REV Demonstration Project Outline

Storage On Demand

Dated: February 27, 2017

Table of Contents

1.0 EXECUTIVE SUMMARY

While recent advances in battery storage technology have made it suitable for grid operation, the cost to build and operate under the current regulatory structure prevents a high level of storage asset utilization and results in the prospect of a low return on investment. A new business approach is needed to allow for sharing and enhanced utilization of storage assets (batteries) to allow for economical investment.

The Reforming the Energy Vision ("REV") initiative's goals include changing the energy system to incorporate a more distributed and resilient architecture and creating new business models to enable utilities and third parties to successfully and profitably build and operate this new system.[1] Consistent with these goals, this demonstration project tests a technology solution and business model that provides the opportunity for two parties to utilize transportable batteries at a higher rate by sharing deployment of the batteries for different purposes at different times throughout the year. The mobility of the technology solution will enable the batteries to be deployed for multiple utility needs over their lifetime, further increasing utilization and solution benefits.

Consolidated Edison Company of New York, Inc. ("Con Edison" or the "Company") expects the Storage On Demand Project (the "Project") will provide the following benefits:

- Enhance the Company's ability to better manage capacity constraints on its distribution system through transportable batteries that can meet a variety of needs;
- Provide empirical data to support future integration of grid-scale energy storage in New York Independent System Operator ("NYISO") markets;
- Benefit the distribution system by clipping peak demands and lowering energy distribution costs; and
- Offset transportable battery solution costs with revenues earned from wholesale market participation.

In support of the Project, Con Edison will partner with NRG Energy, Inc., a Fortune 200 company that owns and operates over 50,000 MW of generation capacity nationwide, to develop and construct the Queens Energy Storage Terminal at NRG's existing Astoria Generating Station. The 1MW/4MWh Project will consist of two mobile battery trailers and one mobile electrical switchgear trailer as shown in Figure 1.

[1] https://www.ny.gov/sites/ny.gov/files/atoms/files/WhitePaperREVMarch2016.pdf

Figure 1: Con Edison and NRG Deployable Storage Asset

The storage assets will be deployable by Con Edison, as needed, for transmission deferral, distribution deferral, or system emergencies, whether for pre-determined periods of anticipated seasonal peak loads or in response to unanticipated contingency events. The mobility of the solution will allow the assets to serve multiple short-term utility needs over the life of the batteries. This will maximize transmission and distribution value when compared with stationary assets.

When not needed by Con Edison or its customers, the storage assets will be located at NRG's Astoria generating facility in NYISO Zone J and will participate in the wholesale electricity market by providing one or more of the following services:

- Day ahead and real time markets;
- Frequency regulation; or
- Operating reserves.

Following a successful demonstration period, Con Edison and other entities will have the opportunity to expand the concept within New York State and beyond.

2.0 BUSINESS MODEL OVERVIEW

2.1 PROBLEM/ MARKET OPPORTUNITY

The standard behind-the-meter energy-storage business model creates value for customers and the grid, but tends to leave significant value on the table. According to the Rocky Mountain Institute ("RMI") report titled "The Economics of Battery Energy Storage," the majority of battery systems sit unused or underutilized for well over half of the system's lifetime.[2] For example, an energy storage system dispatched solely for demand charge reduction is utilized for only 5–50 percent of its useful life. The RMI report postulates that dispatching batteries for a primary application and then re-dispatching them to provide multiple, stacked services would create additional value for all electricity system stakeholders. The Project addresses this wasted value by creating an innovative multi-use energy storage asset that can be utilized by multiple stakeholders and deployed to capture multiple services, including transmission and distribution ("T&D") deferral, wholesale market revenues, and contingency response. In addition, as a mobile solution the assets can be deployed to multiple Con Edison locations during their useful lives to maximize T&D deferral benefit opportunities.

Traditional T&D upgrades typically require an overbuild of capacity relative to network need, driven by the size of available equipment. For example, to solve a 200 kW system constraint during peak hours of a distributed network, a 1,000 kW transformer must be installed. A Non-Wire Alternative ("NWA") allows this investment, and the associated carrying costs, to be deferred until the constraint size is more aligned with the solution as illustrated in Figure 2.

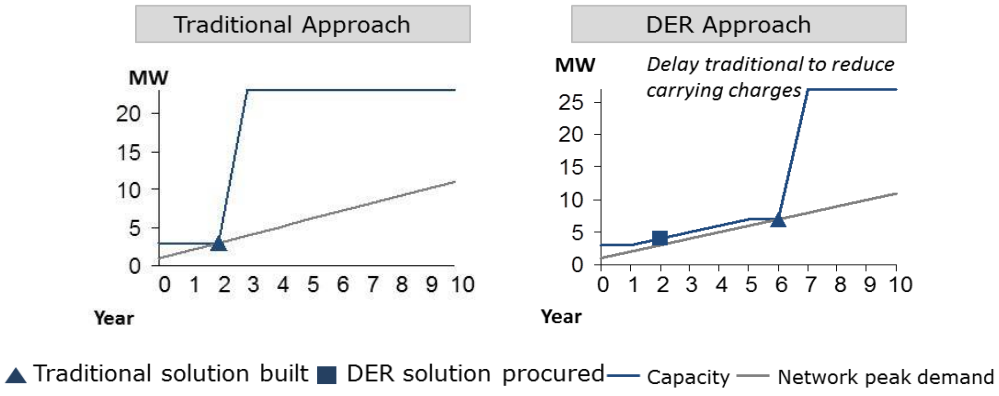


Figure 2: Value of a NWA Solution

[2] Fitzgerald, G., Mandell, J., Morris, J., & Touati, H. (n.d.). The Economics of Battery Storage. Retrieved from http://www.rmi.org/Content/Files/RMI-TheEconomicsOfBatteryEnergyStorage-FullReport-FINAL.pdf

REV seeks to increase the use and coordination of Distributed Energy Resources ("DER"), such as energy storage, and make DER a fundamental part of the planning and operation of an interconnected, modernized grid.[3] Importantly, energy storage offers a way to increase the adoption of renewable energy resources. With greater penetration of intermittent resources, the ability to simultaneously meet load with supply becomes more challenging. By removing the need to instantaneously meet electric demand with electric generation, energy storage offers a mechanism to allow energy production and consumption to vary across time. Thus, not only can storage solutions balance supply and demand, they can fundamentally alter the century old planning and market design model.

