NEW YORK STATE OF OPPORTUNITY. | NYSERDA

2016 Clean Air Interstate Rule Annual Report on the New York Battery and Energy-Storage Technology Consortium

Final Report

June 2017

NYSERDA's Promise to New Yorkers:

NYSERDA provides resources, expertise, and objective information so New Yorkers can make confident, informed energy decisions.

Mission Statement:

Advance innovative energy solutions in ways that improve New York's economy and environment.

Vision Statement:

Serve as a catalyst – advancing energy innovation, technology, and investment; transforming New York's economy; and empowering people to choose clean and efficient energy as part of their everyday lives.

2016 Clean Air Interstate Rule Annual Report on the New York Battery and Energy-Storage Technology Consortium

Draft Report

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Summary

Energy storage can play an important role in the reduction of nitrogen oxide (NO_x) and greenhouse gases in two critical sectors: transportation and the electric grid. For example, energy storage can capture and then deploy energy lost during braking in vehicles, including electrified rail and subway, and store electricity until it is needed on the electric grid. Storage distributed throughout the electric system can also reduce the intermittency of solar electric and wind generated energy, helping these resources to serve as flexible assets when needed. Energy-storage capacity can avoid the need for new transmission and distribution infrastructure, increase system efficiency and resiliency, and reduce the requirement for additional fossil fuel plants to meet periods of peak electric demand, which occurs sporadically. It can integrate with demand response and energy efficiency measures within buildings to achieve greater energy savings without sacrificing occupant comfort. It can enable distributed generation to operate independently or "island" from the electric grid during an outage, providing greater resiliency. Energy storage will help meet New York State's Clean Energy Standard for 50 percent renewable electric generation by 2030, while achieving the State's greenhouse gas reduction goals. Furthermore, it will be an integral component to enabling the future electric system envisioned under the Public Service Commission's Reforming the Energy Vision.

The New York Battery and Energy Storage Technology Consortium™ (NY-BEST) was established in 2009-2010 to help position New York State as a global leader in energy-storage technology for electric grid, transportation, and other large-scale storage applications. NYSERDA was charged with working with industry and academic partners to establish this industry-driven consortium, which has been provided seed money by NYSERDA with approximately $26 million through Clean Air Interstate Rule (CAIR) proceeds.

NY-BEST is a New York State not-for-profit corporation and managed by a 17-member board elected by the NY-BEST membership. In 2010, the Board hired Bill Acker as executive director and Capitol Hill Management Services to provide association management services to NY-BEST. These services continued in 2016.

S.1 Strategies

NY-BEST uses four primary strategies to build the energy-storage industry in New York State:

- Serve as an authoritative resource on energy storage, proactively communicating energy storage related news and information, and facilitating connections amongst stakeholders.
- Advance and accelerate the commercialization process for energy-storage technologies, from research and development to products and widespread deployment.
- Educate policymakers and stakeholders about energy storage and advocating on behalf of the energy-storage industry.[1]
- Promote New York State's world-class intellectual and manufacturing capabilities and providing access to markets to grow the energy storage industry in the State.

This annual report is prepared pursuant to the program plan developed with stakeholder input in 2009 and adopted by the NYSERDA Board and provides an update on NY-BEST progress, expenditures, and results for the year.

Metrics used to assess the progress of NY-BEST are included for NY-BEST operations, testing, characterization, and prototyping capabilities, as well as research and development. The report also includes commercialization progress related to NY-BEST's activities, and independent, external evaluations were conducted. A process evaluation report on NY-BEST was completed in 2015.[2] An impact evaluation on the NY-BEST initiative was completed in 2017 after the report period.[3] These evaluations documented NY-BEST program activities and progress toward the consortium's short- and mid-term outcomes. They also benchmarked NY-BEST in comparison to peer organizations and identified lessons about the consortium model that other groups may consider. The evaluations found that NY-BEST was making good progress in delivering valued services to its members and achieving its objectives. An energy-storage, market-impact assessment was also conducted.[4]

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1 Any NY-BEST lobbying activities (i.e., attempts to influence decisions of government officials) are funded entirely with non-NYSERDA funding.

2 nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2015ContractorReports/2015-NY-BEST-Process-Evaluation-Report.pdf

3 nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2017ContractorReports/Energy-Storage-NY-BEST-Impact-Evaluation-Report.pdf

4 nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2016ContractorReports/2016-10-energy-storage-industry-growth-projections-report.pdf

This analysis found that since 2012 employment in New York State's energy storage sector has grown 30 percent to almost 3,900 employees and global annual revenues increased 50 percent to $900 million. The study projected that by 2030 this sector could employ up to 25,000 people in New York State and could comprise $8 billion in annual revenues. Finally, a market characterization was completed in 2017 and identified key market participants in the energy-storage value chain including NYS firms.[5]

S.2 Accomplishments

Highlights of NY-BEST major accomplishments during 2016 include:

- NY-BEST membership has grown more than 200 percent since its inception in 2010 to over 150 members. Members represent all aspects of the energy-storage sector, with academic institutions, research organizations, entrepreneurial start-up companies, non-profit organizations, small- and mid-sized enterprises and large multinational corporations all represented. Approximately 25 percent are from outside of New York State, which presents an excellent opportunity to attract new firms to the State.
- NY-BEST helped members with introductions to potential customers, facilitated product development and commercialization partnerships, helped members with funding applications and investor pitches, and assisted members with understanding and navigating financial and regulatory requirements for energy storage. Although relationships and negotiations with investors take time to solidify, numerous NY-BEST members who have presented at a NY-BEST investor conference have subsequently raised significant funding totaling more than $200 million.
- NY-BEST launched its virtual incubator program with the assistance of a grant from National Grid to deliver direct business assistance, technical guidance, and mentoring, and helped emerging companies access capital.
- Fifty-four research and development or product development projects were awarded since inception; seven of these have been completed and are making strong commercialization progress, and another 20 were completed and are showing potential, with work continuing beyond the scope of the project. Another 14 projects are ongoing and 13 were either completed but did not show commercialization potential or were terminated because of market or business changes.

