be identified that are best suited to reducing their peak electric demand using energy storage. Distribution utilities, transmission operators and load serving entities, and vendors installing energy storage in customer-sited and distribution/bulk wholesale market use cases are also targeted users.</p>
<p>Market Participants</p>	<ul style="list-style-type: none"> • Building owners and operators • Storage vendors, renewable energy vendors, and service providers • Permitting agencies (authorities having jurisdiction (AHJ) such as building and fire departments) • Architects and engineers • Distribution and municipal utilities, load serving entities, curtailment service providers (aggregators), NYISO • Professional associations and trade associations such as Building Owners and Managers Association (BOMA) and the New York Battery and Energy Storage Technology consortium (NY-BEST)
<p>Market Readiness</p>	<ul style="list-style-type: none"> • Advanced energy storage on the grid, encompassing grid-connected (utility side of the meter) and customer-connected (customer side of the meter) applications are projected to grow globally from 538 MW installed in 2014 worth \$675 million to 21,000 MW worth \$15.6 billion in 2024, and up to \$400 billion by 2030. ⁵ New York firms engaged in the energy storage sector include Fortune 500 companies, original equipment manufacturers, system integrators, and a strong startup and research community. • Battery prices are declining by 10% or more annually. For example, since 2008-2010, lithium-ion battery module cost has decreased by a factor of four while lifetime and

⁵ Navigant Research, *Energy Storage for the Grid and Ancillary Services, 2Q 2016* (providing 2014 and 2024 market data): <http://www.navigantresearch.com/newsroom/energy-storage-for-the-grid-is-expected-to-reach-15-6-billion-in-annual-revenue-by-2024>

Citigroup, *Investment Themes in 2015*, January 2015 (providing energy storage market predictions for 2030): <https://ir.citi.com/20AykGw9ptuHn0MbsxZVgmFyppuQUUt3HVhTrcjz4ibR%2Bx79LajBxIyoHioSDJ3S%2BWRSMg8WOc%3D> and <http://www.energy-storage.news/news/citigroup-predicts-240gw-energy-storage-market-by-2030>

Data from GTM Research, Navigant Consulting, Citibank

	<p>capacity has doubled.⁶ In 2016-17, cost of an installed customer-sited four-hour lithium-ion system in a metropolitan location was on the order of \$850/kWh or greater. Multiple market research firms point to customer-sited systems declining to approximately \$500/kWh or lower by the early to mid-2020's. Other advanced storage technologies also offer the potential for lower lifetime costs and attractive performance attributes. At these projected price points, the number of systems with positive return on investment increases substantially and large-scale deployment is possible.</p> <ul style="list-style-type: none"> • Growth in renewable generation, interest in demand response, and desire for utility non-wires alternatives is positioning energy storage to be a significant component in meeting the needs of the electric system. • The number of vendors developing and selling energy storage solutions continues to increase. Many firms are watching the New York market evolve and ready to be engaged more meaningfully. • Customers are increasingly aware of energy storage but generally remain unclear as to its maturity and value proposition.
Customer Value	<ul style="list-style-type: none"> • Many multifamily, commercial, and industrial operations are striving to manage their energy demand, uncertain about revenue potential in utility/NYISO demand response programs and seeking a straightforward semi-automated mechanism to achieve this value. The proposed strategies will identify and help to deploy energy storage in best fit customers to meet these customer needs. • Under REV, distribution utilities will increasingly pursue less expensive, non-wires alternatives including energy storage integrated directly at substations and aggregated from customer-sited systems to provide load relief. • These soft cost reduction activities, in conjunction with market acceleration storage incentives authorized by the PSC Energy Storage Order, will decrease simple project paybacks to 5-7 years which has consistently been reported to NYSEDRA by customers and vendors as necessary to enable deployment. It will also increase persistence by decreasing the risk of projects being abandoned or systems being under-utilized. This will help to build a library of learnings and successful case studies to further stimulate customer confidence and growth. • Storage can also provide modest resiliency benefits for customers, especially when integrated with on-site generation. • In addition, as intermittent renewables generate the majority of New York's electricity, energy storage will firm these resources so that renewable energy is dispatchable when needed reducing the need for fossil fuel peaker plants, reducing greenhouse gas emissions and health pollutants, and decreasing the cost of meeting peak electric demand.

⁶ Battery price percentage decline prices:
 Battery Power Magazine, October 2013, <http://www.batterypoweronline.com/main/articles/the-lithium-ion-inflection-point/>
 PV Magazine, November 2015, http://www.pv-magazine.com/news/details/beitrag/li-ion-battery-costs-to-fall-50-in-next-5-years--driven-by-renewables_100022051/#axzz4G5vZqQof
 Bloomberg New Energy Finance Summit historical price chart: <http://c1cleantechnicacom.wpengine.netdna-cdn.com/files/2015/09/battery-learning-rate.png>
 Pike Research and Deutsche Bank price trends: <https://grist.files.wordpress.com/2011/09/li-ion-projected-costs.png>
 Lithium ion density trends: http://static.cdn-seekingalpha.com/uploads/2012/5/14/saupload_Battery_20Energy_20Density.jpg
 and <http://www.nissan-global.com/JP/TECHNOLOGY/FILES/2010/07/f4c4d5d2e20391.jpg>

11.1.3 Stakeholder/Market Engagement

Stakeholder/Market Engagement	<p>Engagement to date:</p> <ul style="list-style-type: none"> • Building owners, technology vendors and installers, architects and engineers, permitting agencies, and utilities have been engaged in identifying needs and strategy development; strong engagement will continue with these organizations during program development and rollout. • Relationships have been forged and strengthened with the Fire Department of New York City, NYC Department of Buildings, Con Edison, NY-BEST, and the Distributed Generation Hub at City University of New York (CUNY). • Organizations outside of New York are being leveraged for battery safety modeling (Sandia National Lab), building and life safety codes development (Pacific Northwest National Lab), and distributed energy resource (DER) integration and interoperability (Electric Power Research Institute). These relationships will be expanded to achieve the most with CEF funds. <p>Further engagement:</p> <ul style="list-style-type: none"> • Meaningful engagement with other distribution and municipal utilities, the Department of Public Service (DPS), and the NYISO will be prioritized. • Market participants will be periodically solicited to assess program effectiveness in meeting needs, identify new program opportunities, and refine program strategies based on success in removing barriers. • On-site visits will be conducted to maintain an understanding of project participants' experiences, needs, success, and challenges. • Webinars will be conducted for potential customers and energy storage vendors to share results from these activities and best practices.
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11.1.4 Theory of Change

Market Barriers Addressed	<ul style="list-style-type: none"> • Permitting and siting is exacerbated by safety uncertainty which causes significant delays or prevents projects from being considered. • Best fit customer locations and distribution/bulk power system sites are difficult due to a lack of useful load and system constraint data and are expensive. • Lack of unbiased information on vendor experience or system performance prevents customers or end users from considering energy storage and hinders the distribution utilities and/or NYISO from relying on aggregated storage to address system needs. • Return on investment is poor in many cases when an energy storage system addresses only a single need and/or accesses only a subset of possible value streams the storage system can provide.
Testable Hypotheses	<ul style="list-style-type: none"> • If safety uncertainty is reduced, then permitting agencies will be more comfortable approving systems resulting in a faster path to deployment. • If model operating procedures are developed, there will be greater clarity for permitting agencies and the vendor community resulting in a faster path to deployment. • If soft costs are reduced while battery costs continue to decline through global manufacturing scale-up, then installed cost for a distributed energy storage system in New York State will become much more attractive for greater numbers of installations and deployments will occur without incentives for the use cases with the strongest project economics .⁷

⁷ Refer to the Market Readiness Section for an example of battery installed cost estimates.

	<ul style="list-style-type: none"> • If customers, architects, engineers, and distribution utilities have confidence in vendors and system performance, then more systems will be considered for implementation and market growth will accelerate. • If distributed energy storage systems can predictably earn revenue by addressing electric system needs in addition to those of a host site, then many more systems will be financially viable with paybacks of three to six years⁸ and energy storage will become integrated into planning decisions without the need for NYSERDA incentives.
Activities	<p>Each of the following activities contributes toward reducing soft costs and enabling distributed energy storage installations to be deployed in locations that can most benefit from this resource. These activities will evolve over time to address additional soft cost and siting challenges that arise as deployments increase through the NYSERDA Market Acceleration Incentives authorized by the PSC Energy Storage Order. This soft cost reduction work is fundamental to enabling a self-sustaining sector over time.</p> <p><u>1. Safely deploy and site energy storage technologies</u> by developing permitting and siting guides, working with authorities having jurisdiction (permitting agencies), training first responders, and helping local permitting agencies and communities make informed decisions. Specific activities will be coordinated and deployed in conjunction with NYSERDA's Clean Energy Siting Team and include the following:</p> <ul style="list-style-type: none"> • Develop and continue to refine model permitting guides for energy storage technologies based on local permitting agency needs and evolving codes and standards. • Provide permitting agencies and local communities with technical support and access to subject matter experts to assist with developing responsible, clear and streamlined permitting and siting processes and enable informed decision making. • Hold training sessions for New York permitting agencies, communities and vendors. These training sessions will be integrated with existing training programs, such as PV training, to the greatest extent possible. • Create developer guides to summarize codes and standards and local requirements for siting energy storage systems. • Develop first responder training materials in collaboration with National Fire Protection Association or other organizations to inform safe installation of energy storage systems and identify best practices for containing and extinguishing an energy storage system fire. • Develop Payment in Lieu of Taxes (PILOT) calculators and materials to assist local communities and vendors when planning energy storage installations. <p><u>2. Provide developer facing support and education</u> through educational materials to understand and leverage tariffs and market rules, models to evaluate NYS tariffs in project economics, and resources to identify locations where storage can maximize value.</p> <ul style="list-style-type: none"> • Conduct analyses and validate characteristics to predict best fit customer and grid locations, leveraging available load data and tariff signals such as the Value of Distributed Energy Resources (VDER) value stack. • Create publicly available project modeling tools such as comparing customer electric bills among various tariffs, VDER value stack compensation for energy storage, and wholesale market project economics. • Leverage existing analyses and system planning studies to conduct analyses that highlight distribution or bulk locations where energy storage provides the greatest value including underutilized sites such as landfills or brownfields, existing peaking sites, and locations where renewable curtailment or delivery constraints can be addressed.