Energy storage deployments are generally increasing throughout the U.S. (shown in the figure below). GTM Research expects significant growth in the U.S. energy storage market over the next five years across all sectors, resulting in a 2,081 MW annual market in 2021 – nine times the size of the 2015 market, and seven times the size of the 2016 market.[4]

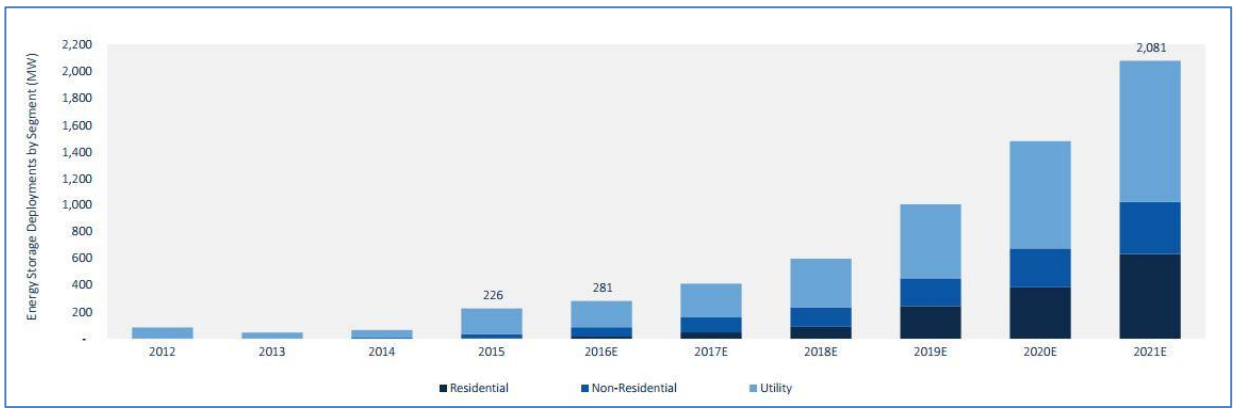


Figure 3: U.S. Energy Storage Deployments
Source: GTM Research, ESA US Energy Storage Monitor, Q2 2016

GTM Research and the Energy Storage Association ("ESA") reported a reduction in battery system prices in 2015, keeping with trends in previous years. This trend is enabled by higher deployment volumes and is driven by the following factors:

- Reduction in battery pack costs, including batteries, wiring, racking and battery management systems;

[3] http://www3.dps.ny.gov/W/PSCWeb.nsf/All/CC4F2EFA3A23551585257DEA007DCFE2?OpenDocument
[4] ESA US Energy Storage Monitor. (n.d.). *Greentech Media Research*. Retrieved from https://www.greentechmedia.com/research/subscription/u.s.-energy-storage-monitor

- Improvements in system integration, required to incorporate batteries with the power conversion systems ("PCS") and the grid; and
- Reduction in balance-of-system costs, in part due to cost pressure from PCS vendors.

A key challenge for energy storage, however, is to ensure that the monetizable value exceeds the costs required to install and operate the system. Even as costs continue to decline, it is necessary to increase the value of energy storage through the revenue side, and one way to do this is to introduce multiple revenue streams. A battery storage system that can be dispatched to defer multiple T&D investments and also realize wholesale benefits captures more revenue streams through higher utilization of the battery asset.

2.2 SOLUTION

The Project involves a technology solution and innovative business model whereby Con Edison and NRG deploy shared 1 MW/4 MWh mobile storage assets, as depicted in Figure 1 in the Executive Summary. NRG will partner with LG Chem and Greensmith to design, build and deliver the mobile storage solution for Con Edison. LG Chem will provide the batteries and equipment while Greensmith will act as the integration provider and deploy a proprietary energy management system.

Business Model Overview

The assets will be managed by NRG when participating in the NYISO markets (including but not limited to frequency regulation, operating reserves, day-ahead and real time energy markets). When not deployed elsewhere, the assets will be housed at NRG's industrial power plant site in Astoria, Queens, within Zone J, where NRG has the physical space, existing interconnection, experienced staff, safety infrastructure, control centers and sophisticated business tools for optimal operation. As a Project partner, NRG is providing the space for the assets and existing electrical interconnection equipment and at no additional cost as an in-kind capital contribution.

The Project is unique in that it is an innovative partnership that will leverage wholesale market participation to reduce the overall effective cost. Con Edison will pay for the capital cost of the storage assets and retain 100 percent of their ownership. Additionally, Con Edison will pay a Mobility Option Premium to NRG for operating and maintaining the units when they are located at the Astoria site and ensuring that they are available for Con Edison as needed. Through the Mobility Option Premium, NRG will recover certain costs to operate and maintain the units, including the cost of labor, insurance costs, taxes, utilities and consumables.

In exchange for the Mobility Option Premium, NRG will reimburse Con Edison an annual payment, to the extent it is available, from gross margin generated by providing NYISO wholesale services. Gross revenue generated from the wholesale market will first be applied to Con Edison up to the amount of the Mobility Option Premium. In the event that NRG is able to annually generate amounts through the NYISO wholesale market that are in excess of the Mobility Option Premium, the additional gross margin will be split between Con Edison and NRG. This shared revenue opportunity incentivizes both Con Edison and NRG Energy to work collaboratively to maximize the value of the Project during the demonstration period.

During the term of the Project, NRG will also provide the necessary real estate at its Astoria site at no additional cost to Con Edison. With the planned revenue sharing mechanism between Con Edison and NRG, the Company anticipates that the entire cost of the system will be less than the cost of an equivalent system purchased by Con Edison and used exclusively for T&D deferral.

Community Engagement

The Company has and will continue to prioritize community engagement as an important aspect of REV demonstration projects. It is important for the Company to be proactive in addressing community concerns in the successful deployment of mobile battery assets. As Con Edison begins to identify potential networks for distribution support, the Company will incorporate information about the mobile storage system in communications with the local community boards. The information will include reliability and environmental benefits. When the Company identifies the specific location in the months prior to summer peak planning, Con Edison will present to the local community board and provide community notifications to the neighboring businesses and residents. Materials will be prepared to provide more specific information about the battery storage system and operational plan. The Company will also reach out to local stakeholders including local chambers of commerce, business improvement districts, and local development corporations. The Company will respond to community concerns and work collaboratively to find a suitable deployment solution for the affected communities.