[5] nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2017ContractorReports/Energy-Storage-NY-BEST-Market-Characterization-Report.pdf

- NY-BEST grew the energy-storage, product-development ecosystem to expand product development services available to battery and energy-storage companies at the BEST Test and Commercialization Center (BTCC), Battery Prototyping Center (BPC) and at Eastman Business Park, all located in Rochester, NY. NY-BEST received $2 million in funding commitments from Empire State Development and leveraged an additional $3 million in additional investments to expand testing services at the BTCC and to add cylindrical cell testing capabilities at the BPC. In addition, NY-BEST worked in partnership with Kodak to develop a battery and capacitor pilot manufacturing facility at Eastman Business Park. New York State, through Empire State Development, has committed $1.2 million to support the development of the facility which is expected to open by the fourth quarter of 2017. These expanded services further strengthen New York State's growing ecosystem for battery energy-storage development and manufacturing.
- NY-BEST served as an active participant in Reforming the Energy Vision, which has proceeded to fundamentally transform the way electricity is distributed and used in New York State to promote a clean, resilient, and affordable energy infrastructure.
- NY-BEST launched an economic development outreach initiative entitled Capture New York's Energy with grant funding from Rochester Gas and Electric, New York State Electric and Gas Corporation and NYSERDA, along with partners Eastman Business Park, DNV GL, and Rochester Institute of Technology (RIT), to promote New York State's unique resources and assets for the energy-storage industry. NY-BEST created a showcase exhibit and displayed it at The Battery Show in Novi, MI and at Energy Storage North America in San Diego, CA. These efforts generated numerous business leads for the partners and new members for NY-BEST. In 2017, NY-BEST will expand these efforts to exhibit at additional conferences and expos and incorporate a number of New York-based start-ups as part of the exhibit.
- NY-BEST made good progress toward operational self-sufficiency for core-member services with non-NYSERDA funding representing almost two-thirds of the total budget. Additionally, financial reserves expanded to approximately $450,000 of generated income on hand as a reserve to enable a smoother transition when NYSERDA core-operation funding is exhausted in early 2018.
- As part of outreach and educational efforts, NY-BEST held its annual conference, a technology conference, its annual invitation-only investment conference, and partnered with NYSERDA on an On-site Power Conference and Expo. NY-BEST expanded its educational efforts through webinars in 2016, presenting on topics with the following titles: The Outlook for Storage in New York State, The Value of Distributed Energy Resources, and The Role for Storage in Increasing Hosting Capacity.

1 CAIR Financial Information

Financial data through December 31, 2016 is presented in Table 1, and details are provided in the remainder of this section.

1.1 NY-BEST Operations and Management

NY-BEST operations and management includes a $4.35 million operation contract between NYSERDA and NY-BEST to partially support NY-BEST's operations, as the consortium works toward self-sufficiency for its core-member services. As of December 31, 2016, ninety-three percent of the operation contract has been expended with NYSERDA's proportion of total consortium expenditures continuing to decrease. The remaining funds under this contract are anticipated to partially support NY-BEST operations through early 2018, at which time the consortium is expected to fund its core-member services through non-NYSERDA funding. Some of the activities performed by NY-BEST are economic development in nature, such as recruiting companies to the State and expanding visibility into the energy-storage supply chain. These activities do not naturally align with the types of services an individual member would find valuable and want to support. In these cases, grant support including from NYSERDA may be appropriate to support targeted economic development and sector building efforts.

Table 1. Budgeted and Committed CAIR Funds as of December 31, 2016

Source: NYSERDA

	Budgeted	Expended/Committed [a]
NY-BEST Operations and Management	$4,548,000	$4,546,477
Research and Development Awards	14,609,441	13,759,925
Testing and Characterization Capabilities	3,445,114	3,445,114
NYSERDA Administration	2,211,000	2,211,000
Program Evaluation and Accountability	500,000	500,000
Brokerage Fees for NOx Allowance Sales	296,105	296,105
New York State Cost Recovery Fee	618,000	489,100
Total	**$26,227,660**	**$25,247,721**

[a] "Committed" includes funds already expended and those that have been committed for specific initiatives.

1.2 Research and Development

Research and development awards have been committed through two program opportunity notices. These opportunities sought seed-stage projects and projects that transition promising storage technologies from proven technical feasibility into working prototypes. Funds also supported initial investment in battery safety testing to begin removing uncertainty within fire and building departments, which is delaying consideration of energy-storage systems for building-energy management. Uncommitted research and development funds resulted from awarded projects that were terminated and NYSERDA is working with NY-BEST to identify the most effective uses for these remaining funds.

1.3 Testing and Characterization

Testing and characterization capabilities funding has been fully utilized for the BTCC, which allows companies, researchers, and customers to test and validate new energy-storage technologies for electric grid, transportation, and other applications.

1.4 NYSERDA Administration

NYSERDA administration covers staffing and direct costs associated with managing the program including the research and development projects, as well as serving in a formative role during the first 21 months of NY-BEST's development, until an executive director and staff were hired by the NY-BEST Board.

1.5 Program Evaluation and Accountability

Program evaluation and accountability included independent, external evaluations of the NY-BEST initiative with a process evaluation completed in 2015, a market characterization completed in 2017, and an impact evaluation completed in 2017.

1.6 Brokerage Fees

Brokerage fees for nitrogen oxide (NO_x) allowance sales represent fees charged by Amerex Corporation in selling the CAIR allowances provided to NYSERDA. New York State's regulations that implemented the federal CAIR program are set forth at 6 New York Codes, Rules and Regulations Parts 243 and 244. Ten percent of the NO_x emission allowances allocated to New York State under these regulations were directed by the New York State Department of Environmental Conservation to the Energy Efficiency and Renewable Energy Technology Account and used to establish NY-BEST. During 2016, no additional CAIR allowances were available or sold.

1.7 New York State Cost Recovery Fee

New York State Cost Recovery Fee is a shared services fee assessed by the New York State Division of the Budget and billed to NYSERDA.

2 NY-BEST Operations

In December 2010, the NY-BEST Board hired Bill Acker to serve as executive director. The Board selected Capitol Hill Management Services to provide association management services and office space for NY-BEST in January 2011. John Cerveny was subsequently hired as director of resource development in March 2011. These services continued during the year.

NY-BEST's objective is to build a vibrant energy-storage sector in New York State. Reaching this objective involves providing support at various stages of the product development and commercialization pipeline as well as proactively working to form partnerships. NY-BEST is helping to facilitate commercial introduction of energy-storage technologies in New York State, building the human capital and expertise needed to sustain a vibrant commercial energy-storage industry, and leveraging NYSERDA's seed resources to create a sustainable organization that provides value to its members and to New York State.

NY-BEST's operational measures and progress during the year are presented in this section.

2.1 Increased Membership

NY-BEST membership exceeds 150 members, a 200 percent growth since its inception in 2010. Members represent all aspects of the energy-storage sector, with academic institutions, research organizations, start-up companies, nonprofit organizations, small- and mid-sized enterprises, and large multinational corporations, all well-represented. During the year, the member retention rate remained at over 80 percent; the member loss primarily reflected start-up companies discontinuing operations and service providers not renewing. Appendix A lists all members of NY-BEST. During the year, the annual membership fee in NY-BEST was $1,500 for corporate organizational members; $1,000 for academic institutions, nonprofit, and government organizations; and $500 for start-up companies (defined as a company in the energy-storage business with 25 or fewer employees). Table 2 presents total revenue earned by NY-BEST including membership fees.

