STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

At a session of the Public Service Commission held in the City of Albany on January 20, 2022

COMMISSIONERS PRESENT:

Rory M. Christian, Chair
Diane X. Burman, concurring
James S. Alesi
Tracey A. Edwards
John B. Howard
David J. Valesky
John B. Maggiore

CASE 20-E-0197 - Proceeding on Motion of the Commission to Implement Transmission Planning Pursuant to the Accelerated Renewable Energy Growth and Community Benefit Act.

CASE 18-E-0071 – In the Matter of Offshore Wind Energy.

CASE 15-E-0302 – Proceeding on Motion of the Commission to Implement a Large-Scale Renewable Program and a Clean Energy Standard.

ORDER ON POWER GRID STUDY RECOMMENDATIONS

(Issued and Effective January 20, 2022)

BY THE COMMISSION:

INTRODUCTION AND BACKGROUND

The Accelerated Renewable Energy Growth and Community Benefit Act (the Act)[1] requires the Public Service Commission (Commission) and New York's electric utilities to develop and implement plans for the electric bulk and local transmission and distribution (T&D) investments necessary to meet the clean

[1] Chapter 58 (Part JJJ) of the laws of 2020.

energy and climate mandates set by the Climate Leadership and Community Protection Act (CLCPA).[2] Achieving these mandates will require significant modifications to the electric grid, as well as investments in renewable generation, to ensure that the system of the future serves New Yorkers across the State in a reliable and cost-effective manner.

One of the central mandates of the Act is the requirement to undertake and publish a comprehensive study of T&D system needs.[3] Department of Public Service Staff (Staff), working with the New York State Energy Research and Development Authority (NYSERDA), filed the Initial Report on the Power Grid Study (Initial Report), including the Power Grid Study, in January 2021.[4] The Power Grid Study consists of: (1) a study on local T&D upgrades necessary to achieve the CLCPA targets (Utility Study); (2) a study of offshore and onshore bulk power transmission infrastructure scenarios, and related environmental permitting considerations, to illustrate possible solutions to integrate the mandated 9,000 megawatts (MW) of offshore wind (OSW Study); and (3) studies of transmission, generation, and storage options for achieving 70% renewable generation by 2030 and a zero-emissions grid by 2040 (Zero Emissions Study).[5] The Initial Report analyzes the various studies and provides several

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[2] Chapter 106 of the laws of 2019.

[3] Act section 7(2).

[4] Case 20-E-0197, Initial Report (filed January 19, 2021).

[5] The Utility Study was initially filed on November 2, 2020, in Case 20-E-0197 and was prepared by Consolidated Edison Company of New York, Inc., Orange and Rockland Utilities, Inc., New York State Electric and Gas Corporation, Rochester Gas and Electric Corporation; Central Hudson Gas & Electric Corporation, Niagara Mohawk Power Corporation d/b/a National Grid, and the Long Island Power Authority (LIPA) (collectively, the Utilities).

recommendations concerning planning, study methodologies, and investment criteria.

To date, the Commission has focused on the local T&D issues raised by the Utility Study and certain related recommendations included in the Initial Report.[6] With this Order, the Commission addresses several other findings and recommendations from the Initial Report, particularly those related to offshore wind, future onshore bulk transmission planning needs, the proposal to consider Renewable Energy Zones (REZs), and approaches to deploying advanced technologies.

NOTICE OF PROPOSED RULEMAKING

Pursuant to the State Administrative Procedure Act (SAPA) §202(1), the Power Grid Study and Initial Report were the subject of a Notice of Proposed Rulemaking (Notice) published in the State Register on January 20, 2021 [SAPA No. 20-E-0197SP4]. The time for submission of comments pursuant to the Notice expired on March 22, 2021. Comments were received from 29 stakeholders. The comments received are summarized in Appendix A to this Order and discussed below, as relevant.

LEGAL AUTHORITY

The Act directs the Commission and Staff to take actions to ensure that renewable energy can be efficiently and cost-effectively injected into the State's T&D system. The Act specifically directs Staff, in consultation with state

[6] See Case 20-E-0197, Order on Phase 1 Local Transmission and Distribution Project Proposals (issued February 11, 2021) (Phase 1 Order); see also 20-E-0197, Order on Local Transmission and Distribution Planning Process and Phase 2 Project Proposals (issued September 9, 2021) (Phase 2 Order).

authorities,[7] the Joint Utilities,[8] and the New York Independent System Operator, Inc. (NYISO), to conduct a "power grid study" to identify T&D infrastructure needed to enable the state to meet CLCPA targets related to renewable energy and energy storage.[9] The Act further directs the Commission to use the results of such study to: (1) develop plans to enable timely upgrades to the local T&D system; (2) identify bulk transmission investments that should be made, including projects that should be pursued on an expedited basis to meet CLCPA goals; and (3) otherwise advance the policies of the Act.

In addition, the Public Service Law (PSL) provides the Commission with broad authority to direct actions to ensure that energy supplies and transmission resources are adequate to meet demand in a manner that is protective of the environment. In particular, PSL §4(1) expressly imbues the Commission with "all powers necessary or proper to enable [the Commission] to carry out the purposes of [the PSL]" which include, without limitation, a guarantee to the public of safe and adequate

[7] Section 7 of the Act identifies the state authorities for consultation as NYSERDA, the New York Power Authority (NYPA), and LIPA.

[8] The Joint Utilities include: Consolidated Edison Company of New York, Inc.; Orange and Rockland Utilities, Inc.; New York State Electric and Gas Corporation; Rochester Gas and Electric Corporation; Central Hudson Gas & Electric Corporation; and Niagara Mohawk Power Corporation d/b/a National Grid.

[9] The CLCPA targets require that a minimum of 70% statewide electric generation be produced by renewable energy systems by 2030, and that by the year 2040 the statewide electrical demand system will generate zero emissions. The CLCPA further requires the Commission to develop programs for the procurement of at least 9,000 MW of offshore wind electricity generation by 2035 and 6,000 MW of photovoltaic solar generation by 2025, and to support 3,000 MW of statewide energy storage capacity by 2030.

service at just and reasonable rates,[10] environmental stewardship, and the conservation of resources.[11] Further, PSL §5(1) provides that the "jurisdiction, supervision, powers and duties" of the Commission extend to the "manufacture, conveying, transportation, sale or distribution of ... electricity."

Under PSL §5(2), the Commission is required to "encourage all persons and corporations subject to its jurisdiction to formulate and carry out long-range programs, individually or cooperatively, for the performance of their public service responsibilities with economy, efficiency, and care for the public safety, the preservation of environmental values and the conservation of natural resources." Section 65(1) of the PSL grants the Commission authority to ensure that "every electric corporation and every municipality shall furnish and provide such service, instrumentalities and facilities as shall be safe and adequate and, in all respects, just and reasonable." The Commission has further authority under PSL §66(5) to prescribe the "safe, efficient and adequate property, equipment and appliances thereafter to be used, maintained and operated for the security and accommodation of the public" whenever the Commission determines that the utility's existing equipment is "unsafe, inefficient or inadequate." Moreover, PSL §66(2) provides that the Commission shall "examine or investigate the methods employed by ... persons, corporations and municipalities in manufacturing, distributing and supplying

[10] See International Ry. Co. v. Public Service Commission, 264 A.D. 506, 510 (1942).

[11] PSL §5(2); see also, Consolidated Edison Co. of New York, Inc. v. Public Service Commission, 47 N.Y.2d 94 (1979) (overturned on other grounds) (describing the broad delegation of authority to the Commission and the Legislature's unqualified recognition of the importance of environmental stewardship and resource conservation in amending the PSL to include §5).

... electricity ... and have power to order such reasonable improvements as will best promote the public interest, preserve the public health and protect those using such ... electricity." The actions taken in this Order fall within the scope of this authority.

DISCUSSION

The Initial Report evaluates the results of the studies included in the Power Grid Study and provides recommendations focused on how the State's electric infrastructure planning can be improved, along with the steps needed to achieve the CLCPA goals. While many of the recommendations in the Initial Report relate to local transmission issues and the investment proposals put forth by the Utilities in the Utility Study, the Initial Report also addresses the findings of the OSW Study and the Zero Emissions Study. Thus, the Initial Report includes suggestions for addressing: 1) the technical and regulatory challenges of integrating offshore wind generation with the power grid; 2) the potential role of energy storage; 3) the timely identification of likely future needs for onshore bulk transmission investment; 4) the identification of high value locations for siting renewables; and 5) the potential benefits of advanced transmission technologies. The following sections address the outstanding recommendations.

OSW Planning and Procurements

The Initial Report's recommendations relating to offshore wind planning suggest that we revisit aspects of the Commission's existing offshore wind procurement program. For context, this section provides an overview of that program and considers possible modifications.

On August 1, 2016, the Commission adopted the Clean Energy Standard (CES) to achieve a statewide deployment goal of 50% renewable generation resources by 2030.[12] The Commission divided the CES into a Renewable Energy Standard (RES) and a Zero-Emissions Credit (ZEC) requirement. In 2018, the Commission incorporated an Offshore Wind Standard into the RES by requiring jurisdictional load-serving entities (LSEs) to serve retail customers by procuring 2,400 MW of new offshore wind resources, evidenced by the procurement of Offshore Wind Renewable Energy Certificates (ORECs) from NYSERDA.[13] The Commission authorized NYSERDA to hold initial procurement solicitations in 2018 and 2019, for 800 MW or more of offshore wind, with a preference for direct radial interconnections. In response, NYSERDA successfully contracted with two projects totaling 1,696 MW.[14] The Commission subsequently authorized NYSERDA to issue an additional offshore wind solicitation in 2020 for up to 2,500 MW, recognizing that the CLCPA established a 9,000 MW goal.[15] NYSERDA's 2020 solicitation resulted in the selection of two more projects totaling 2,490 MW.[16]

On October 15, 2020, the Commission formally adopted the clean energy deployment targets of the CLCPA, including the requirements that at least 70% of statewide load be served by

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[12] Case 15-E-0302, et al., Implementation of a Large-Scale Renewable Program and Clean Energy Standard, Order Adopting A Clean Energy Standard (issued August 1, 2016) (CES Framework Order).

[13] Case 18-E-0071, Offshore Wind Energy, Order Establishing Offshore Wind Standard and Framework for Phase 1 Procurement (issued July 12, 2018) (Offshore Wind Framework Order).

[14] Case 18-E-0071, NYSERDA's Launching New York's Offshore Wind Industry: Phase 1 Report (filed October 23, 2019).

[15] Case 18-E-0071, Order Authorizing Offshore Wind Solicitation in 2020 (issued April 23, 2020) (2020 Offshore Wind Order).

[16] https://www.nyserda.ny.gov/offshore-wind-2020-solicitation

renewable energy resources by 2030 and that 9,000 MW of offshore wind be procured by 2035.[17] In the CES Modification Order, the Commission also granted NYSERDA the authority to procure the remaining amounts of offshore wind resources necessary to achieve the CLCPA goal, with a procurement goal of between 750 MW and 1,000 MW per year through 2027 and the flexibility to take a long-term view and evaluate each contract award decision with a focus on both ensuring CLCPA compliance and obtaining the best overall value.

In the CES Modification Order, the Commission reaffirmed a preference for direct radial interconnections for offshore wind developments. Highlighting the lack of new Wind Energy Areas (WEAs) where eligible projects could be built, which are established by the federal Bureau of Ocean Energy Management (BOEM), the Commission explained that designing and evaluating coordinated transmission solutions without additional WEAs is impractical. The Commission concluded that if more beneficial transmission configurations are identified and new WEAs are designated, NYSERDA could petition the Commission to modify the preference for the direct radial approach.

In this context, the Initial Report and the OSW Study include several high-level recommendations that, if implemented, could facilitate the successful procurement of additional offshore wind resources in a cost-effective manner. These include analysis of the potential benefits of using an offshore mesh transmission network to accommodate future offshore wind developments and an interim recommendation to accommodate within the procurements the option of using a potential future mesh transmission network. The recommendations also propose using

[17] Case 15-E-0302, Order Adopting Modifications to the Clean Energy Standard (issued October 15, 2020) (CES Modification Order).

high voltage direct current (HVDC) transmission and recognizing the crucial role that battery storage on Long Island and in New York City will play in integrating offshore wind generation.

In this section, we focus on potential modifications to the offshore wind procurement process that are consistent with the recommendations in the Initial Report and the OSW Study. In consideration of these recommendations, the Commission approves several modifications to future procurements under the Offshore Wind Standard.

