

Pennsylvania Energy Storage Consortium

KICKOFF MEETING

SEPTEMBER 28, 2021

Microsoft Teams Tips

Basics on Audio and Visual

- Click “Raise Hand” near top-right of screen to ask a question or comment
- Click “Show Conversation” to add a message in the chat to all participants
- Please type questions and comments anytime

Meeting is being recorded

- The recording and presentation slides will be posted online on the PADEP Energy Storage webpage:
<https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/Pages/Energy-Storage.aspx>
- Refer to list of attendee list that was distributed via email

Agenda

1:05 – 1:20 p.m. **Welcome Remarks & Pennsylvania DEP’s Role in the Consortium**

Patrick McDonnell, Secretary, Pennsylvania Department of Environmental Protection

1:20 – 1:35 p.m. **Purpose of the Consortium**

Maggie Field, Engagement Manager, Strategen

1:35– 2:15 p.m. **Pennsylvania Energy Storage Assessment – Findings & Recommendations**

Ed Burgess, Senior Director, Strategen

2:15 – 2:50 p.m. **Stakeholder Discussion, Q&A, Feedback & Target/Goal Recommendation**

Maggie Field, Engagement Manager, Strategen Ed Burgess, Senior Director, Strategen

2:50 – 3:00 p.m. **Next Steps & Priorities**

- Steering Committee
- Upcoming meeting dates

Maggie Field, Engagement Manager, Strategen

Welcome Remarks & Pennsylvania DEP's Role in the Consortium

*Patrick McDonnell, Secretary,
PA Department of Environment Protection*

Consortium Overview

Consortium meetings

- Will be held quarterly through first year, then reassess

Interactive Discussions

- DEP/Strategen facilitating meetings but stakeholders will be the driving force
- Looking for feedback and discussion from all participants

Introductory Poll

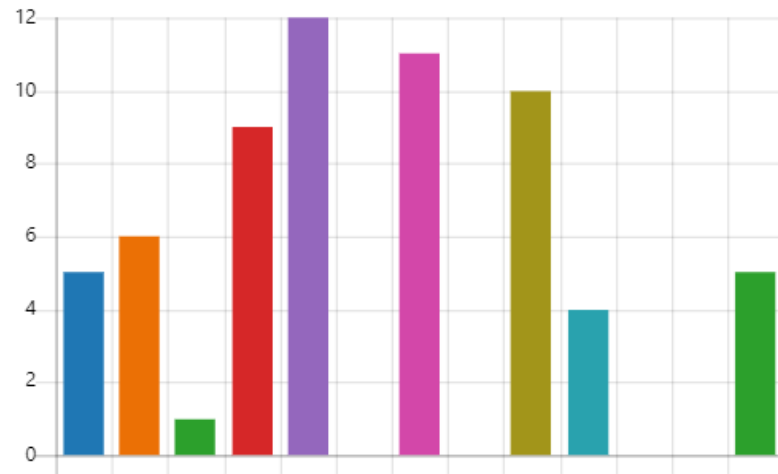
- What type of organization are you from?
- Link to poll question can be found in the chat box [and here](#)

Introductory Poll Results

1. Who's in the room? Please select your industry:

[More Details](#)

● Consulting services	5
● Storage developer	6
● Solar developer	1
● Solar + storage developer	9
● Government – PA state & local	12
● Government – federal	0
● Utility – Electric IOU	11
● Utility – POU or CCA	0
● Non-profit, enviro, education	10
● Trade association	4
● Media	0
● ISO/TSO/RTO	0
● Manufacturer / component su...	5



Example Participating Organizations





Meet your facilitators.



ED BURGESS
Senior Director

- + Leads the Utility and Government consulting practices at Strategen. Focus on issues related to resource and grid planning, DER valuation, energy policy & regulatory strategy, and energy product development & market strategy.
- + Project lead on the PA Energy Storage Assessment, Virginia's Energy Storage Study, and contributions to numerous other state clean energy resource planning studies
- + Serves as Policy Director for the Vehicle Grid Integration Council (VGIC)



MAGGIE FIELD
Engagement Manager

- + Facilitator and stakeholder engagement manager for the energy industry at Strategen
- + Leads content design, planning and execution for internal and external events and educational programming
- + Project lead managing the working group process for New Mexico's Community Solar Rulemaking



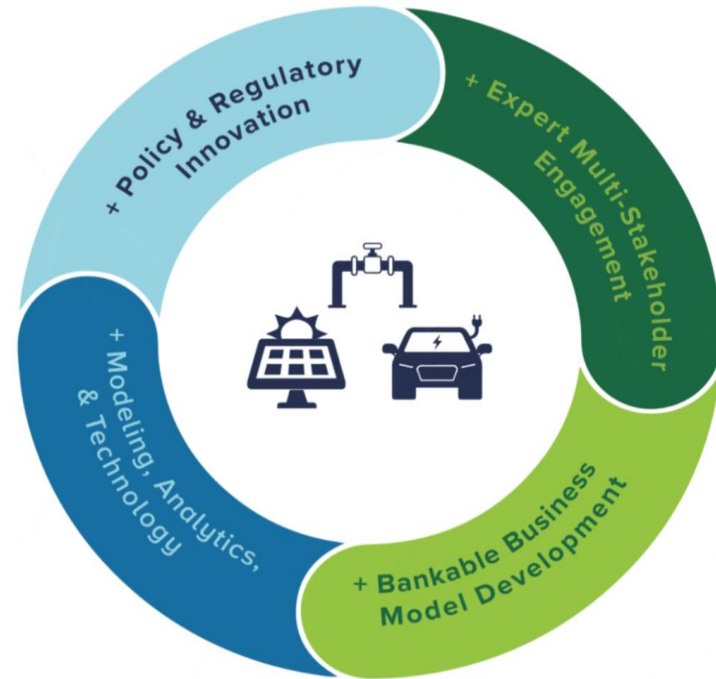
STRATEGEN

Your partner in the energy transition.

We bring an innovative approach to energy sector transformation

Strategen helps our clients achieve energy system transformation through a unique combination of capabilities.

- + Policy & Regulatory Innovation
- + Expert Multi-Stakeholder Engagement
- + Bankable Business Model Development
- + Modeling, Analytics, & Technology



Purpose of the Consortium

- **Structure & Logistics**

- Registration: <https://share.hsforms.com/1ZN38iJHURvCKboUlnlenFw32bvq>
 - **All attendees must register to receive future communications**
- Four PA Energy Storage Consortium Meetings:
 - Dec. 7, and Q1 and Q2 in '22 (dates TBD)
- Creation of a Steering Committee – scheduled in between Consortium meetings

- **Key Desired Outcomes & Goals**

- Intention of creating a stakeholder engagement forum – your participation is key!
- Review "PA Energy Storage Assessment" recommendations & potential for PA energy storage goal
- Discuss new ideas to increase storage deployment
- Evaluate short and long-term goals and core values

Consortium Contact:

