



*National Association of
State Energy Officials*

NASEO Virtual Roundtable: State Efforts to Enhance Energy Storage RD&D

January 25, 2023

Photo Courtesy of RL Martin



Welcome and Introductions

Kelsey Jones, Senior Program Manager, National Association of State Energy Officials (NASEO)

Speakers

- **Vinod Siberry**, Technology Manager, U.S. Department of Energy
- **Dr. Schuyler Matteson**, Senior Advisor, New York State Energy Research and Development Authority (NYSERDA)

Energy Storage RD&D at DOE Office of Electricity

Vinod Siberry

January 2023

Presentation Outline

- Strategic Priorities for DOE and Recent Legislation
- Landscape of DOE Energy Storage RD&D Efforts
- OE Past and Ongoing Involvement with States
- Recent and Open Funding Opportunities
- Opportunities for States to Engage

LONG DURATION STORAGE SHOT TARGET



Reduce storage costs by
90% from a 2020
Li-ion baseline...



...in storage systems that
deliver **10+**
hours of duration



...in **1** decade

Affordable grid storage for clean power – any time, anywhere

Recent Federal Legislation Relevant to Energy Storage

- Bipartisan Infrastructure Law (BIL) stands up 60 new DOE programs; 48 demonstration & deployment programs and expands funding for 12 existing programs
- \$65 billion in power infrastructure investments authorized by BIL including \$505 million for LDES demo program (OCED) & \$10 billion for grid infrastructure programs (GDO)
- Inflation Reduction Act (IRA) funds investments and incentives totaling \$370 billion for US to remain global leader in clean energy technology, manufacturing, and innovation
- Includes investment tax credits (ITCs) and production tax credits (PTCs) for energy storage and new loan authorities given to DOE

OE Leads Grid Storage Efforts Across DOE

	Materials	Components & Devices	System Design	Grid & System Integration	Supply Chain & Manuf.	Operations	End of Life	Investment & Finance	Markets & Value	Workforce	
Electro-chemical	VTO, ARPA-E, SC-BES	AMO, VTO, ARPA-E	VTO, ARPA-E, SETO	AMMTO, VTO	AMMTO, MESC	OCED	VTO	LPO, OTT, OCED, AMMTO, LPO, SETO	OTT, EERE-SA, GTO, WPTO, SETO, IEDO, BTO	AMMTO, VTO, OP, OTT	
OE				OE		OE	OE				
Electro-mechanical	ARPA-E, WPTO	ARPA-E, WPTO	ARPA-E, WPTO	WPTO	WPTO, AMMTO	OCED	OE				
Thermal	ARPA-E, SETO, SC-BES, BTO	SETO, BTO	SETO, BTO	SETO, BTO	AMMTO, BTO	OCED, SETO	SETO	OE			
Chemical	HFTO, SC-BES, ARPA-E	HFTO	HFTO	HFTO	AMMTO	OCED	OE				
Power Electronics	SC-BES, ARPA-E	ARPA-E, AMMTO, VTO	AMO, VTO, CESER	VTO, CESER	AMMTO	OE	OE				

ARPA-E: Advanced Research Projects Agency–Energy, AMMTO: Advanced Materials and Manufacturing Technologies Office, BTO: Building Technologies Office, FE: Office of Fossil Energy, GTO: Geothermal Technologies Office, HFTO: Hydrogen and Fuel Cell Technologies Office, IEDO: Industrial Efficiency and Decarbonization Office, OE: Office of Electricity, OP: Office of Policy, SETO: Solar Energy Technologies Office, LPO: Loan Programs Office, SC-BES: Office of Science Basic Energy Sciences, VTO: Vehicle Technologies Office, WETO: Wind Energy Technologies Office, WPTO: Water Power Technologies Office

