ENERGY STORAGE

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CAN NEW YORK STATE REALIZE ITS LONG-DURATION ENERGY STORAGE (LDES) GOAL OF 600MW BY 2030?

Achieving NYS's goal will depend on market mechanisms that treat it as a unique grid resource.

Achieving NYS's LDES goal depends on bold policy actions, market design reforms, and targeted incentives as technology and declining costs close the gap in economic viability.

With just 1.4 GW of energy storage installed or contracted as of Q1 2025, New York has achieved only ~23% of its ambitious 6GW energy storage target for 2030 —a goal that has doubled from what was initially envisioned back in 2018. The updated target is broken down into three segments: 3GW of bulk, 1.5GW of retail, and 200 MW of residential energy storage by 2030. More notably, **the 6 GW Energy Storage Order[1] introduced a 20% carve-out for LDES within bulk storage procurements**. The NYS state has defined LDES as having a duration greater than 8 hours. Yet today, most, if not all, operational/ contracted energy storage systems in NY are short-duration lithium-ion batteries. To achieve these ambitious goals, substantial changes in current policies and market mechanisms will be required.

Currently, LDES deployment in NY faces numerous obstacles, including existing market designs that inadequately value its capabilities, a lack of ownership models for LDES, financing challenges, interconnection gaps, and significant siting constraints. Further, the feasibility of deploying different LDES technologies varies based on their unique geographical requirements and cost structures. Overcoming these nuanced barriers requires a coordinated and multi-faceted approach involving regulators, utilities, developers, and communities, with a focus on ownership structures/ market designs, transparent data sharing, and innovative incentive structures to accelerate a diverse portfolio of LDES solutions.

Analysis of the NYISO's energy, capacity, and ancillary services (AS) market prices demonstrates significant revenue opportunities for LDES projects hosted in NYC and Long Island for technologies that have a Levelized Cost of Storage (LCOS) of $200- $250/ MWh. A detailed value stack analysis for a hypothetical 10MW/80 MWh system, considering annual energy compensation, capacity, and AS (10 Min Spinning Reserve and Regulation Services), demonstrates LCOS for some LDES technologies such as Compressed Air Energy Storage (CAES), Lithium-ion Phosphate (LFP), and Pumped Hydropower, are currently the most economically viable but may not be geographically feasible for NY. However, in the coming years, many LDES technologies will become possible if bridge funding is strategically made available.

These modeled results are further supported by market trends in NYISO's 2024 pricing data, which reinforce the economic potential for LDES. NYC and LI experienced high average energy prices in January, July, and December 2024, reflecting seasonal peak demand. Lower prices were observed in March and April. This predictable volatility highlights arbitrage opportunities for LDES. AS values for NYC were highest in January, July, and December 2024, aligning with peak energy demand periods. Regarding LI, AS were more evenly distributed, with January and December 2024 being the most notable months.

By leveraging seasonal trends and offering capacity and essential grid support services, including reserves and regulation, LDES can generate and maximize multiple revenue streams, becoming a key resource for resiliency and reliability in the New York grid, regardless of renewable integration opportunities.

Comparison of LDES Technology viability across NYISO's Value Stack

To assess the viability of long-duration energy storage (LDES) technologies in New York, a value stack analysis was performed for a hypothetical 10MW, 80MWh system in NYISO Zones J (NYC) and K (LI). Projected market revenues from energy, capacity, and AS were compared against the levelized cost of storage (LCOS) for seven representative LDES technologies. Table 1 presents LCOS values by technology type[2,3,4], providing a basis to evaluate whether current New York market conditions can support cost-effective LDES deployment. The results of this analysis are presented in Figures 1 and 2.