- PA_energystorage@strategen.com

Purpose of the Consortium

Core Values

- Collaboration
- Technology and business model neutral
- Maximizing environmental and economic benefits
- Energy system resiliency and modernization
- Decarbonization
- Environmental justice



pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION



Energy Programs Office

Pennsylvania Energy Storage Assessment: Status, Barriers, and Opportunities

Released April 2021

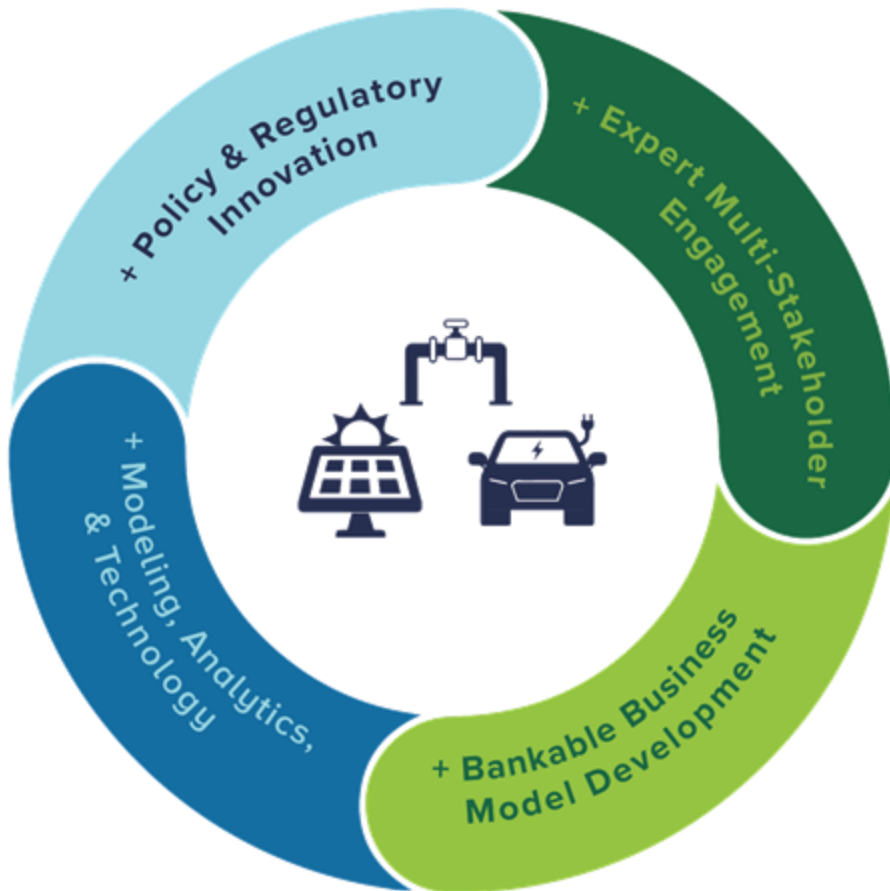


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PROTECTION

Agenda

-
1. Introduction
 2. Energy Storage Technologies and Applications
 3. Energy Storage in Pennsylvania Today
 4. Analysis of Energy Storage Potential
 - Standalone behind-the-meter storage
 - Large-scale solar-plus-storage
 5. Barriers to Energy Storage and Policy Recommendations

About Strategen



We bring an innovative approach to the energy sector transformation

Strategen helps its clients achieve energy system transformation through a unique combination of capabilities

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- + **Modeling, Analytics & Technology**

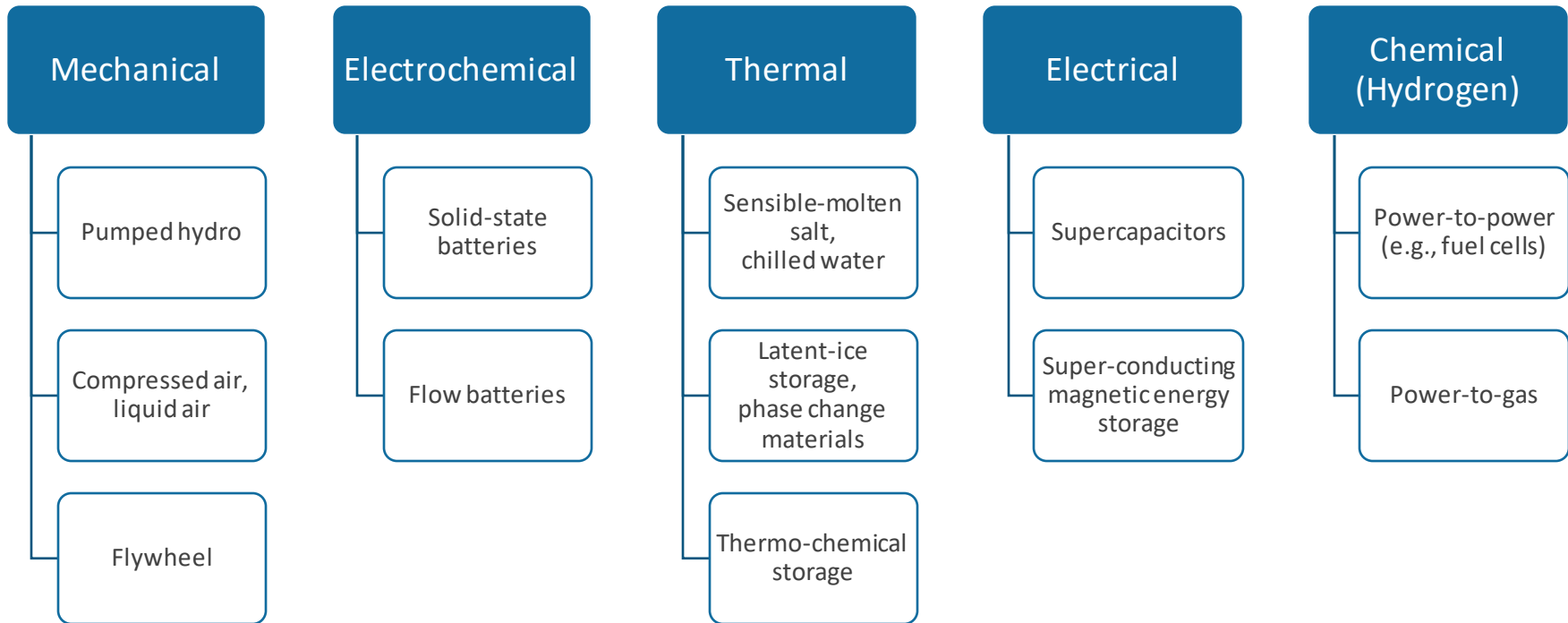
Introduction

- + Purpose of this Report:
 - + Assess the current landscape of energy storage in the Commonwealth of Pennsylvania
 - + Explore the potential benefits of storage
 - + Identify barriers and provide recommendations
- + Today's Objectives:
 - + Provide an overview of the Energy Storage Assessment
 - + Discuss results of analysis and policy options



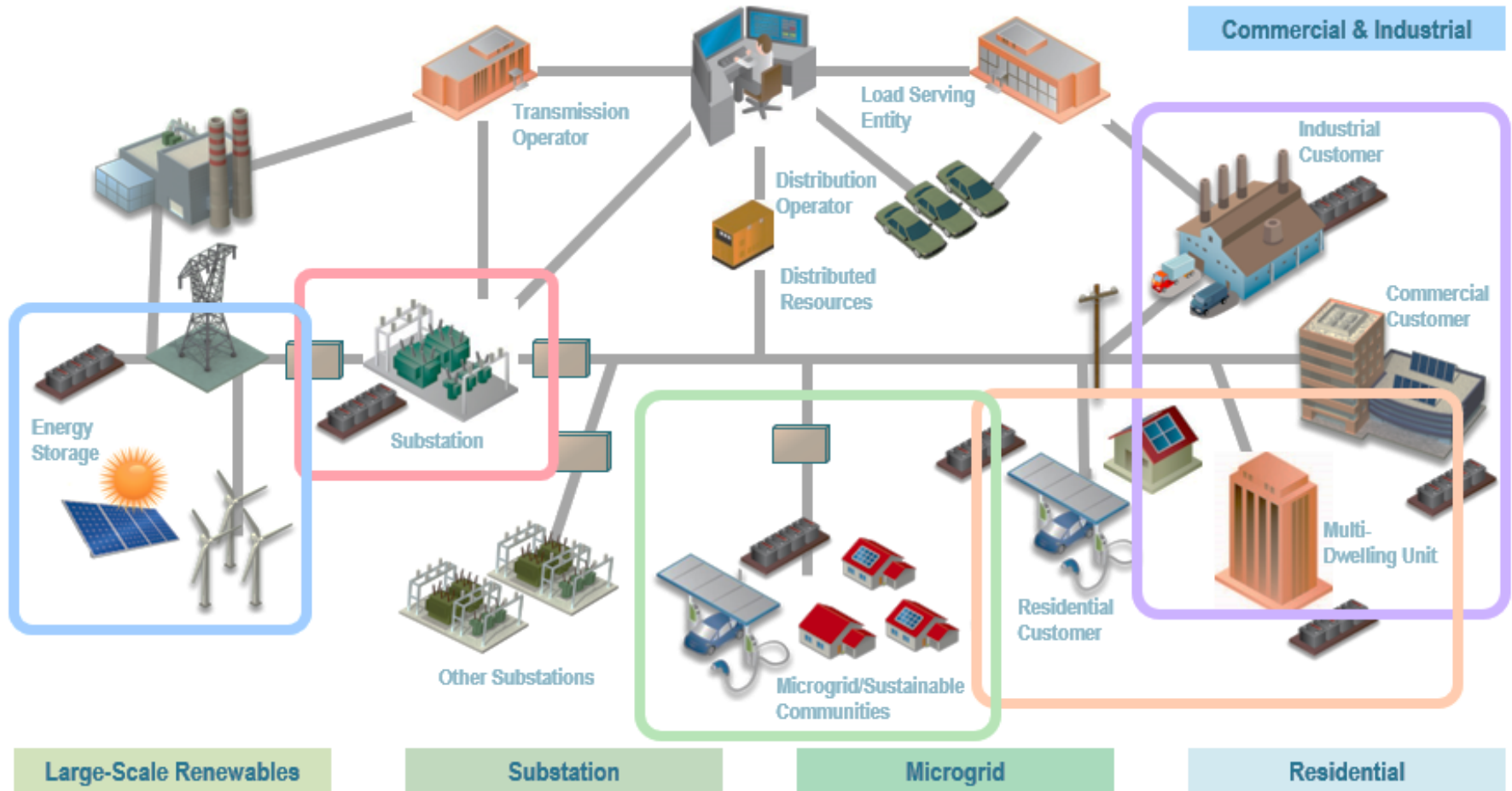
Energy Storage Technologies and Applications