⁸ This is almost twice as fast a payback as many systems today.

	<ul style="list-style-type: none"> • Develop fact sheets and case studies that present various energy storage use cases, especially those that provide value to multiple parties, and clearly explain strategies to maximize values. • Provide technical resources to developers to understand and leverage New York State markets. • Leverage the NY Green Bank to provide financiers with financial clarity on NYS tariffs and wholesale market products to enable lower cost project financing for scalable use cases. <p><u>3. Provide potential customers and energy storage users with tools that support market replication</u> through fact sheets, case studies, and access to independent educational resources.</p> <ul style="list-style-type: none"> • Help potential energy storage customers understand project economics, business models, and benefits that energy storage can provide to them. This will include fact sheets, case studies and webinars for customer-sited installations, paired PV + storage projects, VDER Value Stack compensated projects, and those providing distribution or wholesale services. Materials and outreach will be coordinated with other NYSERDA or utility activities to ensure effective communication. • Support technical and economic feasibility studies that analyze energy storage sites and use cases through NYSERDA’s Flex Tech offering using funds authorized by this investment plan⁹.
<p>Key Milestones</p>	<p><u>Milestone 1 (2016) - Complete</u></p> <ul style="list-style-type: none"> • Issue solicitation to competitively select technical consultants and organizations to assist with soft cost reduction strategies, quality assurance, and feasibility studies under value stacking pilots. <p><u>Milestone 2 (2017) - Complete</u></p> <ul style="list-style-type: none"> • Lead acid, lithium-ion, and flow batteries are independently tested with results aggregated into first responder training materials for authorities having jurisdiction. <p><u>Milestone 3 (2017) - Complete</u></p> <ul style="list-style-type: none"> • Technical consultants or organizations to assist with soft cost reduction strategies, quality assurance, and feasibility studies are selected. <p><u>Milestone 4 (2017) - Complete</u></p> <ul style="list-style-type: none"> • Launch a competitive program funding value stacking pilot. <p><u>Milestone 5 (2018) - Complete</u></p> <ul style="list-style-type: none"> • Model permitting guides are developed for New York City installations. <p><u>Milestone 6 (2018) - Complete</u></p> <ul style="list-style-type: none"> • Public platform is launched including use cases, system performance results, and fact sheets. <p><u>Milestone 7 (2019) - Complete</u></p>

⁹ In the original approved investment plan, pilot demonstrations were competitively sought to demonstrate the ability and economics of a commercial energy storage system providing grid benefits. This resulted in one project comprising \$3,716,899 in NYSERDA funding and \$3,954,101 in co-funding to deploy a total of 6 MW, 12 MWh of energy storage at three community solar installations. Benefits associated with this deployment project will be reported and tracked in the annual State of Storage report required under the PSC Energy Storage Order so that all energy storage deployments are clearly presented in a single place. The market acceleration bridge incentive funds authorized by the PSC Energy Storage Order eliminate the need for this pilot demonstration program and remaining funds have been reallocated for soft cost reduction activities.

	<ul style="list-style-type: none"> • Technical and economic feasibility studies to examine the sizing and project economics of energy storage installations begin. <p><u>Milestone 8 (2019) - Complete</u></p> <ul style="list-style-type: none"> • Increasing numbers of energy storage vendors are engaged in New York State, as surveyed at least annually. <p><u>Milestone 9 (2019) - Complete</u></p> <ul style="list-style-type: none"> • Increasing numbers of customers seek information on storage solutions to mitigate their peak demand and electricity requirements, as determined through vendor interviews and the number of permits submitted to authorities having jurisdiction, surveyed at least annually. <p><u>Milestone 10 (2019) - Complete</u></p> <ul style="list-style-type: none"> • Model permitting guide is developed for statewide use by AHJs and developers. <p><u>Milestone 11 (2020) - Complete</u></p> <ul style="list-style-type: none"> • Market segmentation for NYSEERDA customer acquisition activities supported under this investment plan expands beyond the initial segments of interval-metered customers. <p><u>Milestone 12 (2020) - Complete</u></p> <ul style="list-style-type: none"> • Convincing use cases and best fit customer characteristics and acquisition tools are publicized.
Goals Prior to Exit	<ul style="list-style-type: none"> • Soft costs for distributed energy storage systems have been meaningfully reduced, with a goal of up to \$150 per kWh for a customer sited system and \$50 per kWh for a distribution/bulk sited system by 2025 compared to 2017-18 costs.¹⁰ • Permitting, siting, and interconnection requirements are clear and practical resulting in deployment of large numbers of systems to achieve the State’s energy storage goals • Electrical, building and fire codes and industry standards such as Underwriters Lab adequately address safety and performance concerns to the satisfaction of authorities having jurisdiction, utilities, and customers • Identifying and attracting best fit customers and locations is readily accomplished by vendors as measured through vendor surveys • Ability to use distributed energy storage, including aggregated systems behind customer meters, to meet system needs is understood and readily recognized in utility planning and procurement • Termination of individual interventions will be based upon market conditions measured by project uptake within the market acceleration incentives, annual vendor surveys, permitting and interconnection queues, and customer engagement. NYSEERDA will survey the market periodically to measure progress in these areas and will reduce and adjust support as needed to maximize impact.

11.1.5 Relationship to Utility/REV

Utility Role/Coordination Points	<ul style="list-style-type: none"> • Utilities are key partners in these activities, especially in customer data mining, identifying constrained areas of the distribution feeders, and evaluating load relief using energy storage. Additionally, the REV Track 2 Order and the Energy Storage
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¹⁰ This internal distributed storage soft cost baseline utilized a GTM Research study and then augmented that data with pricing from New York State deployments under the Demand Management Program and vendor inquiries.

	<p>Order requires utilities to propose system efficiency targets such as peak reduction and load factor improvement, both of which can be accomplished through distributed energy storage. NYSERDA will work directly with distribution utility staff who work on smart grid, REV demos, and non-wires alternatives. Initiatives will be implemented in direct coordination with the distribution utility. Additionally, utilities will begin identifying roles for storage in the Distribution System Investment Plans beginning in fall 2016, and Non-Wires Alternative solicitations, and these plans will be leveraged in identifying strategic areas of the distribution system for program implementation.</p> <ul style="list-style-type: none"> • Initial discussions and information sharing with New York Power Authority will be expanded to leverage their ability to finance projects including at municipal and educational customers. • The NYISO is also a key partner to identify wholesale system needs and evaluate the effectiveness of distributed storage solutions in meeting these requirements.
<p>Utility Interventions in Target Market</p>	<ul style="list-style-type: none"> • Con Edison’s Demand Management Program is concluding in 2019. Con Edison’s Brooklyn-Queens Demand Management load relief program is seeking load relief strategies in these feeder circuits. • A number of Non-Wires Alternatives are being pursued by the investor owned utilities. • Long Island Power Authority (LIPA) has solicited proposals for load relief, generally with larger quantities of bulk energy storage, and is implementing a Demand Load Management tariff in 2019 that will compensate value that storage and PV/storage can provide to system relief. • Customers and vendors will be directed by NYSERDA to these respective utility initiatives.

11.1.6 Budgets

The commitment budget for all activities included in this investment plan is as follows:

Funding Commitments		----- Commitments Plan -----						
Budget	Plan Total	Previously Committed	2020	2021	2022	2023	2024	2025
Incentives and Services	4,937,041	3,805,623	-	225,000	225,000	225,000	231,418	225,000
Implementation	7,118,349	2,505,842	50,000	250,000	1,030,000	1,030,000	1,030,000	1,222,507
Research and Technology Studies	-	-	-	-	-	-	-	-
Tools, Training and Replication	12,394,609	5,547,509	50,000	250,000	1,500,000	2,000,000	1,547,100	1,500,000
Business Support	-	-	-	-	-	-	-	-
Total	24,450,000	11,858,975	100,000	725,000	2,755,000	3,255,000	2,808,518	2,947,507

An annual expenditure budget for all activities included in this investment plan is shown in Appendix B alongside expected acquired benefits. Budgets do not include Administration, Evaluation, or Cost Recovery Fee; these elements are addressed in the Budget Accounting and Benefits chapter filing. The budget as presented in the Budget Accounting and Benefits Chapter will serve as the basis for any subsequent reallocation request. The additional level of detail presented within Appendix B is intended for informational purposes only.

