MINUTES OF THE ONE HUNDRED FIRST MEETING OF THE
PROGRAM PLANNING COMMITTEE
HELD ON JANUARY 23, 2018

Pursuant to a Notice and Agenda dated January 10, 2018, a copy of which is annexed hereto, the one hundred and first (101st) meeting of the Program Planning Committee ("Committee") of the NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY ("Authority") was convened at 12:00 p.m. on Tuesday, January 23, 2018, at the office of the New York State Dormitory Authority ("DASNY"), One Penn Plaza, 52nd Floor, New York, New York, and in the Authority's Board Room at 17 Columbia Circle, Albany, New York.

The following Members of the Committee were present:

Mark Willis, Committee Chair
Richard Kauffman. Chair of the Authority
Sherburne Abbott
Charles "Chuck" Bell
Ken Daly
Kate Fish
Jay Koh
John McAvoy

Also present in either New York City or Albany were: Alicia Barton, President and CEO of NYSERDA; Janet Joseph, Senior Vice President for Strategy and Market Development; Jeffrey J. Pitkin, Treasurer; Noah Shaw, General Counsel; Kevin Kelly, Director, Operational Transformation and Lean, Valerie S. Milonovich, Senior Counsel and Secretary to the Committee; and various other members of the Authority staff.

Mr. Willis called the meeting to order, noted the presence of a quorum, and stated that a Notice of the meeting was mailed to Committee Members on January 10, 2018, and to the press on January 11, 2018.

Approval of September 19, 2017 Minutes

The first agenda item concerned the approval of the minutes of the 100th meeting of the Committee held on September 19, 2017. Upon motion duly made and seconded, and by unanimous voice vote, the minutes of the 100th meeting of the Committee were approved.

Authority's Budget for FY 2018-2019

The Members were requested to adopt a resolution recommending to the full Board the adoption of its portions of the Authority's Budget and Financial Plan for the fiscal year ending March 31, 2019 (fiscal year 2018-2019). The Authority's Treasurer, Jeff Pitkin, reported on the more significant items beginning with budgeted revenues which have increased by $530.1 million to $1.56 billion from the FY 2017-2018 approved budget. Mr. Pitkin described significant changes as:

- Utility surcharge assessments increased by $472 million primarily due to prior year expenses which were funded from cash balances under the "Bill-As-You-Go" mechanism;

- Third-party reimbursement revenue increased by about $29 million primarily due to an increase in anticipated reimbursement funding due to the timing of expenditures under the Indian Point Energy Center Reliability Contingency program and additional reimbursement funding for an expansion of delivery of low-income residential efficiency services delivered through the EmPower Program through September 2018;

-Regional Greenhouse Gas Initiative (RGGI) allowance auction proceeds increased by about $16 million from the Fiscal Year 2017-2018 budget to $106.6 million. For Fiscal Year 2018-2019, revenues are based on 85% of modeled allowance price assumptions prepared by an independent contractor in the RGGI program review; and

- Renewable Energy Credit (REC) proceeds reflect estimates of the value of Tier 1 RECs under the Clean Energy Standard (CES) anticipated to be acquired under prior contracts and offered for sale, which reflects an increase in the quantity of REC procurements in years 2016/2017 and projects anticipated to become operational during the upcoming year.

In response to inquiries by Mr. Willis and Mr. Daly, Mr. Pitkin confirmed that no issues are foreseen with maintaining an appropriate working capital balance and that Authority revenue is more closely aligned with its expenditures. Mr. Pitkin also agreed to provide a chart that depicts the fluctuations in spending and collections in response to a suggestion by Mr. McAvoy.

Mr. Pitkin reported that, in summary, total budgeted expenditures increased by about $66 million to about $1.4 billion from the Fiscal Year 2017-2018 approved budget. Program expenditures increased by about $65 million to nearly $1.3 billion due to changes in anticipated expenditure levels. The change is primarily due to an increase of about $54 million in program expenditures for the Clean Energy Fund (CEF) Market Development and Innovation and Research initiatives, reflecting an increase in program activity from recently approved and anticipated initiatives.