1. Mesh Network Optionality

The primary strategic question raised by the Initial Report is whether transmission facilities should continue to be individually built to support direct radial interconnections, or whether transmission facilities should be developed via a shared mesh (also referred to as a backbone) to accommodate multiple projects. In a meshed design, multiple OSW projects are interconnected to an offshore grid, which is further connected to the onshore system at two or more interconnection points. This permits the transfer of energy between individual generation projects and allows the connected projects to inject their energy at multiple onshore locations. The direct radial system is simpler, more commonly used in offshore wind development, and less risky to achieving the anticipated construction dates.[18] A meshed approach offers potential benefits but with added costs and complexity.

In the Offshore Wind Framework Order, the Commission concluded that, pending the establishment of additional WEAs by BOEM and further study on alternative transmission configurations, offshore wind procurements should be based on transmission facilities individually built to support single

[18] Offshore Wind Framework Order, pp. 54-58.

projects. This preference for the radial approach, in contrast to a mesh configuration, was reaffirmed in the CES Modification Order where the Commission stated that, in the event ongoing studies identified advantageous alternatives to direct radial transmission and new WEAs were established, NYSERDA could seek Commission approval to pursue such alternatives through its offshore wind procurements.

While the number of developers and lease sites available to compete for New York's offshore wind procurements at this time is limited, that condition appears likely to change. Notably, a Proposed Sale Notice was published in the Federal Register on June 14, 2021, which described up to eight lease areas in the New York Bight for potential commercial wind energy development.[19] According to BOEM, these lease areas have the potential to unlock over 7,000 MW of offshore wind energy.[20] On December 16, 2021, BOEM released a final environmental assessment that evaluated the potential impacts of these leases and determined that the proposed action would not cause any significant impacts.[21] This recent development, coupled with the recommendations in the OSW Study, suggest the need to revisit the preference for direct radial connections in future offshore wind procurements.

Understanding that the State will need substantially more future offshore wind development to achieve the CLCPA target, we note the Initial Report's finding that a meshed approach would be the most flexible and adaptable to the

[19] https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/86-FR-31524.pdf?

[20] https://www.boem.gov/renewable-energy/state-activities/new-york-bight

[21] https://www.boem.gov/renewable-energy/state-activities/new-york-bight

availability and locations of future WEAs. The report also explains that a shared mesh configuration helps to mitigate generation tie outages and permits the users of the grid to direct their generation to the point of interconnection (POI) where those injections have the highest system value. The ability to transfer energy between onshore POIs also serves to reinforce the onshore grid and reduce network congestion.

The Initial Report also explains that a meshed grid would allow each offshore wind facility to be networked with other New York offshore wind projects, and possibly nearby facilities serving New Jersey and New England, with the potential to deliver additional value to New York via exports or cost sharing with neighboring states on such transmission assets. This may create additional benefits in terms of trading opportunities and increased reliability by making available alternative delivery routes through a neighboring system in the event offshore outages should affect the direct transmission links.

A recent Brattle Group report indicates that the production cost savings of a shared meshed offshore grid in New York may amount to approximately $55 million to $60 million annually.[22] In addition to potential production cost savings, which are predominantly attributable to reduced purchases from neighboring markets, other possible benefits from a meshed grid include improved onshore grid reliability and resiliency, additional ancillary services, and capacity value from increased

[22] Brattle compared the base case to a case with a meshed grid with 1,200 MW of transfer capability between New York Control Area zones J and K to estimate production cost savings. See "The Benefit and Cost of Preserving the Option to Create a Meshed Offshore Grid for New York" study prepared by The Brattle Group, for NYSERDA filed with its comments in Case 20-E-0197 on November 24, 2021.

transfer capabilities between Zones J and K. The study also indicates that the higher cost of implementing a meshed grid in the future, which is estimated to be $120 million to $240 million per link between mesh-ready offshore substations, may be recouped over a relatively short payback period due to its substantial benefits.

Most commenters are supportive of further study or the implementation of a shared meshed offshore grid as soon as possible. Atlantic Shores Offshore Wind (ASOW) supports the development of radial transmission interconnections with the option of later integrating the configuration into a meshed offshore network. Ocean Wind, Shell Energy, and the NYISO all support a meshed system and argue that the decision to implement a meshed system cannot be delayed. Anbaric and Con Edison recognize the benefits of a meshed system, citing improved system reliability, the ability to mitigate losses, and reductions in offshore wind curtailment. Avangrid, ASOW, Joint Utilities, and LIPA all support further evaluation and study around a meshed network approach. NYPA notes that developers have no intention to mesh offshore transmission systems without an incentive or coordination due to significant incremental costs.

We note that neither the OSW Study nor the recent Brattle report fully and comprehensively evaluate the full set of benefits and costs of a networked offshore mesh system. Thus, while we recognize commenters' strong interest, we are not in a position today to decide on whether to modify the Commission's existing preference for a direct radial approach to offshore wind transmission. However, the information and comments in the record to date suggest that it is time to consider a different approach. We direct Staff to work with NYSERDA to undertake studies that will explore and define the

relative benefits, costs, and challenges associated with a meshed offshore wind transmission system.

While we will not prescribe the precise scope of such studies here, the Commission will need information on such diverse topics as: design elements and key determinants that would help New York State identify potential beneficial regional mesh connections and possible inter-regional networked transmission connections; recommendations for overcoming technical, regulatory, and other challenges to the development of an offshore system; whether such a project could enhance innovation opportunities for the benefit of ratepayers; and operational determinants to promote the efficient function of a regional mesh transmission system.

However, we also note that the OSW Study suggests that bidders in future NYSERDA procurements offering radial connections could be asked to include alternative bids with larger offshore transmission platforms that can accommodate the interconnections and substation configurations necessary to create a meshed network. The OSW Study recommends that, while a decision to implement a meshed system can be delayed, new offshore wind facilities should be constructed in ways that facilitate integrating the radial lines into a meshed system at a later date, if necessary. Similarly, the recent Brattle report recommends that we require future OSW procurements to include "mesh-ready" designs.

First, The Brattle study concludes that a networked design is likely to prove economic, provided that it serves at least three offshore wind projects with a minimum aggregate rating of approximately 3,000 MW. Presently, 4,316 MW of offshore wind capacity is under contract in New York, leaving 4,684 MW of capacity left to be procured by 2035. This suggests the scale of the offshore wind development still to be procured

may be economically interconnected using a mesh network. Second, the study estimates that the higher cost of constructing a mesh-ready substation adds less than 0.4% to the total cost of a typical 1,000 MW offshore wind plant.[23] Therefore, the estimated additional cost is not significant in light of the expected economic and reliability benefits of a meshed system.

For these reasons, the Commission finds that NYSERDA should take steps to preserve the future mesh offshore grid option. The cost of including this flexibility in project design at this stage is modest and would reduce the cost of retrofitting facilities in the future if the Commission concludes that such a network will benefit New York's ratepayers. As we evaluate the meshed offshore grid option, NYSERDA shall include eligibility criteria in its offshore wind procurements that would require proposals to incorporate measures that allow the project to integrate into a future mesh system. All bids should include the incremental mesh-ready designs needed to support a potential future mesh network.

Shared mesh-ready optionality also requires some modifications to the current offshore wind pricing and contractual arrangements. The existing Index OREC pricing formula utilized in offshore wind solicitations does not currently consider the possibility that an offshore wind project could interconnect into multiple NYISO zones, which would be possible in the future if an offshore shared mesh system is established. Building this optionality into the Standard Purchase and Sale Agreement could avoid challenging and

[23] The total estimated incremental cost of the physical infrastructure needed to build a mesh-ready substation is $7.71 million with an additional $6 million to $8 million in operating study costs. In comparison, the total estimated cost of a 1,000 MW offshore wind generating plant with a new substation and tie line to its onshore POI is approximately $4 billion.

potentially costly negotiations in the future.[24] Therefore, NYSERDA shall incorporate into future contracts the possibility that a project will ultimately be integrated into a mesh grid and therefore may deliver energy to points in more than one NYISO Zone.

2. HVDC Transmission

The Power Grid Study emphasized the importance of cable design and routing to the overall success and cost-effectiveness of the offshore wind program. The Offshore Wind Standard currently allows project proposals to include either alternating current (AC) or direct current (DC) transmission lines.[25] While cheaper to build, AC lines carry less capacity than DC lines of the same physical size. According to the OSW Study, transmission by high-voltage AC requires three times as many cables as transmission by HVDC for the same amount of energy. Additionally, using HVDC lines provides significant technical benefits over high-voltage AC, including power flow controls and easier black start capabilities.

The OSW Study explains that AC lines risk causing undersea cable corridors to reach capacity before the CLCPA goals are met, leading to enormous additional costs for subsequent projects that would be borne through increased procurement prices passed on to ratepayers. The New York Harbor has multiple spatial undersea transmission cable constraints, including anchorage areas and navigation channels which occupy much of the waterway. Similarly, undersea cable routes to Zone

[24] NYSERDA enters into an Offshore Wind Renewable Energy Certificate Purchase and Sale Agreement with the winners of competitive solicitations for offshore wind generating capacity.

[25] Currently, two of the four NYSERDA-contracted projects under the Offshore Wind Standard intend to use AC lines.

J via the Long Island Sound have physical, ecological, and stakeholder constraints largely related to the geology of the undersea area east of Long Island and the East River. The OSW Study found that interconnecting between 5,000 MW and 6,000 MW of offshore wind into Zone J (which is expected to be required to meet the 9,000 MW CLCPA goal) may be difficult due to the scarce cable routing corridors. Additional transmission would need to be routed through Zone K or via other onshore routes, which may result in increased costs. The OSW Study therefore recommends that interconnections use 320 kilovolt (kV) HVDC cables for most future developments.

In comments, Diamond Offshore Wind, LLC (DOW) states that the cost assumptions in the Power Grid Study associated with the HVDC options should be viewed as less reliable and potentially overestimated given the evolution of HVDC technology, the vintage and limited transferability of cost benchmarks utilized, and the cost uncertainty levels cited by the study's authors. Ørsted is concerned that near-term interoperability issues with HVDC equipment may prevent the successful meshing of offshore generation, as existing HVDC systems lack standards which would allow interconnections of systems by different manufacturers.

The Commission directs NYSERDA to include eligibility criteria in its offshore wind procurements that would require the use of HVDC transmission where appropriate to preserve maximum efficient use of constrained cable corridors. The Commission appreciates DOW's comments on the HVDC cost assumptions used in the OSW Study, but notes that the study highlights the importance of matching cable technology and associated transfer capability to the available routing space into the New York Harbor and the optimal capacity of the POIs. The Commission relies heavily on the need to mitigate space

constraints in its determination that HVDC lines be used where appropriate.

Ørsted is correct that if each developer took its own approach, the results would lead to compatibility issues. Uniform design specifications and standards are likely needed to avoid problems in the future. NYSERDA has the experience and ability to consult with the necessary experts in evaluating interoperability of HVDC equipment, so the Commission is confident that it will act prudently in addressing this issue. Therefore, NYSERDA is directed, in consultation with Staff, to standardize the radial designs for HVDC and the mesh-ready design parameters for all projects, as NYSERDA determines is necessary to the successful implementation of the OSW program.

In addition, the Initial Report identifies the critical importance of State coordination and planning with agencies and other stakeholders to identify feasible siting solutions and to address transmission cable routing limitations. NYSERDA and Staff shall collaborate with other New York State agencies to develop coordinated plans for cable routing to ensure the success of the offshore wind program. NYSERDA and Staff are directed to file a report on their progress with this important issue no later than September 1, 2022.

3. Injection of OSW Generation into the New York Control Area

The Initial Report provides several recommendations relating to managing the integration of offshore wind generation with the New York City and Long Island grids. It concludes that interconnecting the CLCPA target of 9,000 MW of offshore wind generation should be achievable without requiring significant upgrades to the bulk power system, so long as several identified conditions are met.[26] One of these conditions is an assumed

[26] Initial Report, pp. 62-63.

level of well-coordinated system development "that optimizes POIs with the capabilities of the existing transmission system."[27] In this section, we examine the Initial Report's observations concerning the available POIs and the feasibility of different configurations.