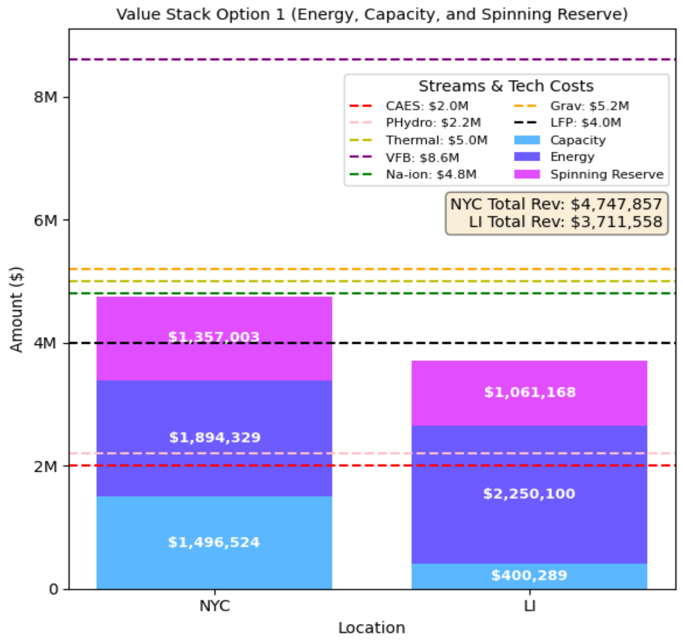

Figure 1 Value Stack Energy, Capacity and Spin Reserves

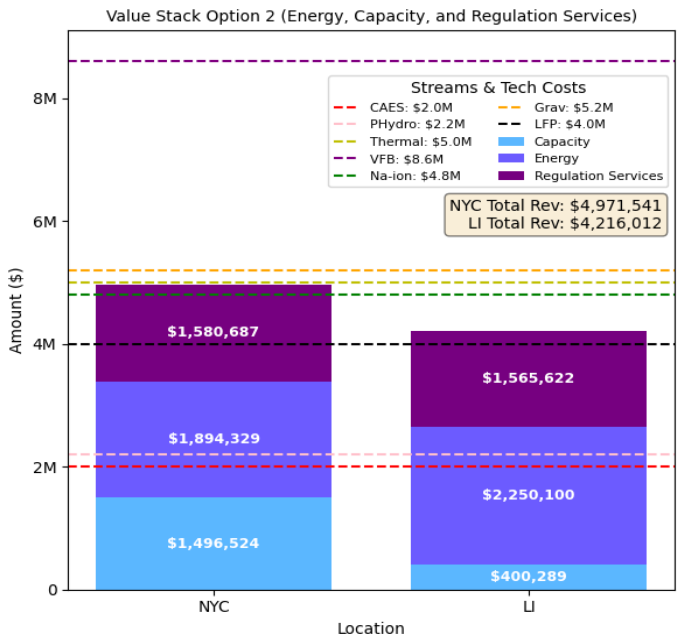

Figure 2 Value Stack Energy, Capacity and Regulation Service

Table 1 LCOS of Different LDES Technologies

Technology	LCOS ($/MWh)
CAES (Compressed Air)	100
Pumped Hydropower	110
Lithium-ion LFP Battery	200
Sodium-ion Batter	240
Thermal Storage	250
Gravitational Storage	260
Vanadium Flow Battery (VFB)	430

Figure 1 highlights the total revenue a 10MW/ 80MWh system can receive through capacity, energy, and Spinning Reserves. Figure 2 is similar but provides AS revenue streams through regulation services. The dashed lines represent different LDES technologies and their corresponding costs for an 80MWh system. Key findings from this analysis are:

- **VFBs and Gravitational storage face economic viability challenges**. By 2030, LCOSs of most LDES technologies will be even lower, suggesting that even the costlier LDES systems can be deployed with proper incentives.
- **CAES, Pumped Hydro, and LFP Batteries are the most viable in both scenarios, but the geographical constraints may prevent their deployment in NYC.**
- **Sodium Ion is a borderline case,** currently breaking even in NYC. This suggests that Na-ion's viability may be sensitive to minor shifts in tariff rates or cost declines.
- **Regulation and Spinning Reserves services materially improve viability**, adding ~$1–$1.5M in NYC and LI—enough to cross the LFP LCOS for in NYC and approach viability in LI.
- **Energy arbitrage provides the most significant single revenue stream across both zones**, especially in NYC, where highly seasonal LBMP volatility enables meaningful spread capture.

