Case 18-E-0130

In the Matter of Energy Storage Deployment Program

Alternative approaches to 12+ hour energy storage in bulk program procurements

September 30, 2025

Filed by Staff of the New York State Energy Research and Development Authority

Introduction

The New York Public Service Commission's ("the Commission") March 21, 2025 *Order Approving Bulk Energy Storage Program with Modifications* ("March 2025 Approving Order") directed the New York State Energy Research and Development Authority (NYSERDA) to "propose an alternative methodology for estimating expected market revenue for 12+ hour resources" in order to "allow NYSERDA to have a methodology for 12+ hour duration resources in advance of the second solicitation"[1] for NYSERDA's Bulk Energy Storage (BES) Program. This paper lays out several options for modifying the Index Storage Credit (ISC) formula for 12+ hour resources. The paper also suggests and invites public comment on an alternative procurement and incentive approach to interday and multiday resources, citing recent examples from peer states.

This filing will be subject to a public comment period under SAPA and subsequent consideration by the Commission.

Revisiting the REAP

The ISC incentive mechanism proposed by the 2022 Energy Storage Roadmap[2] includes a Reference Energy Arbitrage Price (REAP) that is intended to approximate market revenue that an energy resource is expected to derive from performing daily energy arbitrage. The REAP is calculated through a Top Bottom (TB) approach wherein the top and bottom priced hours in a day are paired, netted, and summed. For resources with durations up to 8 hours, a "TBX" approach is used with the X number of hours aligned to the duration of the resource (e.g. TB4 for a 4-hour resource). For resources with durations of 8 hours or greater, a "TB8" approach is applied: any resources with durations at or above 8 hours are treated, for the purpose of estimating energy arbitrage revenue, as if they perform 8 hours of discharge and 8 hours of charging each day.

The March 2025 Approving Order noted that "the REAP methodology discussed in the Roadmap and approved in the 2024 Energy Storage Order did not contemplate participation by 12+ hour runtime duration resource" and that "The REAP formula of using top and bottom priced hours of the day is not compatible with these types of resources."[3] Interday and multiday energy storage resources are not expected, or even able, to perform energy arbitrage on a daily basis. As a result, the daily REAP methodology—in which each day's highest and lowest priced hours are paired, netted, and summed—can be expected to overestimate arbitrage revenue for these resources, potentially resulting in higher Strike Prices.

Below we explore three approaches to modifying the REAP for 12+ hour resources. (For reference, the current REAP methodology is shown in Appendix A.)

Option 1: Weekly and Monthly REAP Approach

One stakeholder has proposed estimating energy arbitrage from interday and multiday resources by applying the "TBX" approach (used for durations up to 8 hours) over weekly and monthly

---

[1] Case 18-E-0130, State of New York Public Service Commission, Order Approving Bulk Implementation Plan with Modifications, Issued and effective March 21, 2025, p. 21.
[2] Case 18-E-0130, NY DPS and NYSERDA, New York's 6 GW Energy Storage Roadmap: Policy Options for Continued Growth in Energy Storage (December 28, 2022).
[3] Op. cit. note 1, p. 20.

timeframes. For resources with a duration of 12 hours up to 24 hours, the REAP would be calculated over a weekly timeframe (e.g. the top and bottom priced hours of a full week would be paired, netted, and summed). For resources with a duration greater than 24 hours, the REAP would be calculated over a monthly timeframe (e.g. the top and bottom priced hours of the full month would be paired, netted, and summed). The formulas for this option are shown in Appendix B.

Modeling of this approach conducted for NYSERDA suggests that, as expected, the weekly and monthly REAP variants would result in lower estimated arbitrage revenue for 12+ hour resources than would be the case using the current daily TB8 approach for 8+ hour resources. This option may, however, deviate from expected real-world behavior in certain respects. Actual cycles may be shallower than assumed. And while daily and weekly energy price variability is largely deterministic (based on demand), most variation in energy prices is attributable to random phenomena. Capturing the month's highest and lowest hours may thus be somewhat unrealistic arbitrage behavior. One might question, further, whether the behavior assumed in these methodologies would align with (and incentivize) the challenges of interday or multiday energy shifting and balancing that these resources are intended to address. Regardless, a weekly/monthly approach would still appear to be more accurate than a daily approach in estimating arbitrage revenue for these resources.

Option 2: Weighted-Average, Effective-Duration Approach

Another option stems from the observation that longer-duration resources will most likely discharge periodically to capture peaks of various durations. In effect, these discharge durations may emulate those of shorter-duration systems (e.g. 2-hour, 4-hour, 8-hour resources). This behavior could be approximated by developing separate REAPs for each effective duration. Each duration would be assigned a weighting, with the weighted average of each REAP resulting in the final REAP. Longer-duration discharge would likely account for a relatively small proportion of total discharge. Modeling suggests that REAP values would be lower overall than under Option 1. However, additional analysis would be needed to arrive at the appropriate weightings, and this approach could create considerable added complexity for bidding and evaluation.