As noted in the Initial Report, the OSW Study identified potential POIs through an iterative screening process. The first step of the onshore grid assessment regarding the ability to accommodate 9,000 MW of offshore wind generation consisted of screening the existing substations in Zones J and K using reliability security analysis and production cost modeling. Two alternative offshore wind injection splits were assessed between New York City and Long Island regions: (1) approximately 6,000 MW of OSW delivered to New York City and approximately 3,000 MW to Long Island; and (2) approximately 5,000 MW of OSW delivered to New York City and approximately 4,000 MW to Long Island. The reliability security and production cost analyses were conducted using a range of onshore grid operating conditions and demand forecasts. The use of energy storage facilities was also incorporated into various scenarios in the analysis. Overall, the analysis identified scenarios of 6,000 MW into New York City and 3,000 MW into Long Island that minimized onshore transmission system upgrades and involved very limited OSW curtailments. Every New York City area and Long Island substation above 69 kV was evaluated in the OSW Study. For each of these substations, a thermal transfer screen analysis was used to identify substations that could accept at least 300 MW of offshore wind. Thirty-six substations were identified using this screening criteria. For those 36 substations, production cost simulations were conducted to

[27] Initial Report, p. 62.

identify the 20 substations with the least curtailments. The OSW Study then evaluated six POI combinations that could deliver approximately either 5,000 MW or 6,000 MW into the New York City area, with the remainder delivered to substations located in Long Island.

The OSW Study's base case (shown in Figure 1 below) selected the following POIs and injection capacities:

- Zone J (NYC): Farragut (1,400 MW), Rainey (1,250 MW), Mott Haven (1,250 MW), and West 49th St. (1,200 MW); and

- Zone K (Long Island): New Bridge (600 MW), Shore Rd. (500 MW), Northport (400 MW), and Syosset (300 MW), and Brookhaven (270 MW).

Figure 1

While the OSW Study concluded that 9,000 MW of offshore wind generation could be feasibly integrated using the interconnection points it identified, the Initial Report points out that one major issue that is unresolved is whether the POIs selected in the base case for New York City have the physical space necessary to accommodate the upgrades for the planned injections. Citing the Utility Study, the Initial Report states

that "reliability needs and space limitations for adding necessary interconnection equipment to existing Con Edison substations" might be an obstacle to implementing the OSW Study's recommendations.[28]

Furthermore, recent developments call into question other assumptions in the base case. For example, since publication of the Power Grid Study, one of the projects proposed in response to NYSERDA's CES Tier 4 solicitation is the Clean Path New York (CPNY) project, which assumes the Rainey substation as the POI.[29] The CPNY project is expected to carry generation associated with up to 1,300 MW of capacity, making it highly unlikely that the same substation can feasibly accommodate an additional 1,250 MW of offshore wind generation as assumed in the base case of the OSW Study. We also note that one of the offshore wind projects under contract award with NYSERDA, Beacon Wind, is planning to interconnect at either the Astoria East 138 kV or Astoria West 138 kV substations,[30] both of which may not have sufficient capacity to cost-effectively or feasibly accommodate that project. Indeed, the NYISO interconnection queue indicates that five projects are seeking to interconnect into the Astoria West substation alone.[31]

Based on our review of the Initial Report, the OSW Study, and recent developments, the Commission finds that additional work is needed to identify plausible scenarios for interconnecting offshore wind generation into New York City at the levels identified in those studies. Because of the need to

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[28] Initial Report, p. 66.

[29] See https://www.nyserda.ny.gov/All-Programs/Clean-Energy-Standard/Renewable-Generators-and-Developers/Tier-Four

[30] See NYISO Interconnection Queue, available at: https://www.nyiso.com/interconnections

[31] Id.

act expeditiously to meet CLCPA mandates, and the timeframes involved in both transmission and offshore wind development, it is incumbent upon the Commission to address the feasibility challenges as soon as practicable. Providing potential bidders greater transparency regarding the availability of POIs that can realistically be used to inject their generation into New York City would improve future NYSERDA solicitations. Indeed, given that the next solicitation is expected in 2022, the Commission notes that time is of the essence.

The record in this proceeding shows that Con Edison may have a potential solution regarding POIs that would enable the State to achieve the distribution of 6,000 MW of offshore wind injections into New York City and 3,000 MW of offshore wind injections into Long Island, as recommended in the Initial Report/OSW study. As noted in the Phase 2 Order, the Utility report proposed, among other things, the construction of certain local T&D projects aimed solely at facilitating compliance with CLCPA mandates, which they identified as "Phase 2 projects."[32] One of the Phase 2 projects proposed by Con Edison is called the New York City Clean Energy Hub #1 (Con Edison Hub), which the company describes as "a conceptual project that will require detailed engineering studies."[33] Con Edison indicates that the Con Edison Hub, which would be built on real estate owned by Con Edison and located in northwest Brooklyn adjacent to the Farragut substation, would be electrically tied to substations serving major population centers in Brooklyn and Manhattan and

[32] See Phase 2 Order, p. 2 (citing Utility Transmission and Distribution Investment Working Group Report (filed November 2, 2020)).

[33] Utilities' Report, p. 112.

could accommodate at least 3,000 MW of offshore wind generation.[34]

Of note, the OSW Study assumed the Farragut substation as the entry point into NYC for 1,400 MW of offshore wind in the base case. As already mentioned, the Con Edison Hub would be sited directly adjacent to that substation and thus could act as alternative for what was considered in the base case. Additionally, while it appears likely that the Rainey substation may be impracticable as a POI for offshore wind (based on the reasons discussed above), the proposed location of the Con Edison Hub would be directly between the Farragut and Rainey Substations. The base case, moreover, already presumes that the Rainey substation (or one near it) would need to accommodate 1,250 MW of offshore wind. In other words, the base case assumes that the Farragut and Rainey substations (or substations near them) would be needed to accommodate close to 3,000 MW of offshore wind.

The Utility Study suggests that the Con Edison Hub would be able to accommodate the precise capacity that will be needed. Given the recognized difficulty in finding feasible and cost-effective POIs in space-constrained lower Manhattan, the Con Edison Hub appears to be a potential solution for offshore wind generation injected into New York City. The Commission thus authorizes Con Edison to file a comprehensive petition addressing the Con Edison Hub that details the requested information below.

As with the "Areas of Concern" identified in the Phase 2 Order, the Commission will need more information on the costs and benefits associated with the project to evaluate whether the project supports progress toward meeting CLCPA mandates. The

[34] Id. at 113, Figure 45; Case 20-E-0197, Con Edison Response to DPS Staff Information Request-1.

Commission will also need information concerning the capabilities of the alternative interconnection points. Thus, Con Edison's petition must provide the Commission with a fuller understanding of the project need, why it needs to be approved in short order, and why it is superior to alternatives, including upgrades to existing substations, from a cost-effectiveness and feasibility perspective. With respect to alternatives, Con Edison should provide specific information regarding why its existing substations cannot accommodate future offshore wind projects. The supportive information associated with the issues in this paragraph include:

- An engineering cost estimate associated with the Con Edison Hub proposal;
- An understanding of the project's ability to both accommodate energy from offshore wind and inject such energy into the NYCA;
- Information related to the areas of New York City that would be provided with energy from the Con Edison Hub and whether energy use would be limited to Con Edison's service area;
- Information related to whether the Con Edison Hub would provide co-benefits, including those related to reliability, redundancies, and resiliency, and the monetization of such benefits, if feasible;
- Alternatives to the Con Edison Hub that have been explored (from size, feasibility, and cost perspectives); and
- Any information on Con Edison-owned real estate and rights-of-way that could facilitate the siting of converter stations and approach routes to the Con Edison Hub.

Additionally, given that most, if not all, of the remaining offshore wind generation to be solicited in the future may be injected into New York City through an HVDC line, Con

Edison should give due consideration to where the converter stations associated with such lines would be located and whether or not the proximity of such converter stations to the Con Edison Hub has logistical and/or cost impacts that may make interconnecting into the Con Edison Hub infeasible or cost prohibitive. In this respect, the petition must also present (1) a reasonable forecast of the location of on-shore HVDC converter station(s), which generally require 5+ acres for a 1,200 MW generation tie-line, and (2) an understanding of the feasibility and estimated costs of routing an AC transmission line from the converter station to the Con Edison Hub. With respect to this second issue, the petition needs to explain what Con Edison or other rights-of-way are available for the AC transmission route.[35]

Given the importance of resiliency regarding all new utility capital projects, particularly those located on the New York City waterfront, the petition must also address resiliency challenges that may be presented based on the location of the Con Edison Hub, including that it would be geographically concentrating, at a minimum, 3,000 MW of offshore wind interconnections at a single substation that would sit directly adjacent to another large substation (Farragut). Specifically, further information should be provided regarding (1) whether the potential for geographically concentrated storm damage to the co-located substations would disrupt delivery of offshore wind generation and how such risks can be mitigated, (2) the climate resiliency of the geographic location including exposure to sea-

[35] While the Commission understands that the offshore wind developer would be responsible for the costs associated with the converter station and interconnection into the Con Edison Hub, it nevertheless needs this information to gain an understanding of whether the Hub would make the interconnection cost prohibitive.

level rise and static or dynamic flooding, and (3) compliance with all applicable reliability criteria, including North American Electric Reliability Corporation (NERC) standards for "extreme contingencies" as specified in NERC Standard TPL-001-4. Finally, as noted in the Phase 2 Order, Con Edison should demonstrate that it is considering the use of advanced technologies in its analysis and how it would deploy such technologies where appropriate.

We take note of the comments made by LS Power and NextEra Energy Transmission New York, Inc. (NextEra) in response to the Utility Study, which assert that the Con Edison Hub lacks sufficient detail for Commission action and should nonetheless be referred to the NYISO public policy planning process because it cannot be considered a local transmission project.[36] The Commission agrees that additional details are warranted and has identified, as noted above, further information that should be provided to facilitate our review. As both companies seem to acknowledge, the Commission certainly has yet to, and may not ultimately, approve the Con Edison Hub. While the Commission expects to address procedural matters following its review of the additional information, the availability of the NYISO process should not interfere with our broad planning authority and review of the options for establishing cost-effective POIs in service of our overarching goal of meeting CLCPA mandates at the least cost to ratepayers.

Energy Storage

The Power Grid Study illustrates the critical role that energy storage will play in achieving the State's clean energy goals. The Zero Emissions Study estimates that to avoid adverse system impacts, 3,000 MW of energy storage by 2030 and

[36] Comments of LS Power, p. 10; Comments of NextEra Energy Transmission New York, Inc., p. 7

15,500 MW by 2040 is needed in specific locations in New York City and Long Island.[37] For example, the study projects that by 2040, over 4,000 MW of energy storage will be needed in New York City and over 3,000 MW on Long Island. If offshore wind injections into the Long Island grid materialize at different locations, or grow faster than projected, the study indicates that energy storage deployment will need to be revised accordingly and the amount of storage may need to be procured more quickly.

The Joint Utilities argue that additional transmission or interconnection facility investment may be needed to accommodate study-assumed levels of energy storage. NEETNY highlights that the Zero Emissions Study assumption that there is optimal charging and discharging is unrealistic as energy storage is not under NYISO's operational control. NY-BEST criticizes the Zero Emissions Study assumption that 3,000 MW of storage will be deployed by 2030, citing the slow deployment of energy storage thus far and lack of NYSERDA incentive funding, and recommends that the Commission and NYSERDA update the Energy Storage Roadmap. NY-BEST also states that the Commission should support establishing energy storage as a transmission asset in order to optimize its placement in strategic locations.

The City of New York argues that the Zero Emissions Study assumption of the level of energy storage needed is too low. The NYISO criticizes the studies' treatment of energy storage as a transmission asset and instead recommends that the Commission model energy storage as a key resource in order to be consistent with its operations in NYISO's wholesale markets. In addition, the NYISO argues that other options for increasing

[37] Appendix E – "The Zero-Emissions Electric Grid in New York by 2040" of the Initial Report of the New York Power Grid Study filed in Case 20-E-0197 on January 19, 2021.

grid flexibility to reduce congestion and curtailments associated with increased offshore wind injections on Long Island should be explored, including using the Neptune and Cross Sound cables to export surplus generation on Long Island to the rest of the State by utilizing parallel paths through other states.

We concur in the Power Grid Study's finding that energy storage on Long Island and in New York City will play an important role in integrating offshore wind generation. Satisfying the expected need may require us to refine our energy storage policies. We note that the next review of our storage programs is scheduled to occur in 2023 and presents an opportunity to revisit policy issues. In the interim, we encourage NYSERDA to address energy storage needs in its ongoing OSW procurements.

We recognize that NYSERDA's offshore wind solicitations have not explicitly included an energy storage component as an evaluation factor. However, we noted in the 2020 Offshore Wind Order that the capacity and grid-balancing benefits that energy storage can provide should be evaluated within the economic benefit category, which comprises 20% of the final score for a project. The Commission explained that these considerations could play a more important role in future solicitations when the results of ongoing transmission planning efforts can inform the value and potential use cases of energy storage coupled with offshore wind.[38] With the results of the Power Grid Study, we are beginning to have a better understanding of the potential value of these assets.