Based on numbers alone, NYC offers the strongest financial case for LDES deployment due to its higher capacity revenues. The reality is less straightforward. Persistent barriers, including land availability, dense urban development, and stringent permitting processes, significantly restrict the ability to site and build large-scale LDES systems. As a result, even though the numbers favor NYC, overcoming these practical challenges will require innovative siting solutions, supportive local policies, and sustained coordination between developers, communities, and regulators to unlock the region's full storage potential.

A Deeper Dive into NY Market Dynamics for LDES Systems

While the previous section used annualized modeling to assess whether LDES technologies can achieve cost recovery through NYISO market revenues, understanding real project viability requires a deeper examination of hourly price behavior and market design. This section analyzes NYISO's 2024 pricing data[5] to uncover the specific timeframes, seasons, and system constraints that influence arbitrage potential, highlight misalignments between policy-defined durations and market peaks, and explore structural challenges that limit LDES participation in the capacity market.

LDES IN NEW YORK'S ENERGY MARKET

Peak-hour pricing data for NYC and LI in January and July strongly support the economic viability and significant arbitrage value of LDES during seasonal peaks. As shown in Figures 3 & 4, NYISO's 2024 hourly LBMP peaked in January, June, July, and December, which had energy prices consistently more than double the 2030 projected lowest LCOS of an LDES system ($64/MWh). Further analysis into the peak days of these months revealed that average prices for 6-hour windows often resulted in **higher compensation than 8- or 10-hour durations**. This signifies the current gap between market-aligned operational strategies and New York's policy-defined duration of 8 hours.

Certain US states have been making strides to launch or expand their energy storage programs. The **LDES Program** within the **California Energy Commission** has invested over $270M in the deployment of LDES (projected: 2025-2029) in 12 different in-state facilities, including hospitals, military bases, and reservations. Projects span 15MWh to 500MWh.

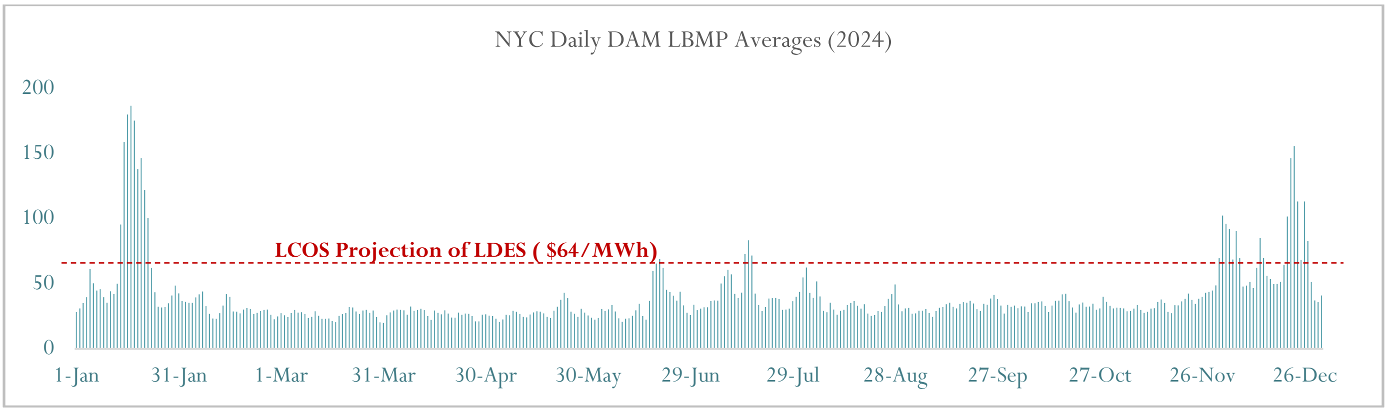

Figure 3: Three Months in NYC where the Energy Payment is higher than the 2030 Projected Cost of an LDES

