

# An Introduction to Battery Energy Storage Systems

**Camille Warner**

Project Manager, Clean Energy Siting Team, NYSERDA

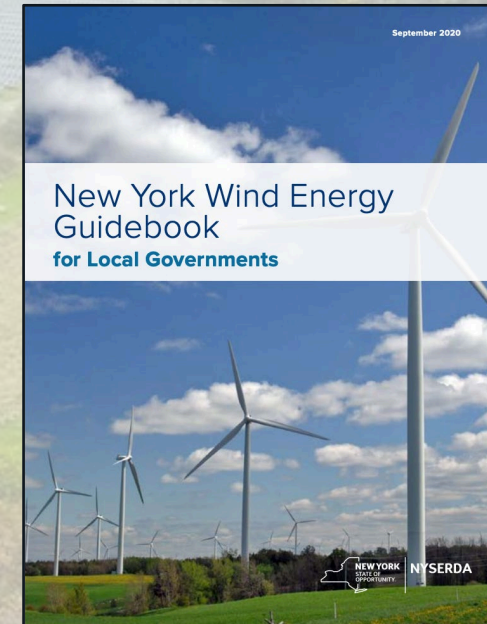
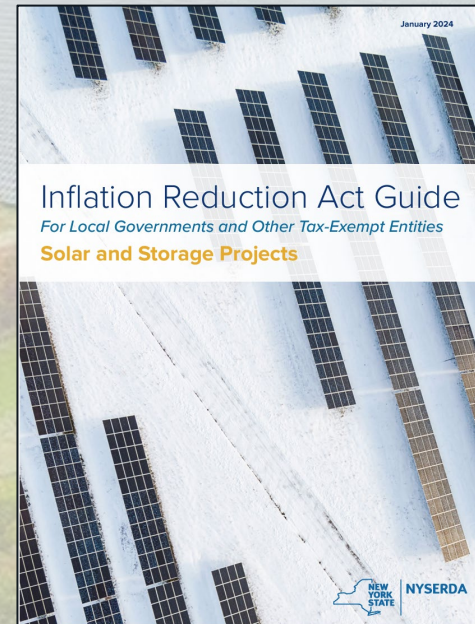
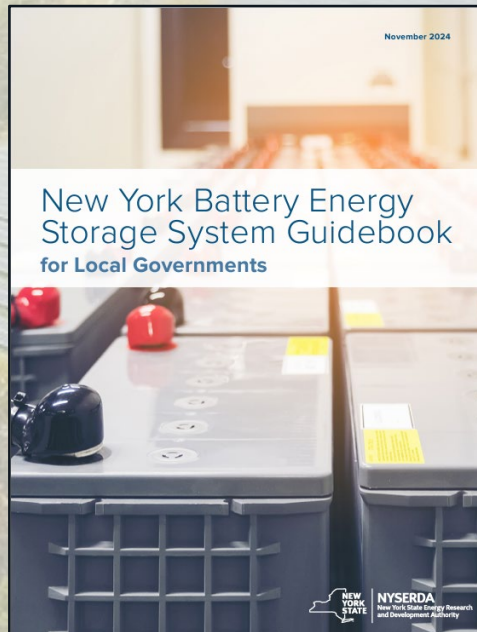
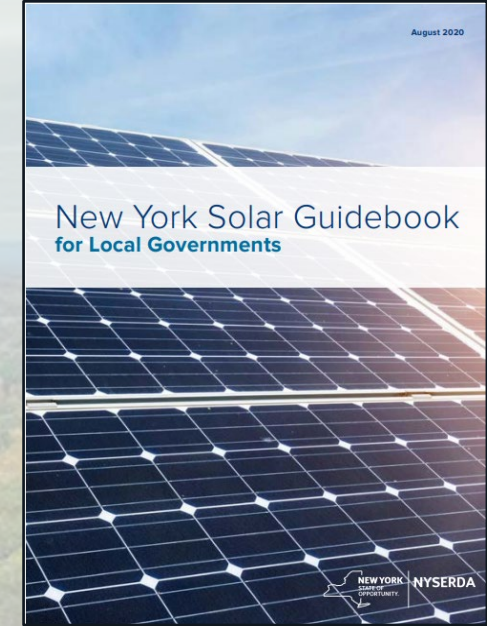
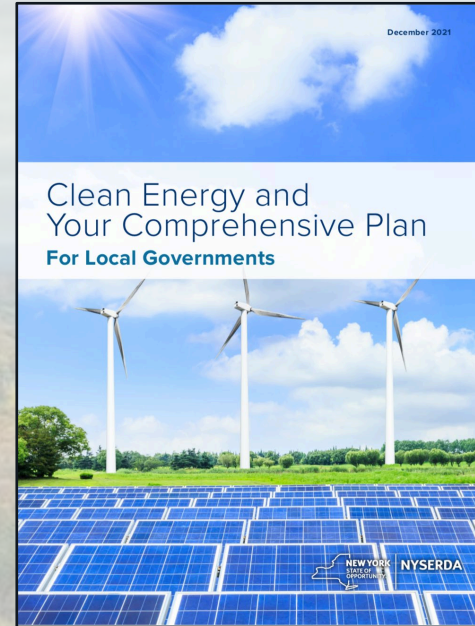
[cleanenergyhelp@nyserda.ny.gov](mailto:cleanenergyhelp@nyserda.ny.gov)

