Energy Innovation:
Storage and Distribution Strategies

Presenters:
Jason Doling
Virginia C. Robbins, Esq.
Linda R. Shaw, Esq.

Moderator:
Keith G. Silliman, Esq.

New York State Bar Association
Annual Meeting
Environmental & Energy Law Section

January 26, 2018

Continuing Legal Education Program
Energy Innovation: Storage and Distribution Strategies

Energy Storage and the Modern Grid

Virginia C. Robbins, Esq.
Bond, Schoeneck & King, PLLC
Syracuse, NY
vrobbins@bsk.com

What is energy storage?

An energy storage system is capable of absorbing energy, storing it for a period of time, and then dispatching the energy for use at another time. For wind and solar energy conversion systems, storage technology allows for use of the power generated at times when there is no wind or sun. Forms of storage include chemical technologies, such as batteries (lithium ion and lead-acid), flow batteries, vehicle-to-grid, and fuel cells; thermal technologies, such as molten-salt and ice storage; and mechanical technologies, such as pumped hydroelectric storage, flywheels and compressed air energy storage.[1] In New York City, in spring 2017, construction commenced on the first behind the meter lithium ion battery to be used at a multi-family affordable housing project (Marcus Garvey Village); in California, lithium ion batteries are being used to provide power to areas affected by a 2015 leak at a gas storage facility outside of Los Angeles; in South Australia, on December 1, 2017, Tesla started up the world's largest battery bank with 100 MW of storage (power for 30,000 homes for one hour) at a wind power project.

What are the benefits of energy storage?

The following benefits of energy storage are described in NY-BEST's Energy Storage Roadmap, dated January 2016. NY-BEST is the New York Battery and Energy Storage Technology Consortium, an industry-led private-public coalition (www.ny-best.org):

[1] *The State of Energy Storage, Energy Resources in New York's Wholesale Electricity Markets*, Report by the New York Independent System Operator, December 2017.

Improves Efficiency and Capacity

Energy storage has the potential to play a big role in energy de-carbonization. Because energy storage technology can both absorb energy and release it when needed, storage can improve the efficiency and capacity of the modern grid, both behind the meter and as part of a generation, distribution and transmission system. Storage can provide capacity by replacing typical fossil-fueled "peaker" plants that run only at times of high demand and that are less efficient (that is, emit more greenhouse gas pollutants) than baseload facilities. Storage can also relieve baseload generation when output is greater than demand by storing the excess energy for use at a time when it is demanded.

Brings Flexiblity To Integration of Renewables Into the Grid

Storage technology can (1) manage variable renewable resources, (2) replace redundant generation sources that would otherwise be needed during times when the output of intermittent sources decreases or ceases, and (3) time shift from the supply side instead of from the demand side (which would require users to curtail demand when renewable resources are not available).

Enhances Reliability and Resilience of the Grid

Energy storage can provide reliability at all points in the grid: behind the meter, at the distribution level, and at the grid level. Storage can provide an uninterruptible power supply, maintain power quality, and smooth the fluctuations inherent in solar and wind resources.

Massive storms have destabilizing effects on wind farms — they drive wind turbines up and down so quickly that many of them shut down for safety. The fluctuations and loss of power threaten the larger grid's reliability. So adding substantial storage to wind farms (and to the transmission grid more broadly) contributes to reliability and resilience.[2]

What are the options for battery technology?

Lithium ion technologies have advanced the furthest and work for applications that require a lot of energy for a short period, that is, in power applications. They work across the grid from large utility-scale installations to transmission and distribution infrastructure, and for individual commercial, industrial and residential systems. Some are well suited to industrial applications that require the batteries to charge and discharge quickly. Nonlithium ion batteries technologies appear to work better in other settings, for example, lead-acid products seem more economic for residential solar-plus-storage applications. Flow cells can be more economic than lithium ion for large-scale wind power.[3]

[2] *Elon Musk Bet That Tesla Could Build the World's Biggest Battery in 100 Days. He Won*., VOX, November 29, 2017, by D. Roberts at www.vox.com

[3] *The New Economics of Energy Storage*, published by McKinsey & Company, August 2016, by P. Aprile, J. Newman and D. Pinner.

Where is battery technology being deployed now on a utility scale?