Recent and Ongoing Storage (or Related) Opportunities

Name and Link	Offices	Closing	Amount	Storage
Grid Resilience Utility and Industry Grants	GDO	12/16/2022	\$2.5B	Eligible
Storage Innovations 2030 Prize	OE	12/16/2022	\$300K	Targeted
Long-Duration Energy Storage Demonstrations	OCED, OE	12/22/2022	\$349.0M	Targeted
Innovations to Accelerate Energy Storage Deployment	SC, OE	1/3/2023	\$500K	Targeted
Grid Innovation Program	GDO	1/13/2023	\$5.0B	Eligible
AMMTO-BTO and OE FY22 Multi-Topic FOA	EERE	2/3/2023	\$17.5M	Eligible
Distributed BESS Integration and Coordination	EERE	2/7/2023	\$6.0M	Targeted
Innovative Pumped Storage Hydropower Technologies	EERE	3/6/2023	\$6.0M	Targeted
Energy Earthshot Research Centers	SC	3/7/2023	\$200M	Targeted
Clean Energy Demos on Current and Former Mine Land	OCED	TBD	\$500.0M	Eligible
Underserved and Indigenous Community Microgrids	OE	TBD	\$9.1M	Eligible

OE Storage Core Focus Areas and Recent Highlights

	Materials	Components & Devices	System Design	Grid & System Integration	Supply Chain & Manuf.	Operations	End of Life	Investment & Finance	Markets & Value	Workforce	
Electro-chemical	Cost-Competitive LDES		Grid & Field Validation			Reliability & Safety					
Electro-mechanical	<ul style="list-style-type: none"> Increased energy density, cell sizes, etc. for Sodium, Aqueous Soluble Organic, Zinc, Redox Flow battery chemistries 		<ul style="list-style-type: none"> New demo systems in IA, AL, NM, WA 								
Thermal						<ul style="list-style-type: none"> Emergency response training support for utilities, fire departments Expertise for ESS Fire Codes & Standards (NFPA, IFC, UL) 			Storage Analytics		
Chemical	<ul style="list-style-type: none"> World's first high power modular GAN-based inverter 						Developing operational standards : <ul style="list-style-type: none"> IEEE 1547.9 ES Interconnection IEEE P2686 BMS IEEE P2688 EMS 				<ul style="list-style-type: none"> QuESt: An open-source tool for Energy Storage financial evaluation Storage tutorials to commissions in IL, PA, MI, UT, IN
Power Electronics	Cost-Competitive LDES		Grid & Field Validation			Reliability & Safety					

Energy Storage Analytics & Regulatory Outreach

The national labs have developed software tools for energy storage valuation, sizing and placement

Sandia National
Laboratories



- Market applications
- BTM storage plus solar applications
- Peaker plant replacement with energy justice (air quality/health) models
- Models performance in extreme climates (hot and cold)

Pacific Northwest
National Laboratory



- Battery Energy Storage Valuation tool (BSET)
- Virtual Battery Assessment Tool (VBAT)
- Pumped Storage Hydropower Evaluation (PSHET)
- Microgrid Asset Sizing considering Cost and Resilience (MASCORE)
- Hydrogen Energy Storage Evaluation Tool (HESET)

ES analytics supports the deployment team, recent successes include:








- Atrisco Heritage High School (Albuquerque, NM)
- Picuris Pueblo (Northern NM)
- Nantucket Island (MA)



SNL and PNNL organize educational outreach activities with state public regulatory commissions



