

Pennsylvania Energy Storage Consortium

MEETING #2

DECEMBER 7, 2021

Welcome & Overview

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Why We're Here & Purpose of Meetings

- Purpose of Consortium series
- Steering Committee role

Mission Statement

- *To engage stakeholders on policy and market topics that identify the opportunities to deploy energy storage for a modern, resilient, cleaner, low-carbon grid for all Pennsylvanians.*

Steering Committee

- Jennifer DeValerio, Senior Manager – Regulatory & Political Affairs, NextEra Energy Resources LLC
- Thad Culley, Senior Manager – Policy, Sunrun
- Tom Bonner, Manager – State Government Affairs, PECO
- Donna Clark, VP Regulatory & General Counsel, Energy Association of Pennsylvania
- Dave Edinger, Fixed Utility Financial Analyst, Pennsylvania PUC
- Joel Harrington, Director of Public Policy & Institutional Affairs – Eastern U.S. Region, Enel North America, Inc.
- Devin McDougall, Senior Attorney, Earthjustice
- Todd Olinsky-Paul, Senior Project Director, Clean Energy Group/Clean Energy States Alliance
- Michael Rooney, Vice President, Rye Development
- Jason Wert, National Market Leader – Renewables, RETTEW

Agenda – Meeting #2, Dec. 7

- I. Welcome & Overview, Housekeeping, Review of Meeting #1**
- II. The Energy Storage Value Proposition**
- III. The Current Landscape of Storage in Pennsylvania: Policy, Deployment & Economics**
 - I. Case studies presented from Enel North America, UGI, PPL, & PA PUC**
 - II. Short moderated panel**
- IV. Stakeholder Discussion and Q&A**
- V. Wrap-Up & Next Steps**

Overview & Housekeeping

- **PA DEP Energy Storage webpage:** <https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/Pages/Energy-Storage.aspx>
 - Registration: All attendees must register to receive future communications from PA_energystorage@strategen.com
 - *Download Strategen’s paper “Pennsylvania Energy Storage Assessment: Status, Barriers & Opportunities
 - *Recording of Meeting #1; Meeting #2 (today) and subsequent meetings will NOT be recorded
- **Structure & Logistics**
 - Four PA Energy Storage Consortium Meetings:
 - Sept. 28, Dec. 7, and March 1, and Q2 in '22 (date TBD): all meetings 1-3pm EST
 - Continuation of Steering Committee as content advisors – scheduled in between Consortium meetings
- **Key Desired Outcomes & Goals**
 - Intention of creating a stakeholder engagement forum – your participation is key!
 - Please use ‘chat’ and ‘raise hand’ functions on Teams
- **Review of Meeting #1 on Sept. 28**

Core Values

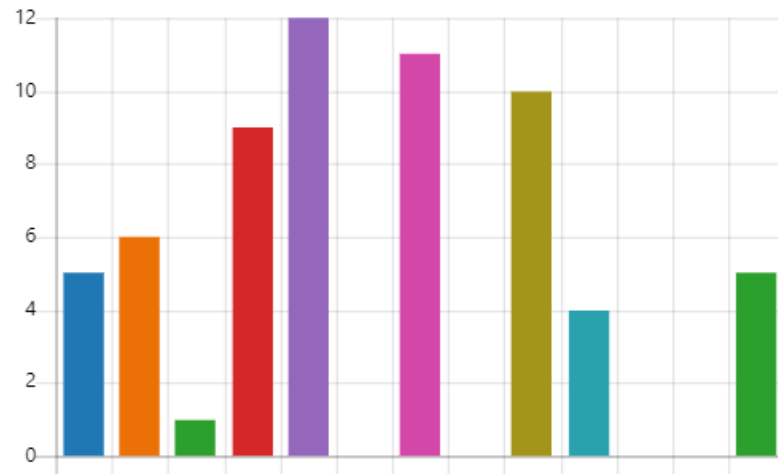
- Collaboration
- Technology and business model neutral
- Maximizing environmental and economic benefits
- Energy system resiliency and modernization
- Decarbonization
- Environmental justice

Introductory Poll Results

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

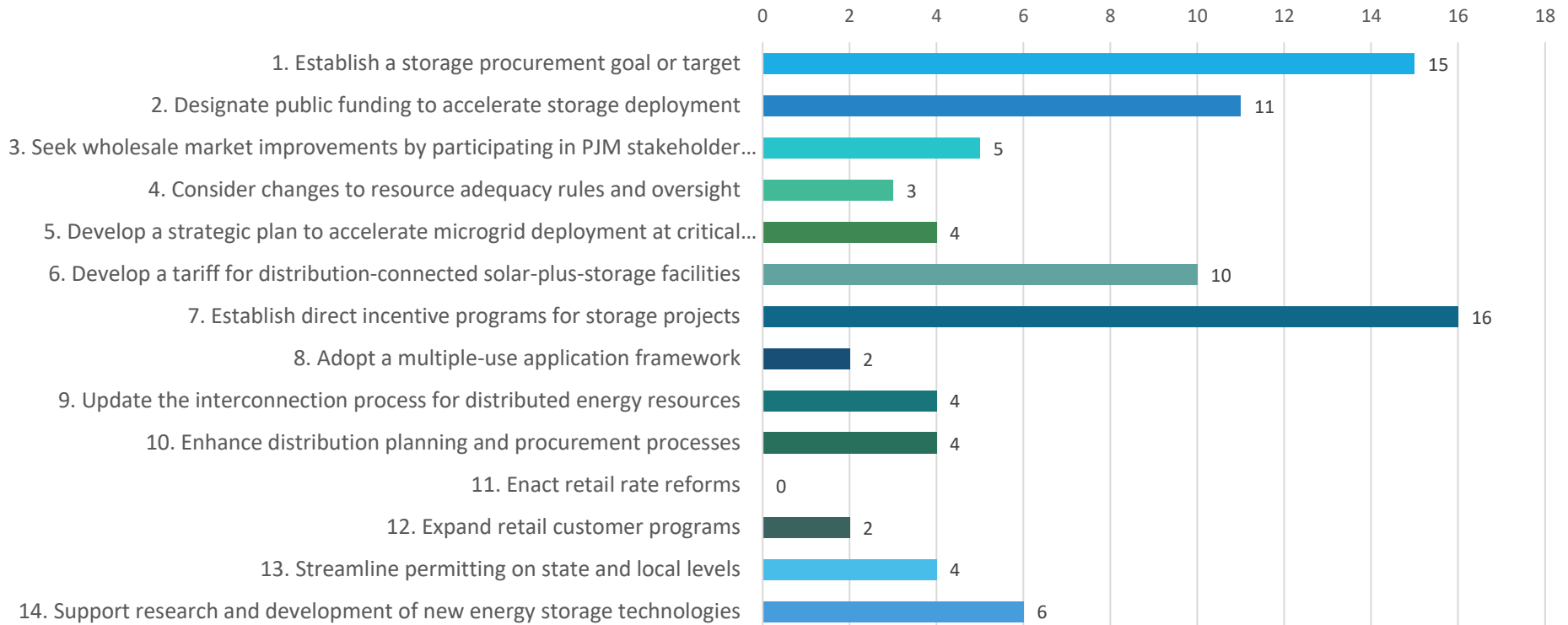
[More Details](#)

● 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



Discussion Poll Results

Pennsylvania Energy Storage Recommendations - choose your top 3 priorities:



Discussion Poll Results

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

[More Details](#)

● Megawatt (MW)	7
● Megawatt hour (MWh)	4
● Percentage of total generation	3
● Unsure	4
● Other	1



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

[More Details](#)

● Distributed/customer-sited	4
● Utility-scale	4
● Distributed/customer-sited an...	9
● Unsure	2
● Other	0



4. Which energy storage technologies should Pennsylvania focus on?

[More Details](#)

● Mechanical	3
● Electrochemical	13
● Thermal	0
● Electrical	1
● Chemical (Hydrogen)	2



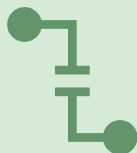
Example Participating Organizations



Remaining Agenda – Meeting #2, Dec. 7

- I. The Energy Storage Value Proposition**
- II. The Current Landscape of Storage in Pennsylvania: Policy, Deployment & Economics**
 - I. Case studies presented from Enel North America, UGI, PPL, & PA PUC**
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- III. Stakeholder Discussion and Q&A**

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



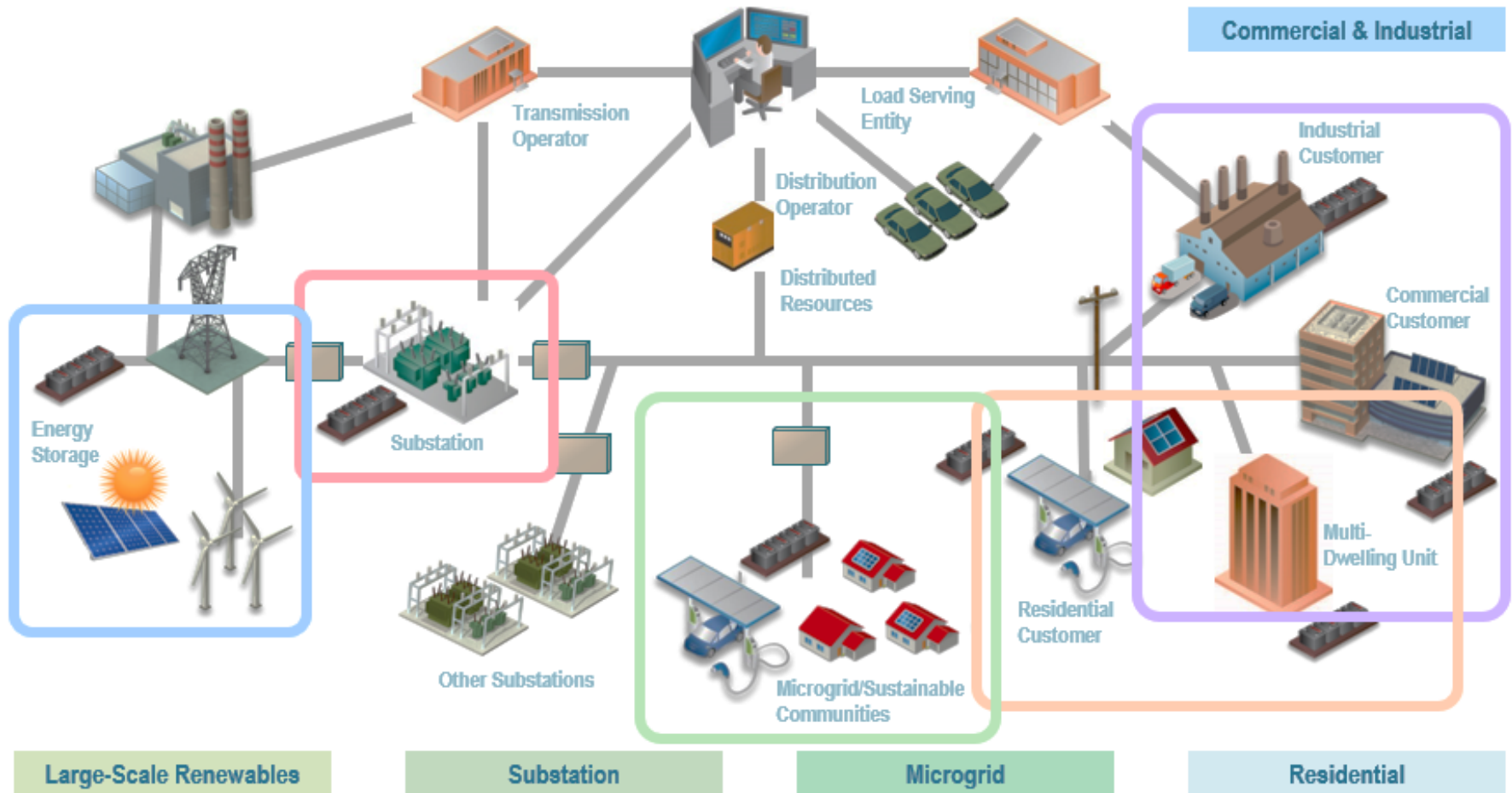
Reduce generation and transmission infrastructure costs



