New York's 6 GW Energy Storage Roadmap

Stakeholder Overview Webinar: Bulk Storage

February 28, 2023

NEW YORK STATE | NYSERDA | Department of Public Service

Webinar Procedures

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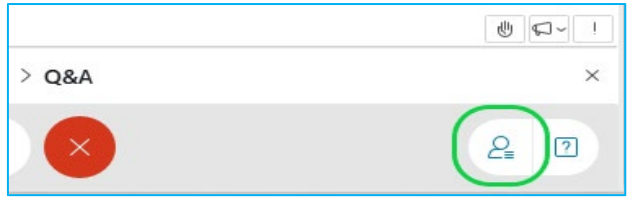
- A copy of the recording and presentation slides will be posted to NYSERDA's Bulk Storage Incentives page in the "Webinar Presentations" section

> Attendees will be muted upon entry

To ask questions:

> Questions and comments may be submitted in writing through the Q&A feature at any time during the event. Questions will be answered at the end of the presentation.



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Agenda

- 6 GW Storage Target: Role and Need
- Progress Towards Storage Goals
- 6 GW Modeling Results: Locations and Durations
- Proposed Procurements by Sector
- Bulk Storage: Procurement and Market Support Mechanisms Considerations
- Index Storage Credit and Additional Program Design Considerations
- Utility Ownership: Storage for T&D Services
- Procurement Costs and Bill Impacts
- Bulk Program Funding Mechanism
- Long-Duration Storage Considerations
- Questions for Stakeholder Comment
- Roadmap Process and Next Steps
- Q&A

Need for New York's 6 GW Energy Storage Roadmap

- The Climate Leadership and Community Protection Act (CLCPA) electric sector goals, in addition to the electrification of transportation and buildings in achieving New York State's future carbon neutral economy, necessitate rapid growth in renewable energy over the next decade.
- Climate Action Council Scoping Plan analysis indicates the need for approximately 12 GW of energy storage by 2040 and 17+ GW by 2050.
- The current interim goal of 1.5 GW by 2025, established through the 2018 Storage Roadmap, combined with the legislated 3 GW by 2030 per the CLCPA, was recognized by Governor Hochul as needing to be updated in early 2022.
- A new 2030 target of 6 GW, enabled by the recommendations in the Roadmap, will play a critical role in achieving the order-of-magnitude growth increases needed post-2030 to put New York on a path towards these longer-term storage needs and achievement of the CLCPA.

Current Progress toward Storage Goals

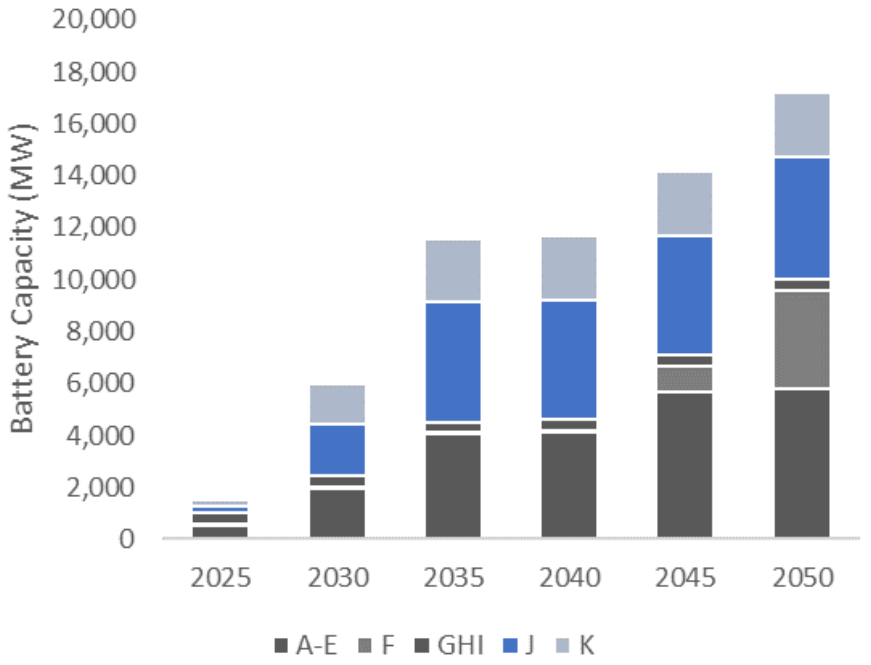
- The portfolio of programs and actions approved by the Commission in the 2018 Energy Storage Order began nurturing and expanding New York's then-nascent energy storage market.
- The 2018 Roadmap led to the codification of the 1.5 GW by 2025 and 3 GW by 2030 targets, which were supported by a set of up-front, standard offer Market Acceleration Bridge Incentive programs administered by NYSERDA.
- The Bridge Incentive offered financial incentives to install energy storage systems for three categories of projects:
  - **Bulk** energy storage projects larger than 5 MW providing wholesale services;
  - **Commercial retail** energy storage systems up to 5 MW;
  - Single-family **residential** energy storage systems installed with solar PV on Long Island.
- To date, **1,301 MW** of energy storage projects have been awarded/contracted, representing 87% of the 2025 target of 1,500 MW. Of this, **811 MW** was approved for funding under the MABI program.