For these reasons, the Commission authorizes NYSERDA to award additional scoring credit in the economic benefits and

[38] 2020 Offshore Wind Order, p. 20.

viability categories for energy storage facilities integrated in offshore wind proposals. This approach is consistent with the RES Tier 1 procurements which provide scoring credit for energy storage paired with Tier 1-eligible resources.[39] However, unlike Tier 1 solicitations where proposals can receive credit for either collocated or non-collocated energy storage, the operational characteristics of offshore wind require limiting the parameters for non-collocated energy storage. The challenge of injecting thousands of MW of offshore wind into Zones J or K requires that the paired energy storage be nearby to facilitate that process. Since the Power Grid Study confirms that large amounts of energy storage will be needed in Zones J and K, NYSERDA shall only provide credit for energy storage paired with offshore wind developments if the energy storage is electrically interconnected into Zones J or K. NYSERDA is also authorized to define specific areas within Zones J and K where the energy storage needs to be located in the event that system needs require more refined specifications.

Additional Onshore Bulk Planning Needs

The Commission shares the concern expressed in the Initial Report concerning the need to monitor emerging bulk system needs. There, the authors caution: "Future needs for additional bulk-power and local transmission upgrades may arise sooner than projected in the Utility, OSW, and Zero Emission Studies. Local transmission needs may arise sooner if renewable generation develops more quickly in certain areas than anticipated ... . Bulk transmission needs may arise sooner for similar reasons: land-based and offshore wind generation may not

[39] Case 15-E-0302, supra, Clean Energy Standard Final Phase 1 Implementation Plan, filed by Staff of the New York State Energy Research and Development Authority and Staff of the New York State Department of Public Service (filed March 24, 2017), p. 26.

interconnect to the jointly planned locations identified in the OSW and Zero Emissions Studies. These needs may arise sooner because the OSW and Zero Emissions Studies likely understate real-world transmission congestion and renewable generation curtailments."[40]

As we enter a period of relatively rapid change and increased electrification, the transmission system must evolve in a way that supports the development of the additional renewable generation that will be needed to meet CLCPA goals. We recognize that the timelines for licensing and constructing new transmission facilities are lengthy, even with the accelerated processing times for license applications imposed by the Act. Because of this, we must consider the CLCPA target deadlines as effectively imminent, compelling us to ensure that transmission needs on the bulk system are identified as early as possible, and that we deploy our planning tools efficiently.

We believe that the coordinated planning process we have undertaken in this proceeding will allow us to anticipate system needs and to respond to them in a timely manner. Our expectation is that the Utilities and the NYISO will align their processes with any necessary modifications, so that the full spectrum of bulk and local transmission needs can be presented to the Commission as they evolve. The Utilities' January 2023 filing, and future CLCPA planning filings, will enable the Commission to assess needs from this perspective. We will implement local transmission upgrades pursuant to our State authorities and invoke the NYISO's Order 1000 process where bulk solutions are necessary, with the goal of deploying the most cost-effective combination of solutions. Going forward, the "state bulk transmission investment plan" will include the

[40] Initial Report, p. 98.

transmission solutions selected through the NYISO's process in response to our referrals.[41]

Thus, we are confident that our revised approach to statewide planning will enable the Commission to anticipate emerging bulk transmission needs. We further believe that our State authorities and the NYISO planning process provide us effective tools to respond promptly when local and bulk needs are identified.

Identifying High Value Locations

The Initial Report on the Power Grid Study includes a recommendation that the Commission consider establishing local REZs.[42] As indicated in the Initial Report, significant renewable generation potential appears to exist in areas of the State that currently do not have access to transmission infrastructure, and new transmission development could facilitate renewable generation development in these areas. The Initial Report recommends assessing the value of creating REZs and proposals for local transmission projects to support renewable generation in such regions. The Initial Report lists a few examples of potential new local renewable energy zones.

The REZ concept has been implemented in other regions of the country to pursue the development of transmission solutions for integrating renewable generation into the electric

[41] This does not preclude the Commission from identifying bulk transmission needs through other avenues, or from making additional public policy findings, as recognized in the NYISO's tariff. We make this statement to clarify that we expect the new planning process to be the primary mechanism for determining CLCPA-driven bulk system needs.

[42] Initial Report, p. 39.

system.[43] One of the most recognized efforts was carried out in Texas under its Competitive Renewable Energy Zones (CREZs) program. The CREZ initiative resulted in construction of over 3,500 miles of transmission lines capable of carrying 18.6 GW of renewable energy from areas of the state where there was previously no high-voltage transmission.[44] We note other examples of REZ programs, such as the Midcontinent Independent System Operator's Multi-Value Projects,[45] and the California Independent System Operator's Location Constrained Resource Interconnection (LCRI) policy.[46]

We understand that the REZ planning processes in these jurisdictions typically define a REZ as a geographic area of high-quality renewable resources, suitable topography and land use designations, and demonstrated interest from developers. Traditional REZ planning processes focus on wind and solar resources that can be developed in sufficient quantities to warrant transmission system expansion and upgrades.

New York has a robust bulk electric transmission system which covers a large majority of the State with

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[43] We note that FERC is examining the applicability of a REZ concept to federal transmission planning. In its recently issued Advance Notice of Proposed Rulemaking (ANOPR) regarding transmission planning under the regional planning processes of Independent System Operators/Regional Transmission Organizations, FERC sought comment on this issue. See Fed. Energy Regulatory Comm'n, ANOPR, "Building for the Future Through Electric Regional Transmission Planning and Cost Allocation and Generator Interconnection." 86 Fed. Reg. 40,266, 40,275-77 (issued July 27, 2021).

[44] http://www.ettexas.com/Projects/TexasCrez

[45] https://www.misoenergy.org/planning/planning/multi-value-projects-mvps/#t=10&p=0&s=&sd=

[46] http://www.caiso.com/informed/Pages/StakeholderProcesses/CompletedClosedStakeholderInitiatives/LocationConstrainedResourceInterconnectionPolicy.aspx

substantial underlying local transmission networks throughout. A 345 kV transmission backbone runs West to East, from Buffalo to Utica to the Capital Region, as well as North to South from St. Lawrence/Massena to Utica to New York City. In addition, there are substantial underlying 230 kV and 115 kV networks to support the customers throughout the local Transmission Owner's (TO) service territories, connecting all the State's major cities and communities through a fully networked transmission grid.

We recognize that there are areas of the State with limited bulk electric infrastructure, as identified in the Initial Report, but these areas are few in number and relative size, and their potential as sources of cost-effective renewable generation is not yet clear. Of more concern to us are areas where renewable generation development interest is already outgrowing the capability of the existing system, such as the Areas of Concern identified in the Phase 2 Order. We find that this existing demand may not call for new transmission system development, but rather requires the application of the more integrated system planning approaches we have initiated through this proceeding.

While the REZ concept may have value for New York in the future, the coordinated planning processes we have initiated pursuant to the Act are intended to support timely achievement of the State's goals for renewable generation. The coordinated State planning process that is under development pursuant to the Phase 2 Order has a clear focus on developing transmission plans to meet the State's CLCPA mandates. We expect the plans will identify the regions of the State with high wind and solar generation potential and developer interest. We anticipate that the Utilities will perform analyses to determine the more efficient resource locations based on transmission system

topology and necessary upgrades to meet these renewable mandates. We also believe, as several commenters have noted, that the NYISO's Public Policy Transmission Planning Process can be deployed to develop cost-effective transmission solutions.

Thus, we do not see a need to create a separate REZ process now. We believe that the steps we have taken to revise and coordinate transmission planning processes will be sufficient for the State to meet the requirements of the CLCPA. If the local and bulk transmission plans that are developed through the CLCPA-driven planning process do not provide access to enough generation to meet our goals, we may reconsider the possibility of establishing a New York version of the REZ concept to enable development in additional areas of the State.

Advanced Technologies

The Initiating Order sought proposals from the Joint Utilities to support the deployment of advanced transmission technologies.[47] There, when listing key elements of the revised planning called for in the Act, the Commission stated that the process "must continue to take fullest practical advantage of new technology and other innovation."[48] In the Phase 1 Order, the Commission recognized certain technologies as sufficiently well developed to warrant requiring the Utilities to consider them in preparing Phase 1 upgrade proposals.[49] The Commission gave the Utilities a similar directive in the Phase 2 Order.[50] However, the Commission has not yet addressed the Initial

[47] Case 20-E-0197, Order on Transmission Planning Pursuant to the Accelerated Renewable Energy Growth and Community Benefit Act (issued May 14, 2020) (Initiating Order).

[48] Initiating Order, p. 4.

[49] Phase 1 Order, pp. 18-19.

[50] Phase 2 Order, p. 36.

Report's recommendation that we find ways to accelerate the testing and deployment of new technologies.[51]

The Utilities' proposals for the deployment of advanced technologies are included in Part 3 of the Utility Study. There, the Advanced Technologies Working Group (ATWG) made recommendations for research and development (R&D) plans for new and/or underutilized transmission and distribution technologies and innovations.

In the filing, the ATWG explains that advanced technologies may be deployed to: (a) alleviate T&D system bottlenecks to allow for better deliverability of renewable energy, (b) unbottle constrained resources to allow more hydro and/or wind imports and reduce system congestion, (c) optimize the utilization of existing transmission capacity and right of ways, and (d) increase circuit load factor. The group identifies the following types of advanced technologies as the "highest prioritized technology categories":

- Dynamic line ratings and improved transmission utilization;
- Power flow control devices (both distributed and centralized);
- Energy storage for T&D services;
- Tools for improving operator situational awareness;
- Transformer monitoring;
- Advanced high-temperature, low-sag (HTLS) conductors; and
- Compact tower design.

The ATWG recommends that the Commission and the Utilities focus on dynamic line ratings, power flow control

[51] Initial Report, pp. 52-56.

devices, and energy storage for T&D services.[52] The filing specifically suggests establishing a consortium of experts, referred to as a "New York R&D Consortium," including participants from the Utilities, LIPA, the NYISO, and NYSERDA, that would be initially charged with carrying out two or three demonstration projects involving these technologies. The ATWG notes that several of the State's utilities have tested or are already implementing some of these solutions, thus providing at least an opportunity for knowledge transfer among the companies.[53] The filing suggests that funding for such projects could be provided by NYSERDA and through Commission-approved rate case allowances.[54]

As for deployment, the ATWG recommends that the New York R&D Consortium be tasked with developing a "pilot implementation plan." As proposed, this plan would provide for the discussion of new technologies, lab testing or demonstration projects for those technologies deemed to have potential benefits to the grid, a cost/benefit analysis, and utility adoption based on each utility's policies and procedures.[55]

The Commission agrees with the ATWG and commentators that advanced transmission technologies can offer significant benefits by increasing the transfer capabilities and associated renewable generation integration headroom of both existing grid facilities and new transmission investments. We also agree that a coordinated R&D platform for assessing and testing new technologies does not currently exist in New York State. Thus, to take advantage of the benefits that technology may offer to

[52] Utility Study, p. 267.

[53] Id. at 263.

[54] Id. at 266.

[55] Id. at 259-260.

ratepayers, we conclude that both near and long-term efforts are necessary.

For the immediate future, we will continue to apply the approach we adopted in the Phase 1 Order to both Phase 1 projects and Phase 2 upgrades. As we noted in that Order, there are several well-developed transmission technologies that the Utilities should consider applying when designing local T&D investments.[56] The Commission will continue to require the Utilities to review the application of these technologies going forward, and to explain why the adoption of these technologies is appropriate when they seek funding approvals, either in rate cases or petitions.

The Commission further notes that many of these technologies can be implemented more quickly than traditional transmission upgrades, and there may be circumstances in which they represent a cost-effective solution where the un-bottling of curtailed renewable generation is most urgent. The Commission will expect the Utilities to consider whether an advanced transmission technology should be applied to un-bottle renewable generation where it may: (1) permanently expand the transfer capabilities of existing grid facilities as a

[56] See Phase 1 Order, pp. 18-19 (referencing Initial Report, pp. 52-56).

lower-cost alternative to traditional upgrades;[57] or (2) temporarily expand the transfer capability of existing transmission facilities until they can be upgraded.

Longer-term, the Utilities' advanced technologies proposal suggests that adoption of less well-established technologies will require two supports: one, a forum or laboratory for evaluating and testing less well-developed technologies, and two, visible and trackable deployment plans. While the Commission will not adopt the ATWG's specific proposal for an R&D Consortium, we believe that the idea can be made to work, with some modifications.