Energy Storage Technologies



Although “energy storage” encompasses a diverse set of technologies, this report focused on the fastest-growing segment: batteries

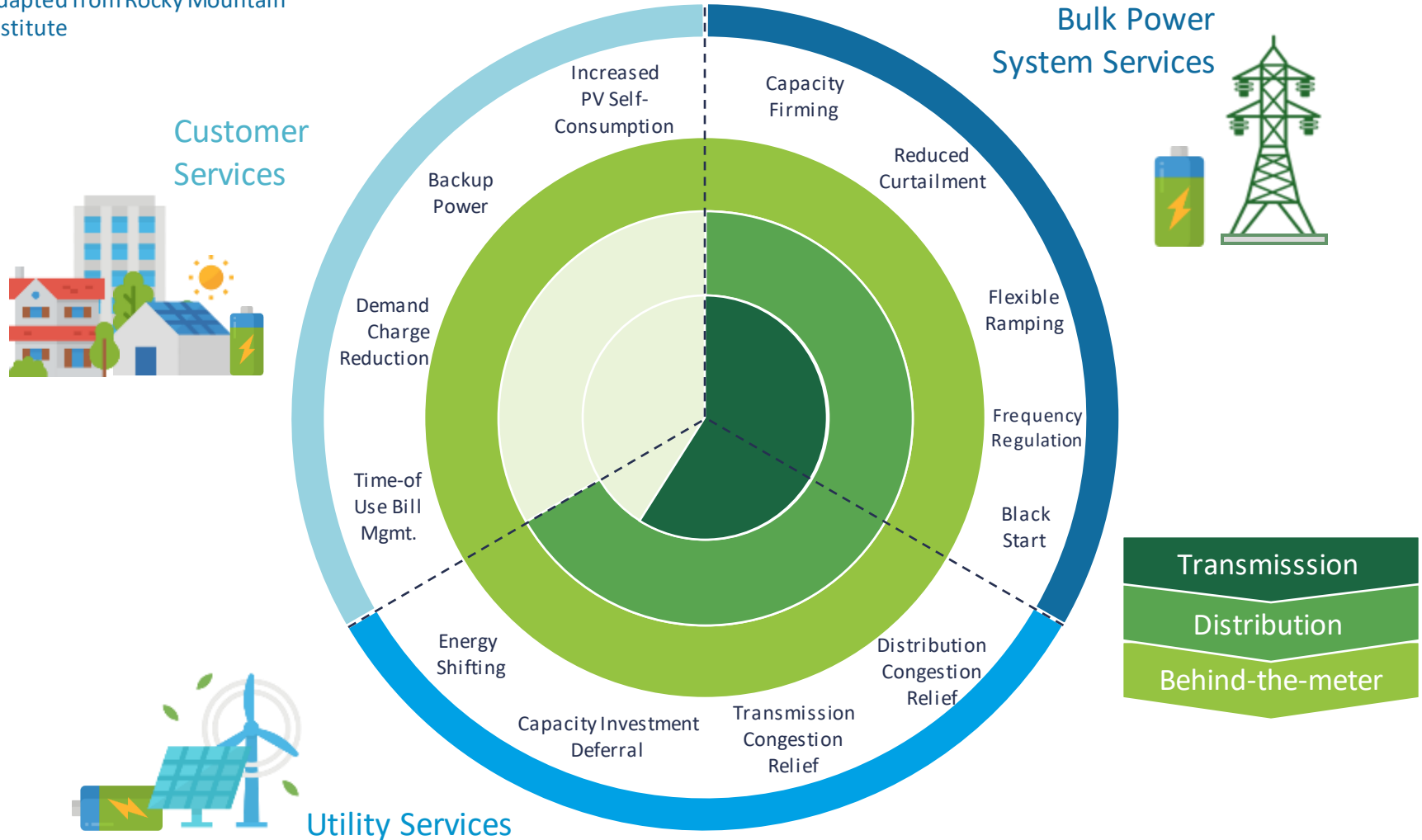
Widespread Potential for Energy Storage



Energy storage can enhance Pennsylvania's climate and resilience initiatives across the entire electric grid – generation, transmission, and distribution

Energy Storage Applications

Adapted from Rocky Mountain Institute

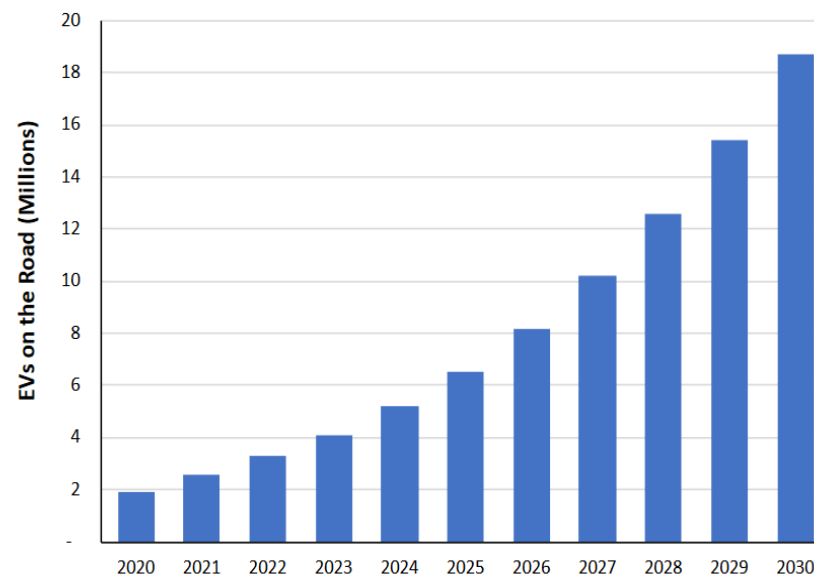


Energy storage can provide value and benefit streams to many stakeholders

Electric Vehicles as a form of Energy Storage

- + Electric vehicles (EV) in the US are going mainstream
- + Experts forecast >6 million EVs deployed by 2025
- + Vehicle-Grid Integration (“VGI”) solutions can unlock value streams for customers and benefits to society:
 - Grid-friendly charging to reduce EV operating costs and help spur EV adoption
 - Emissions-free emergency power during blackouts
 - Electricity infrastructure costs become more affordable
 - EVs can provide new grid services and get paid for it through vehicle-to-grid (V2G) capabilities


U.S. EV Deployment Forecast
(2020-2030)