Mr. Pitkin reported that salaries and benefit costs are projected to be $54.7 million, a $2.5 million increase from the Fiscal Year 2017-2018 approved budget. This reflects an increase in salaries of $1.6 million based on an increase in the assumed level of filled positions. However, there is no increase in the total headcount, but the Fiscal Year 2017-2018 budget assumed that positions would be filled at about 90%, on average. As actual levels have been closer to 92%, the assumption was revised upward, increasing the number of budgeted full-time equivalent employees and related salary expense. The increase also reflects a 3% cost-of-living-adjustment and performance-based salary increases, or awards, assuming similar awards are approved for State employees. Fringe benefits increased by $900,000 generally corresponding to the increase in salary expense.

In response to a suggestion by Mr. Daly based on changes in the industry and what he characterized as a rather lean budget, Mr. Pitkin agreed to consider a review of investments in Authority staff training.

Mr. Pitkin stated that program operating costs are $3.48 million, a decrease of $20,000 from the Fiscal Year 2017-2018 approved budget, primarily related to a decrease in travel and outreach costs for several programmatic areas and offset, in part, by an increase in NY Green Bank professional service and temporary staffing costs.

General and Administrative expenses are $10 million, a decrease of $860,000 from the prior fiscal year budget primarily due to a net decrease in temporary staffing costs for administrative departments and from a decrease in certain non-recurring network system design and enhancement projects budgeted in Fiscal Year 2017-2018.

The budget includes $3.4 million in capital assets, a decrease of $1.6 million from the previous fiscal year budget, primarily due to a decrease of $1.1 million in system development costs associated with program databases that support CES initiatives, a $643,000 decrease for information technology upgrades, offset in-part by an increase of $135,000 in anticipated building improvement costs.

Mr. Pitkin reported that the Authority's restricted net position is projected to decrease by $26.4 million from the previous fiscal year budget to about $338 million due to the implementing the "Bill- As-You-Go" approach. The NY Green Bank net position is anticipated to be $782 million, an increase of about $210 million due to an increase in anticipated loan interest income, "Bill- As-You-Go" revenue, and from fees and other income. The Authority's unrestricted net position is anticipated to remain at the historical level of approximately $3 million dollars.

Mr. Koh suggested that Authority staff evaluate the allocation of resources toward financial cybersecurity, as he predicts that vulnerabilities in this area will only increase over time.

Based on the reports and discussions regarding the Authority's budget for the Fiscal Year ending March 31, 2019, as presented, upon motion duly made and seconded, and by unanimous voice vote, the Committee recommended that the full Board adopt the resolution.

Resolution

RESOLVED, that the proposed fiscal year 2018-19 Budget and Financial Plan submitted to the Members for consideration at this meeting, with such non-material, editorial changes and supplementary schedules as the President and Chief Executive Officer, in his discretion, may deem necessary or appropriate, be and it

hereby is recommended for approval by the Board for submission to the persons designated in Sections 1867(4) and 2801 of the Public Authorities Law.

Energy Storage Efforts

Jason Doling, Program Manager, Energy Storage, presented the Members with an update on the Authority's energy storage efforts, beginning with a description of Governor Cuomo's 2018 State of the State commitment to deploy 1,500 megawatts (MW) of energy storage capacity by 2025, representing the largest per capita goal in the country. For perspective on the scope of the initiative, Mr. Doling reported that the State currently has about 50 MW installed and 100 MW in the planning stages. Regarding economic growth, Mr. Doling reported that this sector has already seen a 30 percent increase in jobs (to 3,900 jobs), and an increase in global revenues to $900 million between 2012 and 2015, with projections to reach 30,000 jobs by 2030. Mr. Doling reported that global revenues can grow to over $8 billion in that same timeframe through activity in electric grid storage, electric vehicles and infrastructure, electronics and medical devices.