11.1.7 Progress and Performance Metrics

The anticipated commitment benefits totals for the initiative with respect to CEF Order target metrics is as follows:

Benefit Commitments

Direct Benefit (2016-2025)	Plan Total
Energy Efficiency MWh Annual	-
Energy Efficiency MMBtu Annual	-
Renewable Energy MWh Annual	-
CO2e Emission Reduction (metric tons) Lifetime	-
Participant Bill Savings Lifetime	-
Leveraged Funds	3,954,101

Indirect Benefit (2016-2030)	Plan Total
Energy Efficiency MWh Annual	-
Energy Efficiency MMBtu Annual	-
Renewable Energy MWh Annual	-
CO2e Emission Reduction (metric tons) Lifetime	-

Benefits summarized in Appendix B represent the plan for acquiring impacts through completed projects or activities.

Benefits listed as direct, are near term benefits directly associated with this initiative’s projects. These benefits will be quantified and reported on a quarterly basis and will be validated through later evaluation.

Appendix C provides program Activity/Output indicators representing measurable, quantifiable direct results of activities undertaken in the initiative. Outputs are a key way of regularly tracking progress, especially in the early stages of an initiative, before broader market changes are measurable. Outcome indicators can encompass near-term through longer-term changes in market conditions expected to result from the activities/outputs of an intervention. Outcome indicators will have a baseline value and progress will be measured periodically through Market Evaluation.

In addition, NYSERDA will also measure and report the following performance metrics annually in the State of Storage Report required by the PSC Energy Storage Order:

- Average total installed cost of energy storage systems
- Total MWs and MWhs deployed, including those funded by NYSERDA incentive funds
- Major progress during the year in reducing soft costs
- New impediments to deployment that have been identified and proposed solutions
- Adjustments to market acceleration incentive funds

All storage deployments in New York State will be aggregated in this report, with direct benefits representing projects that receive NYSERDA market acceleration incentives and indirect benefits representing projects deployed without NYSERDA funding which are expected to be enabled by the combination of soft cost reductions from deploying market acceleration funds and the associated technical assistance supported by this investment plan.

Activities, outputs and outcomes of the soft cost reduction work supported under this investment plan chapter will be reported in this annual State of Storage Report in order to provide a comprehensive perspective in a single document. Electric grid and environmental benefits including peak reduction and carbon will be assessed and reported through independent evaluations described in the NYSERDA Energy Storage Market Accelerations Implementation Plan.

11.1.8 Fuel Neutrality

Fuel Neutrality	This initiative is not being delivered on a fuel neutral basis.
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11.1.9 Performance Monitoring and Evaluation Plans

Performance Monitoring & Evaluation Plan	<p>NYSERDA’s approach to monitoring and assessing the effectiveness of the initiative and overall market development is described below and builds upon the evaluation performance embedded in the Activities section above.</p> <p><u>Test-Measure-Adjust Strategy</u></p> <ul style="list-style-type: none"> • NYSERDA will monitor standard activity/output metrics including completion of training materials and guides, pilots underway, etc. <p><u>Quality Assurance (M&V)</u></p> <ul style="list-style-type: none"> • Quality assurance will be integrated into the specific activities described above with the following approaches: <ul style="list-style-type: none"> ○ Collect and compile data on deployed systems ○ Conduct bill analytics for savings ○ Conduct independent validation to assess technical and cost effectiveness of using distributed storage systems to meet customer and distribution system and/or NYISO needs. • Review of the programmatic measurement and verification will occur as needed. <p><u>Market Evaluation</u></p> <ul style="list-style-type: none"> • Market Evaluation draws on the theory of change of the related logic model and will include baseline and longitudinal measurement of key indicators of success. • Baseline measurements of key performance indicators will occur within one year of initiative approval and will further quantify indicators including cycle time of projects and balance of system costs for distributed energy storage systems. In these areas, NYSERDA will first utilize existing information and will fill gaps in information as needed and feasible for appropriate baselining. • Regular (e.g., annual or biennial) updates to key performance indicators and measurement of market change, including the number of projects and type of energy storage systems approved by AHJs, will occur once the initiative is underway. • Sources of data will include public and commercially available data, balance of system surveys conducted by the National Renewable Energy Laboratory (NREL), and primary data collection through surveys of key market actors.
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11.2 Solar Plus Energy Storage

11.2.1 Overview

Present Situation	<ul style="list-style-type: none"> • Energy storage serves as a critical resource for enabling New York’s clean energy future. As renewable power sources like wind and solar provide a
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	<p>larger portion of New York’s electricity needs, storage will be used to smooth and time-shift renewable generation and minimize curtailment.</p> <ul style="list-style-type: none"> • However, intervention is needed to encourage the industry to mobilize resources to deploy paired solar and storage projects, work in conjunction with utility partners and the NYISO to remove barriers to deployment, and generate the valuable lessons learned needed to prepare for New York having the majority of its electrical energy coming from renewable sources by 2030. Solar plus storage projects are a key application of storage that leverages the capabilities of solar to deploy systems and gain lessons learned. • To leverage the current NY-Sun program, staff recommended that NYSERDA create this incentive for storage systems under NY-Sun to spur new solar plus storage projects while a broader energy incentive program was deliberated and developed. • On December 13, 2018, the New York Public Service Commission issued its Energy Storage Order which authorized an additional \$310 million in collected, unallocated Renewable Portfolio Standard funding to accelerate adoption of both customer-sited storage and storage sited on the distribution or bulk systems, including when paired with clean generation sources. • NY-Sun is currently building a robust pipeline of solar projects. Many projects expected to be built in the next several years have the potential to add energy storage, and recent market factors have improved the value proposition for adding energy storage to a project. Shifting solar energy to other hours in the day can improve its value, and new tariffs allow storage to improve a solar project’s revenue by shifting the hours of the energy output. Combining solar and storage also reduces transactions costs by leveraging the solar project’s siting, design, permitting and financing.¹¹ • A 30% federal tax credit and accelerated depreciation is available to storage charging from solar, but the tax credit is scheduled to begin stepping down after 2019, making the time ripe for pursuing solar plus storage projects to increase benefits to ratepayers.¹² • The cost of battery storage, while declining by an average 10% annually, is expected to remain too expensive for many paired solar plus storage applications in the near term. Until costs decline further, solar developers require additional financial support to add storage to their solar projects to address the fact that adding storage currently complicates their existing business model and adds costs to projects.
<p>Intervention Strategy</p>	<ul style="list-style-type: none"> • NYSERDA will provide financial support to accelerate solar plus energy storage projects. This support, in conjunction with NYSERDA’s Reducing Barriers to Deploying Distributed Energy Storage initiative, will address barriers to the installation of solar plus energy storage and enable projects to be built. The projects will allow developers to gain experience with Value of Distributed Energy Resources (VDER) tariff values, financing, deal structure, retail customer agreements and energy storage interconnection as soon as possible. • These early adopter projects will also provide lessons learned that can be shared with the marketplace to reduce costs and increase the chance of success for future projects. NYSERDA will: <ul style="list-style-type: none"> ○ Provide financial support through NY-Sun to support solar plus storage projects that would otherwise be too risky or not viable, allowing

¹¹ According to NREL, co-locating energy storage with solar could save 26% on soft costs, and up to 36% when combining soft and hardware savings (i.e. shared inverter) as opposed to separate solar and storage.

¹² The Federal Investment Tax Credit will reduce the storage cost by 30% until 2019 before beginning its step to 10% in 2021. This initiative will allow acceleration of these paired solar plus storage projects at a savings of approximately \$12 million by leveraging the federal ITC.

	<p>developers, customers and utilities to gain experience with energy storage implementation. Prior to launching the incentive program, NYSERDA will determine the appropriate incentive level by assessing the level of funding required for projects to break even in high value locations and stakeholder feedback.</p> <ul style="list-style-type: none"> ○ Reduce project siting and permitting barriers that impede broad deployment of solar plus storage technologies. ○ Disseminate learnings to the market utilizing regulatory, industry and utility collaborative efforts (e.g. Interconnection Technology Working Group (ITWG), Interconnection Policy Working Group, (IPWG)). <ul style="list-style-type: none"> ● For a visual representation of this strategy, please reference the flow chart entitled “Logic Model: Solar Plus Storage,” which can be found in Appendix A.
Goals	<ul style="list-style-type: none"> ● Enable energy storage to shift distributed solar generation to times of greater value. ● Reduce costs that prevent solar plus energy storage projects from being built. ● Accelerate lessons-learned by developers and utilities from actual solar plus storage deployments.
State Energy Plan/Clean Energy Standard Link	<ul style="list-style-type: none"> ● The 2015 State Energy Plan identifies energy storage as a key component of New York’s large-scale renewable strategy, noting that “pairing Large Scale Renewables with dynamic distributed energy resources such as demand response and energy storage will maximize the benefits of both kinds of resources.” ● This initiative also supports achievement of the Clean Energy Standard for renewable resource electric generation (50% renewable electric generation by 2030 – “50 by 30” and recommended by the Governor to increase to 70% by 2030) by enabling the deployment of renewables necessary to meet these goals. ● Solar plus energy storage will also play a critical role in reducing peak electric demand, firming intermittent renewables to help reduce the need for fossil generation during peak electric periods, permitting greater customer load control, and reducing electric bills.