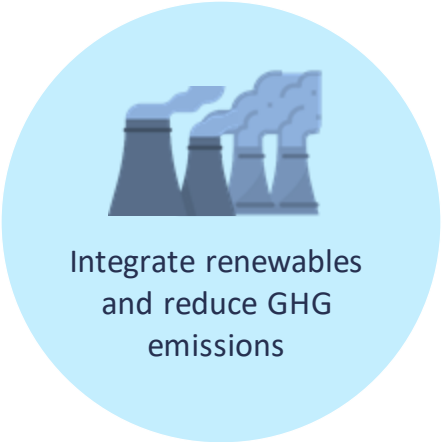
Credit: Edison Electric Institute / Institute for Electric Innovation 2018





Potential Benefits of Energy Storage




Increase grid
resilience, reliability,
and flexibility





Integrate renewables
and reduce GHG
emissions



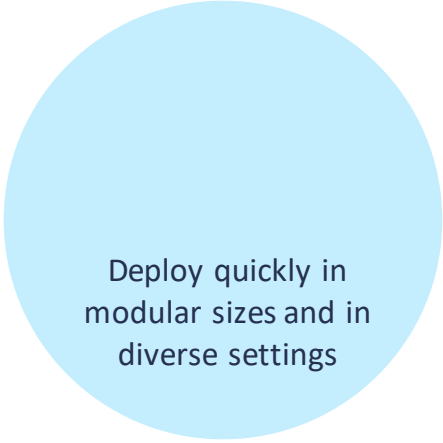
Diversify the energy
resource mix and
create jobs



Empower customer
choice and reduce
energy bills



Reduce generation and
transmission
infrastructure costs

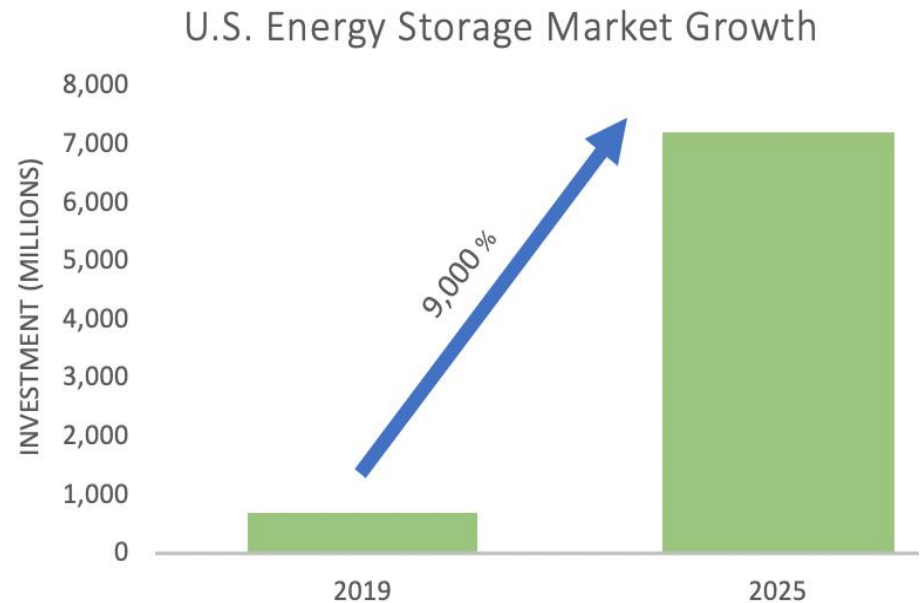


Deploy quickly in
modular sizes and in
diverse settings

Energy storage may play an important role in advancing many of Pennsylvania's energy priorities

Economic Opportunities for Storage

- The U.S. energy storage market is expected to expand from \$712 million in investments in 2019 to \$7.2 billion by 2025.
 - Policy plays an important function in determining where in U.S. new investment will go.
- Several states have implemented storage requirements rather than voluntary goals.
 - Setting legally binding requirement ensures developers will have confidence they need to make investments.
 - This presents a long-term policy signal for storage companies to invest in a growing market.



Data source: U.S. Energy Storage Monitor

Energy Storage in Pennsylvania Today

Energy Storage in Pennsylvania Today

- + **22 operational or announced standalone, utility-scale energy storage projects**

Pumped hydro: *1,070 MW*

Lithium-ion batteries: *18 MW*

Lead-carbon batteries: *12.5 MW*

Thermal storage: *8 MW*

Lead-acid batteries: *3 MW*

- + **Increasing deployment for renewable energy that can benefit from energy storage as a grid-balancing resource**

“Pennsylvania’s Solar Future” goal of 10% solar by 2030



Flywheels in Hazle Township

Beyond legacy pumped hydro, new advanced energy storage projects are in the early stages of deployment in the state

Energy Storage in Pennsylvania Today

- + **Growing levels of utility-scale solar and solar + storage**
- + **Interest in storage as a distribution grid asset to support resilience and reliability**

PUC Docket No. M-2020-3022877

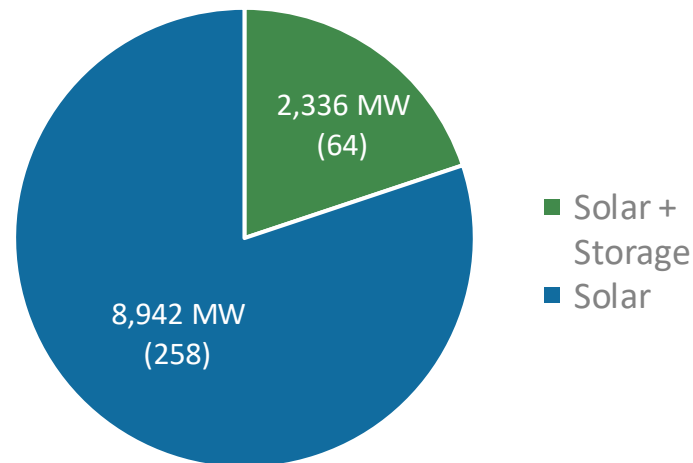
- + **Recent changes to applicable PJM wholesale market rules**

FERC Order 841 requires energy storage market participation options

- + **RGGI participation**

Revenues from RGGI could support and standardize storage projects

Pennsylvania Solar in PJM Queue



The potential for energy storage is a growing topic of discussion in the state and region

Analysis of Energy Storage Potential in Pennsylvania

Overview of Analyses

1. Behind-the-Meter (BTM)

- + **Customer-sited, standalone battery energy storage system designed for a typical commercial customer**

What are the potential benefits to customers (i.e., electricity bill savings) from installing storage “behind-the-meter?”

What additional rates, incentives, or market revenue streams may be needed to encourage deployment?

2. Solar-plus-Storage

- + **Large-scale, hybrid solar-plus-storage system designed as an additive component to a renewable energy power purchase agreement**