In terms of a forum, the Commission notes that the Interconnection Technical Working Group and the Interconnection Policy Working Group have functioned successfully over the last several years to identify and solve technical and policy issues impacting both utilities and DER developers in the context of interconnection. These groups are largely stakeholder-driven but are guided by co-chairs representing Staff and subject matter experts from NYSERDA. They have also retained consultants to assist with technical analysis on issues of

[57] As noted in Section III.D of the Initial Report "advanced technologies applied to the existing grid may be able to create headroom more quickly and more cost effectively than traditional local transmission upgrades, including those proposed as Phase 1 or Phase 2 projects in the Utility Filing. This may be important and valuable in locations where bottled-up renewables are handicapped already today, particularly if such locations are not being addressed through a Phase 1 project. In these locations, the advanced technology may similarly be (a) a long-term solution for these locations as an alternative to a traditional transmission upgrade or (b) a stopgap measure until a cost-effective upgrade can be designed and built (at which point the equipment may no longer be necessary, so it could be redeployed to other locations that are constrained)."

common concern. We believe these groups provide a model for the kind of testing forum that the ATWG proposes.

Such a group, consisting of the Utilities, Staff, and NYSERDA, would at a minimum provide a forum for the utilities to exchange information about their current R&D efforts and projects, thus enhancing knowledge transfer.[58] We direct the Joint Utilities and Staff to establish a group, as described in this Order, and will also require the group to take on the challenge of identifying and removing barriers to the deployment of new technologies. It should include and gather information from national labs, state universities, consultants, other electric utilities, and technology developers.[59] The group should also determine, with the objective of arriving at a common approach to technology adoption across the State, how to deploy the technologies vetted through the evaluation process. Thus, the working group would both perform technology assessment and establish pathways to implementation of beneficial technologies.

As an initial task, we recommend that the working group focus on the three areas of technology development that the ATWG filing states should be priorities. These are: dynamic line ratings, power flow control devices, and energy storage for transmission and distribution services.[60] The Commission directs the Joint Utilities, in consultation with the working group, to develop a plan describing the research needs related to the potential deployment of these technologies, and a proposed

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[58] The Commission encourages the participation of transmission experts from NYPA and the NYISO.

[59] This list is not intended to be limiting; we encourage the Joint Utilities to reach out to any and all participants whose input they expect will be helpful to accomplishing the goals set by this Order.

[60] Utility Filing, p. 267.

budget for any necessary research projects. We note that the level of study that may be needed will vary among the technologies. For example, the Initial Report suggests that dynamic line ratings have such a significant track record in other jurisdictions that further research may not be necessary.[61] The Commission will expect the path to deployment of a beneficial technology that has documented operational history to be more direct than in the case of a less-developed technology.

The Joint Utilities should consider re-purposing existing R&D budgets to support these identified research objectives through the working group in a coordinated manner.[62] The proposed budget and plan shall identify existing sources of funding that can be applied for these purposes. If necessary, the filing may include requests for re-allocation of funds to support the ATWG's efforts. The Joint Utilities shall file the proposed research plan, the budget for the necessary work, and any deployment recommendations within six months of the date of this Order, and a progress report within one year of that date.

CONCLUSION

As noted above, the Accelerated Renewable Energy Growth and Community Benefit Act requires the Commission to address grid planning efforts needed to meet New York's ambitious clean energy mandates set forth in the CLCPA. This Order builds on the Commission's prior orders in this proceeding by addressing bulk system planning issues raised by the Power Grid Study, including aligning future procurements for offshore wind with a potential mesh network and emphasizing the

[61] Initial Report, Chapter 3.B, p. 44.

[62] The Commission also asks NYSERDA to consider whether any research funds can be re-directed or otherwise aligned with the Commission's charge to the working group in this Order.

importance of pairing offshore wind generation with energy storage. The Commission also recognizes that advanced technologies may play a critical part in meeting the State's goals at reasonable cost and has put in place a mechanism to ensure well-supported technologies are deployed. We recognize that the work is not complete and that these steps will lead to others. The Commission will continue to take action to further align T&D planning and investment with the State's clean energy objectives.

The Commission orders:

1. Department of Public Service Staff shall coordinate with the New York State Energy Research and Development Authority to study the relative benefits, costs, and challenges associated with a meshed offshore wind transmission system, as discussed in the body of this Order.

2. The New York State Energy Research and Development Authority shall include eligibility criteria in its offshore wind procurements to require proposals that incorporate measures for the potential integration of the project(s) into a future meshed network system, as discussed in the body of this Order.

3. The New York State Energy Research and Development Authority shall incorporate into future contracts the possibility that an offshore wind project may deliver energy to points in more than one New York Independent System Operator, Inc. zone, as discussed in the body of this Order.

4. The New York State Energy Research and Development Authority shall include eligibility criteria in its offshore wind procurements that would require the use of high voltage direct current transmission where appropriate to preserve maximum efficient use of constrained cable corridors, as discussed in the body of this Order.

5. The New York State Energy Research and Development Authority and Department of Public Service Staff shall collaborate with other New York State agencies to develop coordinated plans for cable routing, and to file a report on the progress of this collaboration by September 1, 2022, as discussed in the body of this Order.

6. The New York State Energy Research and Development Authority is authorized to award additional scoring credit in the economic benefits and viability categories for energy storage facilities integrated in offshore wind proposals, as discussed in the body of this Order.

7. Consolidated Edison Company of New York, Inc., Orange and Rockland Utilities, Inc., New York State Electric and Gas Corporation, Rochester Gas and Electric Corporation; Central Hudson Gas & Electric Corporation, Niagara Mohawk Power Corporation d/b/a National Grid shall file a proposed research plan, as discussed in the body of this Order, along with a budget for the necessary work, and any deployment recommendations within six months of the date of this Order, and a progress report within one year of that date.

8. In the Secretary's sole discretion, the deadlines set forth in this Order may be extended. Any request for an extension must be in writing, must include a justification for the extension, and must be filed at least three days prior to the affected deadline.

9. These proceedings are continued.

By the Commission,

(SIGNED) MICHELLE L. PHILLIPS
Secretary

Summary of Comments in Response to the Initial Report on the New York Power Grid Study

Anbaric Development Partners, LLC (Anbaric)

Anbaric asserts that the benefits of a planned, shared meshed transmission system to consumers, the power system, New York's climate goals, and the environment are significant. Anbaric argues that the assumed 1,310 MW single transmission cable limit described in the Power Grid Study (Study) is not a technical limit nor a New York Independent System Operator (NYISO) restriction, rather it is the size of an existing known system contingency. According to Anbaric, the limit's erroneous use is the single largest factor causing the Offshore Wind (OSW) Study to conflict with a recent 2020 Brattle/Pterra study and to miss significant benefits of a planned, shared meshed transmission system. Anbaric believes the Power Grid Study does not recognize that even if there was a single source loss limit in New York, and reliability issues could not be addressed through upgrades, the use of a networked system allows power to continue to flow to the grid even if there is a fault on a single line.

Anbaric notes that the United Kingdom, which has an abundant coastline, is currently moving to a planned, shared meshed transmission system, and the system operator has determined that delaying this shift from 2025 to 2030 could reduce benefits by half. Anbaric believes that technological standards and future wind lease areas are not reasons for delay, rather the critical factor is ensuring sufficient platform space for networking. Anbaric suggests that the use of shared, larger transmission lines is critical for New York's offshore wind program and that the Study's optimistic view regarding space for

cable routing has significant limiting consequences if it is incorrect.

Atlantic Shores Offshore Wind, LLC (ASOW)

ASOW is a joint venture between Shell New Energies US LLC and EDF Renewables North America that was formed in 2018 to develop a lease area within the New Jersey Wind Energy Area. In its comments, ASOW expresses support for the recommendations in the Initial Report on the Power Grid Study. ASOW encourages the New York State Public Service Commission (Commission) to consider updating the report to incorporate the interconnection requirements that ASOW suggests will likely be needed to accommodate the size and capacity of contracted projects. While the transmission and interconnection analyses continue, ASOW supports a consistent procurement schedule to provide a critical market signal to the offshore wind industry. ASOW explains that transparency in the timing and scope of future procurements would allow developers to maximize the options for transmission and interconnection opportunities.

ASOW supports: (1) further analyzing options for a meshed offshore transmission system following federal designation of Wind Energy Areas in the New York Bight; (2) declaring a need for such a system through the current Public Policy Transmission Needs Planning Process (PPTNPP) and soliciting additional solutions; and (3) selecting projects under the current Clean Energy Standard Tier 4 procurement. ASOW believes that if the State chooses to pursue a meshed system, it should be the subject of an independent solicitation. However, if portions of a meshed system design are integrated into future offshore wind solicitations, ASOW would request that technical requirements, method of cost recovery, and the scope of work, including operations and maintenance, be thoroughly vetted in advance of such solicitation.

Avangrid, Inc. (Avangrid)

Avangrid recommends that New York move forward with another near-term solicitation to take advantage of the remaining Massachusetts Wind Energy Areas' potential to deliver to New York. Avangrid requests that the New York State Energy Research and Development Authority (NYSERDA) remain consistent with the OSW procurement schedule as currently established in order to support critical and transparent market indicators. Avangrid suggests that the next Request for Proposals (RFP) should seek procurement of offshore wind that maximizes the transfer capability of the existing bulk transmission system such that the per MWh hour cost is minimized.

Avangrid notes that neighboring states, such as New Jersey, are proposing a staged approach to OSW transmission, which Avangrid believes would send the right signal to the LSW industry to continue its current development while the State can use the PPTN process to begin upgrading more urgent onshore locations. Avangrid proposes that the Commission consider initiating a staged approach for a meshed network as soon as possible. In addition, Avangrid recommends that clarification be provided in subsequent studies pertaining to associated meshed system cost recovery parameters and technical specifications that would be evaluated in developers' proposals.

Avangrid requests that the Commission and NYSERDA clearly communicate the following issues prior to any issuance of an RFP for a meshed system: (1) developer technical requirements; (2) developer scope of work including operations and maintenance requirements; (3) a mechanism to evaluate benefit to cost ratios of the different alternatives; (4) a mechanism to evaluate and score other benefits to the system; (5) a cost recovery model; and (6) specific actions to address

and mitigate inherent complexities in future RFPs, including a meshed system in competitively bid wind generation projects.

Avangrid recommends that preserving or enhancing revenue certainty be considered a key performance indicator in evaluating the potential impact of a meshed grid structure. In addition, Avangrid suggests further study and clarification of regional coordination with New Jersey, Connecticut, Rhode Island, and Massachusetts on the topics of cost recovery, inter-Independent System Operator (ISO) conflict resolutions, and Federal Energy Regulatory Commission (FERC) approvals.

Avangrid expresses agreement with the recommendation in the Power Grid Study that more detailed and consistent intra-ISO studies be developed to quantify existing headroom. Avangrid supports the advancement of a planning process for a tie-line between Long Island and the rest of the State. Avangrid believes further consideration should be given to the size of the points of interconnection (POIs) identified because the maximum injection criteria used was 300 MW and does not align with the typical output of currently awarded offshore wind project and future trends. Avangrid suggests that a future study include a specified weighting for the selection of POIs with more favorable permitting conditions in the context of OSW procurements.

In addition, Avangrid recommends that the Commission address constraints in the Southern Tier and Central-East regions by issuing a Public Policy Transmission Need (PPTN or Public Policy Process) under FERC Order 1000. Alternatively, Avangrid urges the Commission to designate priority transmission projects to alleviate that congestion.

City of New York (City)

The City recommends that the Commission engage in a comprehensive, coordinated planning effort to identify the

generation, storage, transmission, and distribution infrastructure needed to achieve Community Leadership and Community Protection Act (CLCPA). The City also urges the Commission to direct the utilities to use advanced technologies and no-wires alternatives where appropriate and cost-effective. In addition, the City recommends that the Commission direct the utilities to develop implementation plans to address system needs.

The City asserts that cost-based rates ensure fairness and equity among customers. It cautions that other ratemaking approaches have the potential to be more volatile, result in unjust subsidization of some customers, and could cause other customers to disconnect from the grid and self-supply, which would exacerbate the energy cost burdens in disadvantaged communities. The City suggests that the Commission should only consider incentives on a limited basis where the incentives would align customer and utility shareholder interests, such as in a shared savings model.

The City proposes that the Commission consider the social cost of carbon in its analyses and prioritization of projects. The City also recommends that the OSW Study be supplemented to consider longer duration batteries in order to better understand the implications of those technological developments.