In October 2015, a leak at the Aliso Canyon gas storage facility outside Los Angeles caused it to shut down. The leak reduced fuel supplies for area power plants. In response, the California Public Utilities Commission (CPUC) mandated mitigation measures, including the expedited procurement of about 100 megawatts (MW) of local energy storage resources in the Southern California Edison (SCE) and San Diego Gas & Electric (SDGE) service territories. Renewable and other types of energy stored during the day would be available when electricity demand increased in the evening, thereby avoiding the need for increased fossil fuel generation to serve that peak need.

The CPUC order directed utilities in Southern California to identify storage projects that could be sited, constructed, and put into operation providing electricity to the grid in only a few months. Within 6 months after the CPUC issued its order, two battery storage facilities were completed. SDGE contracted for the installation of two energy storage projects totaling 37.5 MW. Until this year, the larger 30 MW project in Escondido was the biggest lithium ion battery storage facility in service on a utility grid in the world and is capable of serving 20,000 customers for four hours. A battery storage facility was completed also for SCE at the Mira Loma substation capable of powering about 15,000 homes for four hours.

In September 2016, a storm in South Australia involving 80,000 lightning strikes and at least two tornadoes — knocked down dozens of electricity pylons, causing cascading failures throughout the regional electricity grid and casting virtually the entire state of 1.7 million residents into darkness.[4]

Most people had their power restored within 24 hours, though in some cases it took much longer. But there were more blackouts from storms in December, and more from heat waves in February 2017.

In early 2017, the South Australian government unveiled a $550 million energy plan to respond to the crisis and stabilize the grid going forward. Part of that plan involved contracting for around 100 MW of energy storage. Tesla won competitive bidding for the entire energy-storage portion of the project in July by promising to deliver 100 MW of storage in 100 days, and constructing the world's largest grid-scale battery. The Hornsdale Power Reserve battery is attached to the 325 MW Hornsdale wind farm, in construction near Jamestown, South Australia. The Tesla battery bank was completed on November 23, 2017 and testing has commenced.

But the Hornsdale project will not be the largest for long. Another storage project is under construction northeast of Adelaide that will involve 3.4 million solar panels (with a capacity of 330 MW) alongside 1.1 million batteries, or 100MW/400MWh worth — the world's biggest solar-and-storage installation.

---

[4] See article in VOX identified in Footnote 3 above for the information on the storms' devastation and the resulting Tesla energy storage at the Hornsdale project.

How Much Growth Is There In Energy Storage?

The following information was prepared by the Smart Electric Power Alliance for its *2017 Utility Energy Storage Market Snapshot* and was provided in the American Bar Association's webinar on November 30, 2017, "Prologue to Change: Grid Modernization & Power Options:"

> 2016 was a big year for energy storage. Utilities interconnected 207 MW, 257 MWh of energy to the grid, across a total of 829 systems. The total of installed energy storage nationwide at the end of 2016 was 622 MW, 661 MWh, across 2,300 systems. Thirty-one utilities deployed their first energy storage project in 2016. Growth is encouraged by price decreases as the technology advances. The average lithium-ion battery price per KWh fell from $689 to $273 between 2012 and 2016.

But there are impediments to growth. The technology for distributed energy resources (battery storage being one of those resources) is moving faster than regulatory changes to support its deployment and faster than any changes to the utilities' business models. Experts in the field comment that in some states the Commissioners are not up to speed on modern grid technologies and this delays their ability to implement new policies to encourage integration of the technology into the modern grid. Also, there need to be incentives for the utilities to improve their planning to better integrate distributed energy resources so that markets for them develop. The former Chair of the New York State Public Service Commission, Audrey Zibelman, stated that the Commission needed to move quickly because distributed generation is very important to New York's energy future and, therefore, there is a need to create the markets for the technology, and not inappropriate subsidies that upset the market, as she believed had occurred to some extent in Nevada and Arizona.[5] Regarding market development, some energy economists point out that renewables-plus-storage technology will need to outperform natural gas so decisively that investment shifts.

What strategies are states and FERC using to promote the use of energy storage?

New York State, based on Governor Cuomo's energy strategy, Reforming the Energy Vision (REV), is considered by those in the energy field to be achieving the most comprehensive utility regulatory reform in the nation. These REV efforts are being led by the Public Service Commission (PSC), the New York State Energy Research and Development Authority (NYSERDA) and the Long Island Power Authority.

In October 2016, the New York Department of Public Service issued a *Staff Report and Recommendations in the Value of Distributed Energy Resources Proceeding*. The goal of the proceeding is to develop accurate pricing for clean distributed energy resources (DERs) that reflects the actual value created by technologies that produce power outside of the utility grid (e.g., fuel cells, microturbines, and photovoltaics) and

[5] Ms. Zibelman is now CEO of Australian Energy Market Operator, which is responsible for operating Australia's largest gas and electricity markets and power systems.

technologies that produce power or store power (e.g., batteries and flywheels) as well as demand-side measures.