Deploy quickly in modular sizes and in diverse settings

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

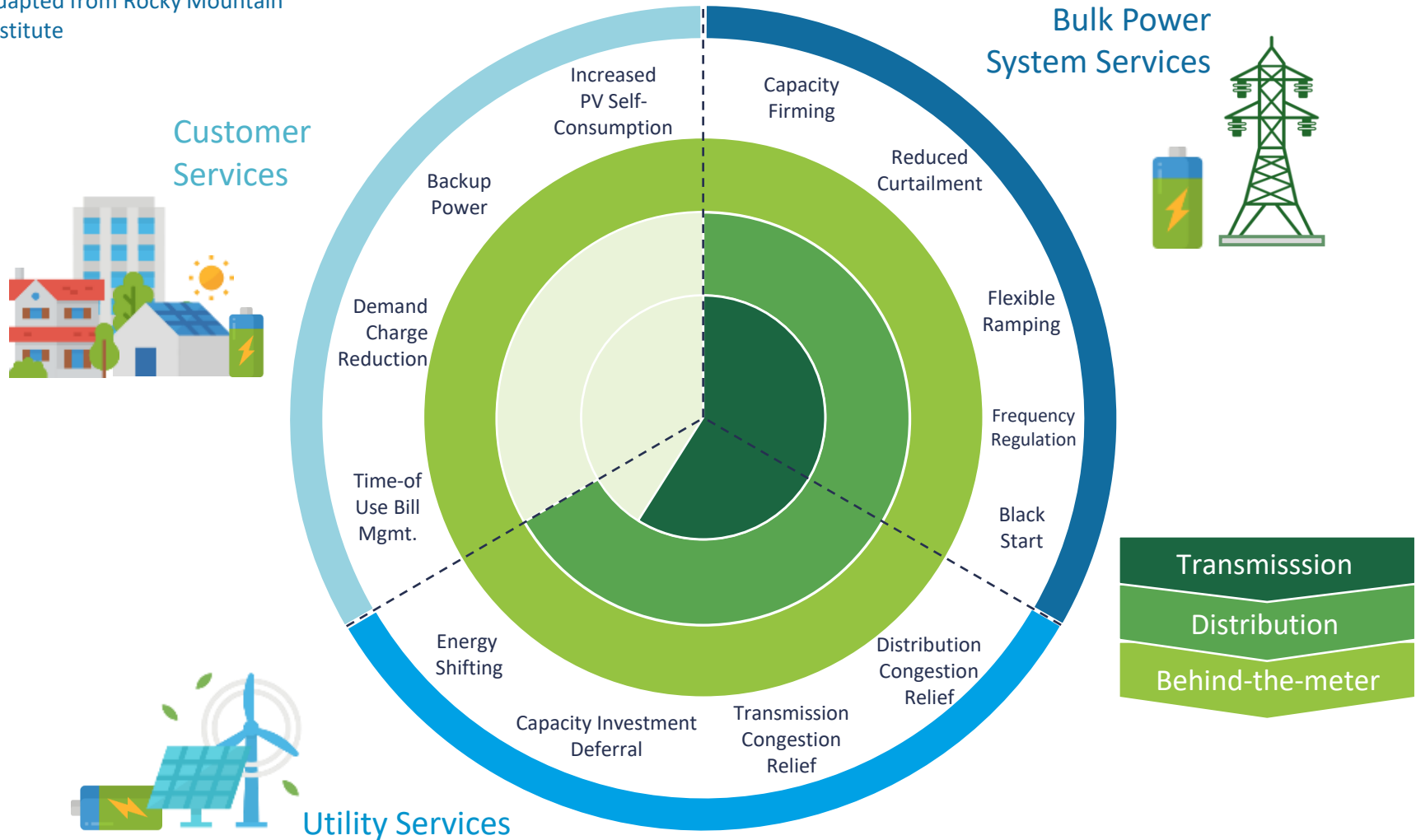
Widespread Potential for Energy Storage



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

The Energy Storage Value Proposition - Agenda

- + **The value proposition of energy storage**
- + **How does the value proposition for storage vary for different parties/who is implementing?**
 - + Energy consumers
 - + Utilities/EDCs
 - + Developers/market participants
- + **Evaluating the value proposition for grid connected storage via where it's located and how it is deployed**
 - + Transmission system
 - + Distribution system
 - + Behind the Meter (BTM)
 - + Hybrid Applications
- + **Energy Storage in PA Today & Challenges to Deployment**

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

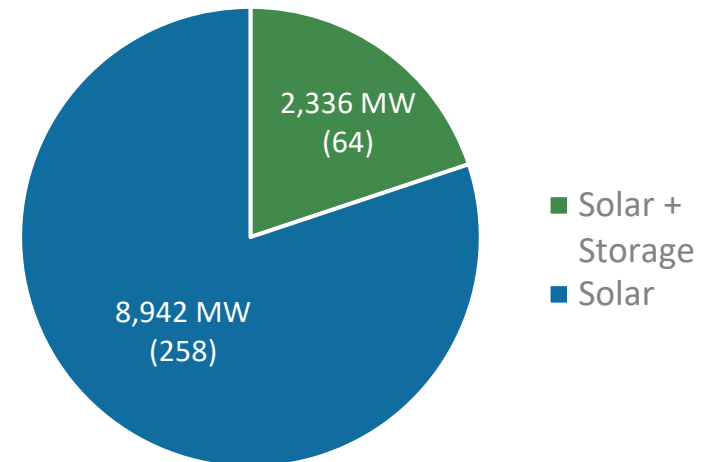
- + **Recent changes to applicable PJM wholesale market rules**

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

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

Enel North America, Inc.

- I. Drivers & Value Proposition for Developers
- II. PA Case Study: Pennsylvania's Largest Battery Storage Project

Presented by: Joel Harrington, Director of Public Policy & Institutional Affairs – Eastern U.S. Region, Enel North America, Inc.



Enel in the United States & Pennsylvania

Changing the face of energy



enel

Enel: A growing green energy giant

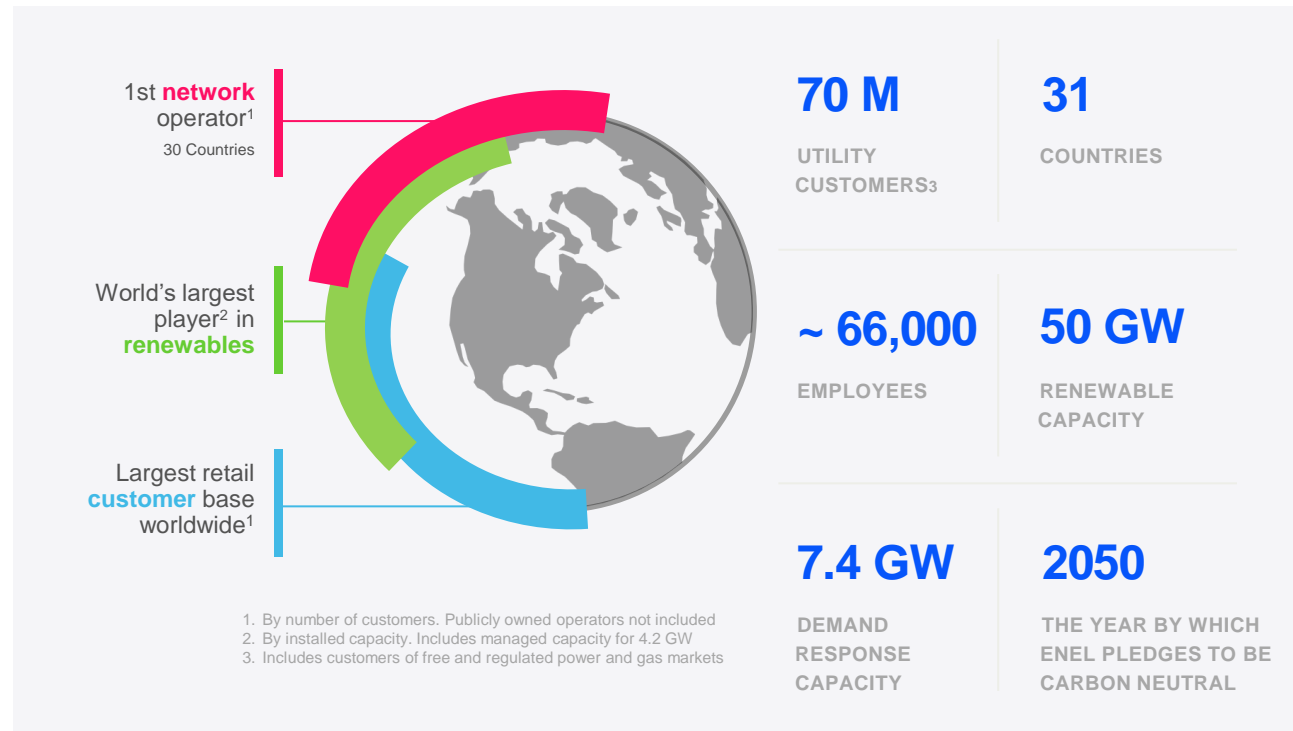


Accelerating the Energy Transition: The focus on decarbonization and electrification

Enel is a multinational power company and a leading integrated player in the global power, gas and renewables markets. We are changing the face of energy as a shaper, leader and enabler of the energy transition.

Enel began as an energy utility over 50 years ago, but today we are not the company we once were.

With a dedicated focus accelerating the energy transition through decarbonization and electrification, we have been listed on the *Dow Jones Sustainability Index* for 17 years and have been included on *Fortune Magazine's* "Change the World" list (2015, 2017, 2018).



Enel X

Overview



Enel X is Enel's business line dedicated to the development of innovative products and digital solutions in sectors where energy is showing the greatest potential for transformation: **cities, homes, industries and electric mobility**. These innovations are key to driving the Energy Transition to be more digital and electric.