Option 3: Capacity-Only Approach

A third option recognizes that Long Duration Energy Storage (LDES) resources are intended to function primarily as capacity resources with limited energy arbitrage revenues. This option would eliminate the REAP outright (or set it to 0) for all resources with a duration of 12 hours or greater. These resources may participate in some level of arbitrage, however, resulting in a Reference Price (as defined in Appendix A) that underestimates wholesale market revenue. While this could potentially allow developers to lower their Strike Prices, it may raise competitiveness and fairness issues at the price evaluation stage, specifically in comparing an 8-hour resource (which would be "underperforming" its REAP) and a 12-hour resource (which would be "overperforming" its REAP).

Recommendation

These options illustrate fundamental tradeoffs between accuracy and simplicity. Option 1 is a logical extension of the daily REAP to weekly and monthly variations but may still overstate arbitrage revenue. Option 2 may improve accuracy incrementally but at the expense of added calculation and evaluation complexity. Option 3 is the simplest approach but creates competitiveness issues.

At this point it is helpful to recall that the ISC is, by design, an index and an imperfect hedge. It is not a perfect hedge or a contract for differences. Reference prices, furthermore, are only valuable to the extent that they serve as true reference points, broadly understood by all program participants. The added complexity of Option 2, despite its likely improved accuracy, strays from the relative simplicity (with an acceptable level of imprecision) of an index. An approach that extends the daily approach to weekly and monthly timeframes has some consistency and strikes a better accuracy-simplicity balance. NYSERDA therefore recommends Option 1 as the preferred option, while seeking stakeholder feedback on all three options. However, NYSERDA also seeks to elevate some broader program and procurement considerations, as discussed in the next section.

<u>Rethinking 12+ hour duration procurement pathways</u>

NYSERDA recognizes that long-duration proponents may consider the proposed—or any—REAP methodology adjustment to be necessary but not sufficient with respect to other ISC design reforms. As a specific example, the methodology of daily ISC creation deliberately limits the daily creation of ISCs to "the MWh capacity of an 8-hour resource…this allows for consistency when NSYERDA is comparing ISC bids from resources with 8+ hours in duration."[4] Crediting a resource for 48, or 100, hours of duration within each (24-hour) day would clearly skew $/ISC price evaluations within the 8+ hour category. Proponents of longer-duration technologies, of course, would prefer no duration limit on daily ISC creation: more ISCs lead to a lower $/ISC cost evaluation. They may thus deem the 8-hour limit artificial, but it is unclear why it would be natural for a daily crediting process to provide credits for more energy storage capacity than can physically be provided in a single day.

This tension is best explained by the simple fact that the ISC and its procurements were never designed with 12+ hour resources in mind. As the 2022 Energy Storage Roadmap explained:

The recommended 6 GW storage target focuses on short-duration storage. Such storage, in the form of 4-hour to 8-hour storage, helps with intraday balancing…. The primary role of long-duration energy storage resources in deeply decarbonized electric grids is to provide power during infrequent but critical multi-day-long periods when electric demand is high and when contributions from renewables and existing clean firm resources are not sufficient to meet demand.[5]

In this sense, it is a feature and not a bug of the ISC that its daily or "intraday" methodologies—including a daily REAP and daily ISC creation—are not well suited to the task of incentivizing and evaluating interday and multiday resources. It is therefore reasonable to ask whether there may be a preferable alternative to shoehorning interday and multiday resources into a procurement and incentive structure that are focused on deploying intraday resources by 2030. Specifically, it may be useful to assess options for an expanded or separate procurement for longer-duration resources.

Some states have recently moved to separately procure interday and multiday LDES resources. As these entities have determined, separate procurements recognize that these technologies form a

[4] Op. cit. note 1, p. 19.
[5] Op. cit. note 2, p. 65.

distinct resource class and provide them with a pathway to deployment with timeframes and incentives that are more appropriate to their needs and capabilities.[6]

U.S. state procurement plans, 12+ hour duration energy storage resources

State	Volume	Procurement timing	Target deployment
California	Max 1 GW of 12+h LDES Max 1 GW multi-day LDES	2026 start	2031-37
Massachusetts	Up to 750 MW >10 to 24h LDES Up to 750 MW >24h LDES	By July 2030	N/A

While these two states are at different stages of energy storage market development, both will have deployed or procured significant volumes (at durations below 12 hours) by the time they have commenced procurements of 12+ hour duration resources. California has deployed more than 13,000 megawatts; Massachusetts will have procured 3,500 megawatts by 2027.