Deployed, Contracted and Awarded Pipeline

Energy Storage Deployed, Contracted and Awarded (MW)		
NYSERDA Bridge Incentive Program		811
Of which: Bulk	480	
Commercial Retail	320	
Long Island Residential	11	
Utility Bulk Storage Dispatch Rights Procurement		120
Renewable Energy Standard		240
NYPA North Country Project		20
Utility Demonstration and NWA Projects		56
Other Projects		54
TOTAL		**1,301**
% of 1.5 GW 2025 Goal		**87%**
% of 3 GW 2030 Goal		**43%**

6 GW Modeling Results: Locations

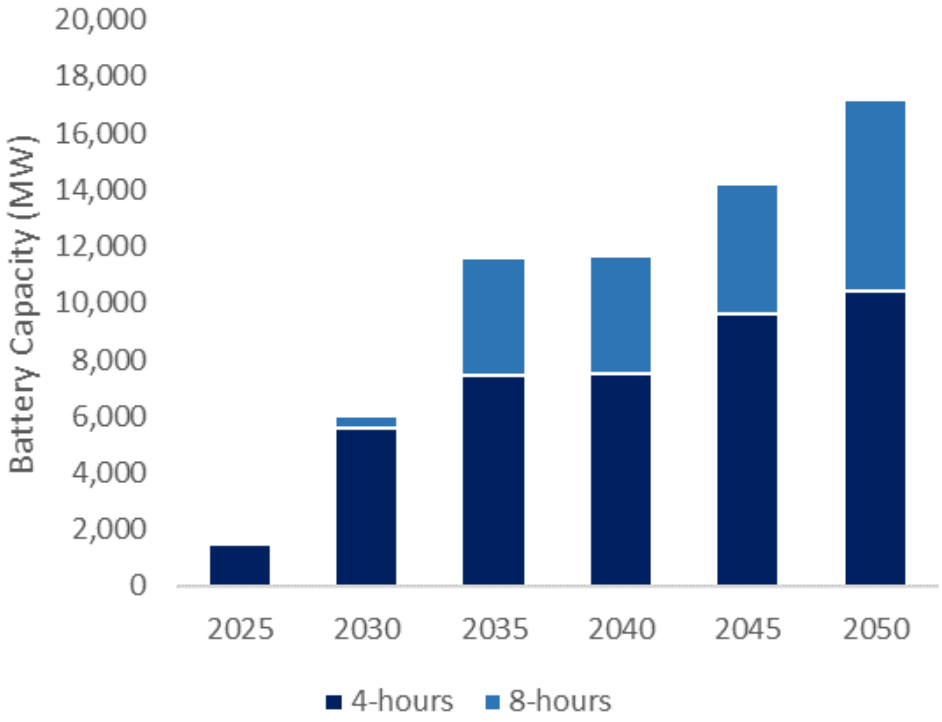
- NYSERDA commissioned Energy and Environmental Economics, Inc. (E3) to conduct system modeling runs to determine optimal timing, locations and durational profile of the 6 GW x 2030 buildout.
- In 2030, model shows 66% of the 6 GW requirement is met with storage in downstate NY (Zones J and K).
- By 2050, the model shows storage selection shifts upstate, to help balance land-based renewables and cost-effectively meet the state's reliability needs.