Climate Jobs NY (CJNY)

CJNY suggests that the Commission enact progressive procurement policies for all transmission projects, including project labor agreements (PLAs) and community workforce agreements for all phases of construction in projects receiving financial assistance of more than $100,000 or that have a total value of more than $3 million. CJNY also recommends that the Commission include prevailing wage requirements for such

projects. In addition, CJNY urges the Commission to require all construction contractors and subcontractors to participate in state-approved apprenticeship programs to ensure a skilled and safe workforce while providing increased employment opportunities for women, minorities, and members of disadvantaged communities.

CJNY asserts that cost allocation for bulk transmission, related on-ramp transmission, and significant distribution upgrades should be shared by ratepayers statewide because all of New York will benefit from a more sustainable, resilient, and cleaner energy infrastructure, which would also be in accordance with CLCPA standards.

Con Edison Transmission, Inc. (CET)

CET supports the creation of an offshore mesh transmission network. CET notes that if New York wants to compete for generation in the New York Bight lease areas, the State should evaluate how to decrease the cost and risk of interconnecting offshore wind to New York State in Long Island and New York City. CET believes the Commission should consider directing the NYISO to issue a Public Policy Transmission Need for offshore transmission to interconnect the leaseholds in the New York Bight as soon as the lease areas are formally established.

CET recommends that the Commission and the NYISO proactively review current rules and protocols to consider any updates needed to accommodate advanced transmission technologies, particularly for intrastate high-voltage direct current (HVDC) transmission. CET cautions that additional transmission will be required to maintain reliability, especially if energy storage and renewable natural gas (RNG) do not materialize at the levels assumed in the Power Grid Study.

Consolidated Edison Company of New York, Inc. and Orange and Rockland Utilities, Inc. (Con Edison and O&R)

Con Edison requests that the Commission approve cost recovery for all of Con Edison's Phase 1 transmission projects and clarify that Con Edison's proposed Phase 2 Clean Energy Hub projects are "local" in the context of the Commission's May 14, 2020, Order on Transmission Planning Pursuant to the Accelerated Renewable Energy Growth and Community Benefit Act. Con Edison also urges the Commission to prioritize Con Edison's Clean Energy Hub projects within Phase 2 and direct Con Edison to submit additional information on them so they can be authorized to proceed before NYSERDA's next offshore wind solicitation.

Con Edison emphasizes the benefits that may be provided by the two Clean Energy Hub Projects that it proposed. According to Con Edison, its New York City Clean Energy Hub #1 is a cost-effective project that could be in operation by Summer 2027 and would create points of interconnection (POIs) for new resources, such as OSW, totaling approximately 3,000 MW. Con Edison notes that its New York City Clean Energy Hub #2, which could be in operation by Summer 2029, would create POIs for new connections totally approximately 1,500 MW and transfer load from three other constrained load pockets on its system. Con Edison reiterates its assertion that its Clean Energy Hubs should be prioritized because they would "provide needed certainty to offshore wind developers regarding viable interconnection locations, facilitate the most competitive and efficient response to any future offshore wind solicitations, and timely satisfy the CLCPA's renewable and offshore wind goals most cost effectively and efficiently."

O&R comments that it agrees with the proposal in the Power Grid Study that the area of Sullivan County be considered for designation as a Renewable Energy Zone (REZ), suggesting

that although renewable project applications have not yet been made in this portion of its service territory, the lower Sullivan County is an area of likely future interest due to its open spaces and relative proximity to load. O&R suggests that the Commission should first consider whether local projects can provide the anticipated level of headroom required. O&R also offers to work with Department of Public Service (DPS) Staff and stakeholders to determine the appropriate scale of upgrades when a project is brought forward in future rate filings. In addition, O&R urges the Commission to approve the Phase 1 projects that O&R proposed.

Diamond Offshore Wind (DOW)

DOW suggests that further consideration is needed of the broader benefit/cost landscape in evaluating OSW bulk transmission solutions. DOW notes that coordinated approaches may yield benefits not contemplated in the Power Grid Study, such as supporting enhanced competition and pricing efficiency, and may help ensure the State does not hinder cost-effective OSW above the 9 GW target. DOW submits that the capital expenditure assumptions associated with the HVDC solutions should be viewed as less reliable, and potentially overestimated, given the evolution of HVDC technology, the vintage and limited transferability of cost benchmarks utilized, and the cost uncertainty levels cited by the Study's authors.

DOW asserts that a coordinated, open-access offshore transmission solution, developed competitively and independently from the State's OSW procurements, would better serve the State than an approach that relies on privately owned, restricted-access generation tie lines. DOW notes that Ofgem, the energy regulator for Great Britain, does not view individual radial offshore transmission links as likely to be economical or sensible, even with the UK's significant coastline.

DOW suggests that a coordinated offshore transmission solution may enable more competitive outcomes for future offshore wind procurements by reducing the economic differentiation of sites being more or less proximate to Zone J/K POIs, which would promote auction pricing efficiency. According to DOW, a coordinated solution may also create new opportunities for smaller offshore wind projects that could encourage innovation and open the market to broader participation. DOW also notes that a coordinated approach could reduce total offshore cable miles and the associated impacts.

DOW cautions that the State has no opportunity to wait and see what will happen with the anticipated federal leasing activities in the New York Bight region, given the NYISO's stated five-to-six-year timeline estimate associated with the Public Policy Process from Declaration of Need to in-service date for bulk transmission solutions. DOW suggests that the State should expeditiously evaluate development of open-access, coordinated solutions that maximize benefit/cost and long-run flexibility and competition, with the expectation that the federal Bureau of Ocean Energy Management will lease additional offshore areas in the NY Bight.

DOW believes that it may not be necessary to plan for a regional approach with neighboring control areas because such coordination is likely to further complicate and/or delay optimization of an OSW-focused bulk transmission solution. DOW suggests that the five-to-six-year timeline for realization of a FERC Order 1000-driven solution may be too long, given the State's near-term ambitions. DOW expresses support for the Commission and other relevant parties acting as quickly as possible to further evaluate and implement a coordinated OSW transmission strategy.

EDF Renewables New York (EDFR)

EDFR urges the Commission to declare key priority areas for grid investments to allow acceleration of Phase 2 or alternative upgrades in those area. DOW

EDFR expresses support for a REZ concept that identifies and enables grid investments based on renewable development potential. EDFR calls for cautiousness with consideration of REZ such that other key decisions are not put on hold, given the real and specific needs of the grid in the short-to-medium term and the accelerated timing of procurement required to meet the CLCPA targets by 2030. EDFR suggests that REZ concepts could also be considered through the Public Policy Process, and that declaring a regional public policy need would implicitly be making that area a REZ for which upgrades would enable renewable development in a cost-effective manner.

Independent Power Producers of New York (IPPNY)

IPPNY suggests that further attention and study is needed to accurately determine the level of dispatchable long-term long duration power generation that is needed to maintain reliability. IPPNY recommends that the Commission coordinate with the NYISO to conduct additional studies identified in the Zero Emissions Study, including of the operational implications of factors such as day-ahead renewable generation forecasting errors, real-time renewable generation uncertainties and associated intra-hour system flexibility needs, the impacts of planned and unplanned transmission outages, and system performance under more challenging weather conditions (e.g., storms, heat waves, and cold snaps). IPPNY also expresses support for further study of effective load carrying capability to better understand the capacity contribution of duration-limited resources. IPPNY emphasizes that additional focus is needed to identify technologies that will be necessary to

reliably and cost-effectively integrate renewable resources while maintaining resource adequacy.

In addition, IPPNY urges the Commission to develop a transmission plan with defined projects and timelines that would ensure deliverability of renewable energy to consumers throughout the state. To develop the plan, IPPNY recommends that the Commission coordinate efforts across the NYISO Public Policy Transmission Planning Process, New York Power Authority's Priority Transmission Projects Process, and transmission owner plans.

Institute for Policy Integrity at New York University School of Law (Institute)

The Institute recommends that the Commission require utilities to take additional analytical steps in connection with current and future projects. Specifically, the Institute asserts that utilities should (1) quantify and monetize the benefits of transmission project portfolios related to avoided emissions and (2) quantify and monetize avoided local pollution. The Institute also recommends that the Commission seek an updated analysis that addresses two assumptions that the Institute characterizes as problematic in the Zero Emissions Study. The first such assumption is the carbon price of $22 by 2040, which the Institute states is less than one-fifth of the $125/ton Social Cost of Carbon estimate recommended by the Department of Environmental Conservation in its 2020 guidance document, "Establishing a Value of Carbon: Guidelines for Use by State Agencies."

The second area that the Institute suggests should be further analyzed is the availability of Renewable Natural Gas (RNG). The Institute encourages the Commission to examine a scenario that excludes RNG from the bulk power system and adjusts project prioritization accordingly. The Institute

suggests that "RNG's emissions profile is unclear and likely non-zero" and that "no model can, at present, credibly show how adequate and timely volumes of RNG would be produced and transported so as to support grid reliability." According to the Institute, examining a scenario without RNG would likely highlight how transmission capacity would need to make up for a possible failure of RNG to meet expectations.

Invenergy Renewables LLC (Invenergy)

Invenergy proposes that DPS Staff conduct additional studies to better capture the necessary upgrades to bring offshore wind onshore and a study of integration that supports both radial and/or meshed backbone technologies. Invenergy recommends that a second OSW study be performed without the assumption of resolved local constraints. Invenergy suggests that now is the time to explore what additional oversized facilities would need to be included for radial connections to evolve to a meshed network and who would pay for the additional cost.

Invenergy supports the creation of REZs to provide opportunities for renewable development in areas otherwise not economically feasible due to the need for expanded transmission. Invenergy believes the implementation of a hub and spoke style of REZ in regions that do not currently have suitable on-ramps for renewable energy would create new opportunities for renewable development and alleviate pressure on the existing system. Invenergy suggests that studies should be coordinated with DPS, NYSERDA and the NYISO to determine suitable REZ areas. Invenergy recommends that the Commission allow for REZ transmission solutions to be considered as part of the NYISO's PPTN process. Invenergy provides a diagram demonstrating regions where it believes renewable development has not yet been proposed due to lack of economic transmission for

interconnection. Invenergy also comments more specifically on renewable energy deployment and suitability for the Southern Tier, North Country, Montgomery County, and the Genesee, Lockport and Lancaster regions.

Joint Utilities (JU)

The Joint Utilities are Central Hudson Gas & Electric Corporation; Consolidated Edison Company of New York, Inc.; Niagara Mohawk Power Corporation d/b/a National Grid; New York State Electric & Gas Corporation; Orange & Rockland Utilities, Inc.; and Rochester Gas and Electric Corporation. The JU express agreement with most aspects of the Power Grid Study, particularly in the conclusion that local transmission and distribution investments are needed to meet CLCPA goals. However, the JU disagree with the Study's suggestion that Phase 2 projects are not needed until 2030. Instead, the JU assert that Phase 2 project development should lay the groundwork for other projects such as electrification. The JU also recommend that the Commission adopt the regulatory policies proposed by the Joint Utilities.

The JU support a coordinated approach to transmission to connect offshore wind to the onshore grid, as it asserts would result in a cost-effective outcome for customers and reduce the cost of NYSERDA OSW solicitations, benefiting ratepayers over the long term. The JU believe that care must be taken to ensure that current offshore development is not delayed or imperiled by uncertainty over interconnection policy. The JU support additional study on whether a meshed approach is optimal for New York. If the Commission decides to pursue a meshed approach, implementation should be done in consultation with stakeholders to ensure against unintended consequences. According to the JU, evaluations of interregional approaches must place priority on New York before expanding a focus on

external resources due to the difficulties in addressing cost allocation in interregional planning.

The JU recommend that the Commission establish a cost allocation working group to be comprised of the Joint Utilities, New York Power Authority, Long Island Power Authority, DPS Staff, NYSERDA, and the NYISO to develop statewide cost allocation pathways.

The Joint Utilities support the REZ concept for identifying future areas of renewable development and buildout transmission in advance. The JU suggest that such an approach would help guide renewables to appropriate interconnection points, reduce time spent in the interconnection process and reduce interconnection costs that renewable developers include in their bids. The JU recommend that identification of REZ regions involve rigorous analysis and input from the developer community and local utility. According to the JU, REZ identification processes should also include provisions that require exploration of development in existing ROWs.