In the context of New York, a separate procurement for 12+ hour resources would delink these LDES technologies from a timeframe (2030) and incentive (ISC) that were not intended for them. As peers have recognized, these resources have longer lead times and may merit schedules aimed at deployment in the 2030s.

These resources also arguably require a more "fit for purpose" incentive structure. While the ISC was designed to provide "missing money" for intraday projects assumed to be performing daily arbitrage, an incentive tailored to the attributes of interday and multiday resources could look different. Such an incentive could, for example, focus on supplementing the capacity market revenue expected to be the primary source of wholesale revenue for these resources. One could envision another indexed credit with only a Reference Capacity Price (as defined in Appendix A), reflecting reliability attributes not yet fully reflected in the state's energy modeling and markets. An alternative would be a "clean firm" credit available to LDES and all other resources in the category of clean firm technologies potentially needed at scale during the 2030s.

Procurement of interday and multiday LDES could in fact form part of a broader clean firm procurement strategy. The draft New York State Energy Plan estimates a need for 17.2 gigawatts of clean firm resources by 2040 to maintain reliability as the State moves towards its goal of a zero-emissions grid.[7] The draft plan recommends the State "identify and propose pathways for the deployment of viable clean firm technologies that can be deployed to address reliability needs," in addition to continued support of innovation and demonstration projects.[8]

As the draft plan notes, NYSERDA and the Department of Public Service (DPS) are currently conducting a technoeconomic study of various clean firm resources. The study is evaluating and comparing eight technologies—including long duration energy storage—across various criteria, including technological and commercial readiness, cost and performance characteristics,

---

[6] California Public Utilities Commission (CPUC), "CPUC Advances Clean Energy with Centralized Procurement Strategy" August 26, 2024; Commonwealth of Massachusetts, "An Act Promoting a Clean Energy Grid, Advancing Equity and Protecting Ratepayers," Bill S.2967, signed into law November 20, 2024.
[7] Draft New York State Energy Plan (July 2025), Electricity (Chapter 1), p. 53, p. 64.
[8] Draft New York State Energy Plan (July 2025), Summary for Policymakers, p. 44.

geographic suitability and scalability for 2040, and emissions and other stakeholder considerations. This study "will provide a resource for the State's ongoing assessment of viable clean firm technologies, to be conducted in conjunction with multiple State agencies."[9]

This technoeconomic study and the final New York State Energy Plan, both scheduled for release in 2025, could provide an analytical foundation to inform an appropriate procurement and deployment timeline, target volume, and incentive design for a 12+ hour procurement strategy. They could also inform various procurement options, such as whether to focus specifically on interday/multiday LDES or to include other clean firm resources.

NYSERDA therefore seeks stakeholder feedback on the viability and potential design of an alternative procurement pathway for 12+ hour energy storage resources. NYSERDA may also continue to consult and benchmark its peers to gather early lessons learned and best practices in the procurement of interday and multiday energy storage resources.

[9] Ibid, pp. 43-44.

Appendix A. ISC formulas for ISCRFP 2025

Index Storage Credit Price

The ISC Price is derived via a monthly settlement framework for the difference between the Strike Price bid into this solicitation and the Reference Price (RP), as described in the following sections and in accordance with the monthly settlement structure provided in the Agreement:

(1) $$ISC\ Price = Strike\ Price - Reference\ Price$$

Where:

Strike Price: [$/ISC]	The Strike Price under this competitive solicitation which approximates the revenue threshold needed to achieve project viability; and is the dollar value from which the reference price will be subtracted to result in the amount paid by NYSERDA for ISCs created.
Reference Price (RP): [$/ISC]	The sum of the Reference Energy Arbitrage Price (REAP) and Reference Capacity Price (RCP).

Reference Price Components

The Reference Price components of the Index Storage Credit are intended to approximate the expected revenue of a bulk storage facility through energy arbitrage and capacity market participation. Energy arbitrage is achieved by charging during periods of low electricity prices and discharging during periods of high electricity prices. Storage facilities can also be compensated in the capacity market for being available to provide energy when needed.