4.7 GW

demand response capacity managed across utilities and businesses

MANAGE OVER \$10.5B

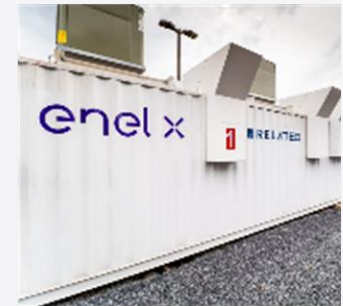
in customers' annual energy spend for about **4,500 business** customers, spanning more than **35,000 sites**

MORE THAN 70

behind-the-meter battery energy storage systems in operation or under contract

~80,000

JuiceBox electric vehicle smart chargers sold, powered by Enel X's JuiceNet, IoT platform for smart management of vehicle charging



Enel in Pennsylvania

Enel has operated in Pennsylvania for more than a decade and has employees who live and work in the Commonwealth.

Currently have 484 MW enrolled in Demand Response programs for some of Pennsylvania's largest commercial and industrial customers, generating ~\$19 million in payments that go back to those customers.



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Policy Implications: Federal and State

Storage Value Proposition: Federal Policy Impacts

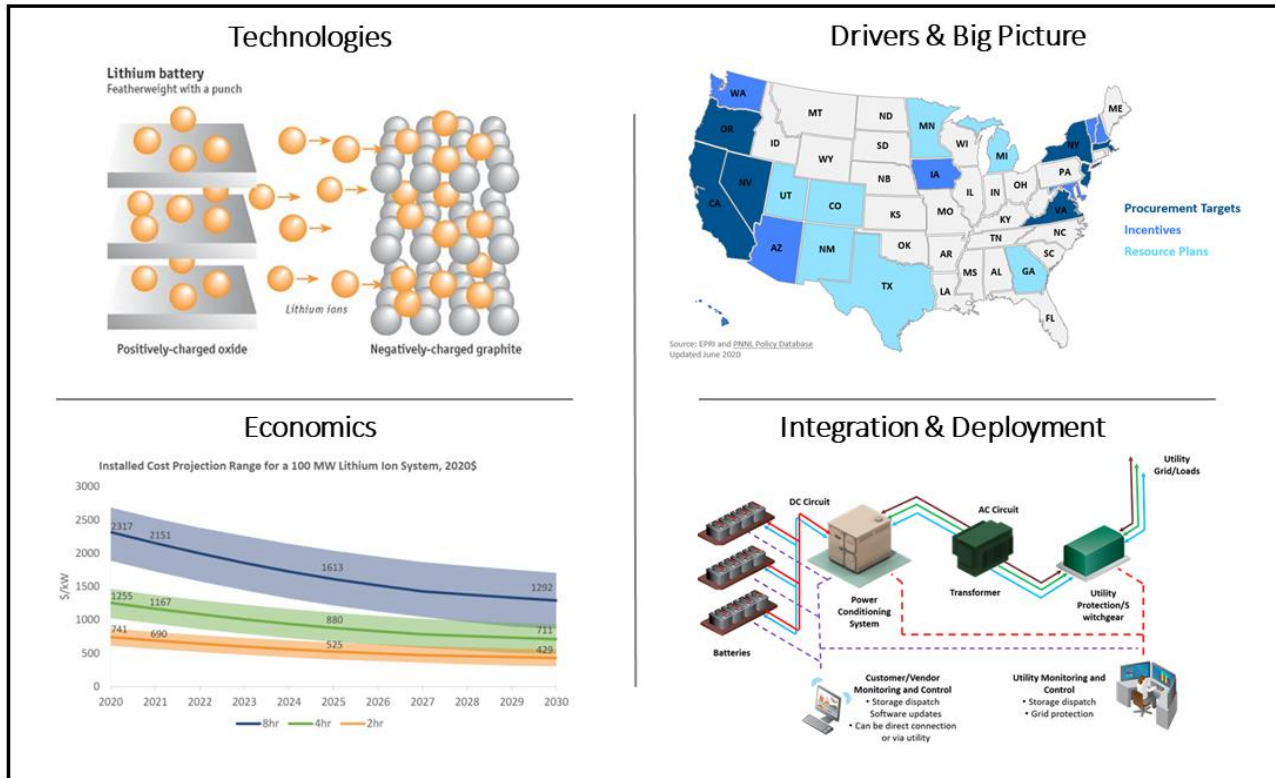
“Build Back Better” Creates New Investment Tax Credit for Energy storage.



- The federal Investment Tax Credit is expanded to include energy storage technology. Technologies such as energy storage will be **eligible for a 6% base credit rate or a 30% bonus credit** rate through the end of 2026.
- Energy Storage Technology – uses batteries and other storage technology to store energy for conversion to electricity and has a minimum capacity of 5 kWh, or stores energy to heat or cool a structure.



Storage Value Proposition: State and Regional Drivers



Source: EPRI

Storage Value Proposition: State and Regional Drivers



Transmission:

- Wholesale market price signals
- Peak shaving
- Renewable Hybrid Integration – smoothing, avoid intermittency



Distribution:

- Non wires solutions
- Resiliency
- Electric transportation

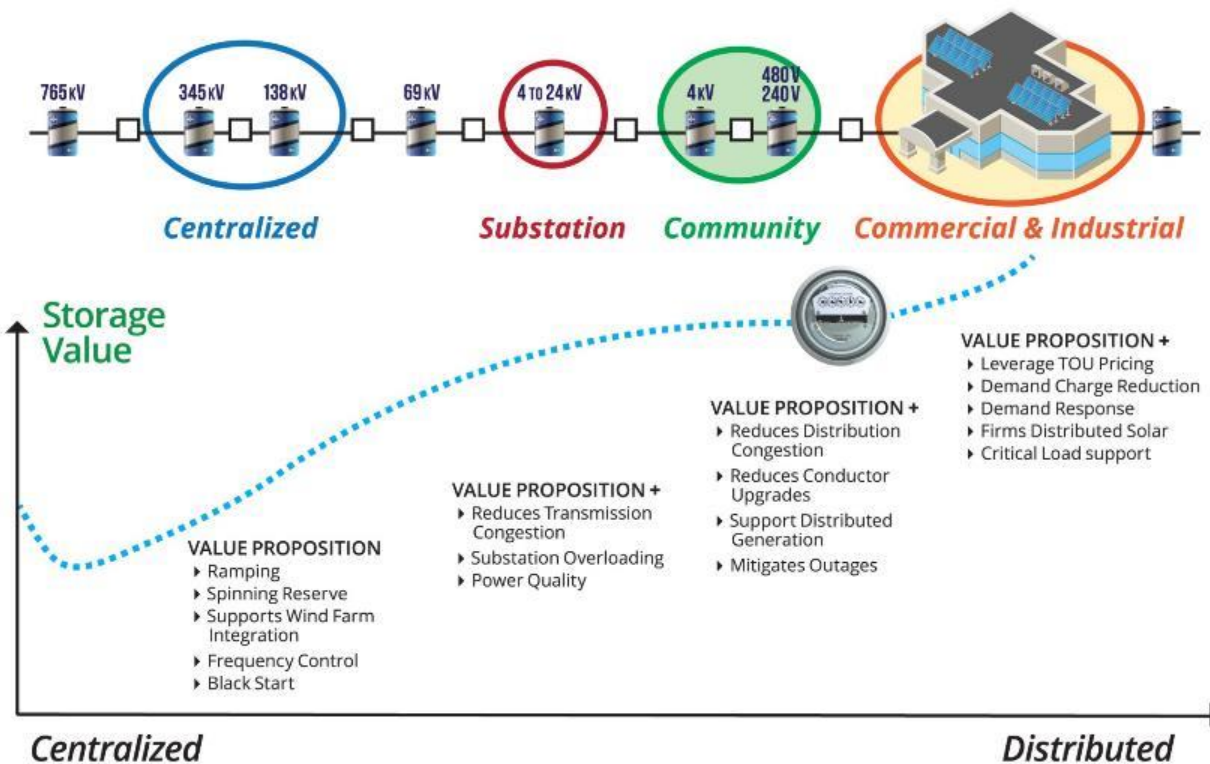


Behind the Meter:

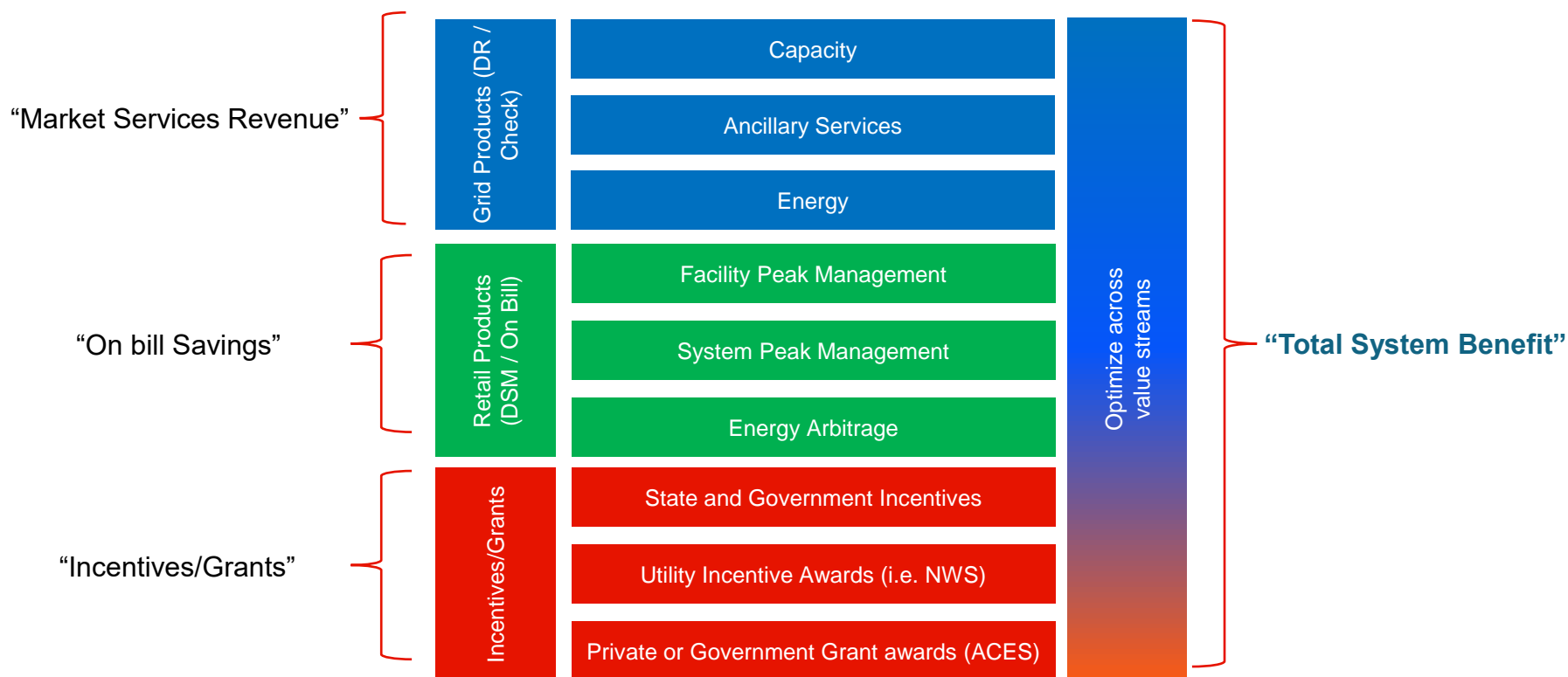
- Decrease energy supply portion of bill
- Peak shaving
- Meet local energy building codes / U.S. Green Building Council

Source: EPRI

Locational Value of Storage



Value stacking for Storage Assets: Asset Management Team



Flexibility Solutions Platform

Connecting any asset to any value-stream

Connect all types of distributed energy assets...



Real-time
Variable Loads



PV & Other
Distributed Generation

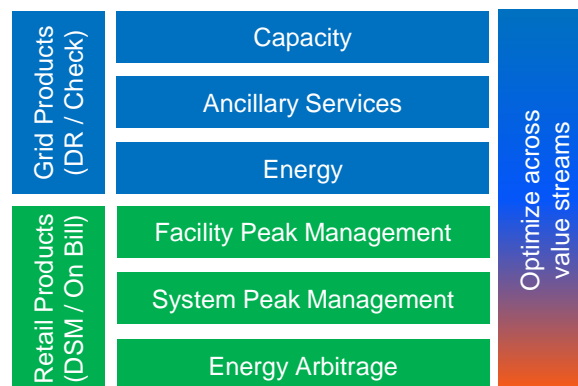


Energy Storage



EV Charging

... and optimize across all available grid and retail value streams



... using a flexible and scalable global “flexibility platform”



Case Study: Utility-Scale Solar + Storage in PA



Enel is developing two utility-scale solar projects in York County with a combined capacity of over 120 MW of clean power

- **Pairing each project with a 20 MW battery system** to help smooth energy supply to the grid and support grid reliability, stability, and resiliency for Pennsylvania consumers
- **One project = 339 jobs, \$21.6 million in labor income** and \$55.1 million in local economic output for York County during construction
- **Agrivoltaics:** Conservation grazing, planting native grasses and forbs, and crop production

“Solar + Storage” Case Study

Making PV+S pencil for University



0.5 MW/2 MWh

lithium-ion battery storage system



1 MW

rooftop solar PV system



11

smart electric vehicle charging stations for public use



\$1.9M

in projected financial value for UMass Boston



- **Zero upfront capital investment by University** that will deliver almost **\$2M in energy savings**.
- **Enel’s fees are entirely performance-based with fully aligned incentives.** Particularly important with complex Application Stacking.
- While TPO solar with performance-based commercials (e.g., PPA) is not new, much of the BTM storage space still requires customers to bear merchant or performance risk.
- **Revenue Stacking, underwritten by Enel X:**
 - Demand charge management
 - Energy Arbitrage
 - Coincident peak management
 - capacity + energy + reserves
 - Utility Daily Dispatch Programs
- Grid services revenues realized via **smart EV chargers** also shared between Enel and University.