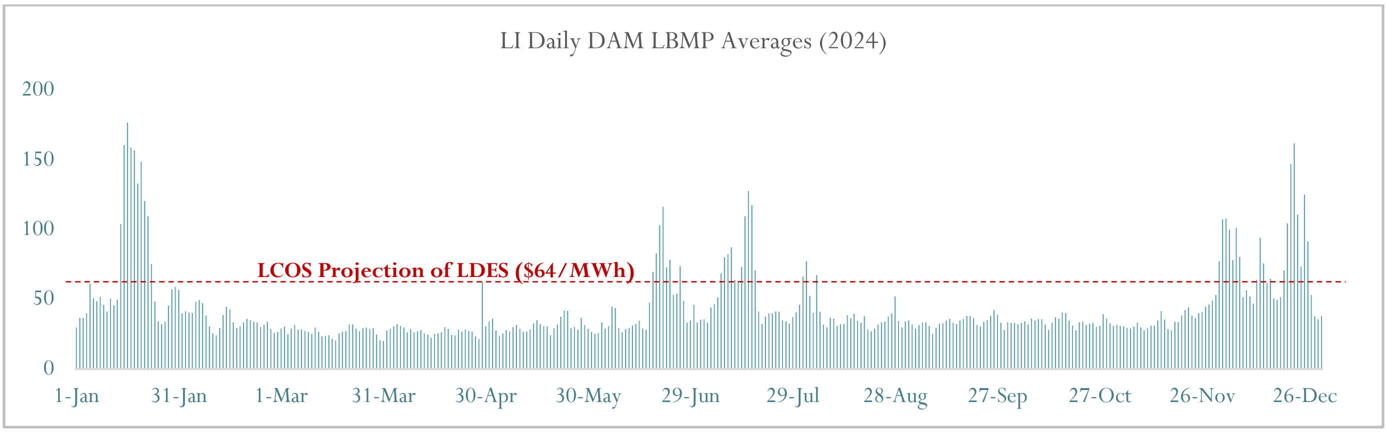

Figure 4: Three Months in LI where Energy Payment is higher than the 2030 Projected Cost of an LDES

Figures 3 and 4 above show that winter months in both NYC and LI and summer months in Long Island are significant energy revenue opportunities for the lowest cost LDES systems.

Tables 2 and 3 below provide an insightful look at daily peak-hour averages of LBMPs in NYC and Long Island across January, July, and December 2024—months that exhibited feasible energy compensation for a low-cost LDES system (i.e., CAES $64/MWh). These insights reveal where and when LDES can generate maximum value through energy arbitrage.

Average LBMP in NYC for 6, 8, and 10 Hour Peak Windows						
Dates	Pk Hrs (6)	6 Hr Avg	Pk Hrs (8)	8 Hr Avg	Pk Hrs (10)	10 Hr Avg
14-Jan	4P-10P	$137	4P-12A	$131	2P-12A	$126
15-Jan	4P-10P	$220	3P-11P	$205	2P-12A	$191
16-Jan	3P-9P	$227	1P-9P	$215	11A-9P	$208
17-Jan	3P-9P	$245	2P-10P	$231	12P-10P	$222
18-Jan	3P-9P	$206	1P-9P	$201	11A-9P	$200
19-Jan	3P-9P	$172	2P-10P	$170	12P-10P	$168
20-Jan	4P-10P	$183	3P-11P	$176	1P-11P	$172
21-Jan	4P-10P	$149	3P-11P	$144	1P-11P	$140
22-Jan	3P-9P	$111	1P-9P	$106	11A-9P	$105
AVG		$183		$175		$170