Storage Summary by Zone						
	2025	2030	2035	2040	2045	2050
A-E	519	1,954	4,030	4,103	5,663	5,808
F	60	60	60	60	1,016	3,759
GHI	430	430	430	430	430	430
J	275	2,005	4,600	4,600	4,600	4,739
K	216	1,551	2,473	2,473	2,473	2,473
Total (MW)	1,500	6,000	11,593	11,665	14,181	17,208

6 GW Modeling Results: Durations

- Most modeled storage builds by 2030 are 4-hour; however, modeling shows significant deployment of longer duration storage in the 2030s.
- 60-70% of the statewide 8-hour storage deployment is placed in NYC (Zone J) and Long Island (Zone K) as expensive peakers retire and to replace other expensive thermal capacity.
- Resources needed by 2040 are pulled forward into the early-to-mid 2030s to capture the expanded Investment Tax Credit (ITC) made available through the Inflation Reduction Act (IRA).
  - More economic to build early with ITC than to wait for further technology cost reductions



Storage Summary by Duration						
	2025	2030	2035	2040	2045	2050
4-hours	1,500	5,600	7,413	7,486	9,606	10,448
8-hours	0	400	4,179	4,179	4,575	6,761
Total (MW)	1,500	6,000	11,593	11,665	14,181	17,208

Proposed Roadmap Procurements by Sector

- There is currently a total of **1,301 MW** of storage already awarded/contracted through Roadmap 1.0, LSR Tier 1 and other procurements.
- More than 23,000 MW of proposed energy storage projects are presently in either distribution-level or wholesale-level interconnection queues.
- To reach the proposed 6 GW goal, **4,700 MW of new projects** will need to be awarded and deployed by 2030.
- The 6 GW Roadmap recommends new programs be developed for three different sectors: **Bulk, Retail, and Residential.**

Sector	Capacity in MW	Incentive Mechanism	Funding Source
Bulk	3,000	Index Storage Credit	LSE
Retail (< 5MW)	1,500	Upfront incentive	CEF Style
Residential	200	Upfront incentive	CEF Style
Total	**4,700**		

Bulk Storage: Procurement Considerations

- The 6 GW Roadmap proposes relying on bulk storage for a significant proportion of new procurements, with at least 3 GW of additional bulk storage procured and installed by 2030.
- Bulk projects require four to six years to proceed through the NYISO interconnection process, which significantly compresses the timeline available for future bulk procurements.
- This requires that bulk projects be procured starting as soon as possible and only as late as the end of 2026. On this timeframe, NYSERDA and DPS Staff expect bulk projects will reach commissioning between 2028 and 2030.
- NYSERDA and DPS Staff recommend that NYSERDA be authorized to procure a total of 3 GW of bulk storage projects over **three annual procurements** starting in 2024.
- An average annual procurement volume of 1 GW would strike a balance between “frontloading” procurements to ensure that the 6 GW deployment target is achieved by 2030, versus “backloading” to leverage battery and equipment price reductions, expected to manifest in the second half of this decade, to minimize program costs and ratepayer impacts.

Bulk Storage: Market Support Mechanisms

- While experience with standard offer, upfront rebates from the 2018 Roadmap's Bridge Incentive programs has been positive for retail and residential programs, this has not proven to be the optimal approach for bulk project procurement.
- Given lessons learned from the bulk standard offer program, supply chain fluctuations, and wholesale market uncertainties, a thorough examination of bulk market support mechanisms was merited as part of the 6 GW Roadmap.
- The Roadmap assessed six options for additional bulk storage procurement along four assessment criteria:
  1. **Implementation Feasibility:** Ease and risks of implementation and administration, legal considerations, likelihood of meeting state goals
  2. **Development Effectiveness:** Whether options meet needs for project development and ensure projects complete construction and maximize lifespan
  3. **Efficiency:** Minimization of ratepayer costs and risk while reducing project financing and revenue requirements, including hedging/revenue risk mitigation
  4. **Compatibility and Acceptability:** Compatibility with wholesale market dispatch signals