Interconnection

Con Edison will handle interconnection when the assets are deployed for T&D deferral upgrade or for emergency applications.

NRG will enroll the assets at its site under the Small Generator Interconnection Process and will address all other steps required for NYISO market participation. NRG will also work with the NYISO and Con Edison to enable the assets to participate in wholesale services while

deployed at sites in the distribution system providing utility-related services. However, this will not be available at the outset and will likely require rule and business process changes at the NYISO. For example, the bulk interconnection process for wholesale market participation, and the related planning tools, assumes a stationary resource. This is especially relevant when a moveable resource is looking to participate in the capacity market. Thus, any capacity market participation is likely only at a later stage in the project development, and projected market revenues reflect this fact. Energy and ancillary service market participation, however, is certainly possible. While NYISO is currently evaluating new market designs for storage and other DER integration and optimization, there are already mechanisms in place for storage to participate in the NYISO energy and ancillary services markets.

Mobility

The mobile units will be available for Con Edison's transport to other locations as needed, whether at pre-determined periods throughout the year for anticipated seasonal peak load periods, to serve temporary load increases, or in response to unanticipated contingency events such as multiple feeders out of service in a network. While a battery module is off-site for Con Edison's use, the asset can be used to mitigate peak loads for T&D deferral. T&D upgrade deferral may require small amounts of energy storage to delay, or possibly avoid entirely, investments in T&D system upgrades. Through the deployment of a relatively small amount of energy storage, which would be located downstream of overloaded T&D equipment, the peak demand served by the T&D equipment would be reduced. As a result, the costs associated with a T&D upgrade can be deferred or possibly avoided.

It may also be possible for NRG to bid the units into the wholesale markets while deployed, subject to confirming this capability with the NYISO. The storage asset would be deployable in Con Edison's system in one block made up of three containers with a capability of 1 MW/4 MWh of operation. When the assets are no longer needed at the Con Edison location, they will return to the site (depot) at NRG Astoria where they will resume their normal participation in the wholesale markets. This process can be repeated as necessary during the demonstration period and through the operational life of the assets.

Wholesale Market Participation

NRG Energy will manage the Project's participation in the NYISO wholesale electricity market. In 2015, NRG launched the Distributed Asset Real-Time Operations Desk – or dDesk. NRG's dDesk is located within NRG's Commercial Operations trade floor in Princeton, NJ. It is one of five 24/7 real-time operations desks that NRG has at this location. This desk is

specifically focused on distributed assets that are located across the United States, with heavy concentrations of assets in Colorado, Texas and Minnesota. The asset mix managed by the dDesk is a very diverse approximately 250 MW portfolio, ranging from back-up generators to bi-directional vehicle charging to complex microgrid facilities. Services vary by asset and are compiled from a mix of: alarm monitoring, asset testing, utility or ISO program dispatch (for programs such as Demand Response), fuel monitoring and ordering, and local and grid asset optimization (which includes efforts such as peak shaving and demand charge management). The desk's unique location within NRG's Commercial Operations trade floor gives it unparalleled visibility into markets, weather, and operations across the country – allowing the desk to easily operationalize many services based on customer needs.

Deployment

Each remote deployment will require Con Edison to provide a cleared and level site with sufficient space required for the battery and electrical trailers to be parked either end to end or side by side. Each trailer is approximately 40 feet long by 8 foot 7" inches wide with a recommended 5 foot clearance between each trailer. The battery trailers are sized to meet the height and weight restrictions of the New York City Department of Transportation ("NYC DOT"); however, the weight of the trailer will likely require an overweight permit (within routine permit limits). The three trailers will require approximately 5,000 square feet for parking and accessibility. Each of Con Edison's sites will need available interconnection to transmission or distribution systems. The interconnection voltage will be determined during the design phase to best suit Con Edison's needs. Con Edison will be responsible for the cost of transporting the mobile battery system from NRG's facility to the desired location for each deployment. This includes supplying tractor cabs to transport trailers and setting up the necessary cribbing to support the trailers. NRG anticipates an initial maximum 2.5 day lead time to move the energy storage system from the Astoria site to a Con Edison location. Con Edison and NRG intend to reduce this lead time using learnings from Project operations, to enable emergency use of the assets in the future. The costs of transportation and deployment services, as well as the costs to connect and disconnect the batteries at the Con Edison sites will be the responsibility of Con Edison. Con Edison anticipates engaging Power Edison to assist with the transportation and deployment logistics. As a New York area based startup focused on mobile energy storage solution, Power Edison brings the technical experience to deal with any logistics challenges that may arise. Given the effort required for initial deployment of these assets, Con Edison anticipates the majority of deployment durations to extend from multiple weeks to several months. For this reason, it is important for the battery system to continue to operate in whichever wholesale markets are available

to maximize revenue. Con Edison and NRG will work together with the NYISO on this current market barrier.

Energy Management Software

NRG Energy has selected Greensmith as the energy storage management system and integration provider. Greensmith has deep experience in the battery storage space with more than 40 installations and over 70 megawatts of energy storage. Greensmith will deploy a plant controller that will interact with the batteries and a power control system layered on top of the battery management system. Greensmith utilizes a software-based plant controller, Greensmith Energy Management System ("GEMS"), which interacts directly with the battery, the plant control system and the battery management system. Over one-third of all energy storage installed in the United States is running on the GEMS platform.

Greensmith's energy management software allows for multiple users (i.e., NRG and Con Edison) to access the same system and apply different security protocols and control levels to each user. The benefits include:

- Battery Optimization - GEMS is tightly integrated with the battery management system to leverage Greensmith's battery optimization algorithms - extending the life of the system; and
- Revenue-Stacking –generate multiple revenue streams by stacking applications, dynamically adjusted based on market conditions and adapting to regulatory changes.

Communication

Access to real time operational data will be available to Con Edison and NRG via the GEMS web portal. While located at NRG's Astoria site, the dDesk will optimize the asset's participation in wholesale markets through NRG's connection to NYISO. Throughout the Project, Con Edison will provide electronic signals to communicate T&D deferral priority both prior to dispatch and while assets are deployed outside Astoria.