The staff report supports including projects that pair any energy storage technology with an eligible generation facility to receive compensation under a proposed tariff. The report also identifies a utility-driven demonstration project supporting solar-plus-storage. Consolidated Edison Company of New York is currently pursuing a demonstration project that combines multiple solar plus storage systems to improve grid resiliency and provide a dispatchable “virtual power plant” that Con Edison can control and rely on in real time. Con Edison is also pursuing grid-scale energy storage through a request for information seeking to demonstrate how large-scale utility storage can improve company operations, and establish how a singular type of energy storage can offer multiple kinds of value.

At its March 9, 2017 session, the PSC approved two significant orders (Order 17017/15-E-0751 and Order 17018/14-M-0101;16-M-0411. One enacted a new compensation structure to value DERs installed in New York. The order establishes compensation values for the first time in New York for energy storage (battery) systems when combined with certain types of DERs. In the second order, the PSC directed the state’s utilities to significantly increase the scope and speed of their energy storage endeavors. By the end of 2018, each utility must have deployed and begun operating energy storage projects at no fewer than two separate distribution substations or feeders. The Commission tasked the utilities with striving to perform at least two types of grid functions with the deployed energy resources, for example, increasing hosting capacity and peak load reduction. The Commission stated that these actions are both feasible and necessary to promote timely development of a modern grid capable of managing DERs.

On November 30, 2017, Governor Cuomo signed legislation (A. 6571) relating to the adoption of an energy storage target (see copy attached). The law calls for the PSC to commence a proceeding to establish the Energy Storage Deployment Program to encourage the installation of energy storage systems. The legislature is expected to address some deadlines in this legislation that are not feasible. One expected revision is an extension until December 31, 2018 of the deadline for the PSC’s determination to establish a target for the installation of energy storage systems by 2030 and programs that will enable the state to meet the target. The PSC will consult with NYSERDA and the Long Island Power Authority in preparing the determination. The bill amends the Public Service Law to define what constitutes a qualified energy storage system.

In June 2017, Massachusetts’ Department of Energy Resources directed utilities in the state to procure 200 MWh of energy storage by January 2020. Also, in early June, Nevada passed legislation directing its Public Utilities Commission to investigate whether the state should require an energy storage procurement by utilities.

Outside of a 20-megawatt flywheel facility in Stephentown, New York has mostly seen small-scale demonstration projects through the REV Initiative or efforts like Consolidated Edison's substation upgrade deferral program. The state's storage pipeline includes 240 megawatts from 15 different projects, according to Green Tech Media Research. Lithium ion deployment has been slow in New York City, where the fire department has dealt with the technology on a case-by-case basis while finalizing safety requirements.[6]

California and Oregon were the first states to set storage targets. California already led the nation in energy storage deployments (73.2 MW), but in the fall of 2016 its legislature adopted and the Governor signed four bills to further develop and streamline the state's storage market. The legislation supports the construction of storage capacity to give the grid more control over when wind and solar power are consumed to achieve 50 percent renewable energy use in the state by 2030.[7]

There has also been activity in the past two years on energy storage at the Federal Energy Regulatory Commission (FERC). This is in response to wholesale power market participants and regulators who seek to better define the opportunities for energy storage in markets and as part of the transmission system.[8]

On November 17, 2016, FERC issued a Notice of Proposed Rulemaking (NOPR) to encourage the removal of barriers to energy storage resources (ESRs) and DER integration in the wholesale markets. FERC indicated its interest in Independent System Operators (ISOs) pursuing efforts to achieve this goal.[9] The NYISO submitted NOPR comments on February 13, 2017, and will develop its market design to be consistent with FERC's proposed rules. In December 2017, the NYISO issued its report, "*State of Storage, Energy Storage Resources in New York's Wholesale Electricity Markets*," in which it acknowledges that as the grid modernizes, ESRs will contribute to maintaining a reliable and cost-effective grid to both meet demand and withdraw electricity from the grid to alleviate excess supply.[10]

What are some of the legal issues connected to the deployment of energy storage technology?

1. Siting approvals – A significant barrier to the deployment of behind the meter lithium ion battery storage is the review and approval of multiple local agencies, for compliance with building codes, zoning regulations and fire codes.