11.2.2 Target Market Characterization

Target Market Segment(s)	<ul style="list-style-type: none"> ● NY-Sun developers active in the community solar and non-residential solar segments.
Market Participants	<p>Market participants include:</p> <ul style="list-style-type: none"> ● Utilities ● Solar and energy storage trade associations such as Solar Energy Industry Association (SEIA) and the New York Battery and Energy Storage Technology consortium (NY-BEST) ● Energy storage developers, vendors and system integration service providers. ● Solar project financiers and investors ● New York Green Bank ● Authorities having jurisdiction (AHJs) such as building and fire code officials ● Commercial and industrial electric customers considering solar ● Subscribers of community solar projects
Market Readiness	<ul style="list-style-type: none"> ● In April 2018 the Commission approved the Value of Distributed Energy Resources “value stack” implementation that enables storage to increase the value of distributed renewable generation by shifting when the energy delivered to the grid. Utilities have been ordered to file tariffs that are expected to go into effect in late in 2018 to compensate a hybrid energy storage and distributed generation system.

	<ul style="list-style-type: none"> • There are currently approximately 400 MW of mature NY-Sun Community Solar projects in the utilities’ queue and a new wave of solar development is expected to result from recent NY-Sun program changes.¹³ Both provide more near-term development of distributed solar which presents more opportunities where the addition of storage may offer value. To leverage this opportunity, some solar companies are beginning to invest business development resources in storage. Some of these companies have experience integrating energy storage and there are several qualified energy storage suppliers with whom they could partner. • The Standardized Interconnection Requirements (SIR) was recently changed to accommodate storage in several important ways to further support deployment. These changes included raising the maximum size of a distributed generator from 2 MW to 5 MW and clarifying that both the solar and storage systems could be 5 MW of nameplate capacity, so long as the export was limited to a total of 5 MW. • Financiers of solar projects are still unfamiliar with obtaining the new ITC for storage and require a premium to cover the perceived risks. The new VDER tariff is also unfamiliar and raises additional financing complexity. • As announced by Governor Cuomo in his 2018 State of the State message, the New York Green Bank will invest \$200 million to ramp up financing for energy storage projects, including those paired with solar, to enable deployment at scale and reduce the cost of capital.¹⁴ • The Public Service Commission’s Energy Storage Order increases authorized funding to accelerate energy storage deployment either as a standalone system or paired with clean generation like PV solar. • Solar and energy storage systems will be new for permitting agencies to review, which adds complexity and time to project development.
Customer Value	<ul style="list-style-type: none"> • Solar developers value the opportunity to expand their sales to include energy storage and gain experience with solar plus storage systems. • Financiers value examples of the performance and value streams of solar plus energy storage systems. • Community solar subscribers, including residential and commercial electric customers, value the increased bill credits energy storage creates by shifting the solar generation to higher value times. • Commercial and industrial solar customers value the ability of storage to shift the timing of solar production to reduce their retail demand charges and provide demand response.

11.2.3 Stakeholder/Market Engagement

Stakeholder/Market Engagement	<ul style="list-style-type: none"> • NYSERDA has engaged with several energy storage and solar developers to gather feedback regarding a solar plus storage initiative. Developers noted that they are just beginning to evaluate adding storage to projects under VDER, and that battery costs are still high relative to the incremental VDER values or bill savings. Given the added costs, on their own developers would
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¹³ On June 18, 2018 NY-Sun announced a program redesign, made in response to a rapidly changing market, includes higher incentive rates, and targeted new incentive adders. NY-Sun also increased the maximum system sizes for both the non-residential and the commercial projects, encouraging to better economy-of-scale. NY-Sun expects increased project development in light if these program improvements.

¹⁴ RFI, Financing Arrangements for Energy Storage Projects in New York State: <https://portal.greenbank.ny.gov/servlet/servlet.FileDownload?file=00Pt0000005HjimpEAC>

	<p>not likely pursue solar plus storage projects until costs come down, including those costs associated with more complicated siting and interconnection.</p> <ul style="list-style-type: none"> • Developers also reported that adding energy storage to their PV projects introduces additional risks including unknown permitting, interconnection and technical barriers, and financing premiums. • Going forward, NYSERDA will work very closely with NY-Sun developers building storage, industry associations, utilities and regulators to ensure complications are addressed to minimize soft costs and barriers.
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11.2.4 Theory of Change

Market Barriers Addressed	<ul style="list-style-type: none"> • High hard costs to early adopters of adding energy storage to solar. High energy storage equipment costs (i.e., batteries) continue to drive high overall costs for solar plus storage projects. NYSERDA incentives will lower project hard costs as the storage industry continues to drive cost declines that have averaged 10% annually. • High soft costs of adding storage to solar. Soft costs¹⁵ are higher for solar plus storage projects, relative to solar alone, and the industry’s lack of experience with new tariffs further increases financing and other costs. Financial support for the initial tranche of solar plus storage projects, as well as disseminating market learnings, will lower future project soft costs by allowing the industry to gain the experience necessary to reduce the impact added design, development and business model risks have on costs.
Testable Hypotheses	<ul style="list-style-type: none"> • If incentives lower the additional hard costs of adding storage to solar projects, then developers will be willing to undertake solar plus storage projects. • If developers deploy storage with solar projects, and NYSERDA provides additional support to address key interconnection and permitting barriers, then the industry will gain valuable lessons learned, translating to a decrease in soft costs, in preparation for future paired solar plus storage deployments. • If NYSERDA actively participates in the Interconnection Policy and Technical Working Groups to reduce solar plus storage interconnection complexities and costs, coordination among the parties will reduce and remove barriers to industry deployment activities.
Activities	<p>Financial Support for Solar Plus Storage Projects</p> <ul style="list-style-type: none"> • NYSERDA will set the incentive level based on projects with the highest economic value. Prior analysis of the opportunities for storage and VDER values analyzed several use cases to determine the incentive level that would be required for solar plus storage projects to break even with sufficient financial returns to enable deployment. The analysis focused on locations where community solar projects are likely to be built, where VDER capacity values were relatively high, and a more general analysis of customer-sited paired systems. • The incentive level will take this analysis into account, as well calibrate the level of funding providing to high value locations where the established storage cost declines will enable projects to make financial sense in the next 3-5 years. NYSERDA will also gather stakeholder input before finalizing the incentive level.¹⁶

¹⁵ Soft costs of adding storage to solar are defined as the additional permitting, interconnection, customer acquisition, and financing costs.

¹⁶ It is anticipated that the incentive level for these early adoption projects could reach 40-50% of the installed cost of the storage system due to higher soft costs and financing costs associated with financier uncertainty of revenue from the VDER tariff and higher initial interconnection costs. This level of incentive is consistent with early adopter markets that were

	<ul style="list-style-type: none"> Using the identified incentive level, NYSERDA will provide a standard offer incentive within the NY-Sun program to reduce the developer’s cost of adding energy storage to a solar project. The incentive will be in addition to financial support received thorough the NY-Sun Megawatt Block program. To access the incentive, NY-Sun developers will apply for storage incentives through the NY-Sun open enrollment applications process. <p>Collaborative Support to Address Permitting and Interconnection Barriers Through funding authorized in the Reducing Barriers to Deploying Distributed Energy Storage CEF investment plan, NYSERDA will:</p> <ul style="list-style-type: none"> Actively engage with industry developers, associations, and regulatory and utility staff to find solutions to barriers encountered by funded solar plus energy storage projects. This will include monthly participation in IPWG and ITWG to ensure the development of standardized, efficient and consistent interconnection technical requirements, policies and procedures for energy storage. Engage siting and permitting agencies to reduce barriers and complexity to the addition of storage to solar projects. NYSERDA may also issue task work orders under existing contracts through the Reducing Barriers to Deploying Distributed Energy Storage initiative to supplement working group participation in addressing specific barriers identified by the solar plus storage projects. These scopes may include tariff analysis, siting and permitting support, project performance M&V, stakeholder outreach and knowledge transfer of lessons learned. <p>Disseminate Learnings to the Market</p> <ul style="list-style-type: none"> Case studies highlighting the performance and value of adding energy storage to solar will be developed and disseminated under through the Reducing Barriers to Deploying Distributed Energy Storage initiative. The work will be conducted via the activity labeled “Increase Confidence.” AHJs have very little experience permitting batteries, so lessons learned will be gathered from developers and disseminated through the Reducing Barriers to Deploying Distributed Energy Storage initiative activity labeled “Safely Deploy Energy Storage Technologies.” The ITWG will also be leveraged as a forum for industry to share their experience amongst themselves and with regulators and utilities to further disseminate lessons learned. Project measurement and verification will also be shared to increase customer and investor confidence in performance and revenue.
Key Milestones	<p><u>Milestone 1 (2018) - Complete</u></p> <ul style="list-style-type: none"> Launch changes to the NY-Sun program providing incentives for paired solar plus energy storage projects. <p><u>Milestone 2 (2018) - Complete</u></p> <ul style="list-style-type: none"> Participation in IPWG and ITWG meetings throughout the year to address issues of adding storage to solar. <p><u>Milestone 3 (2018-2020) - Complete</u></p> <ul style="list-style-type: none"> Award incentives to solar plus storage projects. <p><u>Milestone 4 (2019) - Complete</u></p> <ul style="list-style-type: none"> Participation in IPWG and ITWG meetings throughout the year to address issues of adding storage to solar.

experienced in other NYSERDA initiatives, Con Edison’s initial Demand Management Program, and other states including California.