Anticipated Future Market Model

This Project is intended to test the market appetite for mobile storage and provide operational data to support the ability of mobile storage to provide T&D value and wholesale market services. The market does not currently exist for third-party developers to purchase off-the-shelf mobile storage solutions or for mobile storage to participate in all NYISO market services. Additionally, mobile batteries have not been used to meet utility congestion needs. This Project will animate these markets while providing valuable operational data to demonstrate value of mobile storage solutions. In the Anticipated

Future Market, third-party developers should be able to purchase or develop mobile storage solutions and offer "storage as a service" to various utilities and customers, both within and outside of NY, assuming these users do not have overlapping support needs. For example, Con Edison will likely contract for storage services during summer peaking needs. However, in upstate NY, Pennsylvania, and Canada, the utilities peak in the winter and would likely contract for storage during this season. If the developer can acquire multiple customers, and participate in wholesale markets the remainder of the time, each customer would pay for only the battery capacity used during the months contracted. This would lower the cost of service for the solution to both Con Edison and our customers. The successful utility use of the mobile storage solution for T&D benefit will provide needed operational evidence to prove the value of these assets. This operational proof, in addition to work with NYISO on battery participation in wholesale markets, will reduce operational and revenue uncertainty that is currently a barrier to the solution, thereby animating a market for mobile storage solutions.

2.3 HYPOTHESES BEING TESTED

Via this demonstration project Con Edison is testing three primary hypotheses:

1. MW-scale batteries can be valuable in generating revenues in NYISO wholesale markets, which will offset costs of T&D deferral assets without impacting primary function;

2. Mobility of assets enables the system to solve multiple short-term problems over the course of the batteries' operating lives, with the increased T&D benefits offsetting the incremental cost of mobile solutions compared to a stationary battery installation; and

3. Mobile units will be capable of deployment within emergency operational timeframes, increasing value to the Company.

2.4 LINKAGES TO DEMO PRINCIPLES

Principle	Proposed Measures
Partnership between utility and third-party service provider.	✓ Con Edison will partner with NRG and its existing strategic partnerships with LG Chem, a leader in mobile storage solutions, and Greensmith, a leader in energy storage software and integration services.
Utility identify problems and market should respond with solutions.	✓ Con Edison has identified multiple locations that could benefit from a storage solution. NRG has developed a mobile battery solution that will address these needs while utilizing wholesale market revenues to offset cost of the solution.
Clear delineation of how generated economic value is divided between the customer, utility, and third-party service provider; proposal for how much capital expense should go into the rate-base versus competitive markets.	✓ Con Edison will own the batteries and receive primary rights for utilization of the assets. These assets can be deployed by Con Edison to relieve planned and unplanned T&D issues. The wholesale market revenues earned by the assets will be shared between Con Edison and NRG. As a majority of wholesale revenues will be used to offset cost of assets, customers will benefit from lower cost T&D solutions. NRG will also enter into a contract with Con Edison for the operation and maintenance of the assets during the demonstration period.
Market for grid services should be competitive.	✓ The project offers a mechanism for testing multiple value propositions offered by a battery storage system that will participate in the wholesale market.

Principle	Proposed Measures
Utility and third-party service provider(s) should consider deploying in their demonstrations advanced distribution systems, including two-way communications, real time operation of dynamic load, and other system technologies that support awareness, flexibility, efficiency and cost-effectiveness.	✓ The Project will apply Greensmith's proven energy management software platform to optimize the performance and health of the energy storage system, ultimately lowering operating costs by minimizing degradation to the extent possible. ✓ The Project will provide a platform to inform the ability to utilize mobile battery storage as a cost-effective solution to manage temporary distribution system peak overloading through a NWA. ✓ NRG and Con Edison will establish two-way communications by which Con Edison has visibility into dDesk operations and can electronically schedule batteries for utility needs.

3.0 MARKET ATTRACTIVENESS

3.1 UNIQUE VALUE PROPOSITION

3.1.1 PARTICIPATING CUSTOMER

The Project will enable operational and reliability improvements and cost savings that will positively affect all of Con Edison's customers. Customers will benefit when Con Edison deploys the mobile units at multiple locations in its system for T&D upgrade deferral or temporary local network support. In addition, the experience gained from the integration of these battery storage assets into the system, and the impact these learnings will have on future tariff discussions, will benefit all customers across New York State.

3.1.2 PARTNER/THIRD PARTY

The solution proposed is an innovative model which enables joint utilization of battery energy storage assets by Con Edison and NRG. This strategy allows the assets to be shared for maximum utilization and hence provide better economics for both parties as compared to the parties providing storage individually.

Con Edison will pay a Mobility Option Premium to NRG. In exchange, NRG will provide a number of services to the Project, including performing all necessary routine, preventative maintenance on the units. NRG's dDesk will be responsible for generating NYISO wholesale market revenues for the Project while the assets are located at the Astoria site and potentially while the assets are deployed at a Con Edison location. With its diverse approximately 250 MW portfolio, ranging from back-up generators to bi-directional vehicle charging to complex microgrid facilities, NRG's dDesk is uniquely positioned to manage the commercial operations for the Project assets. As a Project partner, NRG is providing the space for the assets and existing electrical interconnection equipment at no additional cost as an in-kind capital contribution.

Through the Mobility Option Premium described above, NRG will recover certain costs to operate and maintain the units including the cost of labor, insurance, certain taxes, utilities and consumables. Gross revenue generated from the wholesale market will first be applied to Con Edison up to the amount of the Mobility Option Premium. In exchange, NRG will agree to reimburse Con Edison on an annual basis the full Mobility Option Premium, to the extent funds are available, from gross margin generated by providing NYISO wholesale services. In the event that NRG is able to generate amounts greater than the annual Mobility Option Premium through the NYISO wholesale market, the additional gross margin will be split

between NRG and Con Edison. Revenues from the wholesale market will remain transparent to maintain a successful partnership throughout the term of the Project.

Con Edison is partnering with NRG in order to test the business model. Once the business model is proven, this platform concept could be replicated in Con Edison's service territory by NRG in other markets in which it operates, or by other entities.