2. Large energy storage projects need states to develop strong interconnection standards so that projects are not held up by delays because the interconnection process is poorly defined, lengthy or expensive. Also, the cost of interconnection can create delays. A utility may ask a developer to make large payments for

[6] *New York State Lawmakers Pass Energy Storage Target, Await Governor's Signature*, Green Tech Media Research, Energy Storage, June 26, 2017, by Julian Spector at www.greentechmedia.com
[7] *Id.*
[8] Law 360, November 7, 2017.
[9] *Id.*
[10] See NYISO Report identified in Footnote 2 above.

upgrades to the grid infrastructure to accommodate the interconnection, resulting in disputes.

3. At this time, there are regulatory valuation and compensation barriers for energy storage. To be viable, energy storage projects must be compensated for multiple services. State regulations typically do not yet properly compensate energy storage for the full value it provides to the grid. The proper valuation of energy storage is complicated apart from the avoided cost of generation.[11]

4. Energy storage plays an important role in integrating the greater use of DERs. Some utilities may consider energy storage as a threat to earnings. DERs are expected to displace 320 GW of centralized generation from 2014 to 2023 and could outpace centralized generation in annual capacity additions as early as 2018.[12]

5. Multiple parties will assert their rights in the technologies and infrastructure that make energy storage possible. These parties will confront legal issues related to regulatory compliance and permitting, real property interests, contract terms, and financing.

[11] *State Strategies for Advancing the Use of Energy Storage*, National Governors Association, October 2016.
[12] *Id.*

A06571 Summary:

BILL NO A06571

SAME AS SAME AS

SPONSOR Paulin

COSPNSR Walker, Englebright, Hunter, Moya, Buchwald, Cahill, Colton, D'Urso, Galef, Gottfried, Jaffee, Lifton, Lupardo, Niou, Ortiz, Otis, Quart, Schimminger, Simon, McDonough, Sepulveda, Santabarbara, Rosenthal L, Blake, Thiele, Barron, Jones, Palmesano

MLTSPNSR Cook, Magee

Add §74, Pub Serv L; ren §§1020-ii - 1020-kk to be §§1020-jj - 1020-ll, add §1020-ii, amd §1020-s, Pub Auth L

Establishes the energy storage deployment program to encourage the installation of qualified energy storage systems; relates to commercially available technology that is capable of absorbing energy, storing it for a period of time, and thereafter dispatching the energy.

A06571 Actions:

BILL NO A06571

03/09/2017 referred to energy
03/22/2017 reported referred to ways and means
05/09/2017 reported
05/11/2017 advanced to third reading cal.352
05/17/2017 passed assembly
05/17/2017 delivered to senate
05/17/2017 REFERRED TO ENERGY AND TELECOMMUNICATIONS
06/19/2017 SUBSTITUTED FOR S5190
06/19/2017 3RD READING CAL.1887
06/19/2017 PASSED SENATE
06/19/2017 DELIVERED TO ASSEMBLY
11/17/2017 delivered to governor
11/29/2017 signed chap.415
11/29/2017 approval memo.20

A06571 Memo:

NEW YORK STATE ASSEMBLY
MEMORANDUM IN SUPPORT OF LEGISLATION
submitted in accordance with Assembly Rule III, Sec 1(f)

BILL NUMBER: A6571

SPONSOR: Paulin (MS)

TITLE OF BILL: An act to amend the public service law and the public authorities law, in relation to establishing the energy storage deployment program

PURPOSE:

To promote the installation of qualified energy storage systems through the energy storage deployment program.

SUMMARY:

Section one amends the public service law by adding a new section 74, "Energy storage deployment program", which: i) defines a qualified energy storage system as technology that is capable of absorbing energy, storing it for a period of time, and thereafter dispatching the energy; ii) specifies that such storage systems can use mechanical, chemical or thermal processes to store energy that was generated from renewable resources or through mechanical processes; iii) provides that such storage system can store thermal energy for direct use for heating or cooling at a later time. Additionally, it provides that the Public Service Commission (PSC) shall establish 2030 targets for the installation of such systems. In doing so, the Commission will consult with the NYS Energy Research and Development Authority and with the Long Island Power Authority. The latter two entities will administer the Energy Storage Deployment Program starting in 2018, providing: a) estimates for the annual program expenditures till 2030, b) program designs related to the deferred or avoided costs and the reduction of peaks, c) performance reports and anything else the PSC deems appropriate.