Demo Systems Deployment Projects

ES Demo Project Partner	Application	Energy Equity & Community Benefits	ES Technology & System Size	Data Collection & Analytics	Current Status
EPB Chattanooga, TN 	Resilience	<ul style="list-style-type: none"> Microgrid capability utilizing adjacent community solar project 	Li-Ion 1.25MW, 2.5MWH	✓	Complete & Operational
Alliant Energy Decorah, IA 	Renewable Hosting Capacity	<ul style="list-style-type: none"> Allows for greater penetration of community/customer renewable generation 	Li-Ion 2MW, 2.9MWH	✓	Complete, unresolved commissioning issues outstanding
Atrisco Heritage High School Albuquerque, NM 	Resilience & Demand Reduction	<ul style="list-style-type: none"> Reduction of demand charges – money saved goes directly into Atrisco’s student school programs STEM education learning center 	Li-Ion 721kW/2.9MWH	✓	Complete, awaiting interconnection approval
Navajo Tribal Utility Authority Navajo Reservation, AZ, NM 	Off-grid power	<ul style="list-style-type: none"> Providing power to individual homes in rural & remote locations on the Navajo Reservation 	Zinc Manganese Dioxide 3kW, 13kWH	✓	1 of 3 Planned Installations Complete & Operational
Picuris Pueblo Northern NM 	Resilience	<ul style="list-style-type: none"> Provide resiliency from frequent outages to Pueblo Governmental services and residential homes 	TBD (Li-Ion) 400kW, 1MWH (Est.)	✓	SNL Contracting
Alaska Village Electric Coop St. Mary’s Village, AK 	Spinning Reserve	<ul style="list-style-type: none"> Reduce diesel plant emissions/community pollutants Increase renewable generation usage (wind) 	Li-Ion 1MW, 1MWH	✓	System procured, shipping from Germany to University of Alaska, Fairbanks for pre-commissioning
Municipality of Villalba, Villalba, PR 	Resilience	<ul style="list-style-type: none"> Provide resilience to Municipality emergency operation center/community resilience hub during frequent grid outages 	TBD (Li-Ion)	TBD	SNL Contracting



Energy Storage for Social Equity

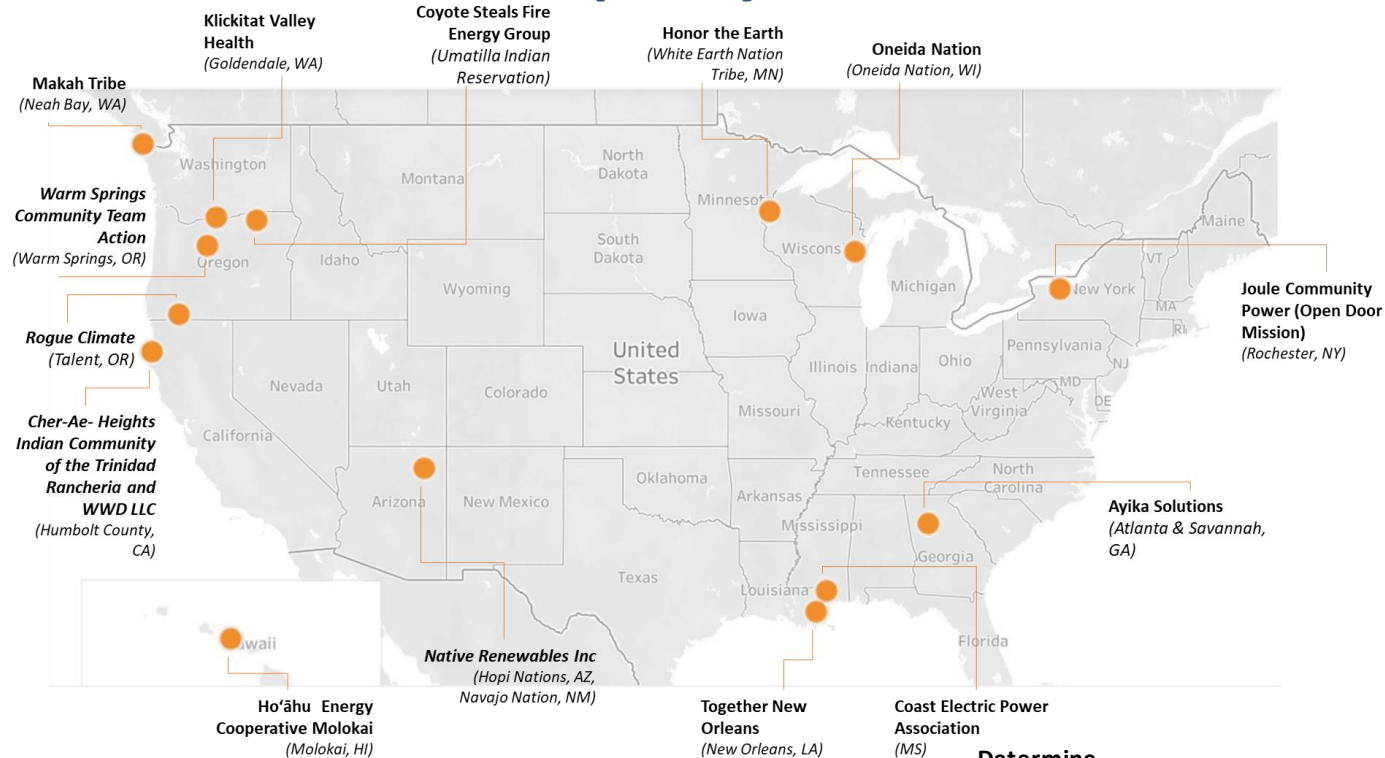
Initiative to increase energy equity and resilience in disadvantaged communities