# Introduction

## Clean Energy Siting Team

[cleanenergyhelp@nyserderda.ny.gov](mailto:cleanenergyhelp@nyserderda.ny.gov)

[www.nyserderda.ny.gov/Siting](http://www.nyserderda.ny.gov/Siting)



# Agenda

- **Overview of NYS Energy Storage Initiative**
- **Intro to Battery Energy Storage Systems**
- **Why do we need BESS?**



# Overview: NYS Energy Storage Initiative

# Energy Storage Initiative

A critical resource for enabling New York's clean energy future

## Benefits:

- Avoid CO<sub>2</sub> emissions
- Reduce the impact of outages
- Allow intermittent renewables to be available during peak demand
- Create 30,000 jobs by 2030 in New York


## NYSERDA Opportunities

- ~\$1.6 billion market acceleration bridge incentives: available for retail and bulk storage systems
- Technical Assistance: permitting, interconnection, customer acquisition, and financing resources

**2025 STATEWIDE ENERGY STORAGE TARGET**  
**1,500 MW**

**2030 STATEWIDE ENERGY STORAGE TARGET**  
**6,000 MW**



A row of white battery energy storage systems (BESS) containers is shown outdoors on a gravel surface. The containers are arranged in a line, and each has a door with a handle and a lock. The background shows a clear blue sky and some greenery. The text "Introduction to Battery Energy Storage Systems" is overlaid in the center in a large, bold, blue font.

# Introduction to Battery Energy Storage Systems

# Battery Energy Storage Systems

- Potential Energy
- Energy Storage = Conversion of kinetic, electrical, or other forms of energy to potential energy.
- Examples of stored energy:
  - Electrical
  - Gravitational
  - Mechanical
  - Thermal



Pumped-Hydro Energy Storage



Beacon Power Plant  
Flywheel Energy Storage – 20 MW

# Battery Energy Storage Systems

## Technology Types



### Pumped Hydroelectric



### Mechanical

- Compressed Air Energy Storage
- Flywheel



### Electrochemical

- Lead acid, Lithium Ion, Sodium Sulfur, Sodium Nickel Chloride
- Flow batteries – Vanadium redox, Zinc-bromine



### Thermal

- Sensible – Molten Salt, Chilled Water
- Latent – ice storage, phase change materials
- Thermochemical storage



### Chemical (Hydrogen)

- Power-to-Power (Fuel Cells, etc)
- Power-to-Gas



# Battery Energy Storage Systems

- Battery energy storage can comprise a variety of different electrochemical makeups:

- Lithium ion
- Lead acid
- Nickel-based
- Flow batteries

- BESS building blocks:

- Cells
- Modules
- Racks



# Battery Energy Storage Systems

|                              | Lead Acid   | Sodium-Sulfur | Flow Batteries | Lithium-Ion  |
|------------------------------|-------------|---------------|----------------|--------------|
| <b>Round-trip efficiency</b> | 70-85%      | 70-80%        | 60-80%         | 85-95%       |
| <b>Typical duration</b>      | 2-6 hours   | 6-8 hours     | 4-12 hours     | 0.25-4 hours |
| <b>Time to build</b>         | 6-12 months | 6-18 months   | 6-12 months    | 6-12 months  |
| <b>Operating cost</b>        | High        | Moderate      | Moderate       | Low          |
| <b>Space required</b>        | Large       | Moderate      | Moderate       | Small        |
| <b>Cycle life</b>            | 500-2,000   | 3,000-5,000   | 5,000-8,000+   | 2,000-6,000+ |
| <b>Technology maturity</b>   | Mature      | Commercial    | Early-moderate | Commercial   |

# Battery Energy Storage Systems (BESS)

**Residential**



**Commercial**



**Utility**

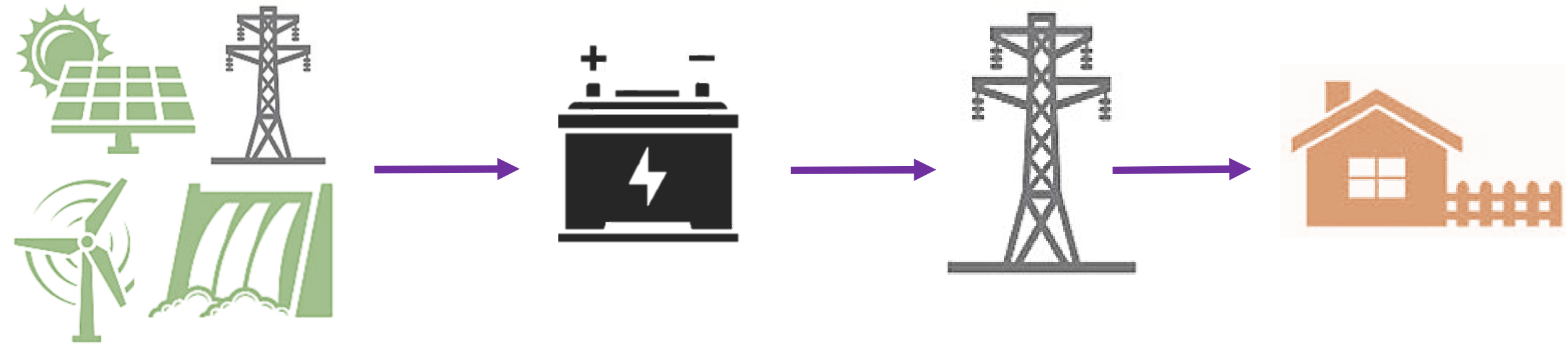


Behind-the-meter  
“Customer-side”

Front-of-the-meter  
“Utility-side”