Section two provides that sections 1020-ii, 1020-jj and 1020-kk of the public authorities law are renumbered sections 1020-jj, 1020-kk and 1020-ll, and a new section 1020-ii is added. The latter states that the Authority shall encourage the installation of qualified storage systems in its service territory, by implementing an energy storage deployment program as defined in the new section 74 of the public service law.

Section three amends subdivision 1 of section 1020-s of the public authorities law to add that section 74 of public service law applies to qualified energy storage systems within the authority's jurisdiction.

Section four provides the effective date.

JUSTIFICATION:

In an effort to combat climate change, renewable energy sources, such as solar and wind, are being used more extensively than in the past. This development is leading to a change in the energy supply and demand patterns.

The fact that solar and wind are intermittent has presented significant challenges. For example, solar produces power primarily during the day. Conversely, wind is stronger at night, leading to a higher production of energy at night than in the day.

Energy storage systems can efficiently solve the issues related to the timing mismatch between energy supply and demand. In fact, by absorbing and storing energy resources, storage systems are able to reduce demand for peak hours, boosting the resilience and reliability of the electric grid. This way, renewable energy can be available continuously, resulting in a reduced need for baseload generation.

This legislation defines qualified energy storage systems, and provides a regulatory framework for the PSC to start the energy storage deployment program. This will encourage the installation of such systems throughout New York State, leading to a more efficient and sustainable use of renewable energy sources.

LEGISLATIVE HISTORY:

New bill.

FISCAL IMPLICATIONS:

None.

EFFECTIVE DATE:
This act shall take effect immediately.

A06571 Text:

STATE OF NEW YORK

6571

2017-2018 Regular Sessions

IN ASSEMBLY

March 9, 2017

Introduced by M. of A. PAULIN, WALKER, ENGLEBRIGHT, HUNTER, MOYA, BUCHWALD, CAHILL, COLTON, D'URSO, GALEF, GOTTFRIED, JAFFEE, LIFTON, LUPARDO, NIOU, ORTIZ, OTIS, QUART, SCHIMMINGER, SIMON, McDONOUGH -- Multi-Sponsored by -- M. of A. COOK, MAGEE, THIELE -- read once and referred to the Committee on Energy

AN ACT to amend the public service law and the public authorities law, in relation to establishing the energy storage deployment program

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. The public service law is amended by adding a new section 74 to read as follows:

§ 74. Energy storage deployment program. 1. (a) As used in this section "qualified energy storage system" shall mean commercially available technology that is capable of absorbing energy, storing it for a period of time, and thereafter dispatching the energy. A qualified energy storage system shall be cost-effective and either assist the integration of variable energy resources, reduce emissions of greenhouse gases, reduce demand for peak electrical generation, defer or substitute for an investment in generation, transmission, or distribution assets, or improve the reliable operation of the electrical transmission or distribution grid.

(b) A qualified energy storage system shall do one or more of the following: (i) use mechanical, chemical, or thermal processes to store energy that was generated at one time for use at a later time; (ii) store thermal energy for direct use for heating or cooling at a later time in a manner that avoids the need to use electricity at that later time; (iii) use mechanical, chemical, or thermal processes to store energy generated from renewable resources for use at a later time; or (iv) use mechanical, chemical, or thermal processes to store energy generated from mechanical processes that would otherwise be wasted for delivery at a later time.

EXPLANATION--Matter in *italics* (underscored) is new; matter in brackets [-] is old law to be omitted.

LBD10350-01-7

2. Within ninety days of the effective date of this section, the commission shall commence a proceeding to establish the energy storage deployment program to encourage the installation of qualified energy storage systems. No later than January first, two thousand eighteen, the commission shall make a determination establishing a target for the installation of qualified energy storage systems to be achieved through two thousand thirty and programs that will enable the state to meet such target. The commission shall consult with the New York state energy research and development authority and the Long Island power authority in the preparation of such determination. The determination shall include the following:

(a) The creation of the energy storage deployment program to be administered by the New York state energy research and development authority and the Long Island power authority;

(b) Estimated annual expenditures associated with the program for each year commencing with calendar year two thousand eighteen and continuing through calendar year two thousand thirty;

(c) Program designs that take the following into consideration:

(1) avoided or deferred costs associated with transmission, distribution, and/or capacity;

(2) minimization of peak load in constrained areas; and

(3) systems that are connected to customer facilities and systems that are directly connected to transmission and distribution facilities;

(d) Annual reports on the achievements and effectiveness of the program to be submitted to the governor, the temporary president of the senate, and the speaker of the assembly; and

(e) Such other issues deemed appropriate by the commission.