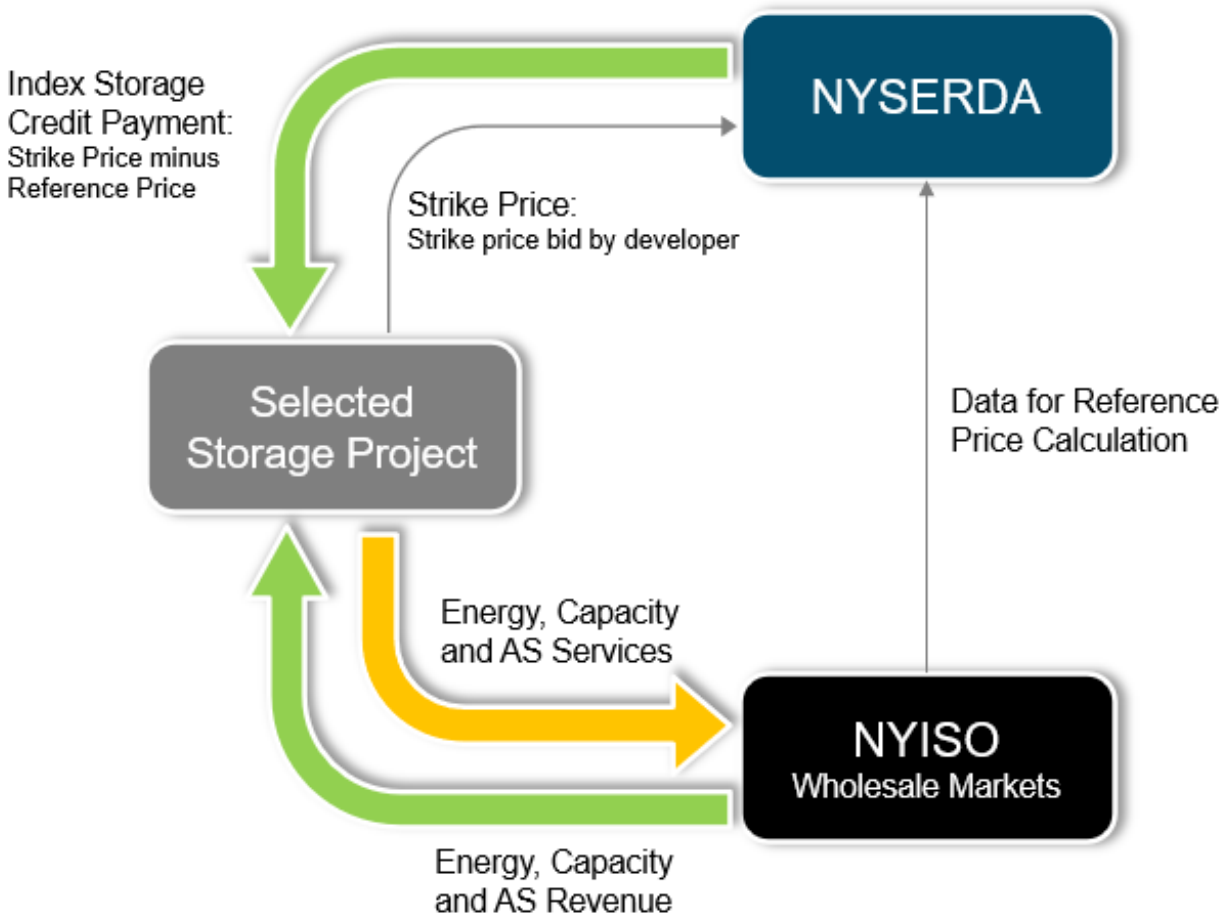
Bulk Market Support Mechanisms: Assessment

	Implementation Feasibility	Development Effectiveness	Efficiency	Compatibility and Acceptability
1. Upfront Incentive	++	--	--	++
	Limited implementation challenges, low admin burden	No hedging available, no long-term revenue support	Higher-cost financing/ratepayer costs than alternatives	Retains market signals
2. Indexed Storage Credit	+	++	+	+
	Some implementation challenges, but familiar concept	Significant hedging benefits attractive to market and reduces attrition	Low financing cost due to high (but not perfect) level of hedging	Maintains local value and market signals, ratepayers exposed to upside and downside of commodity prices
3. Preset Hourly Revenue Support (Clean Peak Credit)	-	++	-	--
	Complexity in setting peak hours and eligible resources	Highly certain revenue, simple operations	Inability to operate based on market signals may drive higher bid prices	Incompatible with markets, may conflict with NYISO dispatch
4. Utility Market-based Ownership	--	+	+	-
	Regulatory changes required, implementation issues, raises market concerns	Low expected risk of attrition	Low cost of financing	Reduces market participation/ opportunity for private sector
5. Utility Dispatch Rights	--	-	-	++
	Time-consuming processes, risks of delay and limited awards in current model	Attrition risk due to contract requirements, uncertainty in post-contract value	Contract requirements raise costs	Projects follow NYISO market signals
6. Utility T&D Ownership	-	++	++	+
	Time-consuming process to launch, unlikely to drive realization of 6 GW target if sole mechanism	Very low attrition risk after identification and approval	Provides grid services at least cost, often where upgrades are already needed	Non-market operations, but projects serve existing needs