Con Edison will engage Power Edison to assist with logistics and transportation of the assets while disconnected from the Astoria site. Power Edison is an entrepreneurial company based in the greater New York area with experience in technologies, financing, and business models for mobile energy storage systems. Power Edison is focused on direct engagement of utilities and their customers to maximize utilization of mobile T&D storage systems.

3.1.3 UTILITY

Direct benefits to Con Edison from the Project include:

- T&D deferral;
- Access to new revenue streams (discussed in Section 5);
- Improved system load factor; and
- The ability to better manage emergency contingency needs.

The most important and valuable of these services would be T&D upgrade deferral. Distribution upgrades are mainly driven by peak demand periods that occur for relatively short times throughout the year. Implementing storage downstream of specific substations can defer large investments (e.g., substation upgrade). Because these assets are mobile, there is a potential for the system to serve as or contribute to multiple NWA solutions. For example, in the first year of the Project, the assets could help to defer the need for the Glendale Project. The Project's participation could yield up to $330,000 annually in T&D deferral benefits and nearly $1 million in avoided costs. Because the Glendale Project responds to a summer need, the assets can be moved back to Astoria to collect wholesale revenues the remainder of the year or deployed to meet other network needs. Larger temporary services requests, such as providing energy for electric cranes required in construction of new buildings, are another potential application of the mobile battery assets.

3.1.4 SYSTEM

The Project has the potential to generate significant benefits for the broader energy system. The Project will contribute to the REV program goal of achieving a secure, reliable, and cost-effective electricity future. By injecting supply and/or shifting load, energy storage offers a

mechanism to balance the intermittency of renewables, thus helping to achieve the State's clean energy vision. The Project will also provide a potential alternative to T&D investment that can be re-deployed as needed.

The information gathered during this demonstration will allow Con Edison to better understand the system-wide potential of mobile battery storage solutions. If the Project proves successful, the availability of modular storage units that can be deployed at the network or substation level can be an important bridge in situations where an overload would otherwise call for a 'traditional' distribution upgrade, creating additional time for appropriate DER-based non-wires alternatives to be designed and implemented.

3.2 CUSTOMER SEGMENTATION

The Project will not directly engage end-use customers. Rather, this model advances the REV objectives by facilitating rapid and flexible deployment of NWAs and other alternatives to traditional infrastructure investments within the Con Edison distribution system. This mobile storage concept will promote more deliberate development and deployment of distributed energy resources to address the REV objective to provide greener energy solutions on a more permanent basis.

3.3 ABILITY TO SCALE

Con Edison expects the demonstration status to span from launch through Q1 2021. Each deployment during the demonstration period will help to identify beneficial uses for mobile energy storage solutions, and promote the development and integration of mobile energy storage into the broader energy markets. At the end of the demonstration period, Con Edison will determine whether the platform meets the criteria established for a viable commercial rollout.

Con Edison believes that the Project is readily scalable within the Company's territory. With a substantial number of host sites available to NRG and Con Edison, the main impediment to scale will be the installed cost for future projects. With accelerating adoption rates of energy storage by utilities and other large-scale energy users and managers, the costs of fully installed energy storage systems will continue to decline. In Con Edison's view, this decline will lead to an economic justification for additional storage services across its service territory – eventually allowing for a broader range of third-party and utility applications for energy storage systems within the distribution system and wholesale market, such as the customer use cases identified during the market assessment.

Specific to the proposed mobile energy storage solution, the installed cost for future installations will likely be lower than for this demonstration project. The solution being offered by NRG requires a significant amount of front-end engineering and design work for the transportable modules. Future installations will be able to capitalize on design work by NRG, Greensmith and LG Chem in support of this demonstration project. All partners will benefit from overall lessons learned, including the operation of a mobile asset by multiple distinct controlling entities in the service of both the transmission/distribution grid and wholesale markets.

For future variations of the business model in which third parties own the assets, the scalability of model is limited only by the distance the developer is willing to transport the batteries. By enabling third-party ownership of the assets, the developer is not constrained to Con Edison's territory or grid needs. An interested developer can build a large mobile fleet sized to as many customers and utilities as it is able to contract and manage.

4.0 DEMONSTRATION PLAN

4.1 METRICS FOR SUCCESS

Con Edison, in partnership with NRG Energy, will execute the Project, which is designed to examine how a mobile energy storage solution can be leveraged to:

- Enhance the ability to better manage capacity constraints on the distribution system through transportable batteries that can meet a variety of needs;
- Enable Con Edison to advance the NYISO market structure for grid-scale energy storage through an empirical project;
- Benefit the distribution system by reducing network peaks; and
- Deliver a lower cost transportable battery solution by earning revenues in the wholesale electricity market when the units are not needed for grid benefits.

Con Edison and NRG will determine key checkpoints to evaluate Project execution and the need for implementation strategy adjustments. NRG plans to deliver quarterly reports to Con Edison which will detail the status of the project, including the achievement of key milestones, applicable remedies if needed, and strategy modifications. The quarterly reports will also serve as an opportunity for Con Edison and NRG to determine whether the metrics outlined below are on track.

Category	Goal	Metric
Design	**Commercial operation of a mobile battery storage solution**	• Successful design / construction of the mobile unit on time and on budget (days delayed, cost overrun)

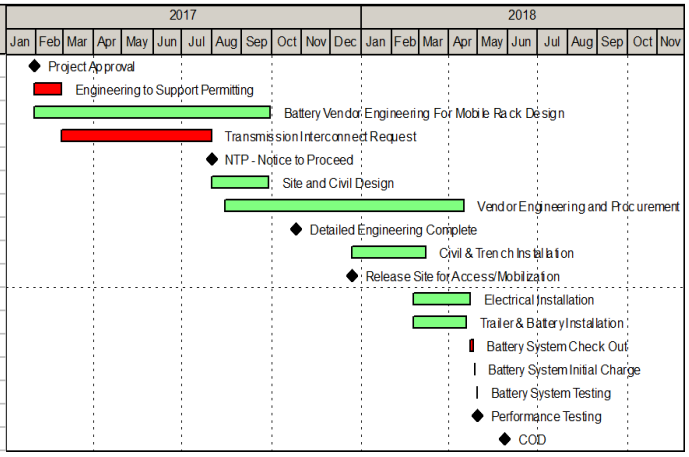
Revenue	**Wholesale revenue**	• Frequency of Market Deployment (%)
		  ◦ Day Ahead
		  ◦ Real Time
		  ◦ Frequency Regulation
		• Market Revenues Earned ($)