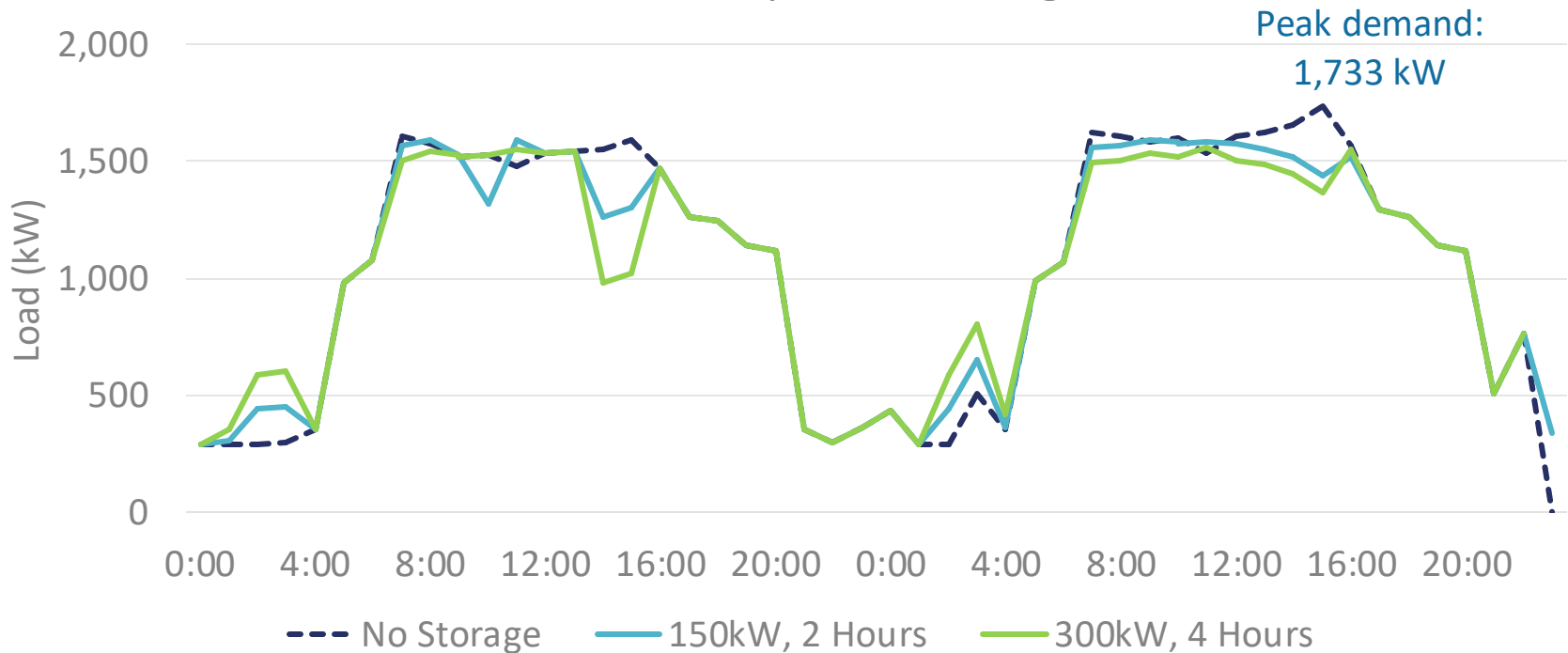
What are the costs and benefits to customers and the grid from including storage as an add-on to a standard solar PPA?

What level of incentive or program support may be needed to encourage this deployment?

Two discrete analyses were conducted in parallel to estimate the benefits from energy storage to Pennsylvania customers

BTM Analysis: Customer Load Profile

Load Profile over Two Days with Economic Dispatch of Storage



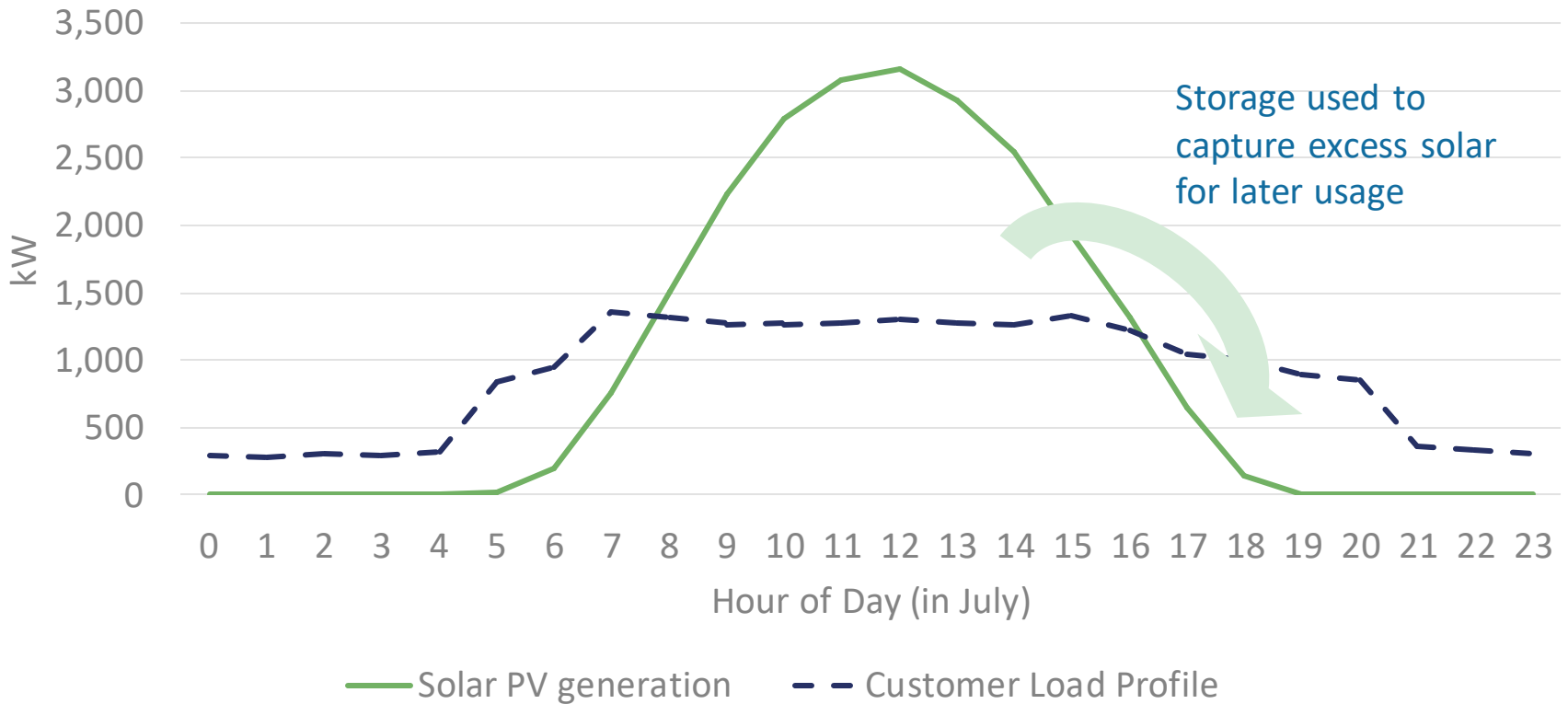
Under the Pennsylvania-specific electricity tariffs analyzed, the primary benefit of energy storage comes from a reduction in demand charges

BTM Analysis: Financial Analysis

	Without storage	With storage					
		100 kW, 2-hr	100 kW, 4-hr	150 kW, 2-hr	150 kW, 4-hr	300 kW, 2-hr	300 kW, 4-hr
Energy Consumption (kWh/yr)	6,694,518	6,709,091	6,715,204	6,715,828	6,724,785	6,735,045	6,752,434
Peak Demand (kW)	1,733	1,638	1,638	1,591	1,591	1,557	1,500
Energy Cost (\$/yr)	\$162,468	\$160,304	\$159,660	\$159,300	\$158,398	\$156,255	\$154,662
Demand Charge (\$/yr)	\$81,889	\$77,386	\$77,044	\$76,379	\$74,979	\$74,690	\$71,550
Annual Bill (\$)	\$244,357	\$237,690	\$236,704	\$235,679	\$233,377	\$230,945	\$226,212
Storage System Costs (\$)		\$69,400	\$133,200	\$104,100	\$199,800	\$208,200	\$399,600
Savings from Storage		\$6,668	\$7,653.03	\$8,679	\$10,980	\$13,413	\$18,146
		2.7%	3.1%	3.6%	4.5%	5.5%	7.4%
NPV		-\$17,261	-\$80,190	-\$37,918	-\$124,827	-\$111,698	-\$284,326

Under current retail rates, BTM energy storage projects generally appear to be uneconomic and suggest that rate reforms could unlock their full value

Solar + Storage Projects



Increasingly, solar PV projects are being paired with battery storage as a means of better matching load of customers and the grid

Solar + Storage Analysis: Results

	Scenario			
	1	2	3	4
Solar Deployment (GW)	11	11	11	11
Solar Paired with Storage	50%	50%	25%	25%
Co-located Storage (GW)	3.1	3.1	1.5	1.5
Storage Duration (hrs)	2.3	2.3	2.3	2.3
Incremental Cost of Storage Component (\$/kW-yr)	\$84.17	\$84.17	\$84.17	\$84.17
Cost Share	50%	25%	50%	25%
Total Program Cost (\$M/yr)	\$129.6	\$64.8	\$64.8	\$32.4
Total Grid & Environmental Value of Solar + Storage Projects (\$M/yr)	\$545.36	\$545.36	\$272.68	\$272.68