# Why are we talking about batteries?

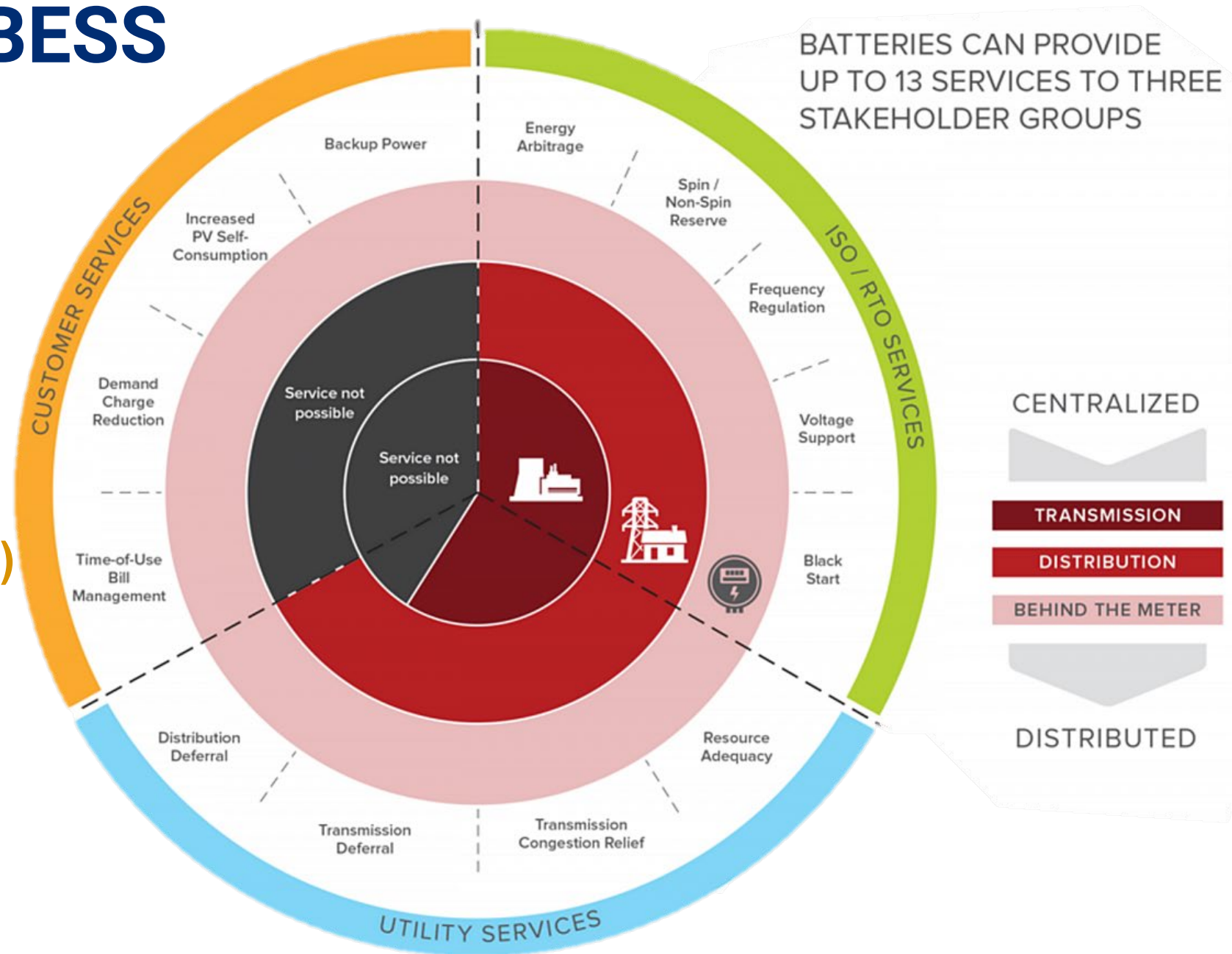
As New York State transitions to renewable energy technologies like wind and solar, energy storage will play a critical role by providing power when the wind isn't blowing, or the sun isn't shining.