Table 2. NY-BEST Financial Summary

NEW YORK BATTERY AND ENERGY STORAGE TECHNOLOGY CONSORTIUM, INC.™
Condensed Statement of Revenues and Expenses (unaudited)
for the Year Ending December 31, 2016

Source: NY-BEST Financial Reports

Revenue	
Membership Dues	$118,100
Registration Fees	55,800
Sponsorships	138,000
Consulting Revenue	188,780
Operating Grants	600,150
Grants for BEST Test Center or Battery Prototyping Center	730,000
BEST Test Center Revenue Share	63,260
Total Revenue	**$1,164,090**
Expenses	
Contracted Services	$737,360
Conference Expenses	207,870
Board Expenses	13,430
Professional Fees	57,160
Travel	41,430
Other Expenses	33,690
Total Expenses	**$1,090,940**
Change in Net Assets	**$73,150**

2.2 Progress Toward Reaching Self-Sufficiency

Table 2 presents sources and uses of funds by NY-BEST during the year. In total, 93 percent of the $4.35 million operating-support contract between NYSERDA and NY-BEST has been expended. The remaining funds are expected to support a portion of NY-BEST's operations through early 2018, with NYSERDA's contribution continuing to decline as earned revenue increases. Non-NYSERDA funds earned by NY-BEST has increased and is used to cover a portion of operating costs and build a reserve fund to enable a smooth transition to sustainability after NYSERDA funding is exhausted. As of December 31, 2016, NY-BEST had approximately $450,000 in reserves.

2.3 NY-BEST Technology Transfer Activities During 2016

During the past year, NY-BEST continued to facilitate connections among energy-storage, supply-chain, and manufacturing resources. One of the important ways NY-BEST works to catalyze the energy-storage industry in New York State is by providing members industry news and information, facilitating connections between members, helping to create pathways to markets, and providing educational and networking opportunities. Activities across these areas during 2016 included:

- Creation of the NY-BEST BRIDGE incubator program. The NY-BEST Business Resources to Innovate, Develop, Grow and Excel (NY-BEST-BRIDGE) is a virtual incubator program that was launched in late 2016 with grant funding assistance from National Grid. The program is designed to provide direct business assistance and guidance, technical expertise, mentoring, access to capital and other funding sources, and access to other technical resources for energy-storage businesses in New York State. NY-BEST is working with the State's network of university centers, incubators, and research institutions to identify and connect with energy-storage related start-ups in order to provide assistance in commercializing their technologies, validate their technical solutions, and help to raise private capital. NY-BEST's goals through the program are to support and grow New York-based energy-storage start-ups, increase the number of new energy-storage start-ups in New York and accelerate the path to commercial success for these companies.
- NY-BEST expert staff continued to provide direct coaching assistance and mentoring services to members, assisted members with access to funding resources and facilitated research and development as well as product development partnerships among members. NY-BEST also actively promoted members through NY-BEST events, the NY-BEST website, and social media.
- In an effort to keep members informed and continue to raise NY-BEST's profile, NY-BEST provided timely and noteworthy communications through a variety of mechanisms including the NY-BEST website, e-newsletters, policy updates, funding and business opportunity alerts, e-communications, blogs, press releases, and social media.
- In 2016, NY-BEST sponsored events and webinars that attracted a total of more than 1,000 participants throughout the year.

3 Testing, Characterization, and Prototyping Capabilities

In 2016, NY-BEST continued its efforts to expand the product development, commercialization, and testing and characterization capabilities in New York State. These efforts resulted in new services and capabilities at the BTCC and BPC at Rochester Institute of Technology (RIT) and Eastman Business Park, respectively.

The BTCC is a wholly owned subsidiary of NY-BEST and comprises 17,000 square feet of space. NY-BEST competitively selected DNV GL to operate the lab under an arrangement where DNV GL will staff and operate the BTCC, relocate an existing energy-storage testing operation from Pennsylvania to Rochester, NY, and will invest in the BTCC over five years. The initial five-year contract term is renewable based upon performance and provides for revenue sharing back to NY-BEST based on gross revenues beginning in April 2015.

3.1 Battery Testing and Commercialization Center

Metrics used to evaluate the BTCC include:

- Use by members of NY-BEST and by non-members, and fees generated.
- Jobs at the BTCC such as technicians and equipment operators.
- Changes in Technology Readiness Levels and Manufacturing Readiness Levels for technologies examined at the BTCC.
- Commercialization success of products tested at the BTCC.

BTCC was opened in April 2014. The state-of-the art Center, located at Eastman Business Park in Rochester, is a subsidiary corporation of NY-BEST. It is operated by DNV GL under an agreement with NY-BEST and provides a suite of test, validation, and independent certification capabilities that are necessary to introduce new energy-storage technologies into the marketplace. It includes testing equipment for battery testing of secondary cells and battery packs, as well as temperature-test chambers and modular walk-in temperature test chambers. Offering testing from single cells to megawatt systems, the center's services include product development, performance validation, and certification testing, as well as a wide range of environmental testing and battery-lifetime testing.

Using a portion of a $2 million State grant secured in 2016, new services are being developed at the BTCC and will be available in 2017. These include: an array of new safety testing for batteries and battery systems and testing for solar paired with storage, including battery grid simulation and solar simulations.

Since its opening, the BTCC has assisted several dozen companies in testing and validating the performance of their products. The director and two test engineers staff the lab full time. They are supported by five other off-site staff members (business development, operations, health and safety, and finance). During 2016, 25 prospective companies visited the lab, 11 test programs were completed, and two test programs were in progress at year-end. A total of $552,000 in testing revenue was earned and DNV GL invested $510,000 operating the center. Revenue sharing back to NY-BEST from the BTCC was $63,000.

Several tested products are approaching commercialization and were tested for pre-field installation. This included Eos Energy Storage's zinc-hybrid battery chemistry, Raymond Corporation's li-ion battery interface, Cadenza Innovation's novel li-ion pack assembly, and Urban Electric Power's zinc-manganese dioxide chemistry.

3.2 Battery Prototyping Center

In March 2015, the BPC at RIT was opened. Through agreements with New York State and NY-BEST, RIT owns and operates the facility with the input and guidance of an advisory board, and provides staffing for the facility. In addition, RIT is leveraging its status as a research university to secure competitive grants and funding to utilize and expand the expertise and research capabilities of the center.

The state-of-the-art prototyping center provides prototyping services and features a 1,000 square foot dry room and includes pouch-cell assembly equipment. NY-BEST members have priority access to the prototyping center and can purchase dry room time at a discounted rate. Access to the dry room includes manufacturing and assembly of lithium ion pouch cells (assembly, electrolyte filling, formation cycles, degassing, and sealing); training for users' employees on the prototyping line equipment; and prototyping technical assistance. In 2016, as a result of State funding received from Empire State Development, plans were developed to add cylindrical cell-battery prototyping capabilities to the BPC. These services will be available in 2017.

In the past year, the prototyping center assisted over two-dozen customers comprising revenue of almost $200,000. A battery assembly training workshop was also held for 40 participants. During the year, the center also expanded key material supplier relationships to expand the battery materials available to prototyping customers. The BPC is currently in discussions for multiple prototyping projects for the remainder of the fiscal year. RIT and the BPC were also awarded a two-year NASA Small Spacecraft Collaboration for a total of $100,000 per year to demonstrate the successful integration of nanomaterial-enhanced devices into a space-power system.

