

A satellite view of the Earth, showing the Western Hemisphere. The image is darkened to serve as a background for text. The title is centered over the continent of North America.

Energy Management Strategies and Emerging Trends

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Agenda



The climate challenge & clean energy movement



Emission reduction strategies



Opportunities for water utilities

“Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes” – IPCC AR6

2021 Pacific Northwest heat wave
Hurricane Ida Makes Landfall as an

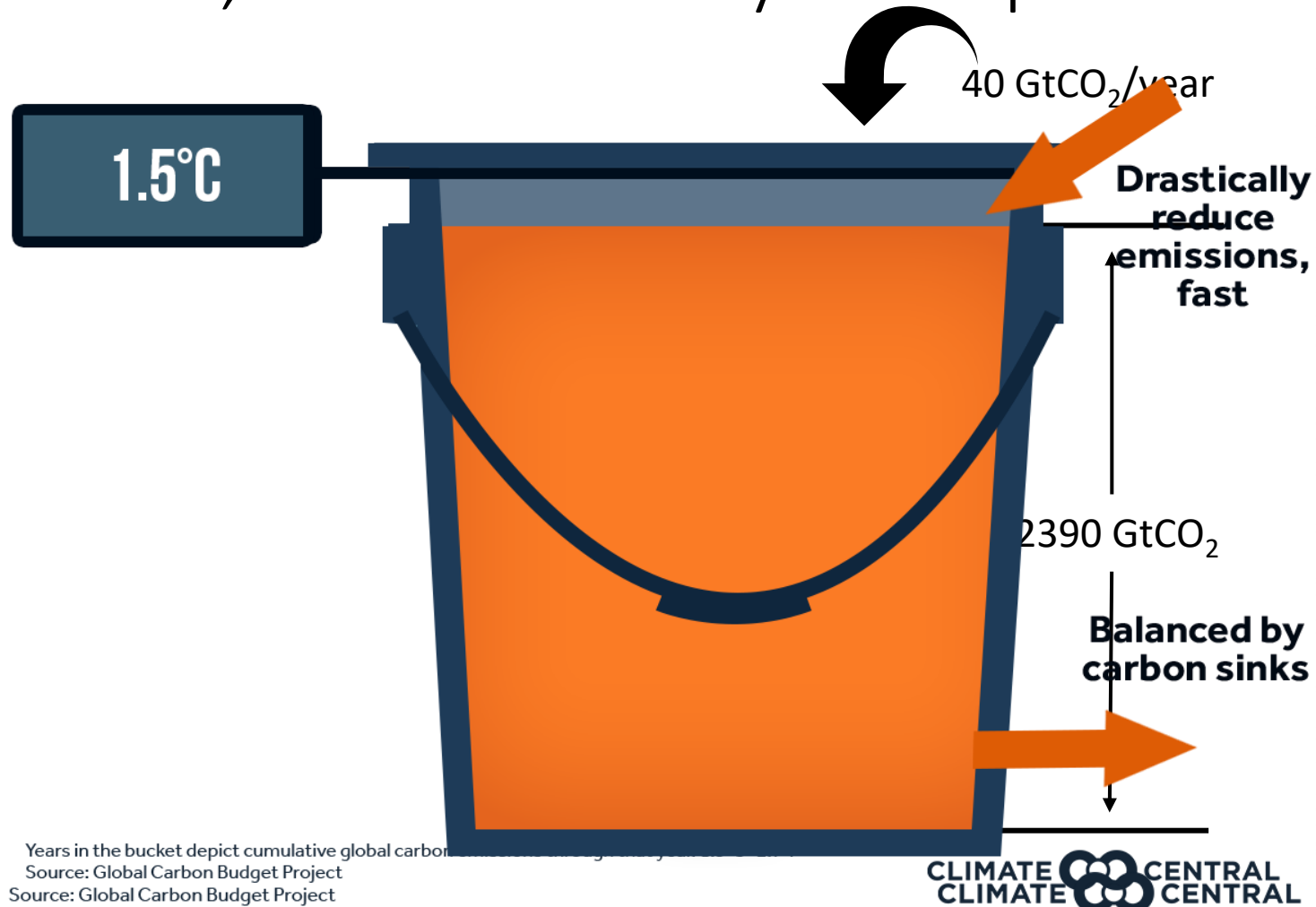
“Climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth are projected to increase with global warming of 1.5°C and increase further with 2°C”