	<p><u>Milestone 5 (2020)</u></p> <ul style="list-style-type: none"> • Publish and release case studies from recently completed projects to provide timely feedback to the market. <p><u>Milestone 6 (2021)</u></p> <ul style="list-style-type: none"> • Publish and release case studies from recently completed projects to provide timely feedback to the market.
Goals Prior to Exit	<ul style="list-style-type: none"> • NYSERDA anticipates the need for continued market support beyond this initiative through the broader energy storage bridge incentive authorized by the PSC Energy Storage Order as declines in energy storage hardware costs begin to materialize and grid values become more refined. • The solar plus storage development activity funded under this initiative will reduce the soft costs of adding storage to future distributed solar projects. As these will be the first solar projects paired with storage, valuable lessons will be learned and these will serve as a model for future projects, enabling a reduction in installation costs in the future. Priorities and approaches to support adding storage to solar will shift as the various policy, market values, applications and proportion of renewables change. • NYSERDA anticipates exiting the activities described in this initiative when adding storage to NY-Sun commercial and non-residential systems makes financial sense based on commercial terms alone due to costs declines and additional value opportunities. Project modeling indicates that many of these paired projects will make economic sense in the next 3-5 years without additional storage incentives based on established cost declines.

11.2.5 Relationship to Utility/REV

Utility Role/Coordination Points	<ul style="list-style-type: none"> • Investor owned utilities have three roles in the market for solar plus storage; implementation of tariffs, distributed generation interconnection, and distributing bill credits generated by community solar projects to subscribed electric customers. Solar plus storage projects will not be eligible for any other incentive funding from the utilities. • NY-Sun will update the utilities on the new program for energy storage and continue to coordinate with the utilities on issues of application processing and queue management. • The utilities publish the tariffs that encourage shifting renewable generation with storage and indicate where DERs are most valuable. The tariffs therefore indicate locations solar plus storage is most valuable and where a NYSERDA market development intervention is most efficient. • The utilities are participating on the ITWG and IPWG. Utility interconnection policy and technical issues will be addressed in the Interconnection Working Groups to coordinate consistent implementation among utilities.
Utility Interventions in Target Market	<ul style="list-style-type: none"> • Utilities are considering solar plus energy storage systems in non-wires alternative procurements on a competitive basis. • The utilities do not offer incentives for solar plus storage projects, however utilities do incent and compensate stand-alone storage in demand reduction and demand response programs. • Con Ed and Orange and Rockland utilities have REV solar plus storage demonstration projects underway that include residential solar, commercial behind-the-meter solar and community solar. • DER tariffs, like the VDER value stack, are under development for LIPA and NYPA customers. NY-Sun has a Megawatt Block offering that supports solar

	projects statewide, including for LIPA and NYPA customers that do not pay into the System Benefits Charge (SBC). NYPA currently does not offer direct financial support for solar plus storage projects currently. NYSERDA will coordinate with LIPA on development of a solar plus storage offering the utility is considering in their service territory.
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11.2.6 Budgets

The commitment budget for all activities included in this investment plan is as follows:

Funding Commitments		----- Commitments Plan -----						
Budget	Plan Total	Previously Committed	2020	2021	2022	2023	2024	2025
Incentives and Services	40,000,000	27,947,799	12,036,500	15,701	-	-	-	-
Implementation	-	-	-	-	-	-	-	-
Research and Technology Studies	-	-	-	-	-	-	-	-
Tools, Training and Replication	-	-	-	-	-	-	-	-
Business Support	-	-	-	-	-	-	-	-
Total	40,000,000	27,947,799	12,036,500	15,701	-	-	-	-

An annual expenditure budget for all activities included in this investment plan is shown in Appendix B alongside expected acquired benefits. This budget has been increased by \$3,716,899 reflecting one energy storage value stacking pilot comprising 6 MW and 12 MWh of energy storage paired with community solar that was awarded under the Reducing Barriers to Distributed Energy Storage investment plan. For consistency, this project will now be reported under this Solar plus Storage investment plan. Budgets do not include Administration, Evaluation, or Cost Recovery Fee; these elements are addressed in the Budget Accounting and Benefits chapter filing. The budget as presented in the Budget Accounting and Benefits Chapter will serve as the basis for any subsequent reallocation request. The additional level of detail presented within Appendix B is intended for informational purposes only.¹⁷

11.2.7 Progress and Performance Metrics

The anticipated commitment benefits totals for the initiative with respect to CEF Order target metrics is as follows:

Benefit Commitments		Indirect Benefit (2016-2030)	
Direct Benefit (2016-2025)	Plan Total	Indirect Benefit (2016-2030)	Plan Total
Energy Efficiency MWh Annual	-	Energy Efficiency MWh Annual	-
Energy Efficiency MMBtu Annual	-	Energy Efficiency MMBtu Annual	-
Renewable Energy MWh Annual	-	Renewable Energy MWh Annual	-
CO2e Emission Reduction (metric tons) Lifetime	-	CO2e Emission Reduction (metric tons) Lifetime	-
Participant Bill Savings Lifetime	-		
Leveraged Funds	20,152,010		

Benefits summarized in Appendix B represent the plan for acquiring impacts through completed projects or activities.

¹⁷ Storage projects in Long Island will not be eligible for this proposed incentive.

Benefits shown in Appendix B, labeled as direct, are direct, near term benefits associated with this initiative's projects. These benefits will be quantified and reported on a quarterly basis and will be validated through later evaluation. Energy benefits (i.e. MWh and MW) and benefit values derived from energy savings will only be included in the State of the Storage Report, as they are unique to Energy Storage and not appropriate to roll up with other NYSERDA Market Development initiatives.

Appendix C provides program Activity/Output indicators representing measurable, quantifiable direct results of activities undertaken in the initiative. Outputs are a key way of regularly tracking progress, especially in the early stages of an initiative, before broader market changes are measurable. Outcome indicators can encompass near-term through longer-term changes in market conditions expected to result from the activities/outputs of an intervention. Outcome indicators will have a baseline value and progress will be measured periodically through Market Evaluation.

Performance metrics, activities and outcomes will also be reported annually in the State of Storage Report required by the PSC Energy Storage Order to present all information in a single location. All storage deployments in New York State will be aggregated in this report, with direct benefits representing projects that receive NYSERDA market acceleration incentives and indirect benefits representing projects deployed without NYSERDA funding which are expected to be enabled by the combination of soft cost reductions from deploying market acceleration funds and the associated technical assistance supported by these investment plans. Soft cost reduction will be tracked in the Reducing Barriers to Deploying Distributed Energy Storage investment plan and reported in the annual State of Storage report.

Under VDER, shifting renewable generation using storage substantially improves its value. The MWs of storage deployed under this initiative are expected to improve the value of the shifted renewable energy by \$3M annually, creating about \$60M of additional value over the lifetime of the solar plus storage asset. The portion of this value that would be passed to retail customer subscribing to a community solar project is estimated at 10%, while 90% would go to be applied to the capital costs of storage.