3.3 Eastman Business Park Battery Manufacturing Expansion

In 2016, NY-BEST partnered with Kodak and secured $1.2 million in funding from Empire State Development and leveraged nearly $5 million in private investment to create a battery-pilot manufacturing facility at Eastman Business Park in Rochester, New York. Under the agreement, Kodak will install two multi-user battery-cell assembly lines at Eastman Business Park. The site will serve battery and capacitor development and production companies. The new lines will complement existing roll-to-roll (R2R) coating capability and expertise at Kodak, the Battery Prototyping Lab at Rochester Institute of Technology, and the Battery Test and Commercialization Center at Eastman Business Park.

The battery-cell assembly facility, which will be operated by Kodak in partnership with NY-BEST, will utilize equipment supplied by Kodak. This includes a dry room and specialized manufacturing equipment for cutting, winding, stacking, welding, filling, formation, and packaging machines to make batteries, ultra-capacitors, and other energy-storage devices.

4 NY-BEST Research and Development

NYSERDA awards and manages all research and development funding using NYSERDA's established solicitation process with input on needs from the energy-storage community and NY-BEST. These awards complement NYSERDA's existing energy-storage programs by focusing on transitioning new energy-storage technologies with proven technical feasibility into working prototypes.

In total, 54 projects were awarded. Seven of the completed projects are making strong commercialization progress including (in the order presented below) the novel electrolyte developed by SUNY Polytechnic, which was spun out to Eonics which has attracted $3.5 million in grants and investments; silicon based electrodes developed at Rensselaer Polytechnic Institute which spun out to form Enermat Technology; Graphenix which executed a $1 million joint development agreement with a capacitor manufacturer worth potentially multimillion dollars per year in electrode sales; BessTech which has raised a $250,000 angel investment and is pursuing joint development agreements with several manufacturers; Eos Energy Storage which has raised over $23 million in private capital and is making its zinc-air batteries at Environment One in Niskayuna; and Raymond Corporation which successfully developed a lithium-ion-battery system and interface with Navitas Systems for sale as a drop-in that is a more efficient replacement for lead-acid batteries in lift-truck applications.

Another 20 projects have been completed and have shown potential with work continuing beyond the scope of the project. Fourteen projects are still ongoing. Finally, 13 projects were either completed but did not show commercialization potential or were terminated because of market or business changes. Total NYSERDA commitment was $13,245,404 and $16,642,736 was provided in co-funding.

Additionally, 64 percent of the projects presented at one or more conferences totaling 97 presentations, 50 journal articles cited funded research projects, and 22 patent applications were submitted or received. Each project is discussed below.

Figure 1 also shows these projects by underlying energy-storage technology. Figure 2 shows intended applications and reflects the composition of the NY-BEST membership, which primarily focuses on electric grid and transportation applications. A wide range of chemistries and systems, each possessing unique attributes best suited to a specific use case have been supported.

Figure 1. Research Projects by Underlying Chemistry

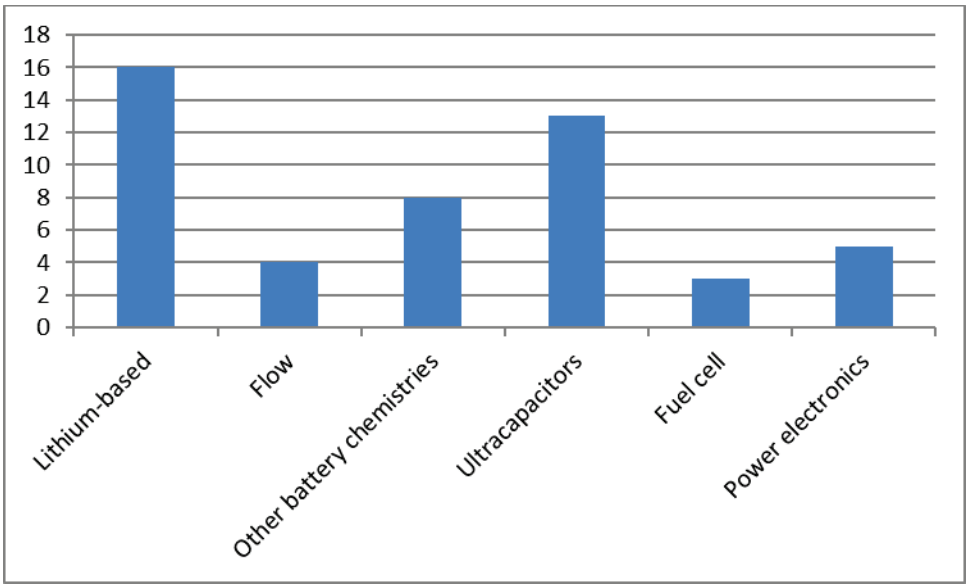
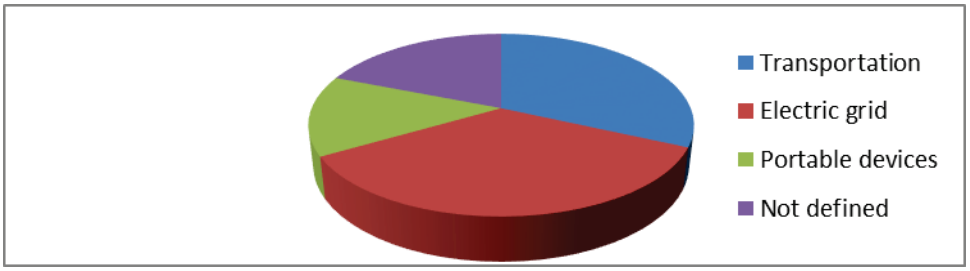


Figure 2. Intended End-Use Applications



4.1 Program Opportunity Notice 1704

The following projects were awarded in March 2010 under Program Opportunity Notice 1704, which supported seed and product development projects:

- Binghamton University (Binghamton): Stan Whittingham, Ph.D., pursued a lithium air energy-storage system for vehicles and stationary applications.
  NYSERDA: $185,850; co-funding: $78,410
  Status: completed; work was presented at 20 conferences and included in five publications.

- Brookhaven National Laboratory (Upton): Feng Wang, Ph.D., is examining lithium-titanate batteries for lower-cost, electric-grid storage.
  NYSERDA: $200,000; co-funding: $100,000
  Status: ongoing; work was presented at one conference and included in three publications.

- Binghamton University (Binghamton): Stan Whittingham, Ph.D., partnered with Brookhaven National Lab and Stony Brook University to develop improved batteries for lower-cost, electric-grid storage, examining lithium-ion batteries.
  NYSERDA: $152,890; co-funding: $147,000
  Status: completed; work was included in three publications.

- Stony Brook University (Stony Brook): Esther Takeuchi, Ph.D., examined new materials for lithium-ion batteries with improved performance and lower cost for electric-grid storage.
  NYSERDA: $199,109; co-funding: $200,000
  Status: completed; work was presented at 12 conferences and included in six publications.

  Cerion Enterprises (Rochester): Researchers explored nanoparticle materials for next-generation lithium-ion batteries, which could make the batteries smaller and lighter—an important characteristics for transportation applications.
  NYSERDA: $199,967; co-funding: $151,072
  Status: completed; work was presented at four conferences, included in two publications, and resulted in five patents issued.