Phase 1: Technical Assistance (TA), managed by PNNL

Phase 2: Project Development and Deployment Assistance (PDDA), managed by Sandia

14 communities selected out of 64 applications

- Held over 600 community meetings, April to December 2022, including in-person meetings.
- Participated with communities to engage state and commission stakeholders.
- Supported and educated communities on interconnection requirements and processes with respective IOUs, Co-ops, and PUDs.
- Completed equity, workforce and social benefit analysis for each community.
- Hosted technical workshops and created educational materials.



More information: <https://www.energy.gov/oe/energy-storage-social-equity-initiative>

Opportunities for States to engage with DOE RD&D

LDES FOA (Released in November 2022)

“Projects are encouraged to include local organizations, labor groups, and Tribal entities for planning and execution. Projects should not have a negative effect on the local community or the local workforce, and every effort should be made to prevent any negative impacts.”

SBIR Storage Deployment Topic (Released in November 2022)

“This subtopic is seeking innovations that accelerate deployment of energy storage by enhancing energy storage’s ability to provide benefits and reducing current barriers that prevent or delay energy storage from being deployed where they are capable of providing benefits.”

Opportunity for state stakeholders to learn more through merit reviewer participation

LDES Pilot Grants Program (Implementation TBD)

“While the Demo Initiative and Demo Projects address pilot demonstration and utility-scale validation, Pilot Grants is an opportunity to address institutional barriers to storage technology adoption in the marketplace. Such barriers can be easier to resolve when a technology has been installed, operated, de-risked, and shown to provide benefit to users, communities, or the power system.”

The following entities are eligible under Pilot Grants:

- (i) a **State energy office**;
- (ii) an Indian Tribe;
- (iii) a Tribal organization;
- (iv) an institution of higher education;
- (v) an electric utility, including-
 - (I) an electric cooperative;
 - (II) a political subdivision of a State, such as a municipally owned electric utility, or any agency, authority, corporation, or instrumentality of a State political subdivision; and
 - (III) an investor-owned utility; and
- (vi) a private energy storage company.