Proposed Bulk Market Support Mechanism: Index Storage Credit

- Based on the assessment of potential market support mechanisms, the 6 GW Roadmap recommends a new Bulk Energy Storage Program be developed using an **Index Storage Credit** mechanism (ISC), which is anticipated to provide long-term certainty to projects while maximizing value to ratepayers.
- The ISC mechanism, as proposed, is analogous to the **"Index REC"** approach adopted by the Public Service Commission and currently applied in NYSERDA's offshore wind and onshore large-scale renewables procurements, with the goal of unlocking similar benefits that the Index REC provides in those programs.
- Under the ISC approach, projects bid in a **Strike Price**, representing the required revenue for the project over a payout period, into a competitive solicitation. NYSERDA would select and contract with storage projects based on pre-determined evaluation criteria including price and non-price factors.
- Payments to awarded projects would be at predetermined intervals over the life of the contract, determined by subtracting a **"Reference Price"** from the Strike Price. The Reference Price represents an approximation of available market commodity revenue that projects could reasonably expect to earn.

Index Storage Credit: Illustration



Index Storage Credit Design Considerations

- **Definition:** Each ISC therefore is proposed to represent one MWh of energy storage ***capacity*** that is operational on a given **day**. Each day a storage project is operational and available for dispatch, it would be credited with/compensated for a number of ISCs equal to the MWh of storage discharge capacity of the unit.
- **Performance Requirements:** Projects would generate ISCs on operational days regardless of whether and how much they discharge; **there would be no performance, discharge, throughput, or operational requirements under the ISC contract.** However, given the proposed indexing of the Strike Price to the Reference Price, projects would still be incentivized to discharge/perform based on market signals.
- **Contract Term:** Previous program data shows projects are designed for a 15 to 20-year project life, meaning a 20-year requirement may force some projects beyond their optimal design. For this reason, NYSERDA and DPS Staff recommend a contract term of **15 years**.

ISC Design Considerations (Continued)

- **Reference Price Components in ISC Calculation:** The proposed Reference Price would include two components:
  - (i) **Reference Energy Arbitrage Price**, based on the difference between the top and bottom price hours (zonal LBMPs) in the day-ahead energy market (for four-hour duration, known as “TB4”).
  - (ii) **Reference Capacity Price**, based on the NYISO Installed Capacity (ICAP) spot auctions, on a locality-specific basis, adjusted according to the prevailing Capacity Accreditation Factor for each duration type.

Index Storage Credit (ISC) = Strike Price – Reference Energy Arbitrage Price – Reference Capacity Price

ISC Design Considerations (Continued)

- **Inflation Adjustment:** As with NYSERDA's onshore and offshore large-scale renewables programs, the Roadmap recommends an optional provision that provides for the Strike Price of awarded projects to undergo a one-time adjustment to reflect changes in certain pre-determined cost indices between the time the project is bid to a NYSERDA procurement and the time at which the project proceeds to construction.
- **ISC Settlement Period:** The Roadmap recommends **monthly settlements** to provide an ideal balance between administrative burden and ongoing value to projects.
- **Payment Floors:** If at certain times the Reference Price were to exceed the Strike Price, the difference would be paid by the project to NYSERDA or netted from future payments from NYSERDA to the project.
- **Future Wholesale Market Rule Changes:** As is the case with existing CES programs, NYSERDA and DPS Staff recommend that ISC contracts be designed to enable amendments to the ISC formula in the event of NYISO market rule changes that alter the type or level of compensation storage projects receive in ways that are not captured adequately by the ISC Reference Price formula that is applied to a project procured under an ISC contract.