- City University of New York (New York City): Pursued a low-cost, nickel-zinc flow battery that could be used in hybrid electric vehicles.
  NYSERDA: $196,526; co-funding: $50,000
  Status: completed; this work leveraged almost $2 million in ARPA-E and National Science Foundation funding and was licensed to Urban Electric Power, a start-up company. The flow-battery technology is not being commercialized at this time as Urban Electric Power works to commercialize their zinc-manganese dioxide rechargeable battery for electric-grid applications, a lower cost solution.

- City University of New York worked with Columbia University (New York City): Pursuing metacapacitors using a printable material to create high-voltage, high-energy, and high-power density capacitors for energy storage.
  NYSERDA: $147,679; co-funding: $1,649,865 including an ARPA-E award
  Status: completed; a $1.6 million ARPA-E award was received; the technology was presented at six conferences and included in nine publications.

- SUNY Polytechnic (Albany): Pradeep Haldar, Ph.D., and Manisha Rane-Fondacaro, Ph.D., developed new electrolytes to improve performance of ultracapacitors.
  NYSERDA: $200,000; co-funding: $116,263
  Status: completed; Eonics, a start-up company, was formed to commercialize this technology and has attracted over $3.5 million in grants and investments; six presentations were made and the technology was described in two publications.

- Cornell University (Ithaca): Emmanuel Giannelis, Ph.D., developed nonflammable battery electrolytes with improved safety and performance.
  NYSERDA: $178,866; co-funding: $213,652
  Status: completed; results were presented at five conferences and included in two publications.

- General Electric Co. (Schenectady): GE partnered with Alfred University (Alfred), Clarkson University (Potsdam), Columbia University (New York City) and Stony Brook University (Long Island) to explore enhancements to the next generation of its sodium metal halide batteries for uninterruptible power backup systems, electric-grid applications and heavy-duty transportation.
  NYSERDA: $2,499,610; co-funding: $2,994,063
  Status: completed; the company decided not to pursue the commercialization of this battery chemistry.

- General Motors (previously in Honeoye Falls, NY, and now in Detroit, MI), in conjunction with Cornell University (Ithaca): Evaluated new materials for improved lithium-ion battery electrodes
  for automotive applications to increase performance and reduce cost.
  NYSERDA: $150,922; co-funding: $67,581
  Status: completed; a provisional patent was filed for the underlying technology and was transferred to Cornell University.

- Hollingsworth & Vose, Co. (Easton): Explored a new advanced separator for more efficient valve-regulated, lead-acid batteries used in start-stop hybrid electric vehicles.
  NYSERDA: $119,965; co-funding: $85,951
  Status: completed; the new separators did not show adequate performance improvements to justify their cost and the project was terminated; the company is exploring other separator formulations.

- Impact Technologies (Rochester): Explored a novel method to increase the lifetime of batteries by assessing battery health through in-cell measurement techniques.
  NYSERDA: $85,734; co-funding: $27,115
  Status: completed; the company has received over $3 million in outside investment and the work has been presented at two conferences.

- Ioxus (Oneonta): Explored enhancements to its ultracapacitors by developing a novel electrode-electrolyte interface in conjunction with the City University of New York.
  NYSERDA: $26,598; co-funding: $26,598
  Status: completed; project was not completed after initial results; Ioxus continues to grow as a company having raised over $21 million in venture capital.

- Rensselaer Polytechnic Institute (Troy): Nikhil Koratkar, Ph.D., developed nanoengineered silicon-based electrodes that could enable greater power and energy density and reduce the cost of lithium-ion batteries.
  NYSERDA: $199,425; co-funding: $424,179
  Status: completed; received a $396,000 National Science Foundation grant to support follow-on work; project was presented at one conference and included in two publications; the technology was part of the underlying basis for spinning out Enermat Technologies to commercialize this technology.

- Rochester Institute of Technology (Rochester): Gabrielle Gaustad, Ph.D., evaluated methods that can help recycle and reuse lithium-ion batteries to minimize landfill waste and maximize reclamation.
  NYSERDA: $195,369; co-funding: $157,200
  Status: completed; the project was presented at five conferences and included in four publications and $772,000 in follow-on NSF funding was received to continue the research.

- Ultralife Corporation (Newark, NY): Sought to develop a multi-element power generation and storage-system with renewable energy.
  NYSERDA expenditures: $393,362; co-funding: $411,638
  Status: project was discontinued after initial project results did not demonstrate commercial potential.

4.2 Program Opportunity Notice 2458

The second research and development solicitation issued by NYSERDA (PON 2458) focused on transitioning energy-storage technologies with proven technical feasibility at the lab scale into working prototypes to assess whether the technology has commercial potential. Demonstrating a working prototype is an important stage that can interest additional funders including private capital. Five rounds were included and projects are presented in the round in which they were awarded.

- Custom Electronics Inc. (Oneonta): Explored a graphene electrolytic capacitor that could provide extra energy to ride through momentary electric fluctuations or interruptions on the electric grid.
  NYSERDA: $250,000; co-funding: $421,032
  Status: completed; a patent application was submitted and the work was presented at one conference.

- SUNY Polytechnic (Albany): Explored an ionic liquid electrolyte to enhance lithium-ion capacitors for improved short-term energy storage in hybrid vehicles and power electronics.
  NYSERDA: $249,979; co-funding: $251,170
  Status: completed; a research agreement is being explored with a company partner.

- Graphenix Development (formerly Graphene Devices Ltd.) (Williamsville/Rochester): Developed a graphene-based, high-energy ultracapacitor with up to three times the energy density of current commercial devices at similar cost, which can be used in smart-grid devices and hybrid vehicles.
  NYSERDA: $300,000; co-funding: $330,000
  Status: completed; several patent applications were submitted; a $1 million joint-development agreement was executed with a capacitor manufacturer worth potentially several million dollars per year in electrode sales; the product is also being sold to strategic partners for testing.

- Ioxus (Oneonta): Developing thermally optimized ultracapacitors for hybrid vehicle applications.
  NYSERDA: $211,601; co-funding: $250,000
  Status: completed; initial results showed some promising incremental improvements to enable better heat dissipation from the cells, and better cycling; work continues beyond the scope of this agreement for those areas most promising; the company has raised over $21 million in venture capital and employs over 50 people in Oneonta.

- Paper Battery Co. (Troy): Developed a production prototype of its thin and flexible ultracapacitor to provide temporary backup power systems.
  NYSERDA: $250,092; co-funding: $353,000
  Status: completed; the company has raised $6.4 million in funding including a $3 million Series A financing to move toward commercialization; product samples have been purchased by customers for testing; four patents have been issued and the technology was presented at five conferences and included in one journal.

- Primet Precision Materials (Ithaca): Sought to develop a production process that could lower the manufacturing cost of key raw materials used in lithium-ion batteries.
  NYSERDA: $87,524; co-funding: $365,835
  Status: completed; the project was discontinued when results did not show sufficient commercial promise.