Leveraging funding from RGGI or other public programs to buy down the cost of storage could help to accelerate and standardize solar + storage projects

Solar + Storage Analysis

+ Examined a *hypothetical* “time-matched” renewable power program

Targeted to support more solar + storage PPAs that are more closely matched to customer load, in lieu of traditional REC PPAs

Renewable energy supply purchases are 24x7-style – i.e., generation coincides with end-use demand

E.g., Google’s 24x7 carbon-free energy commitment

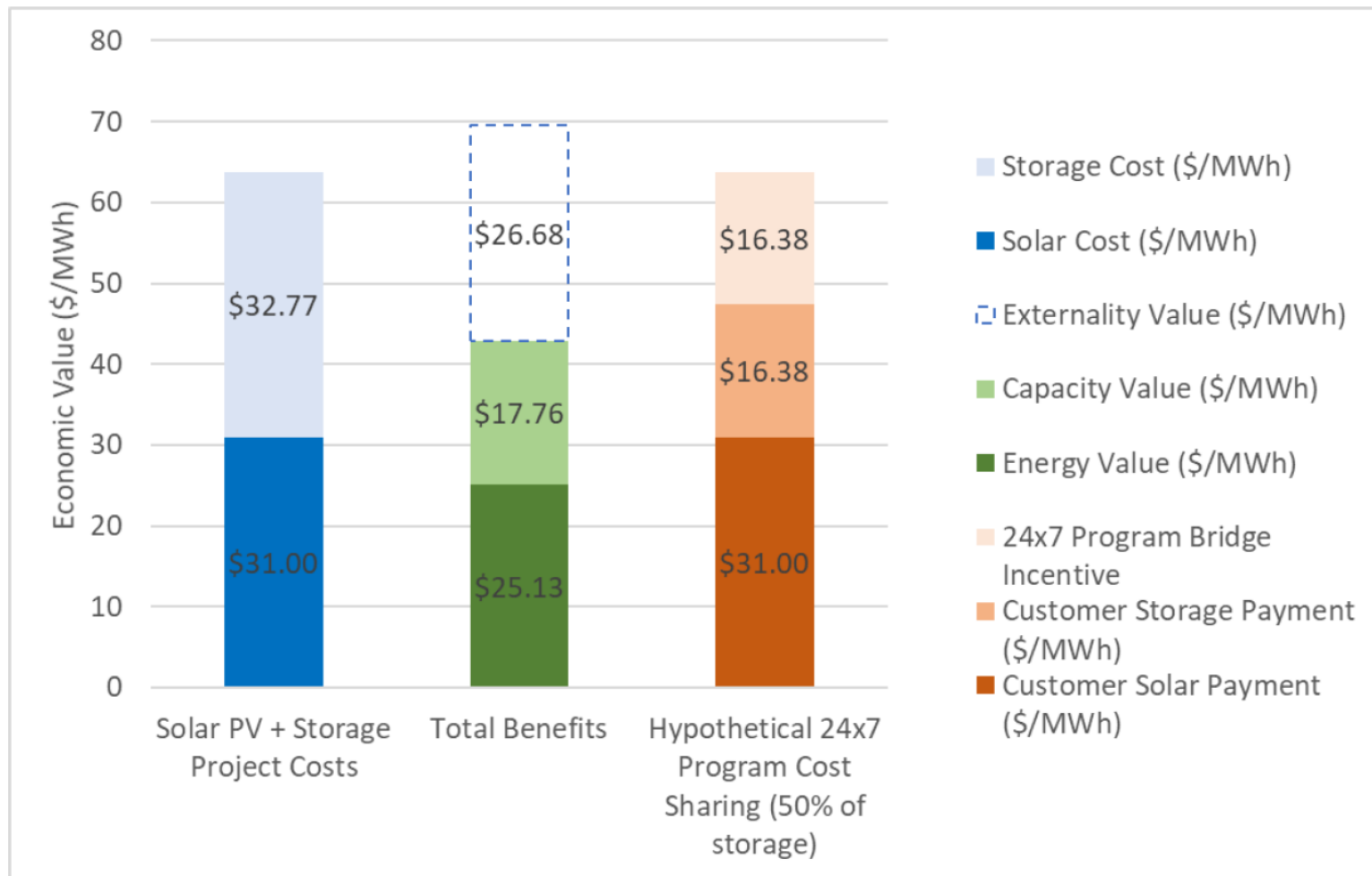
+ Findings:

A typical C&I customer in southeastern PA could match over 80% of their load from renewable energy by adding storage to a solar PPA at a premium of approximately \$33/MWh

This cost could still be less than the total benefits delivered (including externalities)

This option provides an innovative approach with unique benefits that could advance the renewable energy PPA market in Pennsylvania

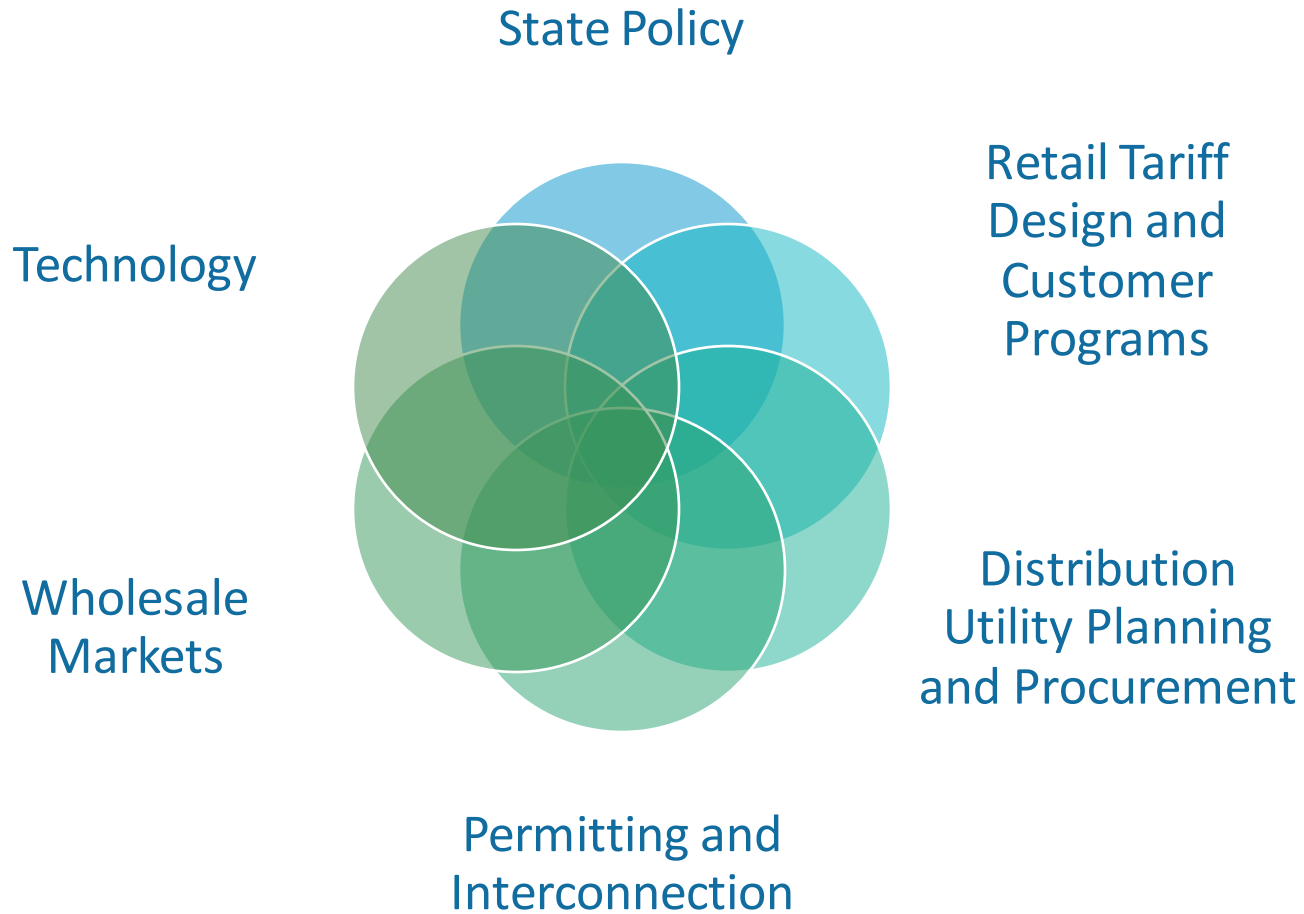
Solar + Storage Analysis: Time-Matched PPA Program