New York 6 GW Energy Storage Roadmap

NASEO Roundtable

Schuyler Matteson, PhD
January 25, 2023

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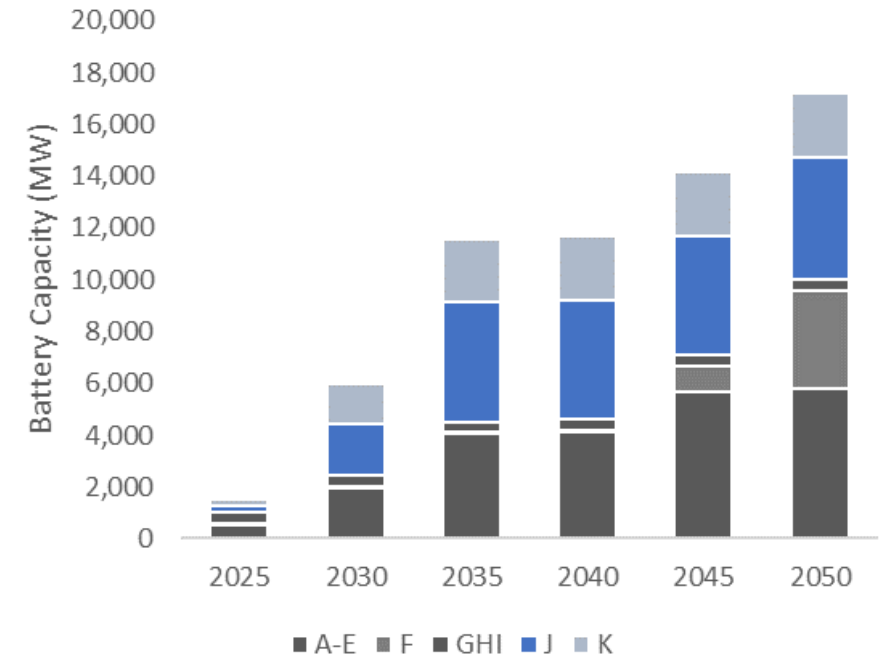
1. 6 GW Target: Role and Need
2. 6 GW Modeling Results: Locations and Durations
3. Roadmap Approach by Sector
4. Bulk Storage Program
5. Retail & Residential Programs
6. Utility Ownership: Storage for T&D Services
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6 GW Target: Role and Need

- Governor Kathy Hochul announced in her State of the State address an intention to double the state's 2030 energy storage deployment target, from the currently legislated 3 gigawatts (GW) of storage to 6 GW of storage by 2030.
- Forecasting the rapidly growing load from electrification, the Climate Act goals and expected fossil fuel retirements, Roadmap analysis indicates the need for ~12 GW of energy storage by 2040 and 17+ GW by 2050.
- Longer-duration (inter-day) storage could play a significant part in meeting zero-carbon firm capacity needs.
- A new 2030 target of 6 GW inclusive of long duration storage 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 levels.