Mr. Doling reported that Authority staff has begun work with New York State Department of Public Service staff and market participants to develop an Energy Storage Roadmap that identifies: current and anticipated electric system needs that storage is uniquely suited to address; levels of energy storage to meet those needs while providing net benefit to ratepayers; and strategies for market backed-policies and market interventions consistent with Reforming the Energy Vision (REV) regulatory proceeding objectives, to build energy storage in the State. The ongoing study effort will identify ranges of cost-effective energy storage that meet electric system needs as greater levels of renewable penetration and carbon reduction are achieved between 2020 and 2030. Several scenarios will be modeled addressing distributed photovoltaic deployment, increasing electric demand from fast-charging electric vehicles, and the implications of the retirement of certain Downstate oil-fired generation plants. Results from the study will be available in early 2018.

In response to suggestions from Mr. McAvoy and Mr. Daly regarding the siting of energy storage projects where they will best serve the electric system given the anticipated renewable build-out and to seek input from the New York Independent System Operator (NYISO) in striving

to achieve the maximum benefits, Mr. Doling and Ms. Barton confirmed that coordination on those fronts is well underway.

Mr. McAvoy also suggested that the NYISO planning process provides a good foundation and alleviates uncertainty regarding what should be included in this type of refined analysis. Mr. Doling agreed that the NYISO planning process is valuable and efforts underway are examining available mapping data, assumptions involving the future status of the Indian Point generation plant and the three largest transmission projects underway, as well as to identify where the maximum benefits are on a NYISO zone basis, which involves projecting where renewable resources will likely be located.

Mr. Doling stated that the overall effort will identify operational requirements that could impede energy storage deployment, with an emphasis on sub-transmission and distribution systems. This should provide a pathway for including energy storage in planning and procurement decisions and to inform market learning. He stated that the resultant programmatic and policy instruments should be timely, operational, understandable, and bankable.

In response to an inquiry by Mr. Kauffman, Mr. Doling provided descriptions of a range of technologies. Stating that the study assumptions are agnostic when modeling technologies, he reported that technologies showing success for shorter time durations include lithium ion batteries and ultra-capacitors; for medium durations (2 to 4 hour), lithium ion batteries and other emerging batteries, such as flow batteries; and for longer durations (6 or more hours), flow batteries, innovative compressed air, thermal storage for compressor load, and pumped hydroelectricity, if available.

Regarding an inquiry by Mr. Koh about resiliency and how it would be measured, Mr. Doling admitted that it is sometimes a challenge to quantify resiliency. From an electric system perspective, it can be assessed by such measures as isolating circuits to avoid the domino effect that leads to more outages. Although this concept is beyond the scope of the work described today, Mr. Doling stated that these concepts are worthy of future work and he welcomes additional utility

input. Stating that the scope and complexity of this effort is impressive, Mr. McAvoy added that microgrids present an additional opportunity for enhancing resiliency.

In response to inquiries by Mr. Willis regarding the ultimate value of battery technology, Mr. Doling provided examples of situations where a few hours of buffering during a short duration electricity outage provides a manufacturer the ability to ramp down operations and avoid damaged product. In other instances, it prolongs the ability for off-line customers to shelter in place and allows an opportunity to move a portable generator into place. Ms. Joseph also stated that much is being learned through the NY Prize effort, such as the benefits of batteries combined with combined heat and power and photovoltaic technologies. Mr. Daly added that, although batteries can be critically important, such as through a non-wires alternative application or in peak shaving strategies, they are not wholly reliable at this time.

Mr. Doling described the categories of potential policy, regulatory and program ideas that have been identified by Authority Staff, Department of Public Service Staff, and stakeholders. Over the next calendar quarter, these ideas will result in an Energy Storage Roadmap. Citing wholesale market changes as one potential area, he stated that the strategy is to identify the best opportunities for, and determining the value of, near-term benefits for existing market structures, which could be pursued while more fundamental, longer-term changes are being considered.

The Energy Storage Roadmap is designed to provide clarity for use cases that address grid needs, market potential, and the range of policy, regulatory and programmatic actions to achieve the future state of the electric grid. That phase of work is anchored on stakeholder input, particularly deployment potential and the impact that potential policies and strategies, individually and collectively, can have on project scale and success. The actions range from those that can be implemented immediately (*e.g.*, expanding the value stack to storage) to ones that will take several years *(e.g.*, wholesale market changes).