Enel Green Power

Investing in the long-term sustainability of our host communities



CREATING SHARED VALUE

CIVIL INFRASTRUCTURE IMPROVEMENT	COMMUNITY WELL-BEING, RECREATION & CULTURAL EVENTS	EDUCATION
ECONOMIC DEVELOPMENT	ENVIRONMENT	RESILIENT AND SUSTAINABLE COMMUNITIES





Thank You

Joel Harrington
Director of Public Policy & Institutional Affairs, Eastern
U.S. Region
joel.harrington@enel.com





Appendix

Enel business

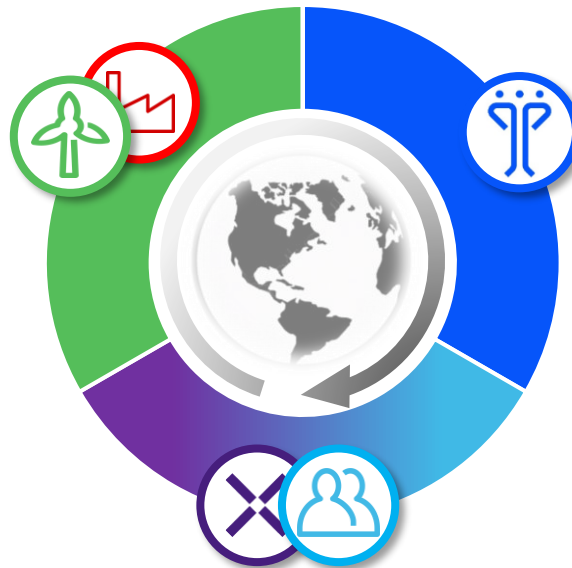


Global Power Generation

Accelerates a sustainable energy transition, increasing **renewables** capacity growth and **decarbonizing** our fleet

Enel X

Enables the energy transition boosting electrification and decarbonization of customers, by providing **innovative services** and **system flexibility**



Global Infrastructure & Networks

Guarantees reliability and quality of service in the energy supply, through **efficient**, **resilient** and **digital** networks

Energy & Commodity Management

Optimizes the Group margin as a single portfolio, finding its **best balance**

Retail

Increases customer value through commodities and “beyond commodities” services also thanks to **customer satisfaction and experience** improvement

UGI Case Study: Battery Storage Deployment

Presented by: Jessica Rogers, Director – Regulatory Strategy, UGI Utilities, Inc.

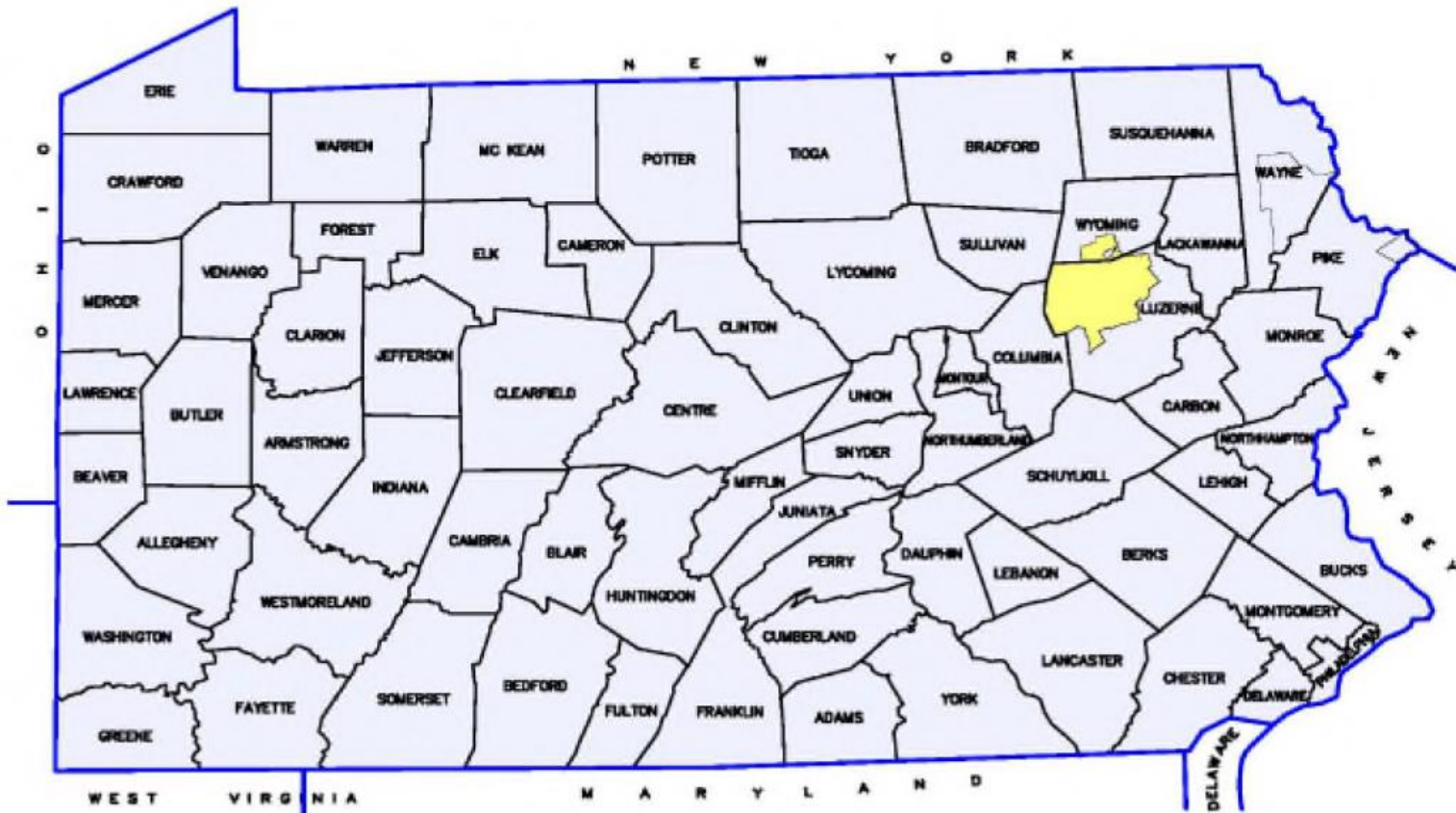
UGI Utilities Battery Storage Proposal

Presented By Jessica Rogers
Director – Regulatory Strategy



Overview of UGI Electric

- Electric distribution company providing service to approximately 65,000 customers
- Service territory includes parts of Luzerne and Wyoming Counties
- Affiliate of UGI Gas, which serves more than 650,000 customers in 45 of Pennsylvania's 67 counties.
- UGI Electric's system contains more than 1,200 circuit miles of overhead and underground distribution lines.
- The service territory is primarily rural in nature.



UGI Electric Battery Project

- Battery project to address a specific reliability issue on a rural radial circuit
 - Terrain surrounding the distribution circuit provides limited options for reliability solutions
 - Steep slopes; railroad tracks; extensive dense foliage
 - Company had already exhausted non-capital solutions, including vegetation management
- UGI Electric evaluated other traditional capital solutions
 - Company concluded the battery was the most cost-effective approach
 - Battery would have covered the entire outage duration for 22 out of 26 outages experienced between 2016 and 2020, and would have reduced the longest outage experienced during those years by more than 50% of its duration.