The JU state that reliance only on interconnection applications may understate economic renewable energy potential in areas developers avoid due to lack of transmission infrastructure. The JU believe it is important to reconcile and understand the differences in forecasts of renewable generation development among the NYISO, NYSERDA and the Joint Utilities. The JU suggest that the Commission direct NYERSDA to conduct a study to identify future REZ areas, and once established, DPS and NYSERDA should work with the local utilities to identify whether there are cost-effective local solutions in these areas. In areas where non-local solutions may be needed, the JU recommend that the Commission declare a Public Policy Transmission Need to seek solutions through the NYISO Public Policy Planning Process.

The JU support the consideration of potential benefits of advanced technologies when appropriate but caution that the application of advanced technology should not slow the progress of Phase 1 projects.

Long Island Power Authority (LIPA)

LIPA offers various factors for consideration when switching a meshed network. LIPA notes that there will be a need to resolve contractual issues between the owner of the network and the interconnected projects. LIPA suggests that while a meshed network is likely to provide benefits, the schedule for completion should be closely coordinated with wind farm development to avoid additional costs associated with delays in network completion. According to LIPA, credible commitments for a meshed offshore network should be made in time to be reflected in OSW bids and regional coordination should be considered. LIPA also points out that there are technology risks with network design that should be addressed during the design phase because they could affect the type and size of projects that could be interconnected.

In addition, LIPA recommends that the Commission modify its procedures implementing the Public Policy Transmission Planning Process to provide more streamlined decision-making in pursuit of the State's CLCPA goals.

LS Power Grid New York Corporation I (LS Power)

LS Power highlights the benefits it perceives from a competitive procurement for offshore wind transmission, including cost savings from regulated ownership and sharing of facilities between multiple generators, synergies from integrated facilities, identification of innovative approaches, and reduced environmental impacts. LS Power argues that the Commission should confirm open availability of existing customer-funded rights-of-way for all bidders to maximize

competition. LS Power suggests that a PPTN process for interconnection and integration of offshore wind resources could save ratepayers hundreds of millions of dollars in transmission costs compared to the current approach.

LS Power argues that the Commission should not entertain Con Edison's proposal to construct Clean Energy Hubs. Instead, LS Power proposes that the need for OSW integration hubs be referred to the NYISO Public Policy Transmission Planning Process to be better defined and to identify the most cost-effective solution. According to LS Power, the location of NYSERDA Tier 1 resources should be sufficient evidence to establish a Public Policy Transmission Need based on reducing congestion and curtailment of renewable generation in certain areas. LS Power believes that it is critical to begin the PPTN process without delay because of the long lead time for transmission development and construction in comparison to renewable generation development and construction. LS Power also recommends that the commission identify increasing inter-regional transmission as an element of a PPTN for renewable integration.

New York Battery and Energy Storage Technology Consortium

The New York Battery and Energy Storage Consortium (NY-BEST) recommends that the Commission increase the State's energy storage deployment goal from the current target of 3 GW by 2030 to a new goal of at least 15 GW by 2040. NY-BEST notes that the Study observed that a fivefold increase in storage deployment will be needed between 2030-2040. NY-BEST urges the Commission and NYSERDA to prepare an updated analysis on the State's Energy Storage Roadmap for the purpose of increasing the storage deployment goal, evaluating the effectiveness of the actions already taken, and to establish a new pathway to achieve the storage goal. In addition, NY-BEST recommends that the

Commission lead efforts to improve system planning and the use of public policy options, in conjunction with the NYISO, and to accelerate deployment of energy storage and renewable resources.

NY-BEST also recommends that the Commission (1) direct utilities to incorporate scenario planning and consideration of the value of optionality into the utilities' analysis and decision making; (2) require utilities to evaluate storage as an asset; (3) adopt a more coordinated and comprehensive methodology for evaluating local transmission and distribution projects; and (4) ensure that advanced technologies are fully considered as a means to increasing hosting capacity of distributed energy resources.

New York Independent System Operator, Inc. (NYISO)

The NYISO recommends that the Commission prioritize transmission expansion for OSW integration for Long Island and New York City in order to meet the 70x30 requirement and additional CLCPA targets. Given the multi-year lead time and coordination required for transmission development in New York, the NYISO supports the Commission's determination that the CLCPA is a Public Policy Requirement that is driving the need to increase transmission capability from Long Island to Southeast New York. The NYISO suggests that the Commission work with various parties to initiate a coordinated local and bulk power transmission planning approach now before opportunities for efficient system design are foreclosed.

The NYISO believes that the Commission must move quickly to support an OSW meshed system and should evaluate several issues when deciding the path forward. Those issues include the technical specifications required to convert radial connections, whether commercially available technology exists to create a meshed system, what the implementation process should look like, how the interconnection rights of radially connected

OSW farms are affected when their generator lead lines are connected to other farms and whether these facilities become subject to open access transmission services under the NYISO's tariff, and whether the meshed system would be considered part of the bulk transmission system operated by the NYISO.

The NYISO encourages the Commission to establish REZs where the necessary energy and land resources exist, especially in areas of the State where NYSERDA has awarded significant RECs and where developers have proposed to interconnect. The NYISO notes that while the specific areas identified in the Initial Report in Zone G and Southern Zone F may be attractive from a standpoint of energy prices and proximity to load, the major barrier to development does not appear to be a lack of "on ramp" transmission. More distributed solar, rather than utility scale solar, is under development in Zone G, which NYISO believes is likely due to challenges in obtaining real estate and permits for larger sites in this region. The NYISO also suggests that to provide full delivery of energy from REZs, a holistic plan should address the bulk transmission needs identified in the NYISO's 70x30 scenario findings.

The NYISO proposes that the Commission treat energy storage as a key resource rather than a transmission asset. According to NYISO, energy storage resources can support grid flexibility, contribute to resource adequacy, help to satisfy transmission constraints, and maximize the use of renewable energy resource by mitigating spillage. The NYISO notes that its own wholesale market rules treat energy storage as a resource eligible to participate in capacity, energy, and ancillary services markets.

The NYISO suggests that the Commission continue to leverage NYISO's capabilities and tariffs to improve coordination and stakeholder inclusion in the transmission

planning process. As part of that effort, the NYISO recommends updating the Commission's 2014 procedures implementing the Public Policy Transmission Planning Process (Public Policy Process) to align with the NYISO's current Open Access Transmission Tariff. The NYISO submits that it would be appropriate for the Commission to revise Step 6 of its 2014 procedures to indicate that the Commission may cancel or modify a transmission need driven by a Public Policy Requirement at any time prior to the NYISO's selection of a transmission solution. NYISO also asserts that the Commission should provide certainty to developers, transmission owners, and other stakeholders by clarifying in its procedures that it will issue a determination in future biennial cycles of the Public Policy Process finding any transmission needs driven by a Public Policy Requirement or finding no such needs.

New York Power Authority (NYPA)

NYPA recommends an additional study with a more holistic approach than the Power Grid Study, which NYPA notes is a compilation of multiple analyses with different methodologies and assumptions. According to NYPA, the studies failed to address how grid improvements in one utility territory could impact neighboring systems and how local solutions could impact the bulk power system, and vice versa. NYPA states that stronger coordination of studies is needed to avoid isolated system upgrades that may result in costly and inefficient over-/under-building of the grid. To that end, NYPA identifies one potential solution as the creation of a standing working group with State authorities, transmission owners, utilities, and the NYISO to ensure coordination on an ongoing basis. NYPA also believes that the grid studies should be updated more frequently than the four-year cycle required by the Act to reflect evolutions in the grid.

NYPA suggests that additional analysis and coordinated evaluation of advanced technologies is needed to determine whether they would be helpful in addressing the specific needs of the New York grid and how such benefits could be quantified and compared with the effort needed to implement and operate them. To support the creation of a coordinated process for testing and evaluating new technologies, NYPA suggests that a collaborative consortium and facility be established to include the various utilities and other stakeholders. NYPA also posits that additional incentives may be necessary to encourage utilities to implement advanced technologies.

To better deploy storage as a flexible resource, NYPA asserts that further analyses should be conducted to model discharging/charging regimes, consider how to quantify the benefits of energy storage for various applications, and to determine the value of using storage to defer capital expenditures.

NYPA also comments that developers appear to have no intention to mesh offshore transmission systems without an incentive, coordination, or other form of support. NYPA suggests that the Commission could require a separate review of what incentives may be necessary to encourage such development.

New York Solar Energy Industries Association (NYSEIA)

NYSEIA believes that greater coordination will be required in planning across the bulk and distribution systems in order to achieve the State's CLCPA goals. NYSEIA urges the Commission to reevaluate the allocation of interconnection costs for distributed energy resources because the benefits of such interconnections are greater and distributed more widely than the costs for the necessary upgrades, which are currently borne only by the developers. In addition, NYSEIA asks the Commission to consider a robust stakeholder process for Phase 2 Plans.

NYSEIA also recommends several improvements to the stakeholder processes for the Interconnection Policy Working Group and the Interconnection Technical Working Group.

NYSEIA recommends that a dashboard be created to reflect the DER State of the Grid, which could be used to monitor progress toward meeting CLCPA goals in comparison with utility investment and renewable deployment.

New York Transco LLC (Transco)

Transco urges the Commission to prioritize improvement and coordination of planning processes in order to achieve CLCPA goals. Transco also recommends that additional studies be conducted to better understand future electric transmission needs.

Transco asserts that the results of the OSW Study are overly optimistic and do not reflect the true realities of the challenges that will exist in reliably integrating these resources. Transco notes that based on the NYSERDA OSW awards announced to date and anticipated to be built to achieve CLCPA goals, there seems to be a significant disconnect with where projects were assumed to interconnect in the OSW Study versus where they are actually going to interconnect, further supporting the need for improved and coordinated planning.

Based on its own transmission planning analyses, Transco suggests that there is a broad need for transmission across New York State in order to meet CLCPA goals. Transco details the transmission needs that it identified in the areas of Western New York, North Country, Southern Tier, Capital Region, and the LIPA and Con Edison Systems.

Transco also expressed concern that the Zero Emissions Study ignored constraints on the lower voltage transmission system, underestimated the levels of curtailments and congestion that would occur in operating the system, and therefore has not

accurately identified the true system needs required to reliably operate the system in the future.

Transco suggests that further studies review the operating flexibility required to maintain system reliability after 2035 as increased solar and wind capacity will create a new stressed operating point during evening peak and shoulder load periods. Transco notes that the evening load increase may come sooner than 2035 if the penetration of behind-the-meter distributed energy resources is high.

Additional study is needed, Transco suggests, to analyze how and where to consider both wire and non-wire solutions in evaluating the most cost-effective solution to achieve CLCPA goals. That analysis should recognize that the solutions should be reliably operational for more than 40 years and the costs that are taken into consideration should include operations, maintenance, and replacement costs in addition to the capital costs.

Transco believes that the following issues have not been explicitly addressed in the Initial Report on the New York Power Grid Study: (1) a roadmap of how the power grid can pragmatically and cost effectively manage the transition and address the reliability and resiliency ramifications of the evolving resource mix on the trajectory towards 70x30 and 100x40; (2) grid operational vulnerability as the system is heading in two directions at once: major HVDC links, BESS, and FACTS "smart" devices to move onshore and offshore renewable energy to Zones J &K, and netload uncertainty at zonal level driven largely by IBR distributed energy resources; and (3) the cost of integrating and operating renewable resources going forward. Transco expressed particular concern with the schedule and timing of emitting fossil generation retirements. Transco asserts that an additional study is necessary to understand a

comparison between the current level of resilience and the resilience in the 70x30 and 100x40 futures.

According to Transco, REZ concepts should be considered through the System Planning Working Group, which has been developed in response to the Phase 2 Order. Transco suggests that these zones not only focus on local transmission, but also consider whether bulk system enhancement might play a role when evaluating the benefits of these zones.

NextEra Energy Transmission New York, Inc. (NEETNY)

NextEra Energy Transmission New York, Inc. (NEETNY) recommends that the Commission revisit the inconsistent assumptions in the Power Grid Study and update the analysis to reflect a consistent view of the future electric grid.

NEETNY references the Texas Competitive Renewable Energy Zones as an example of successful transmission planning for regional renewable energy growth and a National Renewable Energy Laboratory publication that provides an overview of REZ process approaches. NEETNY also discusses the NYISO's 2019 CARIS 70x30 analysis that examines the impacts of the CLCPA on the power system in 2030 and identifies pockets of renewable generation where there is insufficient transmission to fully deliver the renewable generation. NETTNY suggests that once the REZs are established, the Commission may request that the NYISO develop a transmission plan for each zone to inform the Commission on the scale of transmission investments required to delivery energy from each REZ. According to NEETNY, that information may provide a sufficient basis for the Commission to declare Public Policy Transmission Needs for those zones providing the greatest benefits. NEETNY believes that utilizing the competitive transmission process through the NYISO will invite developers to bring innovative and cost-effective

solutions, which may yield the most expeditious and efficient means to developing transmission solutions for REZs.