The Reference Price (RP) in this solicitation applies these principles as the total of the Reference Capacity Price (RCP) and Reference Energy Arbitrage Price (REAP), on a monthly basis, subject to the duration of the number of hours in which the Project can discharge to the grid and the Round-Trip Efficiency (RTE) of the type of storage facility, as follows:

(2) $$Reference\ Price\ (RP)_{Monthly} = RCP_{Monthly} + REAP_{Monthly}$$

(3) $$RCP_{Monthly} = \frac{RUP_{Monthly} \times 1{,}000 \times CAF}{Bid\ Storage\ Duration \times k}$$

(4) $$REAP_{Monthly} = \frac{\sum_{D=1}^{k} REAP_{Daily}}{k}$$

(5) $$REAP_{Daily} = \frac{\sum_{n=1}^{x} max\left(\left[T_n - \left(\frac{B_n}{RTE}\right)\right], 0\right)}{x}$$

Where:

Reference Capacity Price (RCP): [$/ISC]	The price index used to estimate monthly capacity revenues using the monthly Reference Unforced Capacity (UCAP) Price (RUP) and the NYISO's calculated Capacity Accreditation Factor (CAF)[10].
Reference UCAP Price (RUP): [$/kW-month]	The Unforced Capacity (UCAP) Price (RUP), equal to the spot auction prices in $/kW-month for the Project's Applicable Zone as published by the NYISO.[11]
Capacity Accreditation Factor (CAF): [%]	The Capacity Accreditation Factor for the Capacity Accreditation Resource Class (CARC) applicable to the Project as determined by NYISO in accordance with the New Capacity Accreditation Rules.
Reference Energy Arbitrage Price (REAP): [$/ISC]	The price index used to estimate expected daily or monthly energy revenue achieved by the Project based upon pricing differences between periods of charging and discharging electricity from/to the NYCA. The REAP is derived as the sum of spreads between top and bottom priced hours, excluding negative spreads, in the NYISO's Day-Ahead Energy Market over the total number of days within a settlement month. • For resources with a run-time less than eight-hours in duration, the number of top and bottom hours will equal the Bid Storage Duration. • For resources with a run-time greater than or equal to eight-hours in duration, Projects will use the top and bottom eight hours.
k	Number of days in Settlement Period
D	Day
n	Hour
T_n	nth highest priced (Top) hour
B_n	nth lowest priced (Bottom) hour
Round Trip Efficiency (RTE): [%]	In accordance with Commission Orders, the RTE is uniformly prescribed for Projects in this solicitation by technology: • 85% for lithium-ion • 65% for non-lithium-ion • 45% for multi-day facilities
x: [hours]	Bid Storage Duration. In this solicitation, NYSERDA will solicit Proposals and monthly settlements in two categories: less than 8 hours and more than 8 hours, where: • For Projects with Bid Storage Duration less than 8 hours, x=Bid Storage Duration (i.e., x=2 for 2-hour battery duration, x=4 for 4-hour battery duration). • For Projects with Bid Storage Duration of 8 hours or longer, x=8.

For clarity, the conversion factor of MWh to ISC is 1:1.

[10] https://www.nyiso.com/documents/20142/34963268/4%20CA%20Capacity%20Accreditation%20pres.pdf

[11] Historical monthly capacity spot auction prices can be downloaded from the NYISO website at http://icap.nyiso.com/ucap/public/auc_view_spot_detail.do or https://www.nyiso.com/installed-capacity-market. NYISO UCAP prices are not reported by NYISO Zone, but instead by capacity locality, which include each Zone.

Appendix B: Option 1 – REAP methodology for 12+ hour and >24-hour resources

Note that the resource duration will not be capped for the purpose of calculating the REAP since the duration aligns with the number of top and bottom hours. Under the current program the resource duration is capped at 8 hours for the purpose of calculating daily ISC creation to avoid distortion in $/ISC cost evaluation.

Weekly methodology for 12-24 hour resources

$$REAP_W = \frac{\sum_{n=1}^{x} max\left(\left[T_n - \left(\frac{B_n}{RTE}\right)\right], 0\right)}{x}$$

Where:

$REAP_W$	Reference Energy Arbitrage Price for a given Week, W
n	Hour in the week
x	Resource duration, from 12-24 hours (inclusive)
T_n	nth highest priced (Top) hour
B_n	nth lowest priced (Bottom) hour
RTE	Roundtrip Efficiency assumption (85%, 65%, or 45%)

$$REAP_M = \frac{\sum_{W=1}^{k} REAP_W}{k}$$

Where:

$REAP_M$	Reference Energy Arbitrage Price in a given Month, M
$REAP_W$	Reference Energy Arbitrage Price for a given Week, W
k	Number of weeks in Month, M
W	Week

Monthly methodology for >24-hour resources

$$REAP_m = \frac{\sum_{n=1}^{x} max\left(\left[T_n - \left(\frac{B_n}{RTE}\right)\right], 0\right)}{x}$$

Where:

$REAP_m$	Reference Energy Arbitrage Price for a given Month, m
n	Hour in the month
x	Resource duration, more than 24 hours
T_n	nth highest priced (Top) hour
B_n	nth lowest priced (Bottom) hour
RTE	Roundtrip Efficiency assumption (85%, 65%, or 45%)