– IPCC SR1.5

How climate change primed Colorado for a rare December wildfire
NBC NEWS | Elizabeth Chuck

The New York Times

There is a global carbon budget for limiting warming to 1.5°C, and it's already 80% spent



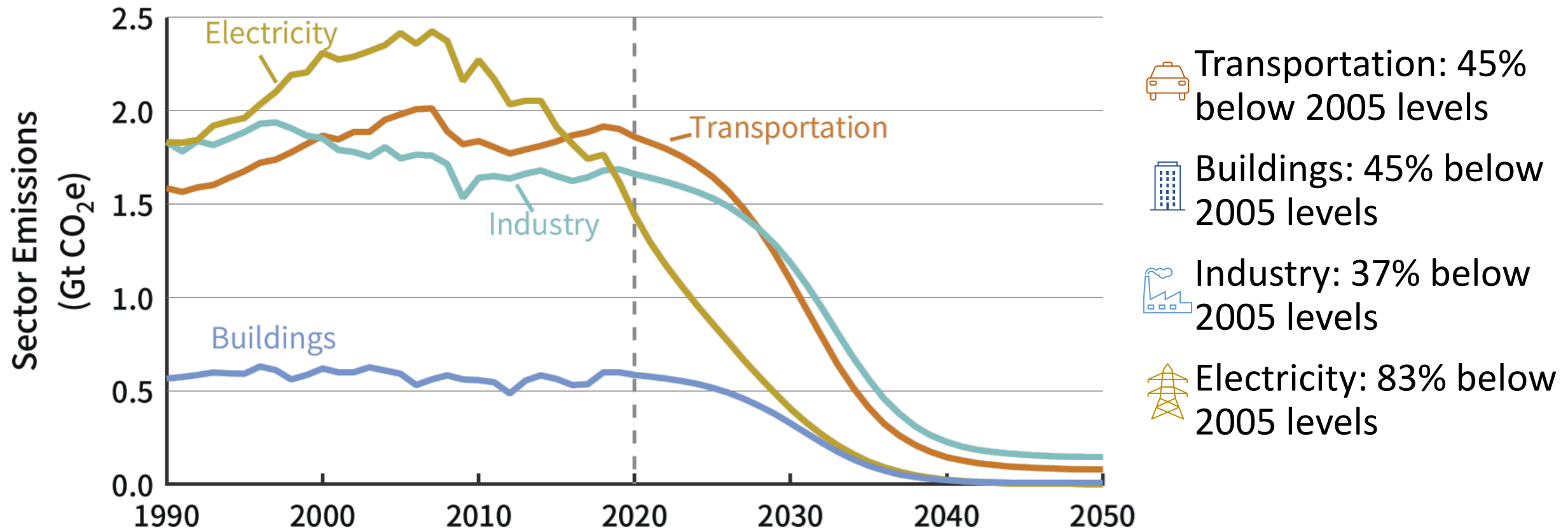
500 Gt CO₂ global carbon budget remaining

~7% is US' 'fair share' of the budget, or 37 Gt CO₂

Less than 10 years at current emissions level (~4.4 Gt CO₂/year)

Years in the bucket depict cumulative global carbon emissions
Source: Global Carbon Budget Project
Source: Global Carbon Budget Project

Keeping cumulative US emissions within the carbon budget requires significant reductions by 2030



High Level Principles of Decarbonization

A review of decarbonization studies show us there are a few near term key strategies to limit warming to 1.5°C