UGI Electric Battery Statistics

- 1.25 megawatt-hour capacity lithium-ion battery
- 67 customers served by the project
 - The project would have saved over 250,000 customer interruption minutes between 2017 and 2019.
- Cost of the project: \$1.5 million
 - Other reliability solutions were projected to cost anywhere from \$3.0 to \$5.1 million.
- To improve cost effectiveness, UGI Electric proposed that it be allowed to use the battery to participate in the PJM Frequency Regulation Market

Regulatory Process

- UGI Electric proposed the project in a base rate proceeding before the Pennsylvania Public Utility Commission
- Project was opposed by the Bureau of Investigation and Enforcement, the Office of Consumer Advocate, and the group representing Marketers and Suppliers
- Arguments in opposition included the following:
 - Insufficient evidence supporting selection of the project
 - Project would only provide reliability support for a limited number of customers
 - Storage should be classified as a generation asset and not a distribution asset
 - Batteries should not be utility-owned; private developers are better situated to provide the service
 - Proposal to participate in PJM Frequency Market may violate the Competition Act
 - Allowing UGI's proposal would harm the competitive market
 - Revenues associated with participation in the PJM Frequency Market are speculative

Terms of Settlement

- Allows for the inclusion of the battery project in rate base
- Requires additional reporting requirements
- Does not allow UGI Electric to participate in the PJM Frequency Regulation Market
- Specifies that the battery storage proposal is non-precedent setting
“This Settlement reflects a carefully-crafted compromise of the parties’ positions and is based on the small size of the battery and the unique circumstance of the Ruckle Hill Road distribution circuit, including its voltage, its status as a worst performing circuit, the surrounding terrain, the nearby vegetation, and the load served by this circuit.”

Challenges to Further Deployment of Battery Storage Technology by Pennsylvania Utilities

- Reducing barriers to project implementation will be critical to further deployment of storage technology by electric utilities
 - Regulatory certainty that appropriate projects will be approved and not cause excessive delay in the litigation process
 - Timely cost recovery is a critical consideration for utilities
 - Striking a balance between competitive market needs and utility/customer needs
- Allowance in Long Term Infrastructure Improvement Plans and cost recovery through the Distribution System Improvement Charge would make battery storage technology more comparable to traditional solutions

Concluding Thoughts

- Commission's existing electric storage policy proceeding may provide necessary clarity on the use of battery storage technology for reliability projects
 - For ratemaking purposes, when is battery storage technology a "distribution" versus "transmission" versus "generation" asset; should allocations apply, and if so, how?
 - What consideration for possible cost offset, such as participation in the PJM Frequency Regulation market, should be made?
 - Battery storage may be a space for innovative utility-private market solutions (e.g., asset management arrangements); should such possibilities be recognized?
 - As a growing technology, how can the Commission encourage innovative deployment and not be tightly proscriptive?

Thank you!

PPL Case Study: Battery Storage Deployment

Presented by: Dave Gladey, Director of Management & Engineering, PPL Electric Utilities

Battery Energy Storage

David Gladey

Director of Distribution Asset Management & Engineering

December 7, 2021

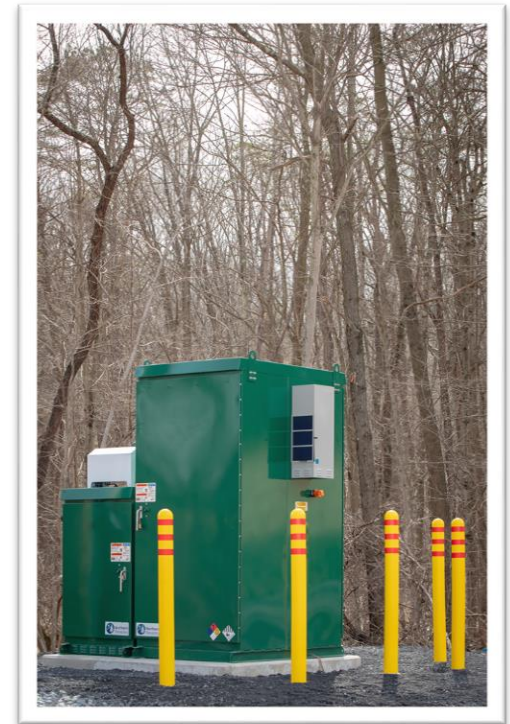
Our Journey

Problem: Annual Reliability Concerns

- Repeated customer outages in a rural area near Harrisburg
- Traditional solutions were cost prohibitive

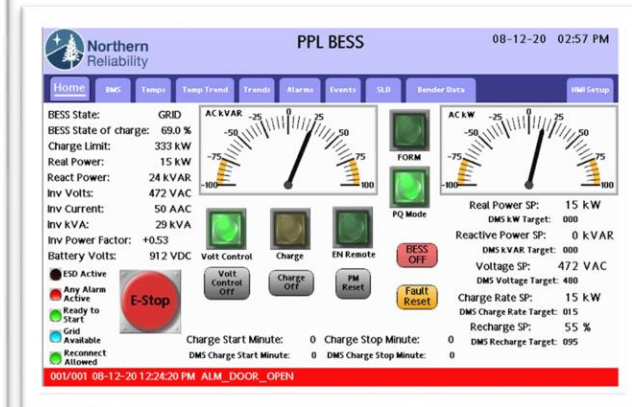
Solution: Battery Storage

- Battery storage can be a cost-effective, innovative solution to improve reliability while simultaneously reducing the need for expensive new tie lines
- This location was perfect since it was at the end of a single-phase tap over 10 miles from a substation on a circuit with reliability challenges



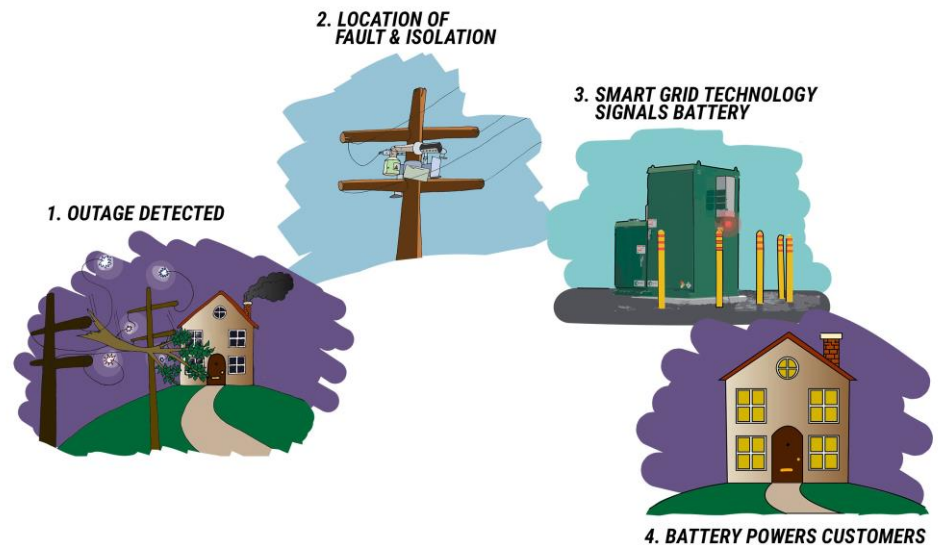
Why Battery Storage?