- Urban Electric Power (New York City): Sought to develop a megawatt-hour battery for peak power reduction using a novel "flow-assisted," zinc-anode battery with an advanced battery management system.
  NYSERDA: $249,847; co-funding: $249,847
  Status: ongoing; the company has raised over $2 million from investors, but has prioritized commercialization of its zinc-manganese dioxide battery.

- Battery Energy Storage Systems (BESS) Technologies (Albany): Collaborated with SUNY Polytechnic Institute and Rensselaer Polytechnic Institute to evaluate a graphene-based electrode for lithium-ion batteries that can store more energy and charge faster than those currently deployed.
  NYSERDA: $218,000; co-funding: $218,000
  Status: completed; results were presented at one conference and joint-development partnerships are being pursued; company has received a $250,000 angel investment.

- Bettergy Corp. (Peekskill): Pursuing improvements to a low-cost, zinc air-flow battery that could be used for grid-storage applications.
  NYSERDA: $189,000; co-funding: $189,000
  Status: ongoing; results were presented at three conferences; the project is also leveraging a $385,000 ARPA-E grant; one patent application was filed.

- Custom Electronics (Oneonta): Sought to develop an ultracapacitor with increased energy-storage potential to provide shorts bursts of power over very long lifetimes for industrial power electronic applications and hybrid vehicles.
  NYSERDA: $233,688; co-funding: $290,000
  Status: completed; work has been presented at one conference and the work continues.

- Eos Energy Storage (New York City): Scaled a novel zinc-based battery with low-cost, high-energy density and an inherently safe design for electric-grid-storage applications.
  NYSERDA: $249,995; co-funding: $250,000
  Status: completed; initial sales have begun and the company is making its batteries at Environment One in Niskayuna; the company has raised over $23 million in private capital.

- NOHMS Technologies (Ithaca and Rochester): Pursued development of a new prototype for longer-lasting batteries for mobile phones and power electronics.
  NYSERDA: $246,788; co-funding: $250,000
  Status: completed; one patent application was submitted; $600,000 in federal/industry research and development grants were previously obtained; $1.35 million in private capital has been raised; and the company recently received a $750,000 NASA award.

- UTS Engineering (formerly Electromotive Designs) in Ronkonkoma, NY: Pursued a low-cost, easily installed, hybrid-electric, add-on system to recapture braking energy in buses and trucks using ultracapacitors manufactured by Ioxus in Oneonta, NY. Verizon will test the system.
  NYSERDA: $187,365; co-funding: $301,940
  Status: completed

- Watt Fuel Cell Corp. (Port Washington, NY): Building a prototype capable of providing electricity and heat from a portable solid-oxide fuel cell for military applications and backup power during electric grid outages.
  NYSERDA: $249,704; co-funding: $812,696
  Status: ongoing; the work has been presented at four conferences.

- Custom Electronics, Inc. (Oneonta, NY): Worked with Binghamton University to develop a new electric capacitor for power conditioning applications.
  NYSERDA: $187,165; co-funding: $294,400
  Status: completed; results were presented at one conference.

- Cornell University (Ithaca, NY): Working with company partner Proton to develop and demonstrate a regenerative fuel cell energy-storage system based on an anion exchange membrane designed at Cornell to produce hydrogen. This technology will seek to address a key obstacle in renewable hydrogen production from electrolysis by reducing the cost of expensive platinum catalysts.
  NYSERDA: $250,000; co-funding: $250,000
  Status: ongoing

- Columbia University (New York, NY): Will scale an electrochemical technology coupled with a bioreactor, which was successfully developed under a $1.5 million ARPA-E award, to convert electricity into energy stored in a liquid fuel. The technology, if successful, will produce biofuels from electricity and from CO_2 with minimal land and environmental burdens.
  NYSERDA: $249,367; co-funding: $271,621
  Status: ongoing; a patent application has been submitted.

- Widetronix (Ithaca, NY): Worked with the Cornell Nanoscale Facility to enhance the power density of the Widetronix betavoltaic platform, which is a millimeter-scale semiconductor chip that converts an embedded isotope into very small amounts of DC electricity for decades of use, such as would be used in sensors.
  NYSERDA: $246,347; co-funding: $397,159
  Status: completed; company received an $800,000 angel investment but has shifted focus to biomedical applications.
-
- Rensselaer Polytechnic Institute (Troy, NY): Working with Finch Paper (Glens Falls) and JNC (Rye) to explore high-energy density cathode materials for lithium-sulfur batteries using a green chemistry approach that uses a low-cost byproduct from the paper industry.
  NYSERDA: $122,009; co-funding: $122,026
  Status: ongoing; results have been presented at two conferences.

- Bettergy (Peekskill, NY): Pursuing a low-cost, rechargeable zinc, manganese-dioxide battery for electric-grid applications.
  NYSERDA: $249,852; co-funding: $249,852
  Status: ongoing; Bettergy has been developing this technology for several years, including under a $484,000 ARPA-E award for the fundamental technology development; the project has been presented at one conference and a patent application was submitted.

- Graphenix Development (Williamsville, NY): Commercialized a nanostructured graphene-based electrode for high-power, high-energy ultracapacitors for applications including hybrid vehicles (start/stop) and hybridized batteries. The company is also leveraging the roll-to-roll manufacturing capabilities at Eastman Business Park in Rochester.
  NYSERDA: $249,998; co-funding: $249,998
  Status: completed; results are presented in the Graphenix project included above.

- Combined Energies (Latham, NY): Partnering with UTS Engineering (Ronkonkoma, NY) to develop a low-cost power conversion device to increase the life of electrochemical batteries in stationary and mobile applications. The team will initially target the airport ground-support equipment market and later target materials for handling equipment as well as specialty mining vehicles. They will field test the system under this project at a Southwest Airlines hub in New York State.
  NYSERDA: $299,495; co-funding: $299,495
  Status: ongoing; one patent has been received and the work has been presented at one conference; company is moving to next phases of work with potential customers testing the system and has been selected by a battery manufacturer to provide power-conditioning equipment.

- Lionano (Ithaca, NY): Pursued commercialize a high-performance, nanoengineered-anode material for the lithium-ion battery sector.
  NYSERDA: $249,784; co-funding: $282,177
  Status: completed; a patent application was submitted and work continues.

- Eonix (Colonie, NY): Developing next-generation electrolytes that increase energy-storage capabilities of ultracapacitors with increased voltage and a wider temperature range.
  NYSERDA: $250,000; co-funding: $250,000
  Status: ongoing

- Custom Electronics (Oneonta, NY): Partnering with UTS Engineering (Ronkonkoma, NY) to construct prototype devices for field-testing and develop a detailed commercialization plan for a high-voltage, graphene-based, electrolytic capacitor for power-conditioning applications such as servers and electrical equipment.
  NYSERDA: $250,000; co-funding: $369,834
  Status: ongoing; two patent applications were submitted.