# Applications for BESS

## Services by Group:

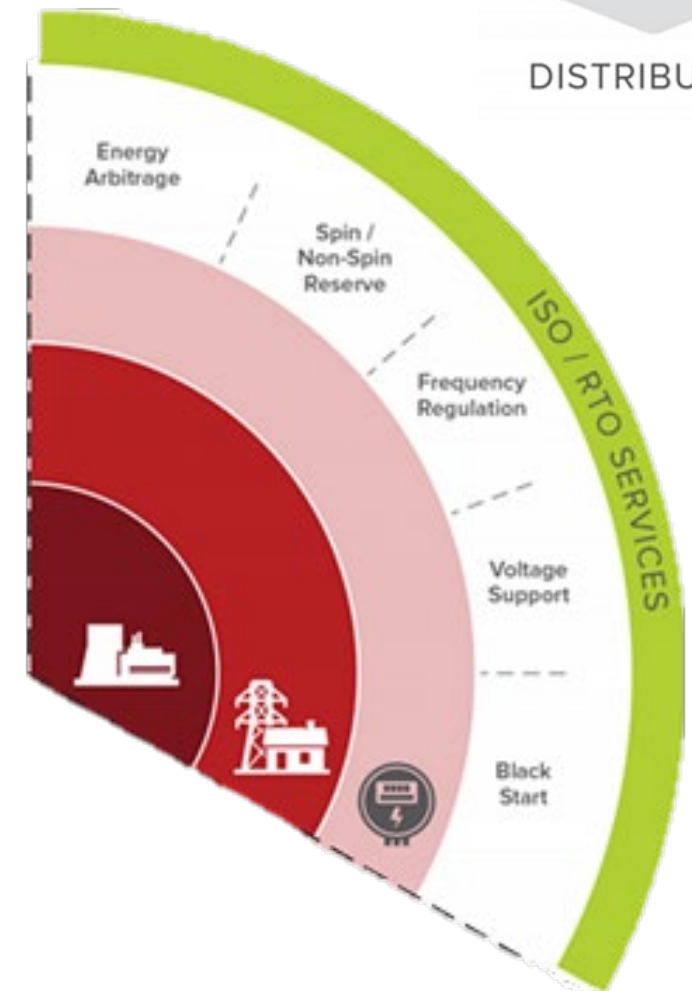
1. **Grid Services (ISOs / RTOs)**
2. **Utility Services**
3. **Customer Services (Residential/Commercial)**



# Grid Services (ISOs, RTOs)

- **Energy Arbitrage** → Charging when electricity costs/demand are low, discharging when high; can also reduce curtailment of renewables
- **Spin/Non-Spin Reserve** → Dispatch energy as needed to ensure that grid supply = demand
- **Frequency Regulation** → Quickly ensure generators are synchronized for grid stability
- **Voltage Support** → Provide/absorb voltage as needed for grid stability
- **Black Start** → Help large generators come online following system failure

“Ancillary Services”