Revenue	**T&D deferral**	• Frequency of deployment (%) • Realized benefit of T&D deferral during periods of deployment (MW) • Unit Performance (% variance from nameplate power, energy and availability)
Transportation	**Deploy mobile assets to Con Edison site**	• Transportation Time • Transportation Cost
Regulatory	**NYISO Market Structure**	• Identify regulatory issues that could impact how Con Edison is able to monetize these assets

4.2 TIMELINES, MILESTONES, AND DATA COLLECTION

Timeline

Activity Name	Remaining Duration	Start	Finish
Project Approval	0d	30-Jan-17*	
Engineering to Support Permitting	21d	30-Jan-17	27-Feb-17
Battery Vendor Engineering For Mobile Rack Design	175d	30-Jan-17	29-Sep-17
Transmission Interconnect Request	110d	28-Feb-17	31-Jul-17
NTP - Notice to Proceed	0d	01-Aug-17	
Site and Civil Design	43d	01-Aug-17	28-Sep-17
Vendor Engineering and Procurement	175d	15-Aug-17	16-Apr-18
Detailed Engineering Complete	0d		26-Oct-17
Civil & Trench Installation	55d	22-Dec-17	08-Mar-18
Release Site for Access/Mobilization	0d	22-Dec-17	
Electrical Installation	42d	23-Feb-18	23-Apr-18
Trailer & Battery Installation	40d	23-Feb-18	19-Apr-18
Battery System Check Out	3d	24-Apr-18	26-Apr-18
Battery System Initial Charge	1d	27-Apr-18	27-Apr-18
Battery System Testing	1d	30-Apr-18	30-Apr-18
Performance Testing	0d		30-Apr-18
COD	0d		28-May-18



Milestones

Assuming Project Approval January 30, 2017, the Project's milestone schedule is as follows:

Date	Milestone
January 30, 2017	Project Approval
August 1, 2017	Notice To Proceed
October 26, 2017	Detailed Engineering Complete
December 22, 2017	Site Released for Access and Mobilization (Civil work begins)
February 23, 2018	Start Receipt and Installation of Battery Trailers
Q2 2018	Electrical Interconnection Work Complete
April 30, 2018	Performance Testing
May 28, 2018	Commercial Operation Date

Data Collection

GEMS will serve as the overall site control software designed to collect a range of operational data points, including, but not limited to: the battery state of health ("SOH"), battery state of charge ("SOC"), real time estimations of available energy for dispatch, power flow, auxiliary power usage, environmental conditions, and dispatch statistics. Con Edison and NRG will work jointly to analyze the GEMS data and the storage unit's performance during the demonstration project. This range of operational data points will allow measurement and verification of not only the design and performance metrics from a technical perspective, but will provide important insight for the revenue metrics by informing the true operating costs of the system.

Battery health information such as temperature, degradation, and failure rates will be recorded by GEMS, and combined with support system maintenance and battery augmentation decisions required to maintain the nominal capacity of the plant. These operational characteristics will help validate, with granularity, the availability of and associated costs for the energy storage system to contribute to markets and distribution system support.

In addition, GEMS will maintain and collect data on the temperature and humidity of the enclosure to ensure batteries do not degrade more than anticipated. The bi-directional meters will record charging and discharging energy usage and, separately, auxiliary power usage.

As discussed previously, NRG's dDesk will be responsible for the mobile unit's day-to-day commercial operations and participation in the wholesale markets. Data related to the Project's participation in the wholesale markets will be aggregated and shared with Con Edison on a quarterly basis. Performance, measurement and verification data will also be available to NRG and Con Edison in real time through the Greensmith web portal.

4.3 PARTICIPATION

The Project is intended to be a true partnership between Con Edison and NRG. Con Edison will apply skillsets, staff, and expertise to the Project aligned with its roles and knowledge base as a regulated utility. Similarly, NRG will apply key skillsets that are unique to its focus and product set and aligned to its roles and responsibilities. In addition, Greensmith and LG Chem will serve as key knowledge and product partners.

Con Edison Team Roles and Responsibilities	NRG Energy Team Roles and Responsibilities
• Program Management • Legal and Regulatory • T&D Operations & Maintenance • Information Resources • Community Engagement • Transportation and Logistics (**Power Edison**)	• Project Management • Engineering • Storage Operations & Maintenance • Information Resources • Dispatch / Commercial Operations • Legal and Regulatory • Storage Technology (**LG Chem**) • Energy Management Software (**Greensmith**) • Results Measurement and Reporting (**Greensmith**) • Performance Management (**Greensmith**)

Together, Con Edison and NRG also plan to engage NYISO during the demonstration period to address DER integration and optimization for energy storage assets. NYISO engagement will include addressing the above challenges (e.g., full capacity market participation, planning challenges), in addition to working with NYISO to develop its storage optimization effort.

4.4 OUTREACH TO TARGETED COMMUNITIES

The Company has and will continue to prioritize community engagement as an important aspect of REV demonstration projects. It is important for the Company to be proactive in addressing community concerns in the successful deployment of mobile battery assets. As Con Edison begins to identify potential networks for distribution support, the Company will incorporate information about the mobile storage system in communications with the local community boards. The information will include reliability and environmental benefits. When the Company identifies the specific location in the months prior to summer peak planning, Con Edison will present to the local community board and provide community notifications to the neighboring businesses and residents. Materials will be prepared to provide more specific information about the battery storage system and operational plan. The Company will also reach out to local stakeholders including local chambers of commerce, business improvement districts, and local development corporations. The Company will respond to community concerns and work collaboratively to find a suitable deployment solution for the affected communities.

Additionally, a successful implementation will require active engagement with the NYISO in order to fully monetize the wholesale market value. NYISO is currently evaluating various energy storage market designs and has kicked off a Distributed Energy Resource Roadmap. NRG actively participates in the NYISO stakeholder meetings and can play a key role in advancing the market design discussions at the NYISO.