Near-term, these early storage applications paired with solar do not present additional carbon savings, due to the roundtrip conversion losses in storage (approximately 15-20%) and the temporal misalignment with more carbon-intense generation. Longer term, however, as the generation fleet includes substantially more renewable energy, adding storage will result in substantial carbon reduction by shifting renewable production to displace fossil generation in other hours of the day. Storage can play a critical role addressing the ramp rate that can occur in the late afternoon when solar production declines and electric demand increases. While the California electric system is different in many respects to the New York system, it does present an illustrative example of this ramp rate issue. On March 4, 2018, solar produced almost 50% of the total electricity in the State of California. However, as solar production started to decline as the sun set the grid experienced a ramp rate of over 7,500 MW of new generation required in a single hour to

make up for the declining solar generation, and almost 15,000 MW over three hours – equal to half of the total electric demand the grid would face in a typical day.¹⁸

11.2.8 Fuel Neutrality

Fuel Neutrality	<ul style="list-style-type: none"> This initiative is not being offered on a fuel neutral basis.
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11.2.9 Performance Monitoring and Evaluation Plans

Performance Monitoring & Evaluation Plan	<p>NYSERDA’s approach to monitoring and assessing the effectiveness of the initiative and overall market development is described below.</p> <p><u>Test-Measure-Adjust Strategy</u></p> <ul style="list-style-type: none"> NYSERDA will monitor the pace of NY-Sun project applications and awards for energy storage support. Marketing messages, incentive levels/structure, administrative process, and other program activities will be adjusted based on periodic review of these metrics. Based on progress of NY-Sun projects awarded storage support and outcome of the contracting and implementation processes, NYSERDA may revise program implementation as needed over the course of the initiative. Factors to be considered include: <ul style="list-style-type: none"> Number of responding solar project owners/developers, and quantity of projects and storage MW/MWh capacity applying Rate of completion, delay, and/or attrition of projects awarded support Insights as to how the initiative can be optimized will be gathered and applied to future initiative design to ensure greatest market impacts within specific sectors of the solar market. <p><u>Market Evaluation</u></p> <ul style="list-style-type: none"> The trend for solar plus storage soft costs will be assessed as systems are commissioned under this initiative. Currently, there are no comparable existing installations in NYS from which a baseline could be derived. The soft cost reduction noted in Table 9 is expected to occur inside of the participant population as experience is gained, but also be transferrable to non-participants as the initiative matures. Regular (e.g., annual or biennial) updates to soft cost measurements will occur to gauge both participant and non-participant (market wide) costs. Sources of data will include public and commercially available data, Salesforce, and primary data collection through surveys of key market actors. <p><u>Impact Evaluation/Field Verification</u></p>
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¹⁹ Case 18-E-0130, New York State Energy Storage Roadmap and Department of Public Service / New York State Energy Research and Development Authority Staff Recommendations (filed June 21, 2018).

	<ul style="list-style-type: none"> • Impact Evaluation will be completed for the NY-Sun portfolio as a whole. NYSERDA will develop an approach to identify these projects in the NY-Sun portfolio and to represent them in the evaluation. • As projects are installed, the amount of renewable energy shifted will be verified via the NYSERDA Distributed Generation Integrated Data System website or other remote monitoring systems. This verification will be conducted according to the International Performance Measurement & Verification Protocol (IPMVP) method(s) most appropriate. • Data from Field Verification/Impact Evaluation can be used to help lend confidence in the market, especially among other end users.
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Verified Gross Savings Specifications

Verified Gross Savings Specification	
Date of CEF filing: See cover page	
CEF Chapter Name: Energy Storage	
Initiative Name	Reducing Barriers to Deploying Distributed Energy Storage
Initiative Period	This initiative was originally offered in September 2019 and was not previously identified with a different name.
Program Description	This initiative targets key barriers limiting energy storage adoption in three sectors: customer-sited (behind-the-meter systems), distribution system, and bulk system, and grid impacts from electrifying the transportation system.
Gross Savings Methodology	As per the New York State Energy Storage Roadmap, the resulting public benefits of the deployment of 3,000 MW of energy storage are expected to include over \$3 billion in gross lifetime benefits to New York's utility customers, approximately 30,000 new jobs, the elimination of approximately 2 million metric tons of greenhouse gas (GHG) emissions, and the avoidance of criteria air pollutant emissions such as nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter deployed in New York over the life of the storage assets. ¹⁹ The carbon benefits from adding energy storage grow substantially as the state approaches higher levels of renewable generation that would otherwise be curtailed,

¹⁹ Case 18-E-0130, New York State Energy Storage Roadmap and Department of Public Service / New York State Energy Research and Development Authority Staff Recommendations (filed June 21, 2018).

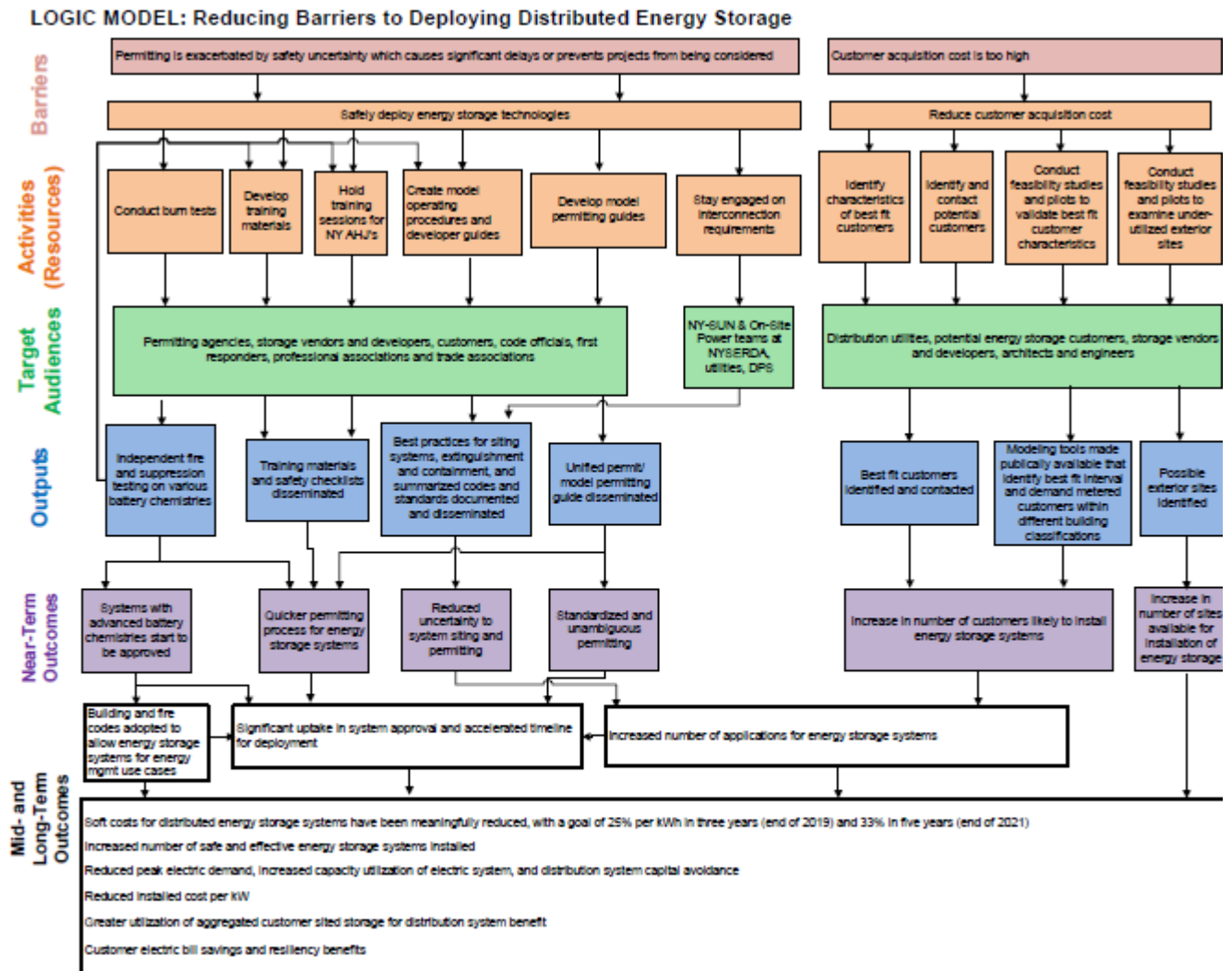
	especially at night. Charging the storage with off-peak renewable energy to discharge and displace fossil generation during peak periods of demand will provide a substantial benefit to the state’s carbon footprint and air quality.
Realization Rate (RR)	No RR has been determined for this program within the preceding five-year time frame
Planned VGS Approach	Reducing Barriers to Deploying Distributed Energy Storage will undergo Gross Savings Analysis for program period 2019-2021. eDetails related to the Gross Savings Analysis methodology will be submitted in an EM&V Plan in Q1 2021. The estimated completion of the Gross Savings Analysis Report is Q4 2021. NYSERDA will competitively procure an independent evaluator to perform the Gross Savings Analysis in Q1 2021
Exemption from EAM Status	N/A

Verified Gross Savings Specification	
Date of CEF filing: See cover page	
CEF Chapter Name: Energy Storage	
Initiative Name	Solar plus Energy Storage
Initiative Period	This initiative was originally offered in September 2019 and was not previously identified with a different name.
Program Description	This initiative works in conjunction with the Reducing Barriers to Deploying Distributed Energy Storage to address soft cost barriers, as well as enabling industry and utilities to address interconnection, metering and compensation mechanisms associated with paired combination systems sooner than otherwise would have occurred. This energy storage market support is closely related to new Value of Distributed Energy Resource tariffs in that it improves the value of distributed renewable energy by shifting the energy output to more valuable times of day.
Gross Savings Methodology	As per the New York State Energy Storage Roadmap, the resulting public benefits of the deployment of 3,000 MW of energy storage are