ISC Design Considerations (Continued)

- **Bid Evaluation Criteria:** In keeping with the approach in NYSERDA's other large-scale procurement programs, NYSERDA and DPS Staff recommend that NYSERDA evaluate bids under the ISC bulk storage program based on price and non-price factors.
  - Price evaluation would reflect projected levelized net ISC cost based on energy/capacity price forecasts.
  - Non-price evaluation factors would include project viability, economic benefits, and societal benefits, such as the extent to which the proposed project would drive reductions in the use of fossil fuel peakers, as specified in the CLCPA and Governor Hochul's 2022 State of the State proposal.
  - Further specifics on the evaluation factors would be developed by NYSERDA for each solicitation.
- **Maximum Bid Prices:** As with NYSERDA's large-scale renewables program, the Roadmap recommends that ISC procurements should apply a maximum bid price evaluation metric, applied in the form of a maximum levelized net ISC cost, to help ensure cost-effectiveness and to simplify the evaluation of bids in the event that bids above the maximum bid price are received in future solicitations.

Index Storage Credit: Example Calculation

Day	Daily Energy Arbitrage Index	Day	Daily Energy Arbitrage Index
1	$70	16	$22
2	$15	17	$21
3	$61	18	$17
4	$33	19	$24
5	$20	20	$20
6	$9	21	$22
7	$19	22	$26
8	$29	23	$19
9	$27	24	$21
10	$21	25	$22
11	$18	26	$23
12	$40	27	$32
13	$30	28	$54
14	$29	29	$64
15	$18	30	$38

Strike Price	$80
Monthly Energy Arbitrage Reference Price	$29
Capacity Reference Price	$20
Monthly Settlement	$31

High Volatility (≥ $40)	5 days
Medium Volatility ($20>X>$40)	17 days
Low Volatility (≤ $20)	8 days

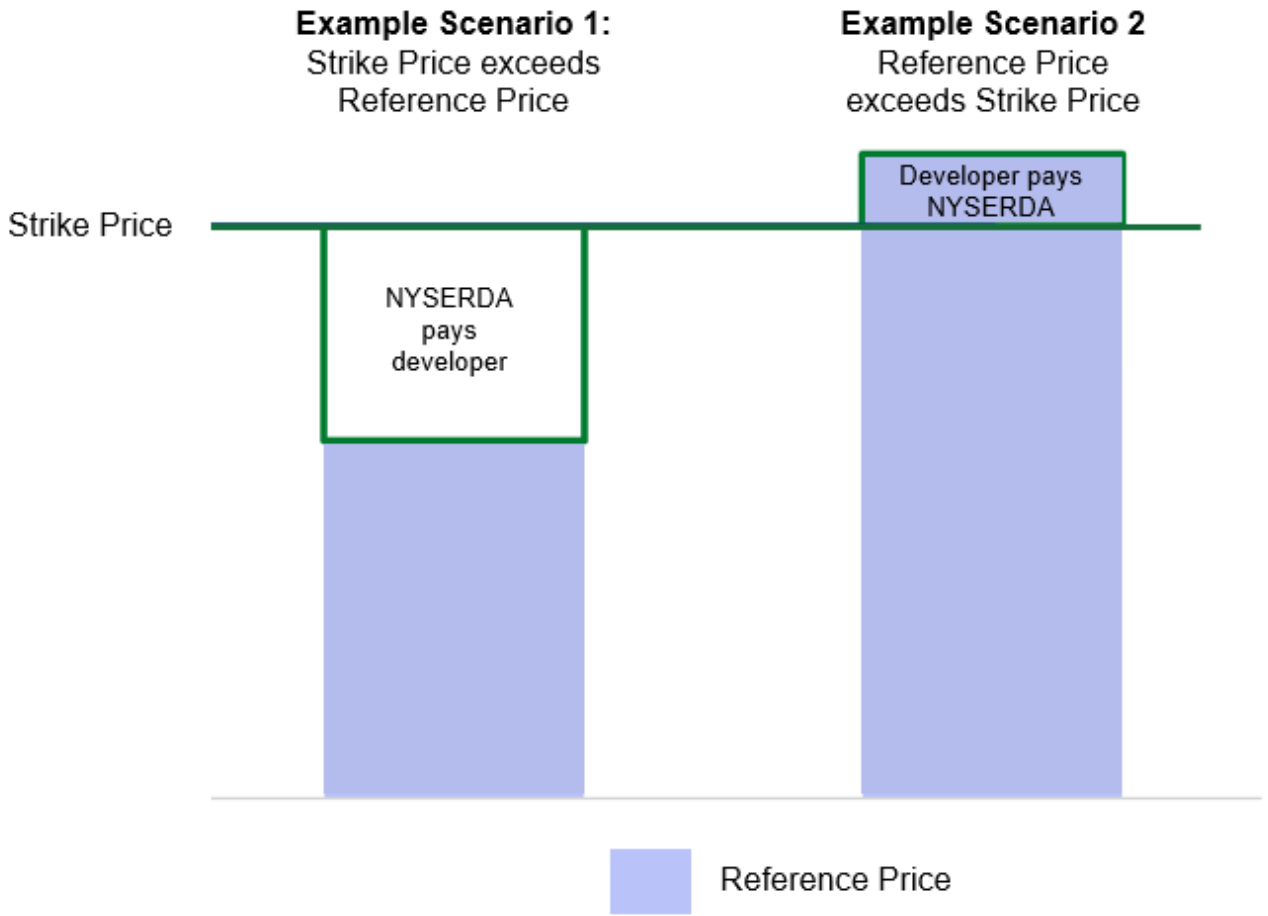
Settlement Calculation Example
Assume 100 MW / 400 MWh asset