Increase Efficiency

- Reduce energy needs in buildings, transport and industry

Build Renewables

- Deploy solar, wind, and battery storage on a massive scale

Electrify Things

- Rapidly adopt heat pumps and electric vehicles

Decarbonize other sectors

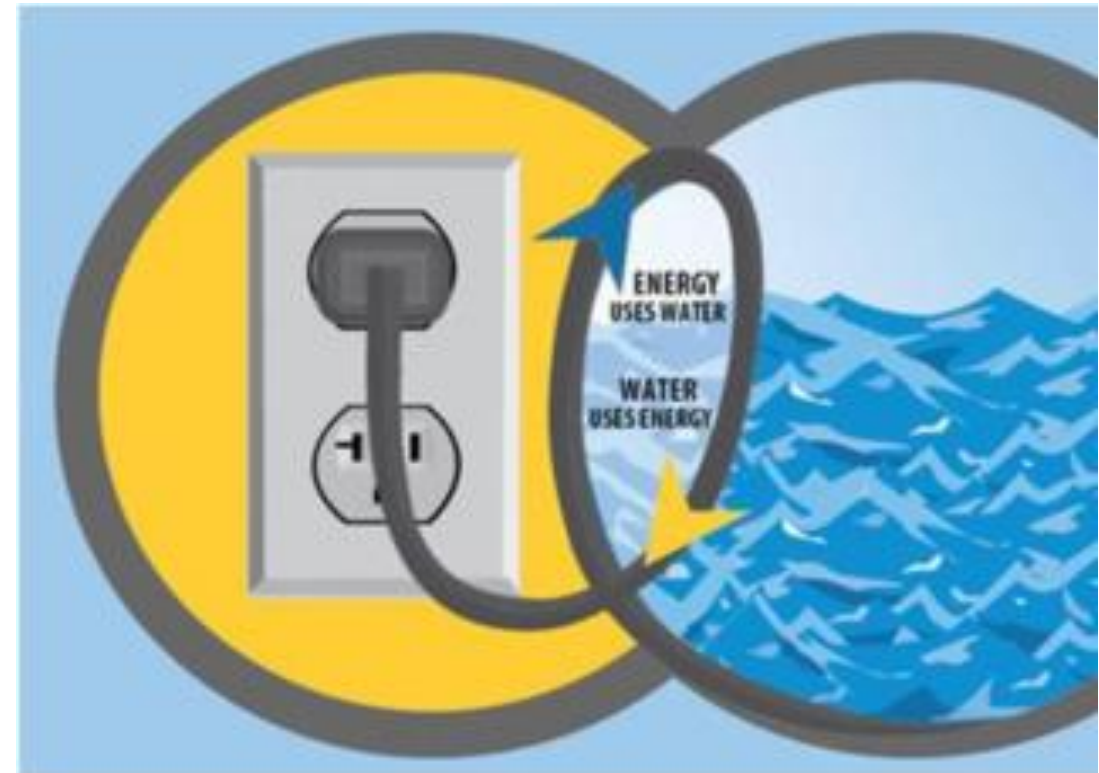
- Develop clean, low carbon fuels
- Build out carbon sinks

The water sector: part of the problem, but also a solution

3% Water sector's share of global GHG emissions¹

4% Water sector's share of US energy use²

5 X Ratio of energy potential in wastewater to energy required for treatment³



Sources of GHG Emissions



CO₂



Methane
(~25x)