Dates	Pk Hrs (6)	6 Hr Avg	Pk Hrs (8)	8 Hr Avg	Pk Hrs (10)	10 Hr Avg
15-Jul	2P-8P	$143	1P-9P	$126	12P-10P	$115
16-Jul	2P-8P	$176	1P-9P	$155	12P-10P	$139
17-Jul	2P-8P	$133	1P-9P	$119	12P-10P	$109
AVG		$151		$133		$121

Dates	Pk Hrs (6)	6 Hr Avg	Pk Hrs (8)	8 Hr Avg	Pk Hrs (10)	10 Hr Avg
20-Dec	1P-7P	$79	11A-7P	$79	10A-8P	$78
21-Dec	3P-9P	$150	3P-11P	$144	2P-12A	$138
22-Dec	4P-10P	$182	3P-11P	$175	1P-11P	$169
23-Dec	3P-9P	$170	1P-9P	$165	11A-9P	$161
24-Dec	6A-12P	$130	5A-1P	$126	5A-3P	$122
25-Dec	4P-10P	$81	4P-12A	$78	2P-12A	$75
26-Dec	6A-12P	$136	6A-2P	$127	6A-4P	$124
27-Dec	5A-11A	$94	3A-11A	$89	1A-11A	$86
AVG		$128		$123		$111

Table 2 Average LBMP for NYC (6, 8, 10-hour periods)

Average LBMP in Long Island for 6, 8, and 10 Hour Peak Windows						
Dates	Pk Hrs (6)	6 Hr Avg	Pk Hrs (8)	8 Hr Avg	Pk Hrs (10)	10 Hr Avg
14-Jan	4P-10P	$152	3P-11P	$148	2P-12A	$142
15-Jan	4P-10P	$211	3P-11P	$197	1P-11P	$188
16-Jan	3P-9P	$216	2P-10P	$206	12P-10P	$199
17-Jan	4P-10P	$184	3P-11P	$176	2P-12A	$170
18-Jan	4P-10P	$169	2P-10P	$165	12P-10P	$162
19-Jan	3P-9P	$152	1P-9P	$152	11A-9P	$151
20-Jan	4P-10P	$167	2P-10P	$163	12P-10P	$161
21-Jan	4P-10P	$148	3P-11P	$140	2P-12A	$134
22-Jan	4P-10P	$137	2P-10P	$127	1P-11P	$118
23-Jan	5A-11A	$109	5A-1P	$97	4A-2P	$90
AVG		$171		$164		$158

Dates	Pk Hrs (6)	6 Hr Avg	Pk Hrs (8)	8 Hr Avg	Pk Hrs (10)	10 Hr Avg
14-Jul	3P-9P	$135	2P-10P	$124	12P-10P	$116
15-Jul	3P-9P	$229	1P-9P	$211	12P-10P	$192
16-Jul	2P-8P	$290	1P-9P	$259	12P-10P	$232
17-Jul	2P-8P	$214	1P-9P	$198	12P-10P	$182
18-Jul	2P-8P	$97	1P-9P	$94	12P-10P	$90
AVG		$193		$177		$162

Dates	Pk Hrs (6)	6 Hr Avg	Pk Hrs (8)	8 Hr Avg	Pk Hrs (10)	10 Hr Avg
20-Dec	2P-8P	$94	1P-9P	$91	11A-9P	$89
21-Dec	3P-9P	$151	3P-11P	$146	1P-11P	$141
22-Dec	4P-10P	$184	3P-11P	$177	2P-12A	$170
23-Dec	4P-10P	$189	2P-10P	$179	1P-11P	$173
24-Dec	5A-11A	$130	4A-12P	$125	2A-12P	$120
25-Dec	4P-10P	$96	4P-12A	$90	2P-12A	$85
26-Dec	4P-10P	$153	3P-11P	$149	2P-12A	$144
27-Dec	4P-10P	$110	3P-11P	$103	2P-12A	$97
AVG		$140		$134		$128

Table 3 Average LBMP for Long Island (6, 8, 10-hour periods)

8-hour window prices used in NY's policy definitions for LDES were consistently lower than 6-hour price averages. As shown in Tables 2 and 3, the average 8-hour LBMPs were 4-12% less in NYC and LI compared to the 6-hour average LBMP. These values remain ~2-2.5x higher than the $64/MWh LCOS threshold, demonstrating continued profitability under longer discharge durations.