ISC = Strike – Energy Ref – Capacity Ref
ISC = 80 – 29 – 20
= **$31 per ISC**

Total ISCs = installed energy capacity x days in the month
Total ISCs = 400 MWh x 30 days
= **12,000 ISCs**

Settlement = 12,000 ISCs x $31 per ISC
= *$372,000 for the month*

Bulk Index Storage Credit: Settlement Possibilities



Additional Bulk Program Design Considerations

- **Geographical Considerations:** Roadmap modeling found that two-thirds of all deployment in a least-cost scenario was sited in downstate NY. Given this, the Roadmap recommends designing the bulk program to ensure that a significant proportion of storage is deployed in Zones J and K, potentially via downstate-specific carve-outs.
- **Duration Considerations:** The Roadmap recommends that NYSERDA should have flexibility to stipulate specific durations of technologies being sought for each solicitation, for instance by carving out designated procurement amounts.
  - NYSERDA solicitations may explicitly incorporate 8-hour duration assets into the procurement program, such as by allocating a given amount of the targeted procurement amount to these assets.
- **Labor Considerations:** To ensure that projects procured in service of the 6 GW target create well-paying jobs, the Roadmap recommends that projects with a capacity of 1 MW-AC and greater participating in any NYSERDA energy storage program pay New York State Prevailing Wage as a contractual requirement, substantiated via quarterly certifications by a New York State-licensed Certified Public Accountant during the construction period.

Disadvantaged Communities and Environmental Justice Considerations

- Bulk storage projects deliver services directly into the transmission system, providing wide-ranging benefits across the electric system.
- Importantly, these benefits are tied to the electrical topology in the area where the projects are built, and not necessarily to the specific physical location of the project. In many cases, projects will be providing services on a zonal basis, often stretching into areas beyond a single county or zip code.
- NYSERDA and DPS Staff therefore recommend, in order to comply with the requirements in the CLCPA, both in terms of DAC benefits and the requirement to specify a proportion of projects targeting the reduction of peaker plant emissions, that **at least 35% of program funding be utilized to support projects in areas of the state with the highest benefits to DACs and peaker reductions.**
- These areas can be found in various locations across the state, but NYSERDA and DPS Staff expect **Zone J (New York City)** to receive particular focus in program design, addressed as part of a subsequent Implementation Plan to be published following approval of this Roadmap, if deemed so by the Commission.

Utility Ownership: Storage for T&D Services

- Certain use cases/revenue streams are not currently available to storage resources through any market, most notably T&D services (e.g., congestion reduction, deferral, transmission security support, curtailment reductions).
- Currently the only way for storage to provide these services would be through utility operations, enacted through utility ownership or some form of contracted arrangement.
- NYSERDA and DPS Staff hence recommend that utilities be directed to study the potential of energy storage to provide **non-market transmission and distribution services** and identify projects that provide cost-effective services when compared to traditional alternatives.
- This option could be implemented in parallel with other procurement mechanisms, with projects proposed/approved of through individual rate cases or CLCPA T&D proceeding.

Procurement Costs and Bill Impacts

- Bulk storage procurement costs are estimated to be $474 million - $1.19 billion (net present value in 2022 dollars) to procure 3,000 MW of bulk storage, paid out over 15-year contracts.
- The range of these projections reflects future uncertainties, most notably those associated with energy and capacity prices.
- The total cost for the three incentive programs procuring 4,700 MW of energy storage, inclusive of administrative costs, is expected to be between $1.0 billion to $1.7 billion (NPV 2022$).
- This equates to an estimated increase in customer electric bills of 0.32% – 0.54% (or $0.34 – $0.58 per month for the average residential customer) on average across New York for the 22-year period of payments under these programs.