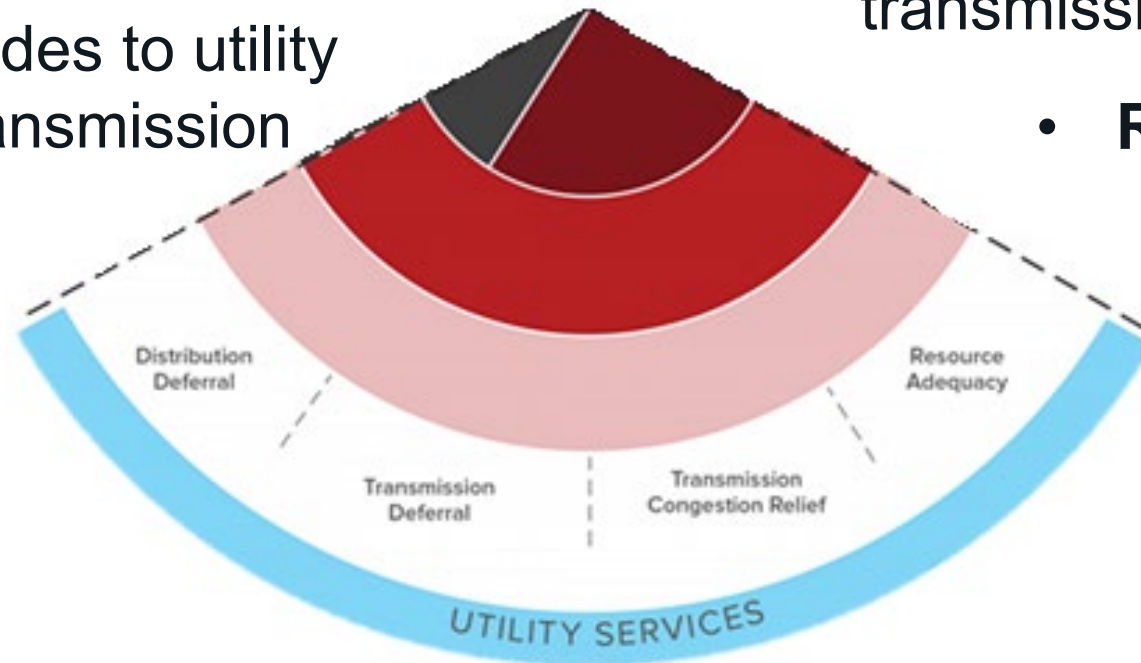
# Utility Services

- **Distribution Deferral**
- **Transmission Deferral**

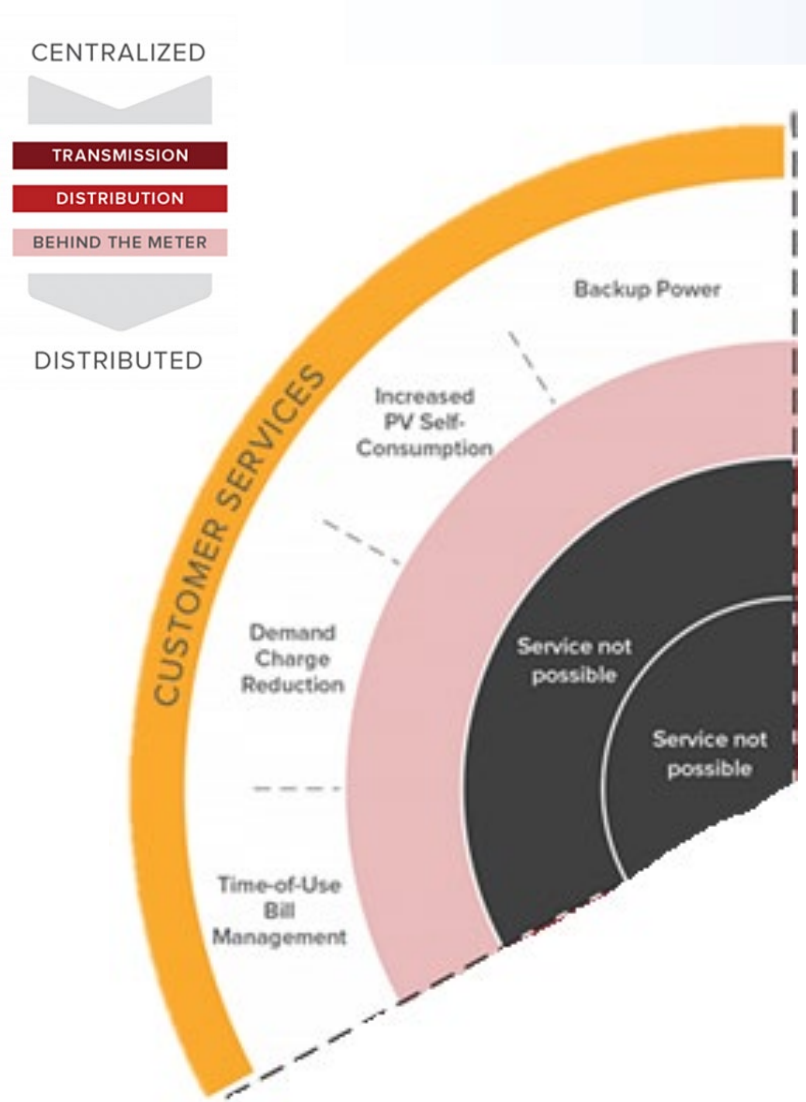
Defer costly upgrades to utility distribution and transmission infrastructure

- **Transmission Congestion Relief:**  
Mitigate congestion in areas with lots of generation or inadequate transmission capacity

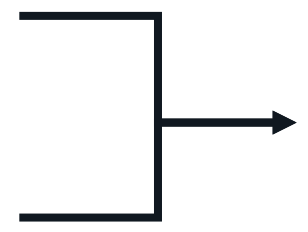
- **Resource Adequacy:**  
Have enough capacity to keep the lights on!