4.5 CONDITIONS/BARRIERS

As this is an innovative proposal that introduces a new business model, and seeks to capture revenue streams across both the wholesale and retail markets, there are challenges associated with monetizing aspects of the project.

Wholesale Energy Market Opportunity and Interconnection – The goal of the demonstration project is to provide both a mobile solution for grid deferrals and resilience, and to provide wholesale products via interconnection into the NYISO, which will require substantial coordination between the partners and the NYISO. Some of these concerns may be addressed in the NYISO discussions around storage and DER integration and optimization, taking place over the next several years.

Energy Market Opportunity

The Company anticipates that the demonstration project could participate as an Energy Limited Resource ("ELR") as defined in the NYISO tariff. Such resources must be able to provide at least one MW for at least four consecutive hours. ELRs are eligible to provide both reserves and regulation to the wholesale market. Given that the resource will be located in a mitigated zone, there are daily bidding rules that must be followed. If the resource is bidding in order to optimize its charging/discharging capability, the bids must adhere to these mitigation rules.

While not the preferred path forward, the demonstration could participate on a much more limited basis and provide only regulation if NYISO does not change current participation rules. In this case, the demonstration project would participate as a Limited Energy Storage Resource ("LESR") under the NYISO Tariff. LESR is intended for projects that can sustain a maximum injection/withdrawal for less than one hour. If participating in the LESR program, however, the NYISO will manage the charge/discharge feature of the battery resource in order to ensure optimum participation as a regulation resource.

Interconnection

The NYISO has two kinds of interconnection processes – one for energy and one for capacity. Once completed, a unit that has interconnection rights would be able to participate in the corresponding wholesale market. NRG anticipates that an energy interconnection is possible during the demonstration period. A capacity interconnection is also possible, although it will require additional market design and planning changes to accommodate a moveable resource that is sometimes located on the bulk system and sometimes located on the local distribution system.

Currently, the NYISO contemplates resources that are "stationary," meaning that they are permanently interconnected at a single point on the system. While it is possible to interconnect a moveable resource to supply both energy and capacity into the system, the day-to-day market participation would require market participation rule revisions in order to accommodate a resource that may be located at different parts of the system at different times. If the NYISO revised its rules to allow mobile energy systems to earn capacity revenues, it could potentially add over $100,000 per year of revenues for a project the size of the demonstration project.

For the purposes of this demonstration project, the Company anticipates that the Small Generator Interconnection process will be required for the Project to participate in the

wholesale energy market. This interconnection process is applicable to generating facilities up to 20 MW. If the project qualifies for Fast Tracking, the time required to achieve interconnection will be materially reduced. The final goal is to achieve an Interconnection Agreement ("IA") which may be required to be filed at the Federal Energy Regulatory Commission ("FERC"). At a minimum, NRG expects the full Small Generator Interconnection process to take 3-6 months for an energy only request. A high-level summary of the steps includes:

1) Submit Interconnection Request;
2) Evaluation for Fast Track Process;
3) Study Process (if not eligible for Fast Track) may include the following studies;
    a. Feasibility Study;
    b. System Impact Study;
    c. Facilities Study;
    d. Interconnection Agreement; and
4) If required, file Interconnection Agreement with FERC.

Mobile Interconnection and Transportation –NYC DOT regulates the size and weight of trucks as well as hazardous materials. The battery trailers have been designed to be within the length, width, and height restrictions, but will likely be overweight. The Municipal Transit Authority ("MTA") regulates the tunnels and bridges and requires overweight permits in advance of crossing any tunnels or bridges, issued through the NYC DOT. The battery enclosures are expected to be overweight, but within the routine permit limits. Permits will be obtained for each move, with 48 hours lead time required. Limitations may consist of: fees, specific dates and time of day restrictions, and route surveys.

Beyond the size and weight restrictions, Lithium-ion batteries are rated as Class 9 hazardous material subject to the 49 CFR 173.185 – DOT Pipeline and Hazardous Material Administration. Requirements from these regulations are summarized as follows:

1. Prevent a dangerous evolution of heat:
2. Prevent short circuits;
3. Prevent damage to the terminals; and
4. No battery can come in contact with other batteries or conductives.

NRG and LG Chem are responsible for ensuring that these requirements are met in the configuration of the battery enclosure during transportation.

The setup of the trailers enables side-by-side or end-to-end connections and an interconnection at 480V. Each move will require disconnecting power, auxiliary, and communication cables between the trailers, and disconnecting the modules in the battery

trailers. LG Chem is working to improve the structural stability of its racks to enable non-static loading, which would allow the modules to be moved in the racks as opposed to separately packaged boxes.

Separate from this project, LG Chem has also been working with the Fire Department of New York City ("FDNY") to certify the safety of its modules. LG Chem has already provided modules for the FDNY to conduct testing, and NRG will work with LG Chem and FDNY to build on this testing to obtain approval for the mobile battery system.

5.0 FINANCIALS

5.1 UTILITY REVENUE STREAMS

Con Edison expects to test three principal future revenue streams and sources of value:

1. **T&D Deferral -** By using the battery asset for distribution upgrade deferrals, Con Edison can qualify for compensation based on the net benefits associated with deploying the batteries and DERs rather than engaging in traditional distribution upgrades that typically are more costly and time consuming. As mentioned in Section 3A, this asset can be applied to many future NWAs and similar opportunities. For example, an estimated $330,000 per year can be generated by these assets if used as part of portfolio solution for deferring the Glendale Project. The Glendale Project need is only in the summer months, therefore the assets can capture additional revenue in wholesale markets the remaining nine months of the year.

2. **Market Revenue -** through the unique revenue sharing mechanism for revenues received for participation in the NYISO wholesale market outlined in Section 5.2, Con Edison will receive:
    a. Revenues to offset quarterly Mobility Premium Option payments from Con Edison to NRG; and
    b. A portion of the annual revenue margins generated in the markets by the Project that exceed the amount necessary to offset the Mobility Premium Option payments.