§ 2. Sections 1020-ii, 1020-jj and 1020-kk of the public authorities law, as renumbered by chapter 388 of the laws of 2011, are renumbered sections 1020-jj, 1020-kk and 1020-ll and a new section 1020-ii is added to read as follows:

§ 1020-ii. Energy storage deployment program. The authority shall encourage the installation of qualified energy storage systems in its service territory through implementation of the energy storage deployment program as set forth and defined in section seventy-four of the public service law.

§ 3. Subdivision 1 of section 1020-s of the public authorities law, as amended by section 9 of part A of chapter 173 of the laws of 2013, is amended to read as follows:

1. The rates, services and practices relating to the electricity generated by facilities owned or operated by the authority shall not be subject to the provisions of the public service law or to regulation by, or the jurisdiction of, the public service commission, except to the extent (a) article seven of the public service law applies to the siting and operation of a major utility transmission facility as defined therein, (b) article ten of such law applies to the siting of a generating facility as defined therein, (c) section eighteen-a of such law provides for assessment for certain costs, property or operations, [~~and~~] (d) to the extent that the department of public service reviews and makes recommendations with respect to the operations and provision of services of, and rates and budgets established by, the authority pursuant to section three-b of such law, and (e) that section seventy-four of the public service law applies to qualified energy storage systems within the authority's jurisdiction.

§ 4. This act shall take effect immediately.

Energy Storage and the Modern Grid

NYSBA Environmental & Energy Law Section
Virginia C. Robbins, Esq.
January 26, 2018

Energy Storage Systems

- Capable of absorbing energy, storing it for a period of time, and then dispatching the energy for use at another time
- **Chemical technologies:** batteries (lithium ion and lead-acid), flow batteries, vehicle-to-grid, and fuel cells;
- **Thermal technologies**: molten-salt and ice storage; and

Energy Storage Systems

- **Mechanical technologies**: pumped hydroelectric storage, flywheels and compressed air energy storage
- Lithium ion batteries: storage projects in Brooklyn's Marcus Garvey Apartment Microgrid Project (sited outside); Southern CA; South Australia

Benefits of Storage

- Improves the efficiency and capacity of the modern grid
- Brings flexibility to integration of renewables
- Enhances reliability and resilience of the grid
- Lithium ion technologies seem best across the grid for power applications – a lot of power for a short period of time
- Lead-acid products considered more economic for residential solar-plus-storage

BOND SCHOENECK & KING

Utility-Scale Deployments

- Southern California to address leak at Aliso Canyon gas storage facility – combined 3 li ion projects about 100 MW
- South Australia – world's largest grid-scale li ion battery for 100 MW of energy storage
- Northeast of Adelaide – construction of 3.4 million solar panels (330 MW) alongside 1.1M li ion batteries (100 MW worth of storage)

BOND SCHOENECK & KING

Strategies to Promote Storage

- Value - net metering since 1997– every kWh exported to grid credited on bill
- Transitioning now to more precise method of valuing distributed energy resources (VDER)
- VDER recognizes that not every kilowatt hour is equal – time and location of generation count
- PSC issued two Phase One VDER Orders in 2017

BOND SCHOENECK & KING

Strategies to Promote Storage

- Integration of storage options included in Phase One when paired with an eligible technology
- Phase One provides a pathway to monetize solar and storage
- Expected that stand-alone and other storage issues will be addressed by PSC in Phase Two VDER Order

BOND SCHOENECK & KING

Strategies to Promote Storage

- NYS legislation signed by Governor on Nov. 30, 2017 to establish Energy Storage Deployment Program and to set a target for storage capacity
- 4th state to mandate targets (CA, MA and OR)
- 2010 CA law compelled investor-owned utilities to procure storage capacity by 2020 (1.3GW)

BOND SCHOENECK & KING

Strategies to Promote Storage

- Jan. 3 State of the State: Invest $200M to achieve 1,500 MW of energy storage by 2025
- At the end of 2016 total of installed energy storage nationwide: 622 MW
- NYS ranks 8th in U.S. for rated power of energy storage projects (w/o pumped hydro storage)
- Should remain a good market for investment

BOND SCHOENECK & KING

Strategies to Promote Storage

- FERC NOPR November 2016 to amend regs and remove barriers preventing ESRs and DER aggregators to participate in wholesale markets
- FERC January 2017 Policy Statement on ESR services and relevant rates for those services
- Await further FERC action on NOPR