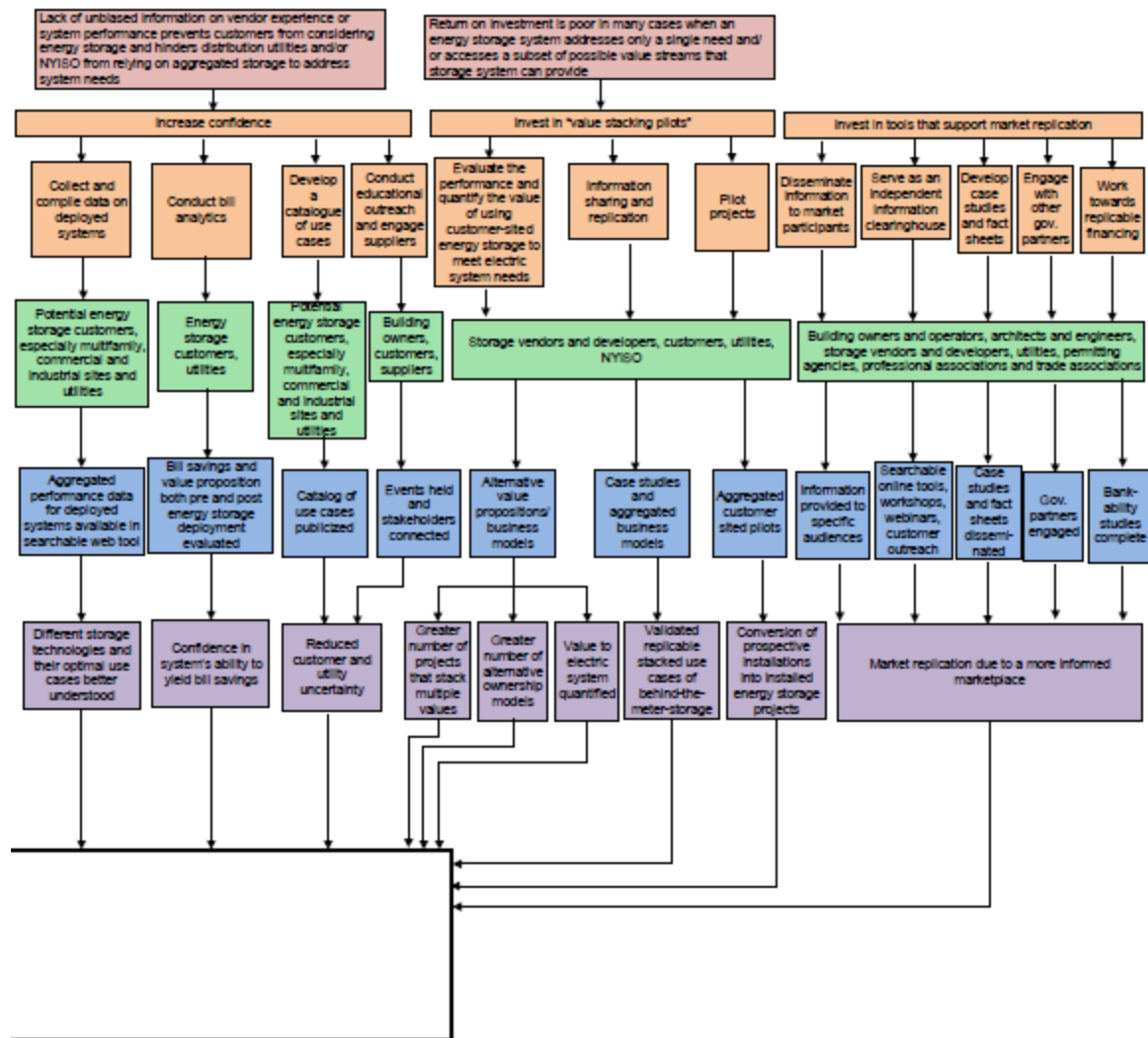
	<p>expected to include over \$3 billion in gross lifetime benefits to New York’s utility customers, approximately 30,000 new jobs, the elimination of approximately 2 million metric tons of greenhouse gas (GHG) emissions, and the avoidance of criteria air pollutant emissions such as nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter deployed in New York over the life of the storage assets.²⁰ The carbon benefits from adding energy storage grow substantially as the state approaches higher levels of renewable generation that would otherwise be curtailed, especially at night. Charging the storage with off-peak renewable energy to discharge and displace fossil generation during peak periods of demand will provide a substantial benefit to the state’s carbon footprint and air quality.</p>
Realization Rate (RR)	No RR has been determined for this program within the preceding five-year time frame
Planned VGS Approach	Solar Plus Energy Storage will undergo Gross Savings Analysis for program period 2019-2021 and details related to the Gross Savings Analysis methodology will be submitted in an EM&V Plan in Q1 2021. The estimated completion of the Gross Savings Analysis Report is Q4 2021. NYSERDA will competitively procure an independent evaluator to perform the Gross Savings Analysis in Q1 2021
Exemption from EAM Status	N/A

²⁰ Case 18-E-0130, New York State Energy Storage Roadmap and Department of Public Service / New York State Energy Research and Development Authority Staff Recommendations (filed June 21, 2018).

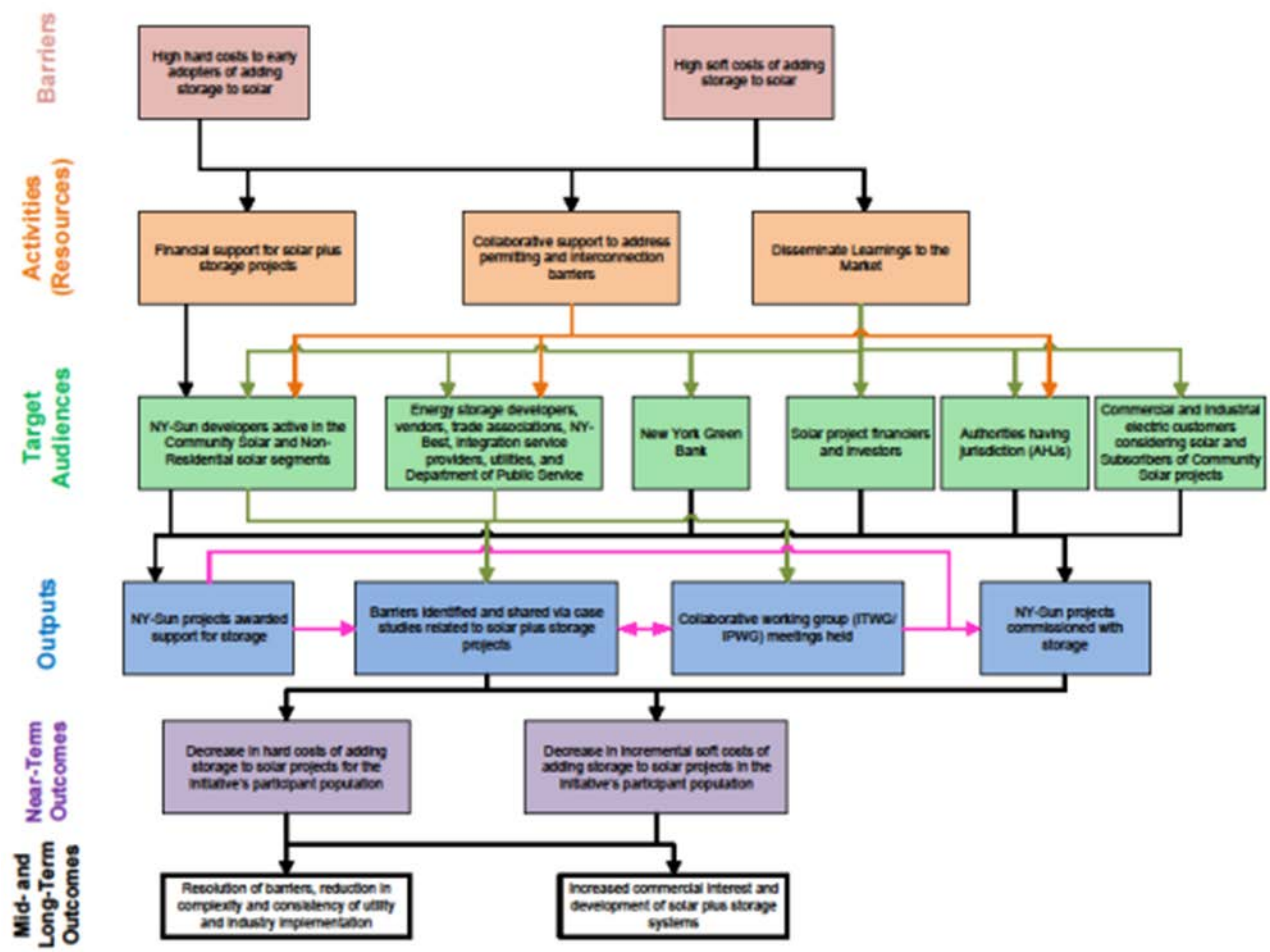
Appendix A – Logic Model



Model continued on next page



LOGIC MODEL: Solar Plus Energy Storage



Appendix B | Initiative Budget and Benefits Summary

Reducing Barriers to Distributed Deployment

		Benefits Acquisition Plan														
Direct Benefit	Plan Total	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Energy Efficiency MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficiency MWh Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficiency MMBtu Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficiency MMBtu Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficiency MW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable Energy MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable Energy MWh Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable Energy MW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2e Emission Reduction (metric tons) Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2e Emission Reduction (metric tons) Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Participant Bill Savings Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Participant Bill Savings Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leveraged Funds	3,954,101	-	-	-	-	-	-	3,954,101	-	-	-	-	-	-	-	-