Deploying solar + storage projects could yield significant environmental and energy system benefits, but may benefit from a dedicated solar + storage tariff

Barriers to Energy Storage in Pennsylvania and Policy Recommendations

Barriers and Recommendations



Barriers to Energy Storage in Pennsylvania

State Policy

- Lack of storage or clean energy targets or requirements

Retail Tariff Design and Customer Programs

- Lack of retail programs and rates tied to grid services
- Limited pathways for retail customers to provide grid services through DERs

Distribution Utility Planning and Procurement

- Lack of framework and incomplete valuation of storage in procurement and planning

Permitting and Interconnection

- Cumbersome local permitting and interconnection processes
- Limited local industry experience in advanced battery technologies

Wholesale Markets

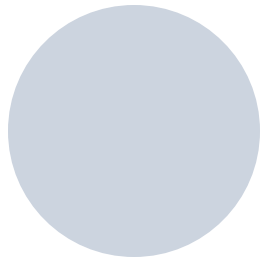
- Restrictive requirements for participation in PJM energy, capacity, and ancillary services markets
- Unclear market participation rules for hybrid systems, storage as transmission, and DER aggregations
- Limits on market access for multiple uses for storage

Technology

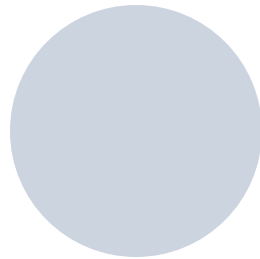
- Potentially high battery costs and technical limitations

Recommendations and Policy Actions

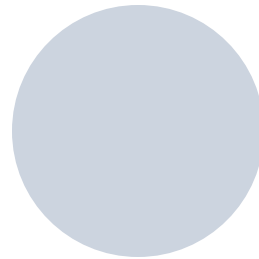
State Policy



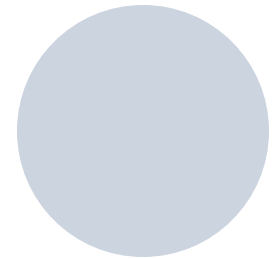
Establish a storage procurement goal or target



Designate public funding to accelerate storage deployment



Convene a statewide “Storage Issues Forum”



Accelerate microgrid deployment at critical facilities

A storage deployment goal linked to 25% of the Solar Futures goal would equate to 1,500 MW of storage by 2030

Comparison of State Energy Storage Policies

State	Goal/Target/Mandate
California	1,825 MW by 2020 (Requirement)
Nevada	1,000 MW by 2030 (Requirement)
Massachusetts	1,000 MWh by 2025 (Requirement)
New Jersey	2,000 MW by 2030 (Goal)
New York	3,000 MW by 2030 (Requirement)
Oregon	Minimum 5 MWh, up to 1% peak load by 2020 (Requirement)
Virginia	3,100 MW by 2035 (Requirement)

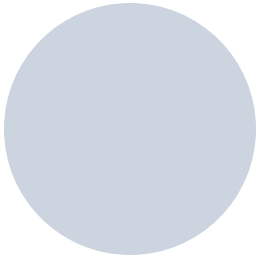
- Seven US states have policies that emphasize the role that energy storage will play in their future energy system
- Virginia currently has the largest energy storage procurement target in the US (in MW terms)

Source: Energy Storage Association

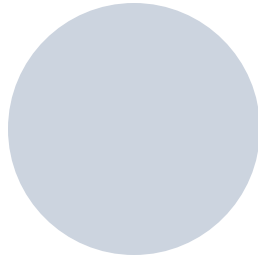


Recommendations and Policy Actions

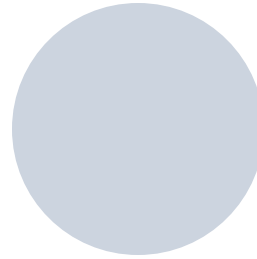
Retail Rate Design and Customer Programs



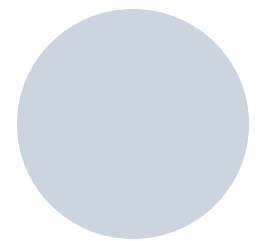
Establish direct
incentive programs
for storage
projects



Expand retail
customer
programs



Enact retail rate
reforms

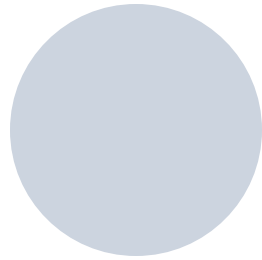


Develop a tariff for
distribution-
connected solar +
storage

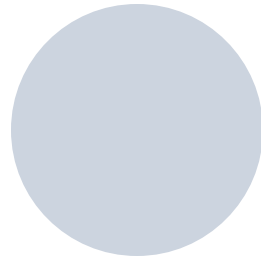


Recommendations and Policy Actions

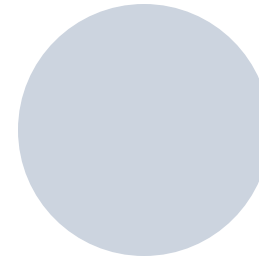
Wholesale Markets



Adopt a multiple-use application framework



Seek wholesale market improvements through PJM stakeholder processes

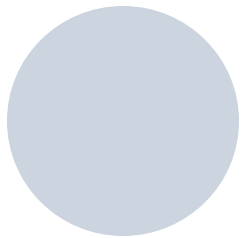


Consider changes to resource adequacy rules and oversight



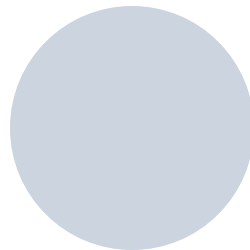
Recommendations and Policy Actions

Distribution Utility Planning and Procurement

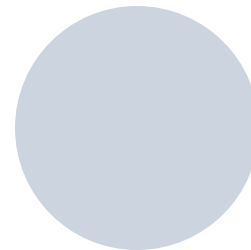


Enhance
distribution
planning and
procurement
processes

Permitting and Interconnection

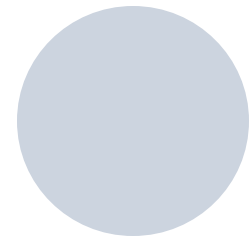


Streamline
permitting on state
and local levels



Update the
interconnection
process for
distributed energy
resources

Technology



Support research
and development
of new energy
storage
technologies

▶ Summary and Timeline of Recommendations	Near-term	Mid-term	Long-term
1. Establish a storage procurement goal or target	■		
2. Convene a statewide “Storage Issues Forum”	■		
3. Designate public funding to accelerate storage deployment	■		
4. Participate in PJM stakeholder processes	■		
5. Consider changes to resource adequacy rules and oversight	■		
6. Accelerate microgrid deployment at critical facilities		■	
7. Develop a tariff for distribution-connected solar + storage facilities		■	
8. Establish direct incentive programs for storage projects		■	
9. Adopt a multiple-use application framework		■	
10. Update the interconnection process for DERs		■	
11. Enhance distribution planning and procurement processes			■
12. Enact retail rate reforms			■
13. Expand retail customer programs			■
14. Streamline permitting on state and local levels			■
15. Support R&D of new energy storage technologies	■	■	■

Energy Storage and RGGI

- + **Revenues from the sale of carbon dioxide allowances under RGGI could potentially be used to support storage market policies and programs**