6 GW Modeling Results: Locations

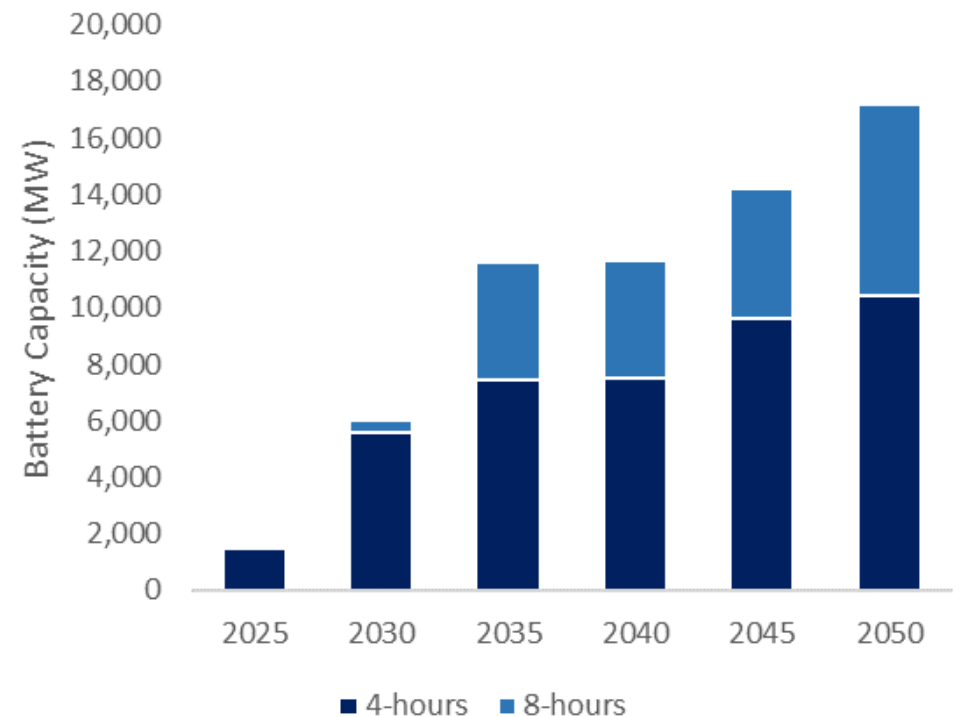
- NYSERDA commissioned E3 to conduct system modeling runs to determine optimal timing, locations and durational profile of 6 GW x 2030 buildout
- Results incorporate “base” 30% ITC for solar/wind/storage through IRA passage
- In 2030, 66% of the 6 GW requirement is met with storage in G-K; in line with contracts awarded to date
 - ~1.5 GW built in Zone K by 2030, increasing to ~2.5 GW by 2040
- By 2050, 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 storage builds by 2030 are 4-hr, with 8-hr storage “glide path” introduced to require 400 MW by 2030 and 1.6 GW by 2035
- Glide path ensures that about 10% of 2040 8-hr storage need is built in 2030 and 40% in 2035, reflecting the need for near-term deployment to spur learning-by-doing and innovation
- In 2030s, 60-70% of the statewide 8-hr storage is placed in NYC and LI as expensive peakers retire
- Additional 8-hr storage in 2030 and 2035 mostly replaces expensive thermal capacity and not 4-hr storage since the latter is still needed in the 2040s



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

Roadmap Approach by Sector

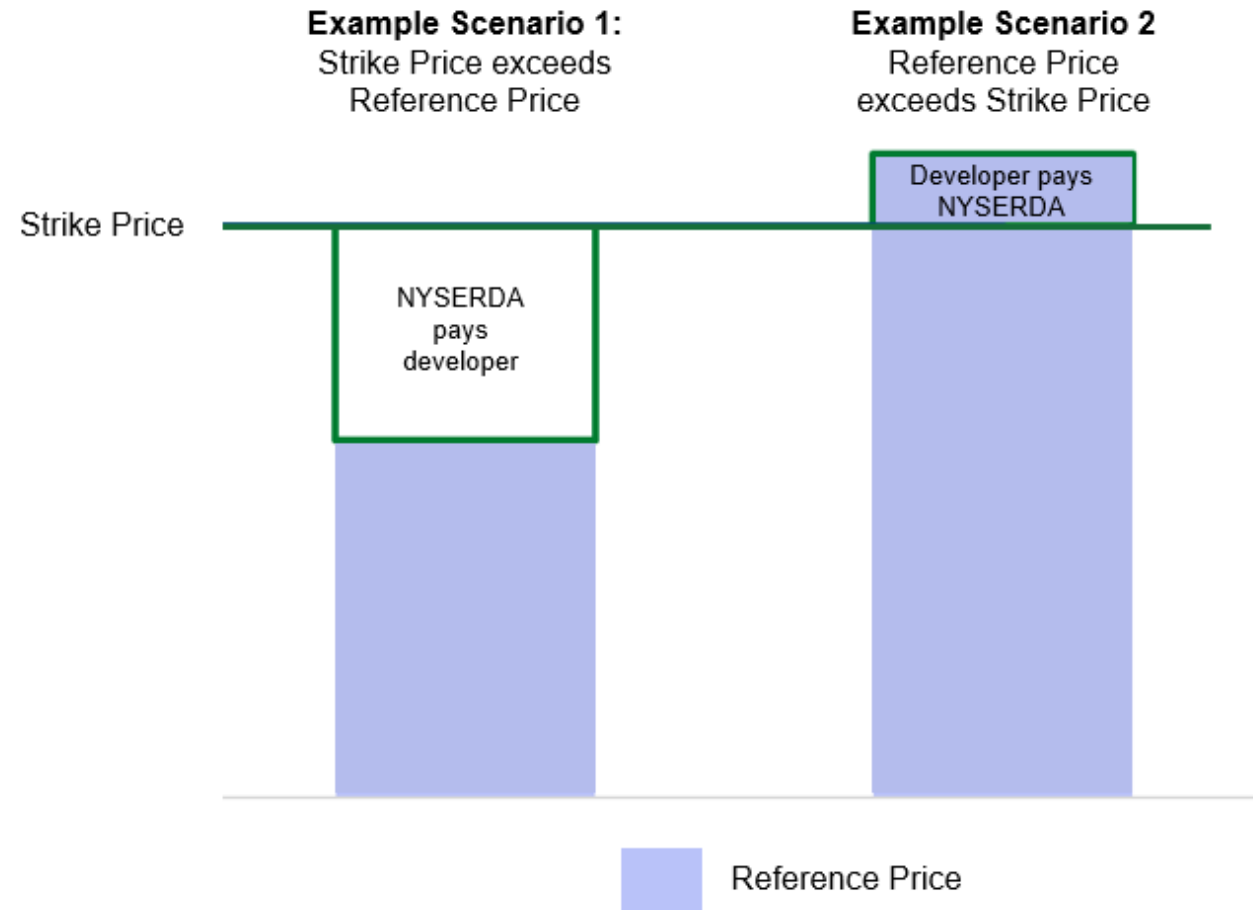
- We have a total of 1,301 MW of storage already awarded/contracted through Roadmap 1.0 and LSR Tier 1 procurements
- Approximately 12,000 MW of proposed energy storage projects are presently in either distribution-level or wholesale-level interconnection queues
- To reach the proposed 6 GW goal, **4,700 MW of new projects** will need to be awarded and deployed by 2030, at an estimated cost of \$1.0-\$1.7 billion
- The 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		