BOND SCHOENECK & KING

Barriers to Market Development

- Report prepared for NYSERDA: Market Characterization and Assessment, Feb. 2017
- **Economic barriers**: Core cost of storage technologies has decreased dramatically, "balance of system" costs are substantial
- For residential and commercial BTM storage: control device, power conditioning equipment, safety equipment, meters and instrumentation
- These costs can be up to 50% of system

BOND SCHOENECK & KING

Barriers to Market Development

- **Informational barriers**: Monetizing the value of energy storage is significant economic and informational barrier
- Why? Novel applications and combinations
- Difficult to quantify the value of storage without pilot tests and analysis of results

BOND SCHOENECK & KING

Barriers to Market Development

- How storage technologies are used drives monetization
- Whether a storage device serves multiple functions within the grid, including generation
- NYSERDA to conduct “value stacking” pilot to test the ability of storage systems to provide benefits to multiple parties

Barriers to Market Development

- Vertically integrated utilities will have advantage in maximizing cost effectiveness of storage
- Will be able to monetize the full range of applications

Barriers to Market Development

- **Institutional barriers**: policy and regulatory uncertainty
- Utilities need a cost recovery mechanism in place for infrastructure investment
- Others need to be sure a good investment
- Who should own the equipment?
- What purpose should it be used for?
- In urban areas, policy decisions relating to building codes will affect investment

Barriers to Market Development

- **Technological barriers**: performance and system compatibility
- Storage industry is fragmented
- Need certainty in system compatibility
- Need standardization of communications protocols
- For grid scale projects, technologies must be reliable to be included in strategic planning

BOND SCHOENECK & KING ATTORNEYS

Barriers to Market Development

- For some advanced batteries, lack of large-scale manufacturing inhibits funding for commercialization of energy storage in U.S.
- Need for high volume manufacturer of batteries

BOND SCHOENECK & KING ATTORNEYS

Legal Issues

- Siting
- Building code compliance
- Permitting
- Interconnection Agreements
- Financing vehicles
- Contracts
- Real estate

BOND SCHOENECK & KING ATTORNEYS

Integrating Solar, Energy Storage, Combined Heat and Power, and Fuel Cells

Microgrid Distributed Generation for NY Buildings

Presented by

FUTURE ENERGY DEVELOPMENT, LLC

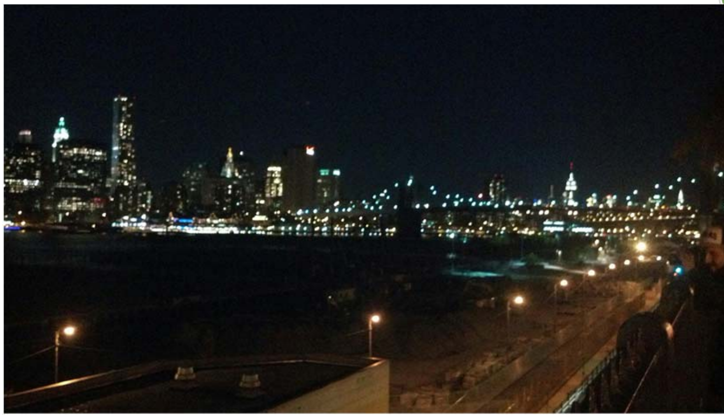
Linda Shaw, Esq., Principal
lshaw@futureenergydev.com

Microgrid Definition

A microgrid is: "A group of interconnected loads and distributed energy resources (DER) with clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid [and can] connect and disconnect from the grid to enable it to operate in both grid-connected or island mode." U.S. Department of Energy, Microgrid Exchange Group

NYSERDA references this definition in the NY Prize guidance.

Institute of Electrical and Electronics Engineers (IEEE) 1547.x is a set of industry standards for interconnecting distributed energy resources to electric utility systems. IEEE 1547 is being amended to accommodate microgrids and higher penetrations of DERs.



Why is this Important?