- Improved grid reliability
- Operational efficiency
- Reduced outage duration
- Cost-effective solution
- Reduced human intervention and reduction of human error



How it Works

- Activates automatically when needed to keep customers in power
- Can be controlled remotely from Operations Center
- Associated with a new single-phase Viper for isolation
- Comprised of stacked banks of lithium-ion batteries
- Provides power to at least 8 customers for 6+ hours



Lessons Learned

- How to maintain public safety and the distribution system's integrity
- How to communicate with the battery using our Distributed Energy Resource Management System
- How to safely isolate our system from the "intentional island" we create when using the battery to restore customers during an outage
- How to protect the distribution system and the public if a fault were to occur on the "intentional island"



Next steps

- Battery storage is a non-wires alternative solution that we actively consider when evaluating reliability improvements
- We continue to evaluate key areas within our distribution grid where battery storage would provide significant value to our customers

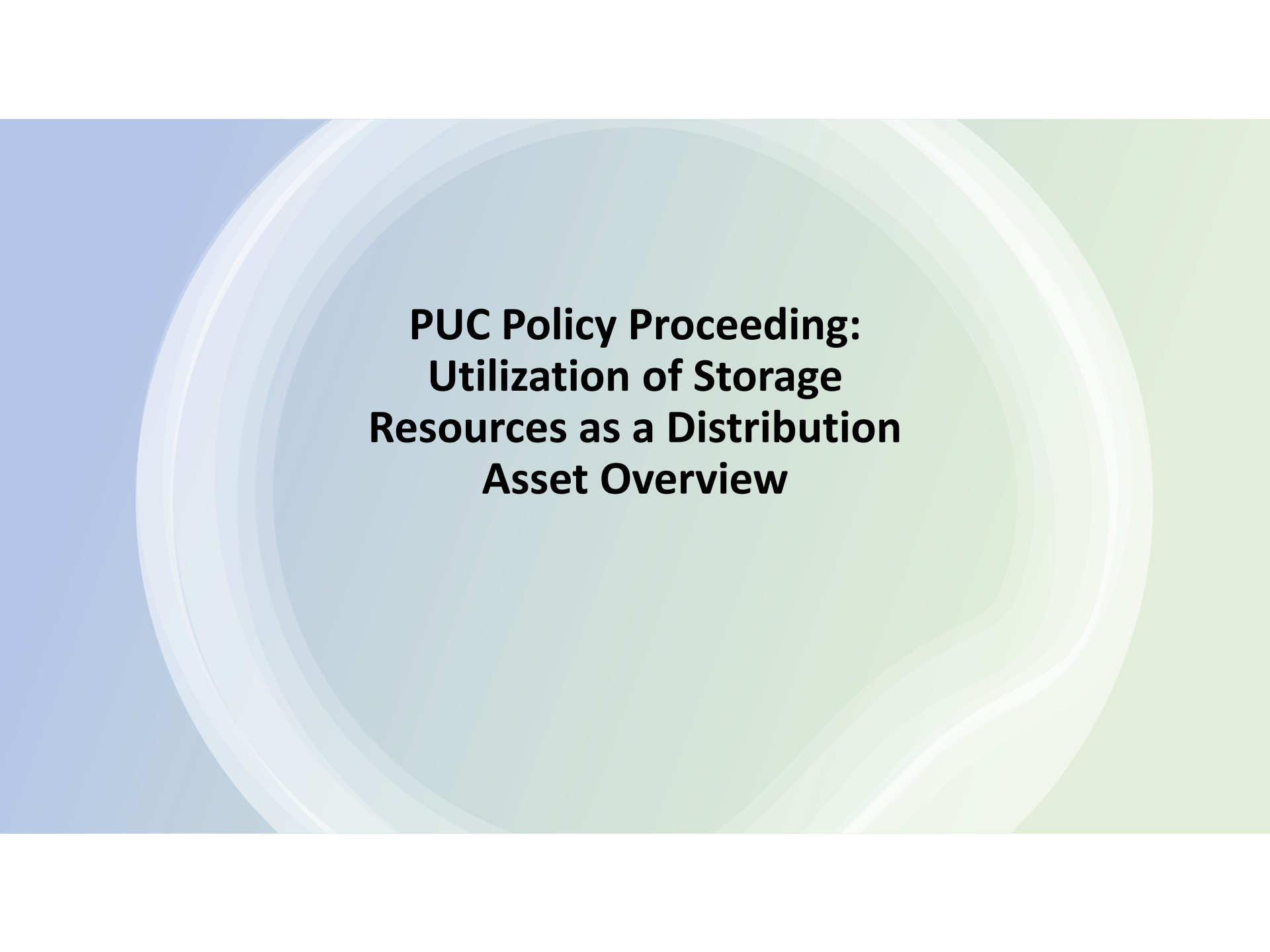


Thank you!



PA PUC: Utilization of Storage Resources as a Distribution Asset

***Presented by: Dave Edinger, Fixed Utility Financial
Analyst, Pennsylvania Public Utility Commission***



**PUC Policy Proceeding:
Utilization of Storage
Resources as a Distribution
Asset Overview**

Background

- Secretarial Letter issued December 3, 2020
- Three questions asked
 - What applications can electric storage provide as a distribution asset for utilities that would facilitate improved reliability and resiliency?
 - What are the defining characteristics of electric storage used for distribution asset planning as distinguished from generation resources? What thresholds, if any, would classify electric storage as a generation resource and therefore outside permitted distribution ratemaking and recovery?
 - Is it prudent for utilities to include electric storage in their distribution resource planning and, if so, where and under what circumstances? Further, is it appropriate for utilities to include such investments in rate base?

Outcomes of December 2020 Secretarial Letter

- Two prominent themes
 - Agreement that energy storage can enhance reliability and resiliency on the distribution grid
 - Disagreement on how energy storage should be *deployed* on the distribution grid
- Several more questions raised
- Second Secretarial Letter issued August 12, 2021

August 12 Secretarial Letter

- Seven additional questions

1. What are the parameters that would allow for the use of energy storage on the distribution grid? For example, what factors should be used in the consideration of the energy-storage project? Should the energy-storage project meet certain thresholds and demonstrate certain requirements, e.g., demonstration of cost-effectiveness as compared to alternate measures, demonstration of need, required RFPs to solicit potential third-party providers, limitations on project size and scope, etc.?
2. What EDCs have undertaken energy-storage initiatives as a pilot program and what were the results and lessons-learned?
3. Under what circumstances is it appropriate to deploy energy storage as compared to traditional infrastructure upgrades?
4. Who should own an energy-storage asset? EDCs, third-party vendors, or some combination of both?
5. What processes should the Commission use to review requests to utilize energy storage as a distribution asset and recover associated costs?
6. What cost recovery mechanisms should be implemented for the ownership and operation of energy-storage assets?
7. What are the appropriate models and limitations necessary to allow energy storage to participate in wholesale power markets?

Panel

Moderator: Ed Burgess, Senior Director, Strategen

Dave Edinger, Fixed Utility Financial Analyst, Pennsylvania Public Utility Commission

Jessica Rogers, Director – Regulatory Strategy, UGI Utilities, Inc.

Dave Gladey, Director of Management & Engineering, PPL Electric Utilities

Joel M. Harrington, Director of Public Policy & Institutional Affairs - Eastern U.S. Region, Enel North America, Inc.

Stakeholder Discussion

- **Any additional work that needs to be done between this meeting and future meetings in terms of additional analysis on sort of value proposition?**
- **In addition to or building off the Strategen "PA Energy Storage Assessment" report, what are folks interested in seeing beyond that to help move ball forward in various policy discussions?**

Wrap-Up & Next Steps

Next Consortium Meeting Date:

- *March 1st, 1:00-3:00 PM EST*

Stakeholder Engagement & Feedback:

- PA_energystorage@strategen.com