- Raymond Corporation (Greene, NY): Worked with Navitas Systems (a lithium-ion manufacturer) to develop and test an advanced lithium-ion, energy-storage system for electric lift trucks. Compared to existing lead-acid technology, this energy-storage system showed improved cold temperature performance, lower operating costs, more efficient opportunity charging during operator breaks, and increased productivity.
  NYSERDA: $250,000; co-funding: $416,000
  Status: completed; the product was successfully demonstrated at Maines Paper and Food Service located in Binghamton, NY and yielded positive feedback from both the forklift driver and warehouse management. A Public Standard Interface Specification for all trucks, batteries, and chargers was published. A lithium-ion battery system was successfully demonstrated as a drop-in replacement for lead-acid batteries in a Reach Truck application with 17 percent productivity improvement. The Navitas Starlifter lithium-ion battery will be available for purchase in 2017 and Raymond will begin offering truck conversion kits.

- Urban Electric Power (New York City): Will demonstrate a rechargeable zinc, manganese-dioxide battery chemistry developed by City University of New York with ARPA-E funds and move toward a target sale price of less than $100 per kilowatt-hours for grid applications.
  NYSERDA: $299,898; co-funding: $299,898
  Status: ongoing; company continues to pursue manufacturing scale-up and commercialization.

- Applied Power Systems (Hicksville, NY): Developing a multi-chemistry battery charger/low voltage power supply for use on commuter rail cars to improve the functionality and efficiency of a charger originally designed exclusively for lead-acid batteries.
  NYSERDA: $205,686; co-funding: $205,686
  Status: ongoing

- Varta Microbattery (Rye, NY): Developing a backup power system for residential solar electric systems by leveraging the solar inverter and developing an island interconnection device to serve as the interface between the building's microgrid and the electric grid.
  NYSERDA: $250,000; co-funding: $405,000
  Status: ongoing; work was presented at two conferences and in one journal.

- Enermat Technologies (Clifton Park, NY): Working to commercialize high-performance graphene anodes for li-ion batteries with increased energy and power densities as well as excellent cycle life with target markets in the electric grid and transportation sectors.
  NYSERDA: $249,859; co-funding: $249,859
  Status: completed; company continues to pursue manufacturing scale-up and commercialization.

- American Fuel Cell (Rochester, NY): Demonstrating the manufacturing scale-up of fuel cell membrane-electrode assemblies using high-volume, roll-to-roll equipment and evaluating performance metrics to assess superiority of the company's membranes in targeted applications including transportation.
  NYSERDA: $250,000; co-funding: $320,625
  Status: ongoing; work was presented at one conference.

- PowerHub Systems (Blacksburg, VA) and Applied Power Systems (Hicksville, NY): Developing a high-density, silicon-carbide-based power inverter for grid-interfaced, small-footprint, energy-storage systems with better performance, higher efficiency, and potentially lower cost than alternative products.
  NYSERDA: $249,925; co-funding: $249,953
  Status: ongoing

Projects with the following companies were awarded but not contracted for various reasons including changes in the company's business model or commercialization timeframes:

- GE Energy Storage (Schenectady, NY) and Raymond Corporation (Greene, NY)
- Ambri (Cambridge, MA)
- Hollingsworth & Vose (East Walpole, MA)
- DNV GL (Mahwah, NJ)
- Bren-Tronics (Commack, NY)

5 Commercialization Progress

Commercialization progress for members of NY-BEST is measured by outside funding received including grants and private investment, product sales and new products launched, licenses executed and licensing revenue, cost savings, capital expenditures, and jobs created and retained. Energy, economic, and environmental benefits realized by utilizing energy storage will also be assessed as part of the independent evaluations conducted.

This section presents commercialization progress of NY-BEST members who were assisted by NY-BEST's staff during the year. This assistance included introductions to new partners, facilitating product development and commercialization partnerships, helping with investor pitches, identifying funding opportunities, and helping members understand and navigate financial and regulatory requirements for energy storage. NY-BEST members have achieved the following results, in part, as a result of these activities. Commercialization progress related to research and development awards is included in the NY-BEST Research and Development section.

Investor Funding: In addition to advising and providing introductions and coaching throughout the year, NY-BEST continued its annual Energy Storage Investment Conference where selected NY-BEST members present to leading venture capital, angel, and institutional investor firms including GE's investment arm, Kleiner Perkins, and Braemar Energy Ventures. NY-BEST coached and helped seven member companies prepare for presentations at the 2016 NY-BEST Investor Conference in New York City. Although many of these relationships and negotiations take time to solidify, numerous NY-BEST members who have presented at a NY-BEST investor conference have subsequently raised significant funding, totaling more than $200 million, including Green Charge Networks ($56 million), Eos ($40 million), Ambri ($50 million), Ioxus ($69 million), Paper Battery Company ($4 million), NOHMs ($1.8 million), Widetronix ($2.2 million), Graphenix ($1.5 million), and EnStorage ($17 million). Other funding efforts are in due diligence and/or not publicly disclosed.

Grant Funding: NY-BEST routinely provides advice and guidance for member companies in their funding applications and worked closely with over two dozen members to identify specific grant funding opportunities and help them prepare, edit, review, and submit more than four dozen applications to federal, New York State, and nonprofit organizations during the year. A number of these were subsequently selected for funding totaling almost $10 million from organizations including NASA, U.S. Department of Energy, ARPA-E, and the Department of Defense. NY-BEST members receiving awards included Bren-Tronics, Applied Power Systems, Varta Microbattery, Enermat Technologies, American Fuel Cell, PowerHub Systems, Applied Power, Urban Electric Power, NOHMs, Bettergy, Cadenza, and Eos.

Facilitating Research and Development and Product Development Partnerships: NY-BEST plays an active role forging new partnerships among members through direct introductions and by providing numerous face-to-face networking opportunities throughout the year. Direct introductions between companies related to product development and research and development occurred over one-dozen times over the past year. Important introductions were made for battery developers to companies in the supply chain to provide key materials, processing and/or expertise needed to move their products from the prototype stage into production. Examples where NY-BEST facilitated introductions include connecting a battery developer to a customer; connecting a system integrator/project developer with an energy services company; and helping an emerging battery maker identify manufacturing partners to provide initial production capability.

Technical and Business Guidance/Early Stage Mentoring: In the past year, NY-BEST provided more than three-dozen established and start-up companies with substantive and, often, ongoing technical and business guidance. These companies included Bettergy, Viridity, Demand Energy, Lionano, NOHMs, Eos, Standard Hydrogen, Xallent, Tumalow, Tesla, Stasis, Navigant, OSW Power, Vizn Energy, Tabuchi, Schneider Electric, Stem, Brammo, Cadenza, Phillips Lytle, Effen Systems, Bollinger Motors, NTEA, EverOn24, Greenwich Energy, Innovari, SolarCity, C4V, Constellation, ABB, BYD, Vionx, Stem, Fluidic, Wildan, Convergent Energy, Stasis Energy, Nextera Energy, and BYD. The services and guidance spanned areas as diverse as business development and market-entry strategies (including siting requirements for energy storage in buildings in New York City) to connections to resource providers in legal, financial, technical, and manufacturing arenas.