Mr. Doling stated that this will be an ongoing dialogue that continues through the first quarter of 2018, resulting in an Energy Storage Roadmap and Recommendations that will be released as a White Paper for public comment during the first half of 2018. This document will present a recommended range of actions and cost/benefit analysis that will form the foundational work necessary to arrive at any potential Public Service Commission action by the end of 2018.

In response to a request by Mr. Kauffman to compare the New York effort to that of the California effort, Mr. Doling described the California effort as a 1,300 MW of installed storage capacity mandate, of which one-half is to be owned by utilities and the other half achieved through procurements using somewhat generous incentives. Mr. Doling observed that the California approach appears to have sparked participation yet. in his opinion, lacks clear market signals. Opportunities to learn from the California experience include focusing on all utility networks – from retail through wholesale – and identifying the value that energy storage can provide could be an aggressive tact, like New York's efforts with non-wires solutions. He also suggested that the development of a bridge mechanism, such as a tariff, could provide nearer term market confidence until an entity is willing to provide financing. The timing of cost declines was another identified learning opportunity, as was the lack of an organic market mechanism built into rate or market design that would allow projects to be built without utility procurements or state incentives.

In response to an inquiry by Mr. Willis as to how these efforts affect the incentive for activity that manufacturers should be undertaking on their own, Ms. Barton stated that the premise is to launch that sector toward a better functioning and more sustainable market for distributed energy resources that will empower customers to individually take on this role, recognizing that it is difficult for that sector to be a "first mover". As demand for these technologies grows and learning increases, cost declines will also result. Regarding changes in the economic proposition, Mr. Doling stated that the goal is to strive for rate signals that are so precise that it alleviates the need for other customers to pay for the cost. Mr. Kauffman added that these efforts will add to the State's ability to create the right price signals and lead to a more efficient generation fleet.

Mr. McAvoy suggested that the scope of the analysis should consider the whole host of revenue streams that could be affected by these technologies.

In response to an inquiry by Ms. Fish regarding mobile storage, using the potential deployment of fleets of municipally-owned vehicles as "mobile battery units" as an example, Mr. Doling reported that Authority Staff are examining the potential for these approaches outside of the Energy Storage Roadmap effort.

In response to a comment by Mr. Willis regarding the Authority's work with fire departments, Mr. Doling reported that, using the new guidance, the fire and building departments have now approved about 25% of the projects that were in the implementation queue. Authority Staff has re-engaged with these departments to develop guidelines for interior systems and good progress is being made. Ms. Barton added that Authority Staff is working together with these departments to provide technical evaluation and other guidance on the real-world operation of these systems to increase the level of confidence.

University Engagement Efforts

Jeff Peterson, Senior Advisor for Entrepreneurship, Technology and Business Innovation presented the Members with an update on the Authority's university engagement efforts that began in June 2017. Mr. Peterson stated that, although research universities and community colleges have always been strategic partners with the Authority, they can serve a bigger role in addressing the State's energy and environmental goals. These institutions have human capital and research facilities that can be better leveraged; the mission to educate the next generation of clean energy leaders and entrepreneurs; the history and expertise to develop innovative technologies and business models; and be catalysts in the community by providing clean energy education and tools for action. In addition, Authority Staff has found that universities and academic research institutions are interested in engaging in the State's large energy initiatives such as REV and implementing the Clean Energy Fund (CEF).

Mr. Peterson explained that the initial step in the process involved traveling to individual campuses to gain a better understanding of where campus visions and priorities overlap with New York State energy and environmental challenges. The intelligence gained from the meetings is informing existing Authority initiatives and, if necessary, will be used to build new programs to

leverage academic resources and generate long lasting outcomes. Authority Staff believe that the long-term outcomes of the initiative are likely to include:

- Strengthening deeper relationships between NYSERDA and academic institutions;
- Increasing involvement of the university community in the development and commercialization of technologies that will enable the achievement of REV and CEF objectives;
- Growing and sustaining partnerships between universities and the energy industry;
- Increasing university involvement in campus and community sustainability initiatives;
- Increasing recruitment and development of the next generation of clean energy scientists, engineers and entrepreneurs; and
- Continuing collaboration to sharing best practices in university/private/public partnerships for innovation and entrepreneurship.