LDES revenues concentrate in certain months (e.g., January, July, December), making a stronger case for incentivizing operations that support winter/summer peaking needs.

- In January, NYC's 6-hour peak LBMP averaged ~$183/MWh per day—nearly three times the projected $64/MWh LCOS for LDES systems. July pricing also showed strong potential, with the 6-hour average reaching ~$150/MWh. Long Island, while showing similar January peaks ($171/MWh), recorded even higher July averages, with the 6-hour peak window hitting ~$193/MWh. This regional divergence likely reflects Long Island's status as a vacation-driven load center during summer, reinforcing the case for location-specific LDES strategies across New York State.
- Notably, December averages were lower than January and July but still presented viable arbitrage windows. In contrast, March 2024 marked the lowest observed LBMPs, with NYC and LI both averaging ~$26/MWh over 6-hour off-peak windows—just 40% of the LCOS threshold. This seasonal low underscores the importance of timing when optimizing LDES operations.

Across the selected weeks, hypothetical **LDES systems in NYC and LI (80MWh system) could have earned approximately $1.8 – 2.3M** per year.

LDES IN NEW YORK'S CAPACITY MARKET

NYISO's current capacity market design has not fully evolved to incorporate energy storage systems greater than 8 hours. However, there is a significant push towards longer duration systems >4 hours through its Duration Adjustment Factors (DAF) shown in Table 4.

Energy Duration (Hours)	Duration Adjustment Factor (DAF)
8	100%
6	100%
4	90%
2	45%

Table 4 Energy Duration and Respective DAF for NYISO ICAP market

Shorter duration systems (e.g., 2-hour) are significantly scaled down in their accredited ICAP—receiving only 45% of their nameplate capacity—while systems 6 or 8 hours can receive up to full capacity credit (100%), provided they meet other reliability requirements.

Capacity markets in NYISO typically compensate resources for their availability offers through monthly, spot, or auction prices. In 2024, NYC's monthly capacity prices ranged from $8-16/kW-month, approximating $96,000 – 192,000/MW-year of capacity payments. For large-scale LDES plants, which are typically deployed at sizes of 100 MW or greater (sometimes around 1 GW), this translates into multimillion-dollar annual capacity payments. Therefore, LDES systems are not uniquely disadvantaged in participating in capacity markets; rather, these large sums reflect the role and scale intended for bulk-system reliability assets that provide resource adequacy, reliability, and resilience.

LDES IN NEW YORK'S ANCILLARY SERVICES MARKET

Additional compensation from ancillary services can make or break LDES projects in New York for several technologies. Regulation and spinning reserves compensation were analyzed, providing resources with bidding opportunities in the Day Ahead Market[6]. If reactive power capability is demonstrated, LDES systems can also offer Voltage Support Services, which are currently compensated at a rate of ~$3,436/MVAR per year. Analysis in Figure 5 shows that Regulation Services provide an ancillary service revenue stream throughout the year. Currently, the NYISO market lacks compensation mechanisms for energy storage in Black Start and Energy Imbalance Services.

Combined Energy, Capacity, and Ancillary Service Value

Combined energy, capacity, and ancillary service values were highest in December, January, and July for both NYC and LI. NYC consistently showed significantly higher combined value than LI, suggesting a stronger economic value proposition for LDES in NYC due to local market dynamics and constraints. This highlights the importance of a "value stack" approach for LDES.

Regulation Service and Voltage Support Service (VSS) values are the same across all NYS zones. In general, Regulation Services offer the highest monthly revenues except for July, when the Spinning Reserve values were higher in NYC.