# Customer Services (Residential/Commercial)



- **Backup Power** → Power availability during outages
- **Increased PV Self-Consumption** → If paired with solar PV, ability to better utilize your own generation
- **Demand Charge Reduction**
- **Time-of-Use Bill Management**

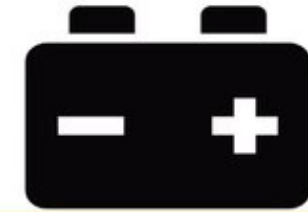


Shift your consumption to save money during periods of high demand

Also known as demand or peak shaving or load shifting



# Example: Peaker Replacement



|                      | <b>Gas Peaker</b>                            | <b>Energy Storage</b>                          |
|----------------------|--|--|
| <b>Range</b>         | ~80% of capacity –minimum operational limits | 200% of capacity – can act as supply or demand |
| <b>Utilization</b>   | Low—only to meet peak demand or emergencies  | High—simultaneous grid services                |
| <b>Dispatch Time</b> | Minutes                                      | Seconds  |
| <b>Standby</b>       | Costs and emissions                          | No costs or direct emissions                   |

# Clean Energy Siting Homepage

[Comprehensive Plan Guide](#)

[Solar and Storage Projects – IRA Funding](#)

[Energy Storage Guidebook](#)

[Energy Storage Trainings for Local Governments](#)

[EV Charging Station Permitting Resources](#)

[Siting for Large-Scale Renewables](#)

[Solar Guidebook](#)

[Technical Assistance and Workshops](#)

[Transitioning Underused Spaces](#)

[Wind Energy Guidebook](#)

[Clean Energy Siting Email List](#)

NYSERDA offers several resources to empower local governments with knowledge, training, and best practices to manage responsible clean energy development in their communities. These resources include step-by-step instructions and tools to guide the implementation of clean energy, including permitting processes, property taxes, siting, zoning, and more. Through NYSERDA's [Build-Ready Program](#), local governments can partner with NYSERDA to turn underutilized land into a renewable energy project.

- [Clean Energy and Your Comprehensive Plan Guide](#): Step-by-step instructions for local governments looking to incorporate clean energy goals and objectives into their communities' comprehensive plans.
- [Energy Storage Guidebook](#): Information, tools, and step-by-step instructions to support local governments managing battery energy storage system development in their communities.
- [Energy Storage Trainings](#): Prerecorded webinars and upcoming sessions related to responsible energy storage system development for local government officials, including municipal board members, first responders, and code enforcement officers.
- [EV Charging Station Permitting Resources](#): Materials to help municipalities, developers, planners, and planning board members learn the basics of charging stations and to navigate the process for permitting and promoting EV charging station installations.
- [Siting for Large-Scale Renewables](#): Information on State-level review processes for renewable generating facilities totaling 25 megawatts (MW) or greater.
- [Solar Guidebook](#): Information, tools, and step-by-step instructions for local governments managing solar energy development in their communities.
- [Solar and Storage Projects – Inflation Reduction Act Funding](#): Resources and information on expanded funding opportunities for tax-exempt entities through the IRA to develop solar and energy storage projects.
- [Technical Assistance and Workshops](#): List of free technical assistance on clean energy zoning and permitting available to local governments, including workshops for Continuing Education Credits.
- [Transitioning Underused Spaces](#): Information for municipalities and private landowners on repurposing underutilized land such as brownfields, landfills, former industrial sites, and farms for renewable energy development.
- [Wind Energy Guidebook](#): Information to support local governments managing wind energy development and project siting in their communities.

If you have a question on clean energy siting in your community, or need help with one of our resources, email [cleanenergyhelp@nyserda.ny.gov](mailto:cleanenergyhelp@nyserda.ny.gov).

Stay up-to-date with the latest about Clean Energy Siting by [joining our email list](#) for local government officials.

*Ask the team any question by sending an email to [cleanenergyhelp@nyserda.ny.gov](mailto:cleanenergyhelp@nyserda.ny.gov)*

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