Mr. Peterson described the observations gleaned from interactions with the academic institutions, faculty, students and cleantech start-up companies and corporate partners. A sample of those observations includes the desire to: increase visibility and leadership; attract high- quality faculty and students; increase external funding (such as through licensing revenue); increase research funding support; garner results that ultimately create new businesses; and increase access to technical expertise and high-grade facilities. Mr. Peterson stressed that students seek opportunities to address real world problems that will result in internships and full-time employment.

Mr. Peterson also mentioned the recently executed Memorandum of Understanding between the Authority and the State University of New York (SUNY), which has 64 campuses and is responsible for 40% of the energy consumption in the State's facilities. The Memorandum addresses sustainability in SUNY facilities, workforce development, entrepreneurship, research and innovation. This new alliance will be designed to: provide access to rapid technical due diligence for NYSERDA and the finance community; align research focus and thesis topics on strategic energy issues; advance a multi-disciplinary carbon pathways initiative to achieve State goals; and develop a clean tech start-up internship program. Additional efforts described by Mr. Peterson include the continued evolution of existing programs such as the REV Campus Challenge, workforce development and the communities and local government efforts with the Cooperative Extension.

Mr. Daly stated that this is a timely presentation, given SUNY Chancellor Johnson's address of its top priorities and he looks forward to working together to pool resources, mentioning the Geothermal Academy as an example of what resource pooling can accomplish. Ms. Joseph added that she welcomes a "concierge" approach whereby the Authority and utilities would collaborate to provide a single point of resource for academic institutions.

In response to an inquiry by Mr. Kauffman as to similarities with innovation hubs, Ms. Joseph stated that the approach is to focus on research activities of high priority areas at institutions that may manifest into the formation of a hub.

Mr. Kauffman suggested that it may be useful to engage commercial-sector customers who are willing to be "fast followers", as the behavior of government customers is not necessarily indicative of, or can truly test, the market.

Mr. Bell stated that he finds this effort exciting, and in response to his suggestion to stimulate the interest of low-to-moderate income students in clean energy technology careers, Mr. Peterson provided details about collaborative work with the City University of New York in this area. Mr. McAvoy also highlighted a successful energy technology high school effort between Consolidated Edison, National Grid, and the City University of New York in Queens that celebrated its first graduating class in June 2017.

Echoing Mr. Bell's observation regarding the emphasis on research, Mr. Koh suggested the United Kingdom as a model for increasing training of specialized workers through technical universities for jobs with off-shore wind and other clean energy sectors.

Ms. Abbott suggested that the challenges in furthering these efforts will require: (1) addressing the mismatch between the goals and the institutional accreditation requirements, particularly regarding engineering, adding that public and private institutions often operate in different space but are subject to the same accreditation process; and (2) continued challenges with university-funded research that led to the creation of hubs. Mr. Daly stated that these suggestions are very helpful, particularly regarding and support for the wind and solar sectors.

In response to an inquiry from Mr. Kauffman regarding her thoughts on this effort, Ms. Abbott stated that, in her opinion, institutions may be moving in another direction, so success will require a concerted effort. Mr. Willis added that there is much knowledge to be tapped among the Board Members.

In response to a suggestion by Mr. Kauffman that Brookhaven National Laboratory may provide a good example, Ms. Joseph stated that the Authority has a robust partnership with Brookhaven that continues to grow. Mr. Bell suggested looking to other states for potential models, as well. Ms. Barton thanked everyone for their suggestions and agreed that these ideas bear further investigation.

Other Business

Mr. Willis indicated that the last item on the agenda was other business. There being no additional business to consider, upon motion duly made and seconded, and by unanimous voice vote, the meeting was adjourned.

Respectfully submitted,

Valerie A. Milonovich

Valerie S. Milonovich
Secretary to the Program Planning Committee