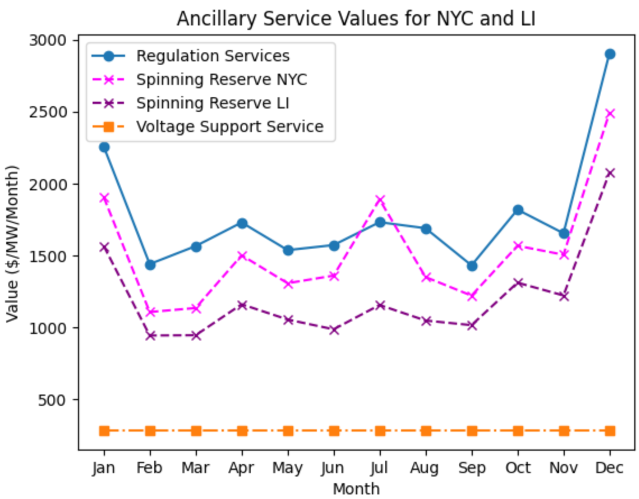

Figure 5: Ancillary Service values for NYC and LI.

CONCLUSION AND RECOMMENDATIONS FOR ACCELERATING LDES DEPLOYMENT

While NYISO's current market design provides viable revenue streams for several key LDES technologies, it is not fully optimized for systems with durations beyond 6–8 hours. As a result, multi-day to seasonal LDES projects may be insufficiently rewarded for the full range of grid services they can provide. In addition, the broader industry ecosystem remains underdeveloped—many critical LDES components (e.g., turbines, compressors, heat exchangers) serve small, specialized markets, limiting manufacturers' incentives to pursue cost-reduction innovations without targeted policy or regulatory support. To close these gaps, policymakers and regulators should implement a coordinated set of measures that expand market value recognition, reduce capital barriers, secure long-term revenue certainty, and streamline deployment. Recommended actions include the following:

Recommendations to Accelerate LDES Deployment

Value Stacking Initiatives

- **Consider a flexible definition of LDES**: Lowering the duration from 8hr minimum to 6hr minimum will increase energy value compensation.
- **Update NYISO and utility tariffs** to explicitly compensate LDES not only for energy arbitrage, but for AS and congestion relief. This rewards LDES for the full suite of grid services it provides.
- **Establish and prioritize market products that reward long-duration flexibility**, such as a new "Long-Duration Reserve" market or product category.

Upfront Capital Support

- **Launch state grant programs** and targeted state investment tax credits for LDES. Mirror programs such as the federal Investment Tax Credit (ITC) for storage or DOE demonstration grants
- **Offer green bonds** specifically marked for LDES projects to reduce the cost of capital and encourage private investment

Performance-Based Operational Incentives

- **Compensate LDES projects** for being available during system peak and grid-stress events, not only for actual energy delivered
- **Provide insurance** or funds to de-risk penalties for operational shortcomings, supporting investor confidence

Long-Term Contracts

- NYISO can offer **long-term agreements** to ensure revenue predictability and project bankability.
- Utilities should be **assigned specific LDES targets**. These targets can be similarly developed to short duration targets based on utility load share.

Integration with Renewables and Grid Needs

- **Offer additional incentives for LDES projects** that are sited with renewable generation, supporting resource adequacy and renewable integration
- **Create local or state-level streamlined permitting mechanisms** with guaranteed review timelines for eligible location-specific LDES technologies
- **Accelerate queue access** for LDES in congestion-prone and high-value zones (e.g., NYC, LI) through fast-track permitting and dedicated interconnection processes

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Vrinda Inc. is a New York-based business and technology firm. Vrinda creates success for your business through a focus on value creation by providing trusted, actionable advice, and practical solutions. We provide business and technology consulting services to the Energy, Utility, and Transportation sectors. Vrinda operates in the United States and Latin America and brings innovative expertise. www.vrindainc.com

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