Indirect Benefit	Plan Total	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Energy Efficiency MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficiency MMBtu Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable Energy MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable Energy MW Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2e Emission Reduction (metric tons) Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2e Emission Reduction (metric tons) Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Energy Usage	Plan Total	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Direct Energy Usage MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Direct Energy Usage MWh Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Direct Energy Usage MMBtu Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Direct Energy Usage MMBtu Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indirect Energy Usage MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indirect Energy Usage MWh Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indirect Energy Usage MMBtu Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indirect Energy Usage MMBtu Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Participants	Plan Total	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Customers Engaged	169	-	1	17	-	-	12	15	16	16	16	16	15	15	15	15
Vendors Engaged	176	-	-	2	-	-	10	16	15	18	21	21	21	20	20	12
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	345	-	1	19	-	-	22	31	31	34	37	37	36	35	35	27

		Budget Expenditures Plan														
Budget	Plan Total	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Incentives and Services	4,937,041	-	-	2,000	74,729	2,016,995	225,000	225,000	225,000	225,000	500,000	500,000	400,000	300,000	143,317	100,000
Implementation	7,118,349	-	105,885	1,193,873	752,981	77,420	150,000	300,000	600,000	600,000	600,000	600,000	600,000	500,000	500,000	538,190
Research and Technology Studies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tools, Training and Replication	12,394,609	-	120,868	1,504,608	2,061,908	370,844	150,000	500,000	750,000	750,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,186,381
Business Support	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	24,450,000	-	226,753	2,700,481	2,889,619	2,465,259	525,000	1,025,000	1,575,000	1,575,000	2,100,000	2,100,000	2,000,000	1,800,000	1,643,317	1,824,571

Table Notes:
 * With the May 2021 IPPR filing of all investment plans, each Appendix B table that accompanies an investment plan was transitioned from yearly commitment-based budget and benefit plans to plans that forecast expenditures and acquired benefits.
 a. Starting 2019, all Storage-related program benefits metrics as well as activities, outputs, & outcomes are tracked and reported on in the annual "State of Storage" report.

Appendix B | Initiative Budget and Benefits Summary

Solar Plus Energy Storage

		Benefits Acquisition Plan														
		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Direct Benefit	Plan Total															
Energy Efficiency MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficiency MWh Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficiency MMBtu Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficiency MMBtu Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficiency MW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable Energy MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable Energy MWh Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable Energy MW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2e Emission Reduction (metric tons) Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2e Emission Reduction (metric tons) Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Participant Bill Savings Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Participant Bill Savings Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leveraged Funds	20,152,010	-	-	-	-	-	4,980,317	15,171,693	-	-	-	-	-	-	-	-
Indirect Benefit	Plan Total															
Energy Efficiency MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Efficiency MMBtu Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable Energy MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable Energy MW Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2e Emission Reduction (metric tons) Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2e Emission Reduction (metric tons) Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Energy Usage	Plan Total															
Direct Energy Usage MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Direct Energy Usage MWh Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Direct Energy Usage MMBtu Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Direct Energy Usage MMBtu Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indirect Energy Usage MWh Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indirect Energy Usage MWh Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indirect Energy Usage MMBtu Annual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indirect Energy Usage MMBtu Lifetime	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Participants	Plan Total															
Participants	15	-	-	-	-	-	4	11	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	15	-	-	-	-	-	4	11	-	-	-	-	-	-	-	-
		Budget Expenditures Plan														
		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Budget	Plan Total															
Incentives and Services	40,000,000	-	-	-	-	-	9,885,500	30,114,500	-	-	-	-	-	-	-	-
Implementation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Research and Technology Studies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tools, Training and Replication	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Business Support	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	40,000,000	-	-	-	-	-	9,885,500	30,114,500	-	-	-	-	-	-	-	-

Table Notes:

* With the May 2021 IPPR filing of all investment plans, each Appendix B table that accompanies an investment plan was transitioned from yearly commitment-based budget and benefit plans to plans that forecast expenditures and acquired benefits.

- a. Starting 2019, all Storage-related program benefits metrics as well as activities, outputs, & outcomes are tracked and reported on in the annual "State of Storage" report.
- b. This initiative will leverage the activities in the Reducing Barriers to Deploying Distributed Energy Storage initiative to disseminate learning to the market, therefore the budget here is solely for providing financial assistance.

Appendix C | Initiative Outputs and Outcomes Summary

Reducing Barriers to Distributed Deployment

	Indicators	Baseline (Before/Current)	2019 Target	2020 Target	2021 Target
			(cumulative)	(cumulative)	(cumulative)
Outputs	Total number of projects by project size and technology type seeking approval by authorities having jurisdiction such as local fire and building departments (AHJs)	approx. 15 lead acid and li-ion batteries and thermal storage	0	0	150 systems including lead acid, li-ion, flow, and other chemistries and thermal storage
	Number of projects and type of energy storage systems approved by AHJs	5 lead acid battery systems and 2 thermal storage	0	0	100 systems including lead acid, li-ion, flow, and other chemistries and thermal storage
Outcomes	Cycle time of projects from customer proposal to commissioning	Lead acid median of 19.5 months. Thermal storage not provided.	0	0	6-18 months
	Soft costs \$ decline per kWh of battery storage based on CEF strategies	Lead Acid: Min. \$50/kWh; Max. \$100/kWh (Median of 20% of average soft cost of installed lead acid systems). Lithium ion and other storage types not provided.	0	0	Reduce soft costs by up to \$50 per kWh for a distribution/bulk storage system and up to \$150 per kWh for a customer sited system by 2025 compared to a 2017-18 baseline
	MWs of energy storage deployed from value stacking pilots	\$3,716,899 in NYSEDA funding and \$3,954,101 in co-funding to deploy a total 6 MW, 12 MWh of energy storage at three community solar installations.	0	0	6 MW
	Percentage of distributed energy storage installations deployed throughout the New York market that provide value to two or more parties (customer, distribution utility, load serving entity, NYISO)	<10%	0	0	50%

Table notes

- a. A 0 (zero) denotes that the actual value is currently believed to be zero for baseline/market metrics.
- b. Revised baseline metrics reflect the recently-completed Energy Storage market baseline evaluation. This study will be available publicly on NYSEDA’s website and in the DPS Document and Matter Management system in the near future.
- c. The separate internal NYSEDA program-led distributed storage soft cost baseline utilized a GTM Research study and then augmented that data with pricing from New York State deployments under the Demand Management Program and vendor inquiries.
- d. Soft cost reduction outcomes are collectively supported through energy storage incentives and technical assistance. Both sets of activities work in parallel to reduce the non-hardware costs of energy storage installations. Storage incentives are funded through \$310 million approved by DPS under NYSEDA’s Energy Storage Market Acceleration Incentives Implementation Plan, filed under Case 18-E-0130, as well as \$40 million in CEF funding in the Solar Plus Energy Storage initiative, filed in the Energy Storage Chapter under Matter Number 16-00681. Technical assistance activities to reduce soft costs are provided through \$24.45 million of CEF funding approved under the Reducing Barriers to Distributed Energy Storage initiative, filed in the Energy Storage Chapter under Matter Number 16-00681.
- e. This value is based on internal discussions with developers as part of the separate NYSEDA program-led distributed storage soft cost baseline.

Appendix C | Initiative Outputs and Outcomes Summary

Solar Plus Energy Storage

	Indicators	Baseline	2019 Target	2025 Target
		(Before/Current)	(cumulative)	(cumulative)
Outputs	Number of NY-Sun projects awarded support for storage	0	16	16
	MW of storage capacity awarded for support	0	38.3	40
	MWh of storage awarded support	0	123.8	130

Table notes

- a. A 0 (zero) denotes that the actual value is currently believed to be zero for baseline/market metrics.
- b. The separate internal NYSERDA program-led distributed storage soft cost baseline utilized a GTM Research study and then augmented that data with pricing from New York State deployments under the Demand Management Program and vendor inquiries.
- c. Soft cost reduction outcomes are collectively supported through energy storage incentives and technical assistance. Both sets of activities work in parallel to reduce the non-hardware costs of energy storage installations. Storage incentives are funded through \$310 million approved by DPS under NYSERDA's Energy Storage Market Acceleration Incentives Implementation Plan, filed under Case 18-E-0130, as well as \$40 million in CEF funding in the Solar Plus Energy Storage initiative, filed in the Energy Storage Chapter under Matter Number 16-00681. Technical assistance activities to reduce soft costs are provided through \$24.45 million of CEF funding approved under the Reducing Barriers to Distributed Energy Storage initiative, filed in the Energy Storage Chapter under Matter Number 16-00681.