Proposed Bulk Mechanism: Index Storage Credit (ISC)

- Proposing 3 GW of bulk storage projects procured through a new Index Storage Credit (ISC) mechanism, which is anticipated to provide long-term certainty to projects while maximizing value to ratepayers
- Developers bid in a strike price which represents the required revenue for the project paid over a 15-year payout period
- NYSERDA selects and contracts with most viable/cost-effective projects; projects are free to participate in wholesale markets as they see fit to maximize revenue
- Payments to project determined by comparing strike price to a reference price, which would include:
 - (i) **Energy arbitrage** revenue component, based on top and bottom-priced four hours of the day in day-ahead market for four-hour duration (“TB4”; can be extended to other durations as well)
 - (ii) **Capacity** market revenue component
- **Index Credit = Strike Price – Reference Energy Arbitrage Price – Reference Capacity Price**
- Settlements executed monthly, based on monthly average energy arbitrage/capacity reference price

Bulk Index Storage Credit: Settlement Possibilities



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
 - Some of this work is underway, with the JU drafting an RFP for consulting services to begin the analysis
 - Projects could be proposed/approved of through individual rate cases or CLCPA T&D proceeding

Retail & Residential Approach

- Due to the unique development pathways in various regions of the State, NYSERDA and DPS Staff recommend continuing a Market Acceleration Bridge Incentive Program implemented through region-specific, declining block incentives for energy storage systems up to 5 MW
- The retail and residential programs are expected to be designed in a way that pays projects the full contract amount at the time of commissioning
- Collections will use a CEF-style approach, with a transparent pay-as-you-go methodology utilized in other recently approved programs such as NY-Sun

Process and Timing

- Roadmap Filing: December 2022
- 60-day SAPA comment period, with deliberation of comments
- Technical stakeholder Session in Q1 2023 to describe proposals, plus Q&A to help inform stakeholder comments
- Commission consideration/ruling in Q2/Q3 2023
- Implementation Plan and Programs Launch: H2 2023