Bulk Program Funding Mechanism

- NYSERDA and DPS Staff recommend a funding mechanism for the bulk storage program similar to that used by Tiers 2, 3 and 4 of the CES and the Offshore Wind Standard; i.e., a payment obligation for jurisdictional Load-Serving Entities (LSEs) in proportion to their share of statewide load.
- NYSERDA and DPS Staff also recommend that NYPA and LIPA, as non-jurisdictional LSEs, agree to participate voluntarily and accept ISC obligations in proportion to their share of Statewide load.
- In the event that LIPA or NYPA directly procure or develop bulk energy storage projects outside of the NYSERDA procurement program, NYSERDA would take such independent storage procurement into account in its assessment of amounts of bulk storage needed through its solicitations.
- Projects that meet the requirements of the storage program proposed in the Roadmap, could be credited towards their load share compliance obligation.

Long-Duration Storage (LDS) Considerations

- The recommended 6 GW storage target focuses on short- and medium-duration (4-hour to 8-hour) storage, which helps with intraday balancing.
- However, due to the electrification of building heating needs, electric demand will be higher in the winter than it is today in New York. Winter months also often coincide with extended periods of low renewables output.
- Therefore, LDS resources, as well as firm zero-carbon resources, are likely to play a critical role in maintaining reliability in the winter, during infrequent but critical multi-day-long periods when demand is high and contributions from renewables and existing clean firm resources are not sufficient to meet demand.
- Roadmap modeling analysis shows that, depending on its duration, LDS can serve as a one-to-one replacement for 5+ GW of other zero-carbon firm capacity. This shows that there is likely a role for LDS to play in providing some proportion of firm energy needs competitively.
- NYSERDA's Innovation program is currently supporting research, development and commercialization of LDS technologies. The Roadmap recommends that the Innovation program continue to evaluate further funding needs within the existing program framework, particularly related to the ability to begin demonstrating projects at a larger scale (50-100 MW) and prioritize those resources that have a high likelihood of providing value to the State on a GW scale before 2040.

Questions for Stakeholder Comment

- Should action be taken on the remaining JU Bulk Storage Dispatch Rights procurement requirement? Numerous utilities have yet to fulfill their requirement from the 2018 Storage Order and NYSERDA and DPS Staff are currently assessing the ramifications of future programs on these procurements.
- What methods should be used in each program to attract storage projects in preferred locations and durations? For example, should procurements seeking 8-hour duration assets utilize a TB8 mechanism for Reference Energy Price, or should all resources compete with the same reference prices in the same solicitations? What impacts do duration or location carve-outs have on competitive procurement?
- For programs supporting bulk and off-site retail projects, how should incentive programs and procurements be best designed towards ensuring that at least 35% of proposed program funding is utilized to benefit disadvantaged communities and drive peaker plant emissions reductions, beyond a program focus on Zone J as proposed?
- What type and size of LDS demonstration projects should be considered in future programs, and how should the program be designed to maximize value and learning?
- What mechanisms need to be considered when evaluating options for operating and compensating LDS projects on the grid?

Roadmap Process and Next Steps

- Roadmap filed on December 28, 2022.
- Open for public comments through March 20, 2023. Comments can be filed on the Department of Public Service's website under Case Number 18-E-0130.
- NY Public Service Commission may then issue an Order approving or denying the items requested in the Roadmap. The PSC has the ability to approve a modified version of the Roadmap.
- If approved, NYSERDA would then file an Implementation Plan specifying additional program design details, which may also be subject to a public comment period and Commission approval.
- NYSERDA would then implement the approved program design as part of the first Bulk Storage solicitation.

Questions & Answers

Please use the Q&A feature in WebEx to submit a question.

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Thank You

- **If you have questions about this presentation, please contact energystorage@nyserda.ny.gov.**
- A copy of the recording and presentation slides will be posted to NYSERDA's Bulk Storage Incentives page in the "Webinar Presentations" section.
- **The Roadmap is open for public comments through March 20, 2022. Comments can be filed on the Department of Public Service's website under Case Number 18-E-0130.**