From 2022-2030, RGGI is estimated to increase gross state product by nearly \$2 billion

- + **For example, RGGI revenues could be used to:**

- + Establish new incentive programs to reduce the upfront costs of energy storage projects

e.g., California's Self-Generation Incentive Program offers incentives for behind-the-meter storage

- + Establish a cost-sharing program to encourage renewable energy buyers to pursue time-matched, solar-plus-storage projects

e.g., New York used \$53 million in RGGI funds to offer "bridge" incentives for solar-plus-storage

- + Offer technical assistance and training on storage-related codes, standards, and safety for local jurisdictions

e.g., New York works with local governments and first responders to understand, plan for, and site energy storage

- + Reduce required AEPS compliance costs for procurement of hybrid resources, like solar-plus-storage
- + Provide funding for EDCs to implement pilots in emerging storage technologies
- + Reduce the cost of site assessments for storage manufacturers

Revenues from RGGI potentially offer an opportunity to accelerate energy storage deployment across Pennsylvania's electricity supply chain

Contact Us



+ Edward Burgess

Senior Director

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(941) 266-0017

Poll:

Of the 15 Recommendations –

**Pick 3 you think are highest priority to
advance energy storage In Pennsylvania**

[Poll Link](#)

Questions?

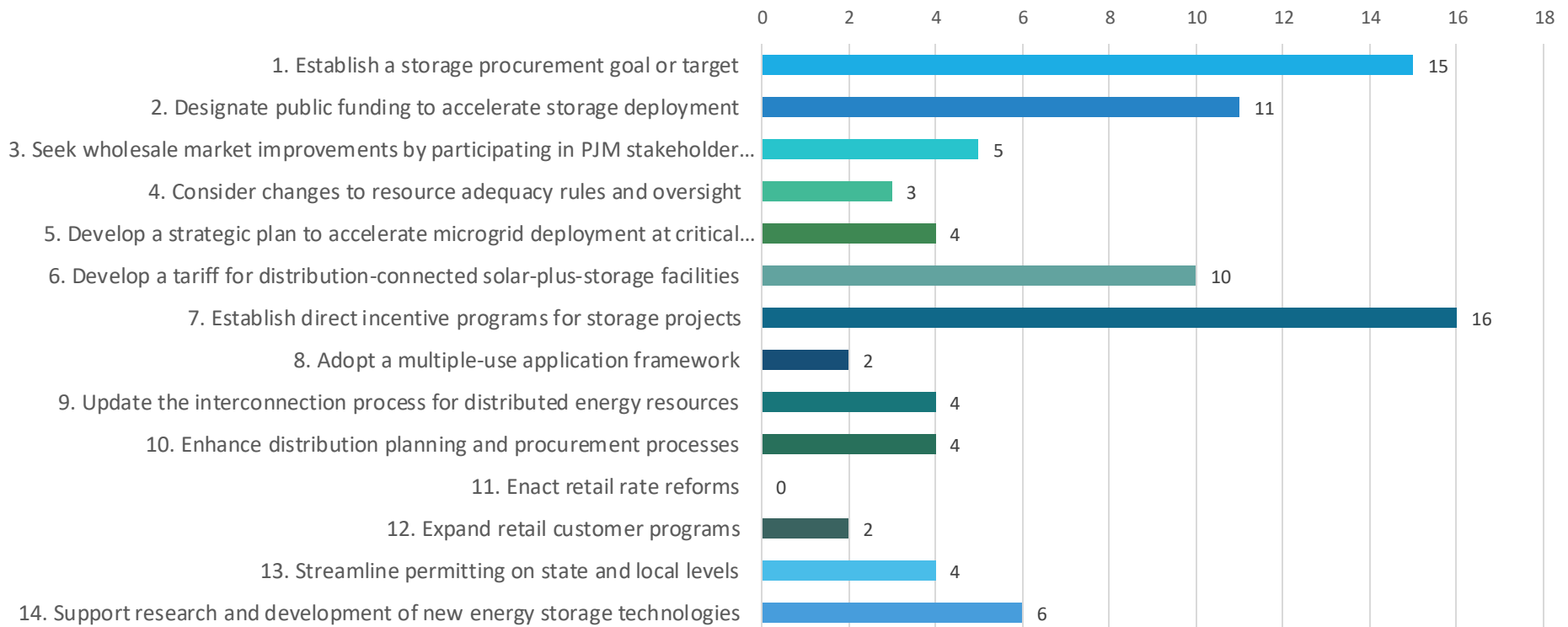
Stakeholder Discussion

1st Recommendation of the PA Energy Storage Assessment – setting an energy storage goal or target – thoughts?

- Considering the energy storage goals other states are setting, what kind of value could that bring for Pennsylvania, and what do you want to see for our state?
- How can PA send a policy signal that they are open for storage business through a storage target or goal?
- [Stakeholder Discussion Poll Link](#)

Discussion Poll Results

Pennsylvania Energy Storage Recommendations - choose your top 3 priorities:



Stakeholder Discussion Poll

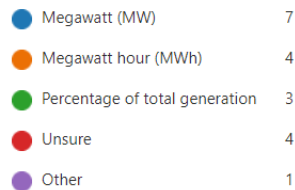
Stakeholder discussion poll:

- What is the best approach for a potential PA storage goal? (MW, MWh, percentage of generation, other, not sure)
- Where do you most want to see market growth for storage? (distributed/customer-sited; utility-scale; both equally important; not sure)
- Which types of storage technologies should PA focus on? (mechanical, electrochemical, thermal, electrical, chemical)
- Review the list of core values for this Consortium - any core values missing?

Discussion Poll Results

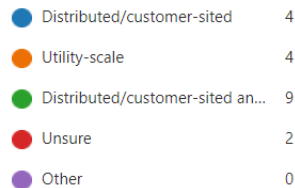
2. What is the best approach for a potential Pennsylvania energy storage goal?

[More Details](#)



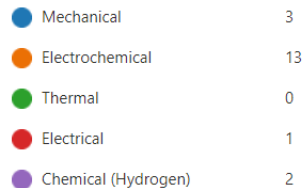
3. Where do you most want to see market growth for energy storage?

[More Details](#)



4. Which energy storage technologies should Pennsylvania focus on?

[More Details](#)



Below are the Core Values identified for the Consortium. Are any missing?

- *Collaboration*
- *Technology and Business Model Neutral*
- *Maximizing Environmental and Economic Benefits*
- *Energy System Resiliency and Modernization*
- *Decarbonization*
- *Environmental Justice*

Stakeholder Discussion

Optimizing PA's Energy Storage Consortia Series:

- What are the key topics we should be discussing? Are there any priority or focus areas that are missing from Strategen's list of 15 Recommendations? What topics can help spur the conversation?
- Who needs to be a part of this forum? Are there any folks you noticed are not on the attendee list who should be here? What partners should we be reaching out to?

Next Steps and Priorities

Steering Committee

- *Fill out expression of interest form for volunteering, by October 5th*
 - **Form link:** <https://share.hsforms.com/1cHczelFRRFieY-6N0VlIJQ32bvg>
- *Desired representatives for steering committee participation:*
 - *Labor*
 - *Environmental justice or environmental organizations*
 - *Manufacturers*
 - *Storage providers*
 - *Utilities and Independent Power Producers (IPPs)*
 - *PJM, PUC*
- *First steering committee meeting to be held October 22nd 1:30-3:00 PM EST*

Next Consortium Meeting Date

- *December 7th 1:00-3:00 PM EST*

Appendix

Connected Solutions – A New Funding Mechanism to Make Battery Storage Accessible to All:

<https://www.cleangroup.org/wp-content/uploads/connected-solutions-policy.pdf>

Energy Storage Policy Best Practices from New England: Ten Lessons from Six States:

<https://www.cesa.org/resource-library/resource/energy-storage-policy-best-practices-from-new-england/>

ESA: Energy Storage Goals, Targets, Mandates: What's the Difference?

<https://energystorage.org/energy-storage-goals-targets-and-mandates-whats-the-difference/>