NEETNY asserts that the NYISO is best positioned to perform the role of integrated planning of New York's local transmission and bulk transmission solutions. Under the approach envisioned by NEETNY, the Commission would periodically request a special study from the NYISO to ensure the transmission system can support public policy. The Commission would also direct the utilities to cooperate with the NYISO and provide the data needed to perform that analysis. The results of the study could form the basis for the Commission to declare a public policy need or justify local transmission investments.

OW North America LLC (OW)

OW believes shared offshore transmission infrastructure to be a viable option, as demonstrated in other jurisdictions, but seeks further detail to plan for such an approach in upcoming solicitations. As a non-incumbent OSW developer in the State, OW finds the current generator lead-line interconnection approach challenging because the majority of coastal, easy to access POIs are already designated for existing projects. OW urges consideration of any offshore transmission solution as soon as practicable to avoid the ineffective use of scarce cable corridors and onshore POI availability. OW recommends that the Commission consider a centrally coordinated approach through evaluation of the following issues: non-discriminatory access to the offshore transmission infrastructure; liability for lost income due to delayed realization of offshore transmission capacity and unavailability of offshore transmission capability beyond reasonable industry standards; coordination of maintenance outages; ownership interface between OSW farm owner and OSW transmission owner; coordination of design information and models to ensure

compatibility of interface and of measurements and control signals; access of OSW farm owner to offshore transmission facilities for installation, testing, and operation of array cables up to interface; and whether there should be a mechanism to differentiate between projects compatible with a meshed system versus simple radial transmission.

Ørsted

Ørsted cautions that the Study's conclusion that 9,000 MW of OSW can be integrated without major onshore bulk transmission upgrades may be based on incomplete or dated information. Specifically, Ørsted is concerned the Study has aggregated many small POIs that will not be able to accommodate the size of current or future generation economically or technically. Ørsted recommends that the Commission reevaluate the availability and accessibility of the identified POIs and consider other actions to preemptively address transmission additions. Ørsted notes that interconnection costs may have been underestimated in the study. According to Ørsted, off-peak load periods should also be considered in further Commission studies.

Ørsted worries that near-term interoperability issues with HVDC equipment may prevent the successful meshing of offshore generation, as existing HVDC systems lack standards that would allow interconnections of systems by different manufacturers. Ørsted supports the Study's conclusion that enhancements to the interconnections between Zones J and K is needed to facilitate the buildout of offshore wind and recommends that the Commission continue to explore competitive approaches to securing the most reliable and cost-effective solutions. Ørsted recommends a holistic approach to future studies and planning that includes both storage and offshore wind transmission needs.

Potomac Economics, Ltd.

Potomac Economics, Ltd. (Potomac) recommends that the Commission avoid planning specific energy storage projects and locations. Instead, Potomac suggests that NYISO market signals could more effectively guide investment in efficient locations, quantity, and design of energy storage projects. According to Potomac, Public Policy Transmission Needs should be identified with a focus on the underlying public policy objective rather than identifying specific projects or paths to be upgraded. Potomac encourages reforms to NYISO's Economic Planning Process to support CLCPA goals and address congestion that is not specifically identified as a PPTN. Potomac also recommends improvements to the Public Policy Transmission Planning Process to enable evaluation of a transmission project's impact on the total cost of satisfying CLCPA goals. In addition, Potomac proposes the alignment of local transmission and distribution and bulk system planning processes with the use of common modeling scenarios and methods for evaluating benefits.

Public Interest Organizations (Natural Resources Defense Council, Sierra Club, and Earthjustice) (PIOs)

The PIOs recommend that updated studies assume higher amounts of installed capacity of OSW because the 9 GW mandate is a minimum requirement and several studies have forecasted that greater than 9 GW is needed. The PIOs believe that the points of interconnection analysis should be updated as soon as possible to reflect the size of existing OSW projects that have won NSYERDA awards and the likely size of future projects, noting that the four projects that have won NYSERDA OSW bids are three to four times larger than the POIs evaluated in the OSW Study. The PIOs assert that coordination with NYISO is needed to determine the maximum OSW injection capacity, which may be larger than the assumed 1,310 MW limit in the Study.

The PIOs recommend that the Commission consider promoting a meshed network through the NYISO by identifying the meshed OSW network in the Public Policy Transmission Needs Planning Process. The PIOs suggest that the Commission identify an interregional link as a preferred option for the design if it identifies a Public Policy Transmission Need for a meshed system.

In addition, the PIOs emphasize that State agencies should be provided additional resources to meet the challenges and opportunities of the CLCPA and Accelerated Renewable Energy Growth and Community Benefit Act.

Renewable Energy Organizations (Alliance for Clean Energy New York, New York Offshore Wind Alliance, American Clean Power Association, and Advanced Energy Economy Institute) (REOs)

Once new offshore Wind Energy Areas are established by the federal government and the Clean Energy Standard Tier 4 projects are selected and their interconnection points are known, the REOs recommend that New York reevaluate the needs of the electric grid in order to achieve 9,000 MW of offshore wind, including the cost and benefits, technical considerations, cost sharing and operation and maintenance issues associated with an offshore transmission meshed system.

The REOs suggest that New York State should consider pursuit of a meshed offshore transmission system by 1) declaring a need for such a system through the current PPTNPP and calling for solutions, and 2) further analyzing options for such a system following federal designation of Wind Energy Areas in the New York Bight, as well as selection of projects under the current Clean Energy Standard Tier 4 RFP. However, the REOs believe NYSERDA should not delay annual OSW solicitations while it continues to explore a meshed offshore transmission system because a regular schedule provides an important market signal

and is necessary to meet CLCPA goals. The REOs believe NYSERDA should only include a meshed system alternative in future OSW solicitations once it has developed clear requirements regarding technology, cost sharing, cost recovery and operation and maintenance arrangements.

The REOs suggest that the Commission use the NYISO public policy process to advance privately developed alternatives for a meshed offshore wind transmission system. According to the REOs, once the new Wind Energy Areas are designated in the NY Bight, the Commission and NYSERDA should immediately update and expand their analysis of a meshed offshore transmission system. The REOs suggest that NYISO undertake a special interregional study with neighboring regional transmission originations to determine the level of investment required to limit congestion at the seams while DPS and NYSERDA should coordinate closely with neighboring states, such as New Jersey, as well as federal agencies and discuss whether there are common practices and standards that could be adopted.

The REOs believe that the points of interconnection analysis should be updated as soon as possible to reflect the size of existing offshore wind projects that have won NYSERDA awards and the likely size of projects going forward. To ensure that cabling capacity through New York Harbor is maximized, the REOs recommend that NYSERDA solicit stakeholder input and specify design requirements in future solicitations that would apply to any projects proposing to install transmission cabling through the Harbor.

According to the REOs, NYSERDA should develop clear technical requirements before including a meshed system provisions in its OSW solicitation. The REOs comment that an alternative to including a meshed system alternative in future

OSW solicitations could be to advance such a system through the NYISO Public Policy Process. The REOs recommend that the Commission identify the meshed offshore wind network as a Public Policy Transmission Need as soon as possible, in the current PPTNPP on a parallel path to the NYSERDA procurement process. The REOs express support for the Commission to identify enhanced export transmission capacity on Long Island in the current PPTNPP under FERC Order 1000 that is currently underway. The REOs comment that additional analysis of both the offshore and onshore transmission systems is necessary to ensure that the system is optimized when all of the costs and benefits of injections into Zone J and K are considered.

The REOs suggest that transmission investments in identified REZs should be pursued along with the Phase 2 projects, and that the REZ concept could also be the subject of the Public Policy Transmission Planning Process. The REOs believe that the REZ concept better aligns transmission and generation planning because transmission investment will guide future generation siting decisions. The REOs assert that in identified REZs, NY could integrate renewables more efficiently by building strategic 345kV collector stations and 115kV lines to connect new generation. The REOs recommend that the Commission ensure transparent and inclusive stakeholder engagement in developing the REZs. In addition, the REOs suggest Commission consider resource quality, land topography, environmental feasibility, and developer interest when assessing appropriate locations for REZ designations. The REOs express general support for exploration of REZ concepts but caution that it should not slow down Phase 1 and Phase 2 projects because it is important to continue to prioritize known grid issues.

In addition, the REOs recommend that the State streamline the Public Policy Transmission Planning Process and

Article VII siting process to provide an expedited timeline to consider and certify projects.

Shell Energy (Shell)

Shell urges the Commission to: (1) direct DPS Staff to hold a technical conference to define the best structure for a transmission footprint and issue a white paper presenting a detailed transmission proposal in 30 days for stakeholder comment; and, based upon the comments received, (2) issue an order or orders defining the transmission footprint structure that will be implemented to support New York State's OSW generation mandate and determine that the transmission footprint shall be designated a Public Policy Requirement to be in effect for NYSERDA's next OSW solicitation.

Shell characterizes the adoption of a meshed system as a no regrets solution that would alleviate the need for extensive onshore upgrades and could be subsequently converted, as warranted, to a full-scale backbone system. Shell suggests that as a first step, NYSERDA could specify in its OSW solicitation that developers of the first project in a specific location will be required to lay direct current conduit for eventual use alongside AC cable to provide for better use of interconnection points, cable routes and land. Shell urges the Commission to identify implementation of a meshed network as a Public Policy Requirement following its review of the Power Grid Study. Shell recommends that the State consider exploring opportunities to direct installations that will maximize access through the Verrazano Straits. Shell points to the experience of the European Union as an illustration of the importance of transitioning from a radial connection model to a meshed system.

Transource Energy, LLC, and Transource New York, LLC

Transource Energy, LLC, and Transource New York, LLC (Transource) recommend that investment in proven technologies be

prioritized over a research and development approach such as the one proposed by the Joint Utilities. Transource suggests that DPS Staff and the Commission provide detailed parameters for the use of advanced technology in Phase 1 and Phase Proposals, NYPA Priority Transmission Projects, and Public Policy Requirement solutions declared by the NYISO. Those parameters, Transource asserts, should focus on "(1) mitigating the potential impacts of transmission development by increasing the transfer capability of existing rights of way, (2) reducing the need for additional rights of way, and (3) minimizing environmental impacts that so often are the cause of delays in the approval process." Transource highlights its own Breakthrough Overhead Line Design technology as an existing proven technology.

WATT Coalition (WATT)

The WATT Coalition (WATT) is a group of seven companies seeking to facilitate the adoption of advanced technologies on the electric transmission system to improve reliability, lower costs, and accelerate decarbonization. Grid Strategies LLC serves as the convener of the WATT Coalition, which is comprised of Ampacimon, Heimdall Power, Lindsey Manufacturing Company, LineVision, NewGrid, Smart Wires, and WindSim.

WATT recommends that DPS consider including the following success metrics for the deployment of advanced transmission technologies: MW transfer capacity between zones, MW renewables integrated, MW industry electrified, MWh avoided curtailment, grid utilization percentage compared to rating, metric tons per year of GHG reduction, dollars of congestion charges, and smart grid indicators.

WATT suggests that the Commission could require advanced technologies as an evaluation alternative within the Article VII process. Alternatively, WATT, poses that the

Commission could work with NYISO to adopt a requirement for utilities to evaluate advanced technologies in all reliability, generation interconnection, and economic project submissions, as well as in ongoing transmission operations. Another option that WATT submits for the Commission's consideration is to make a filing at FERC under Section 205 of the Federal Power Act for tariff modifications in those areas or to intervene in cases where advanced technologies should be considered. In addition, WATT recommends that the Commission formalize a loading order approach to transmission planning that would require utilities to demonstrate that they are optimizing, then upgrading, and finally expanding the network to maximize system efficiency. WATT also proposes that the Commission require the utilities to report on their use of advanced technologies and its impacts.

WATT recommends that the Commission facilitate a process to enable market participants to propose and fund advanced transmission technology projects after first giving the utilities a Right of First Refusal. To facilitate that process, WATT suggests that technical data, criteria for evaluation, and analyses of alternatives be made available to all potential respondents in order to avoid preferential treatment of incumbent utilities.

In the long-term, WATT suggests that the Commission also establish incentives to encourage the deployment of advanced technologies. WATT recommends that the Commission adopt a competitive shared-savings incentive based on the benefits produced by projects rather than their size or costs. WATT asserts that a shared-savings model would encourage utilities to prioritize advanced technology projects while lowering costs to consumers.