The market revenues available to the Project from the NYISO market could include one or more of the following, as discussed in Section 4.5 Conditions/Barriers:

1. Capacity payments;
2. Energy revenues; and
3. Ancillary services, including frequency response.

	2018	2019	2020	Q1 2021	Total
T&D Benefit (MM)	$0.330	$0.330	$0.330	$0.000	$0.99
Energy Revenue (MM)	0.024	0.024	0.024	0.000	0.07
Frequency Response Revenue (MM)	0.086	0.099	0.099	0.013	0.30
Total Revenue (MM)	$0.44	$0.45	$0.45	$0.013	$1.4

5.2 INVESTMENTS

The total initial cost to design, build, and implement the Project is approximately $7.63 million. The total costs that will be incurred by Con Edison during the demonstration period include the design and construction of the energy storage system, balance of system components, site preparation, installation, Mobility Option Premiums (refer to Section 3.1.2), transportation costs, and development and implementation of the Project. The total projected Project costs are provided below.

	Total	2017	2018	2019	2020	Q1 2021
Total	$10.4mm	$7.63mm	$0.84mm	$0.85mm	$0.85mm	$0.16mm

Investment timing details remain to be determined with NRG, but design phase activities will begin immediately upon contract signatures. Con Edison intends to execute contracts following regulatory approval, and is striving to begin work on the Project shortly thereafter. Investments will end no later than the conclusion of the demonstration project.

5.3 RETURNS

The partnership with NRG includes a revenue sharing provision. This shared revenue opportunity incentivizes both Con Edison and NRG to work collaboratively to maximize the value of the Project during the demonstration period.

During the term of the agreement, Con Edison will pay NRG an annual Mobility Option Premium. Through the Mobility Option Premium, NRG will recover certain costs to operate and maintain the units including the cost of labor, insurance costs, taxes, utilities and consumables. In exchange for the Mobility Option Premium, NRG will agree to reimburse Con Edison for the annual payment, to the extent funds are available from gross margin generated by providing NYISO wholesale services. In the event that NRG is able to annually generate amounts through the NYISO wholesale market greater than required to reimburse Con Edison for the quarterly payments, the additional gross margin will be split between Con Edison and NRG.

Ultimately, the cost effectiveness of the construction and operation of the Project will provide insight to utility industry and stakeholders when deciding upon future investments in mobile battery storage projects.

Con Edison does not anticipate that the total revenue realized during the demonstration period ($1.4MM) will exceed total demonstration costs ($7.63mm). This is due in part to Con Edison's desire for flexibility to test and iterate on several monetization strategies within the demonstration, which may mean potential revenue is sacrificed in favor of increasing demonstration learning. At the end of demonstration, however, Con Edison will be in a position to evaluate the potential of each revenue stream, and increase the scope and corresponding benefits beginning in 2021 and beyond.

	2018	2019	2020	2021
T&D Benefit (MM)	$0.330	$0.330	$0.330	$0.000
Energy Revenue (MM)	0.024	0.024	0.024	0.000
Frequency Response Revenue (MM)	0.086	0.099	0.099	0.013
Total Revenue (MM)	0.44	0.45	0.45	0.013

6.0 REPORTING

Con Edison will report to the Commission every quarter on key demonstration metrics, which will allow Con Edison and the Commission to track the progress of the Project. All key metrics will be reported for the quarter, for the calendar year, and from the initiation of the demonstration project. Such data will be reported on an absolute and relative (to plan/budget) basis, and will include:

- Status update on the construction of the mobile unit;
- Lessons learned against key hypotheses;
- Milestones achieved (or not);
- T&D Deferral values and Market Revenues; and
- Permitting progress.

7.0 CONCLUSION

7.1 POST-DEMONSTRATION BENEFITS

7.1.1 QUALITATIVE

Through this demonstration project, Con Edison will partner with NRG to deliver a cost-effective, mobile battery storage solution that will provide T&D deferral benefits while also participating in the NYISO competitive markets. The Project partners plan to work together with the NYISO to develop a procedure and/or special allowance for mobile storage assets to participate in wholesale markets. In addition, the Project will analyze the market potential for customer use cases to further asset utilization beyond utility needs and market participation.

Over a 10-year asset life, Con Edison expects that the mobile energy storage solution will be used to defer multiple T&D investments. The invaluable operational experience gained through the Project will also enable increased utilization of additional mobile storage assets in future years – both in Con Edison's service territory and by other entities in other markets.

7.1.2 QUANTITATIVE

The Project represents a major innovation in targeted and efficient use of utility capital in support of grid needs, as well as engaging a third-party partnership to leverage the merchant power value of the underlying storage asset, lowering the utility's effective cost and maximizing the value of the assets to the system as a whole. If this project is successful in

participating in the NYISO capacity market, an additional $100,000 per year in capacity revenues will be unlocked.

This REV demonstration project will help quantify the value of a T&D deferral asset that can be relocated at multiple utility locations within Con Edison's service area. When the assets are not deployed, Con Edison will also be able to quantify the value of having storage assets that can participate in the wholesale markets.

7.2 PLANS TO SCALE

Given the current cost of batteries and the cost to develop a first-of-its-kind mobile solution, the Company does not expect the Project to break-even, instead it is meant to allow Con Edison to test key REV hypotheses. However, Con Edison believes that given the declining cost curve for battery storage, the business model may represent a sustainable, low-cost investment for reliability once allocated across multiple utility solutions over the life of the asset.

Con Edison will launch the Project in Q2 2017 and the demonstration period will span through Q1 2021. If the Project is successful, the Company anticipates that the platform could be leveraged in the future to roll out a larger scale program to generate grid benefits, both within our territory and outside NY.

7.3 ADVANTAGES

The REV initiative's goals include changing the energy system to incorporate a more distributed and resilient architecture, engage customers, and create new business models to enable utilities and third parties to successfully and profitably build and operate this new system. The proposed Project is consistent with the intent and criteria of REV and will advance both the evolution of the grid, through the deployment of a significant energy storage asset that can serve multiple uses, and the advancement of a new business model in the form of an innovative partnership between Con Edison and NRG.

Specifically, the Project aims to allow Con Edison to demonstrate that mobile storage assets can serve as a valuable T&D deferral option while also participating in the NYISO wholesale markets. Compared to a stationary battery installation, the incremental costs associated with the mobile solution will be offset by the ability to serve multiple utility needs during the life of the asset.

The lessons learned and the opportunities created through this demonstration project will be essential to Con Edison and the State of New York as it embarks on the 21st century reformation of the utility sector.