View of Midtown Manhattan Just Before Hurricane Sandy

View of Midtown Manhattan After Hurricane Sandy

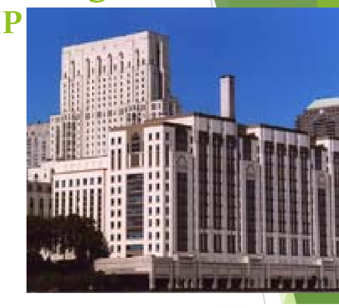
Empire State Building's new CHP Unit Kept Powering the Lights

View of Lower Manhattan from Brooklyn
Before Hurricane Sandy

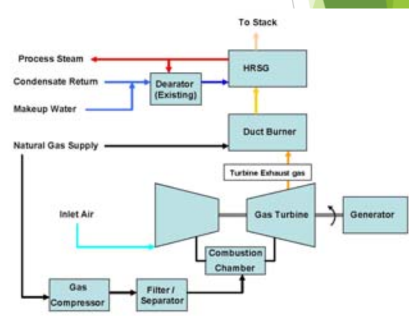
View of Lower Manhattan from Brooklyn
After Hurricane Sandy

Critical Care Facilities Need Microgrids

New York Presbyterian Hospital CHP



- 7.5 megawatt system with waste heat recovery
  - Provides 60 to 100% of hospital electricity demand
  - Waste heat drives centrifugal chillers for conditioning systems
  - Relieves load on local ConEd distribution system
  - Operates in event of power outage
- Overall efficiency of 85%
- Expected to save $5 million/year
- $1.1 million NYSERDA grant utilizied in support of estimated $16.9 million project



"Superstorm Sandy demonstrated the need for resilient power generation when critical facilities like hospitals lose electricity. . .Combined Heat and Power (CHP) technology is a clean energy, common-sense solution that keeps the lights on and systems running during emergencies. It is important that we invest in the installation of these kinds of power systems across the state to fortify our infrastructure against severe weather to maintain essential services and business productivity, and most of all, protect New Yorkers."
New York Governor Cuomo
Announcing $40M CHP Incentive Program

NYSERDA's New CHP Acceleration Program - The maximum incentive per project is $2M and the maximum CHP system size is 1.3MW.

One River Place CHP

•One River Place - 42nd Street &12th Avenue

•CHP is saving real dollars by generating electricity and using excess heat for 2/3s of hot water demand and all pool heat.

•State of the art CHP system generates up to 150 kilowatts of Electricity and One Million BTU/hr of usable heat

•CHP Incentives Used -

- oFederal tax credit of 10%
- oFederal 5-year MACRS depreciation
- oNational Grid incentives for Metro NYC (Brooklyn, Queens, Staten Island) (up to 50% of cost up to $250K)
- oNY Brownfield tax credit incentives
- oNYSERDA incentives

SILVERSTEIN PROPERTIES

FUTURE ENERGY DEVELOPMENT, LLC

Smart Grid or "Microgrid" Solar, Energy Storage & BMS Project

- Large capacity energy storage devices (e.g. batteries) can smooth variability of solar panels and shift power availability to higher value peak periods
- Also provides relief to T&D congestion in urban areas
- As technology improves and costs of storage decrease, storage will have significant financial returns

Smart Grid Demonstration Project at Brooklyn Army Terminal combined Solar PV, Battery Storage and building energy management system

Fuel Cells in Building Applications

Benefits of Fuel Cells for Distributed Generation in Building Applications:
•Reliable and consistent supply of electricity
•Can be used for CHP in place of combustion systems and produce overall efficiencies as high as 90%
•Can use various fuels: natural gas, hydrogen, propane, methanol
•Quiet operation vs. combustion systems.
•Near zero emissions at point of generation (compare with combustion systems).

Incentives Previously Available:
•Federal 5 Year MACRS and available bonus depreciation
•30% Federal ITC (up to $3,000/kW)
•NYSERDA Incentives (>25 kW systems)
  oCapacity incentive $1,000/kW (up to $1,500 for essential services)
  oAdded performance incentive of $0.15/kW-hr/yr for three years
  oMax. of $1 million/site

Comparison of Benefits

	CHP (combustion)	Fuel Cells	Battery Storage
Range of electrical output	Low to Moderate	High	High
Thermal load range	Moderate to High	Moderate	None
Initial Installed Cost	Low to Moderate	High	Moderate
O&M Cost	Low to Moderate	High	Low
Noise	Moderate to High	Low	Low
Modularity	Low to Moderate	High	High
Emissions at Location	Moderate to High (fuel dependent)	Low	Low
Electrical Efficiency	Moderate to High	High	High
Peak Demand Management	Low to Moderate	Moderate	High

What are the Problems?

- Cost is still high
- Payback is still 7 years or more
- Technology Confusion – Which technology is proven and is there a long term warranty?
- Education Hurdle – Civil Engineers and Architects are still not well educated on the different technologies
- Incentives are inconsistent
- Interconnection Charges and Utility resistance
- Lack of Community Based systems to share costs