Appendix A: NY-BEST Members

1. Advanced Energy Center at Stony Brook University
2. AES Energy Storage
3. Alfred University
4. alpha-En Corporation
5. Ambri
6. American Fuel Cell
7. American Renewable Energy Associates, Inc.
8. American Vanadium Corp.
9. Apogee Power USA
10. Applied Power Systems
11. AppliedLogix LLC
12. Arnold Magnetic Technologies
13. Ascension Industries Inc.
14. BAE Systems Controls
15. Bess-Tech
16. Bettergy Corp.
17. Binghamton University, SUNY
18. Bond, Schoeneck & King PLLC
19. Braemar Energy Ventures
20. Bren-Tronics Inc.
21. Brookhaven National Laboratory
22. Cadenza Innovation
23. CEC Energy
24. Center for Economic Growth
25. Central Hudson Gas & Electric
26. Charge CCCV LLC
27. City University of New York (CUNY)
28. Clarkson University
29. CODA Energy
30. Columbia University
31. Combined Energies LLC
32. Conamix Inc.
33. Consolidate Energy Solutions LLC
34. Consolidated Edison Company of New York, Inc.
35. Constellation (An Exelon Company)
36. CooperHill
37. Cornell University
38. Corning Incorporated
39. CQuest Partners LLC
40. CSA Group
41. Curtis Instruments, Inc
42. Custom Electronics, Inc.
43. Customized Energy Solutions
44. Delta Products Corporation
45. Demand Energy Networks
46. DNV GL
47. EaglePicher Technologies, LLC
48. Eastman Business Park
49. ECG Consulting Group Inc.
50. Elco Motor Yachts, LLC
51. Electron Storage, Inc.
52. Energy Technology Savings, LLC
53. Enerlogic LLC
54. EnerMat Technologies
55. EnStorage Inc.
56. EnSync Energy Systems
57. Eonix
58. EOS Energy Storage
59. EWI
60. Expansion Energy LLC
61. Fire & Risk Alliance, LLC
62. Fluidic Energy
63. G4 Synergetics, Inc.
64. General Electric
65. Genesis Energy Systems LLC
66. Graphenix Development
67. Green Charge Networks
68. Grid Energy
69. Harris Beach PLLC
70. Hecate Energy LLC
71. Helix Power Corporation
72. Heslin Rothenberg Farley & Mesiti PC
73. Hitachi America Ltd.
74. Hollingsworth & Vose
75. Hydrogenics Corporation
76. Hylie Products, Inc.
77. ICF International
78. ICL-IP America Inc
79. Ideal Power Converters
80. Innovation Core SEI, Inc.(Sumitomo Electric)
81. Intertek Testing Services NA, Inc
82. Invenergy Storage Development LLC
83. IPLAN Access
84. ITM Power Inc
85. Johnson Controls, Inc.
86. JuiceBox Energy, Inc.
87. Landis+Gyr
88. LeChase Construction Services

89. LG Chem ltd.
90. LG CNS America Inc.
91. Lionano
92. Lumens Energy
93. Lux Research Inc.
94. MeOH Power, Inc.
95. Mesha, LLC
96. MGA Research
97. MPEG LA
98. National Grid
99. Navitas Systems
100. NEC Energy Solutions
101. New York Institute of Technology
102. New York Power Authority
103. New York State Electric & Gas
104. NextEra Energy
105. NGK-Locke, Inc.
106. NOHMs Technologies, Inc
107. Northeast Transportation Electrification Alliance
108. Northern Power Systems
109. Novorocs Technologies
110. NRG Energy
111. O'Brien & Gere
112. O'Connell Electric
113. OneD Material LLC
114. Pacific Northwest National Laboratory
115. Paper Battery Company
116. Peak Power Energy Corp
117. Phillips Lytle LLP
118. PowerHub Systems
119. PowerPHASE LLC
120. Primet Precision Materials, Inc.
121. Primus Power
122. Renewable Energy Systems
123. Rensselaer Polytechnic Institute
124. River Road Research, Inc.
125. Rochester Gas and Electric
126. Rochester Institute of Technology
127. S&C Electric Company
128. Saft America, Inc.
129. Samsung SDI
130. Sendyne Corp
131. Sharp SEC – ESSG
132. Skyview Ventures LLC
133. SolarCity
134. Solid Cell Inc.
135. Stem, Inc.
136. SUDANO Consulting Inc.
137. Sustainable Innovations
138. Syracuse University
139. Tesla Motors
140. The Raymond Corporation, Division of Toyota Industries
141. Third Power
142. Ultralife Corporation
143. UniEnergy Technologies, LLC
144. Unique Technical Services LLC
145. University of Rochester
146. Urban Electric Power Incorporated
147. Valence Technology
148. VARTA Microbattery Inc.
149. VIONX Energy Corporation
150. Voltaiq
151. Watt Fuel Cell
152. Widetronix Inc.
153. Xcogen Energy, LLC

Appendix B: NY-BEST Board of Directors

The 17-member Board of Directors, elected by the NY-BEST membership, represents industry, the research community, end users and government partners. Board terms are staggered so that half of the Board seats are elected each year. The Board met four times during 2016. Current Officers and Board Members for 2016 are listed below. Board Members whose terms expired after 2016 or who were replaced in the 2017 elections are noted with an asterisk.

Michael Field, Raymond Corporation – Chair

Cathy Hill, CooperHill & Skidmore College – Vice Chair At Large *

Matt Fronk, Matt Fronk & Associates – Vice Chair Industry

Stan Whittingham, State University of New York – Vice Chair Academia

Paul Mutolo, Cornell University – Treasurer/Secretary

Fernando Gomez Baquero, BESSTECH LLC

Victor Cardona, Heslin Rothenberg Farley & Mesiti PC

Christina Lampe-Onnerud, Cadenza Innovation, LLC

Carrie Cullen Hitt, NextEra Energy Resources

Pratima Rangarajan, Current, Powered by GE *

Patrick McHugh, Consolidated Edison Co.

Robert Hull, Rensselaer Polytechnic Institute *

Jim Misewich, Brookhaven National Laboratory

Ryne Raffaelle, Rochester Institute of Technology

Barry Watkins, Alfred University *

John Rhodes (Ex-Officio), NYSERDA (in May 2017, Mr. Rhodes resigned upon his nomination by Governor Cuomo to Chair the New York State Public Service Commission)

Matthew Watson (Ex-Officio), Empire State Development

* In 2017, these directors were replaced with Suzanne Escudier, S&C Electric; David Mitlin, Clarkson University; Alan West, Columbia University; and Davion Hill, DNV GL.

NYSERDA, a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA professionals work to protect the environment and create clean-energy jobs. NYSERDA has been developing partnerships to advance innovative energy solutions in New York State since 1975.

To learn more about NYSERDA's programs and funding opportunities, visit nyserda.ny.gov or follow us on Twitter, Facebook, YouTube, or Instagram.

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State of New York
Andrew M. Cuomo, Governor

New York State Energy Research and Development Authority
Richard L. Kauffman, Chair | Alicia Barton, President and CEO

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