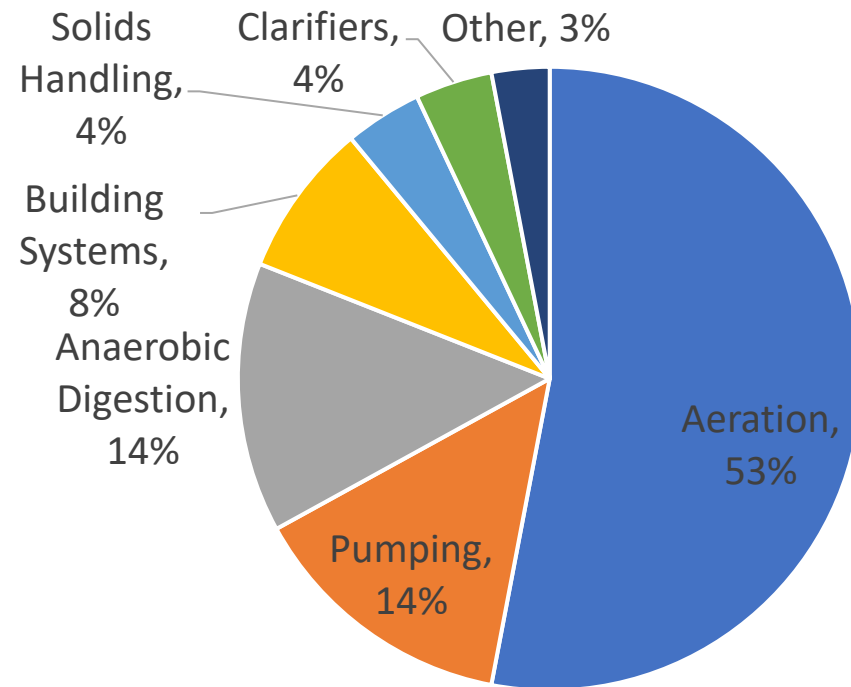


N₂O
(~298x)

Reducing Energy Needs in Water Utilities

Typical WRRFs can reduce energy use by 15-30%¹

- Benchmark energy use
- Focus on energy intensive processes/equipment
- Turn it off (or turn it down)
- Implement automated process controls
- Right-size equipment
- Monitor equipment performance to maintain efficiency



Energy Efficiency Incentive Programs

*Funding available for high efficiency
equipment and controls for process, HVAC,
and lighting equipment*

Pittsfield, MA Nutrient Removal Upgrade: \$200,000

- Mixing equipment, aeration blowers, aeration controls, boilers

South Street Ridgefield, CT Upgrade: \$410,000

- UV controls, process blowers, process pump and blower VFDs, lighting, HVAC

Enfield, CT Upgrades: \$500,000

- Aeration blowers, process pump VFDs, mixing equipment, mixer VFDs



Rhode Island Energy™

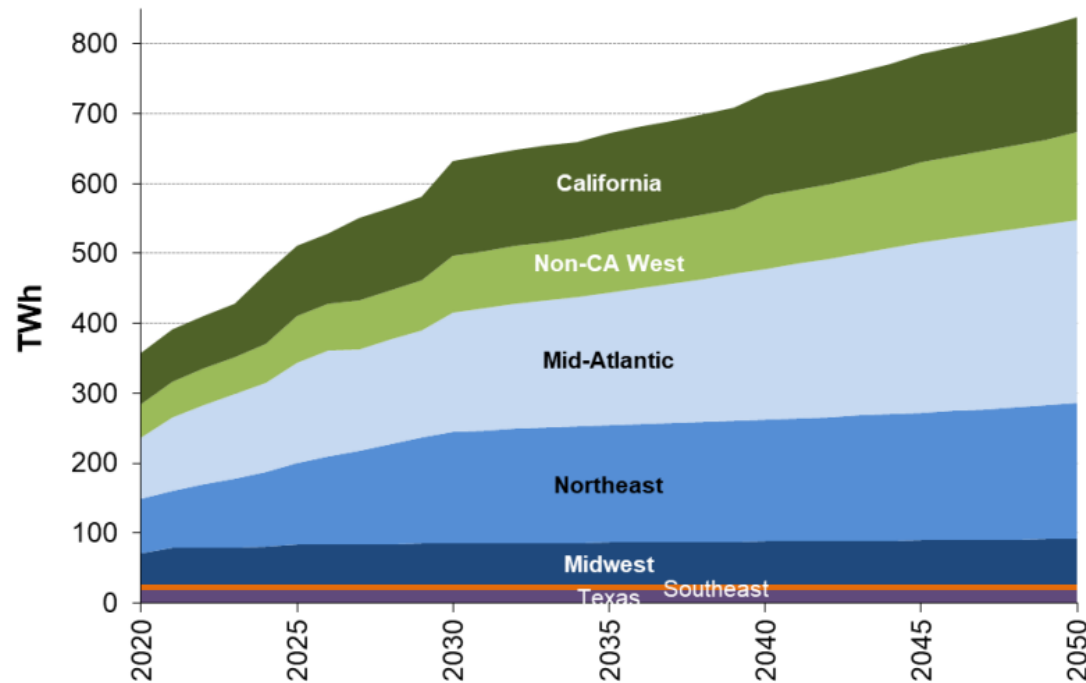
a PPL company

Decarbonizing the electric grid



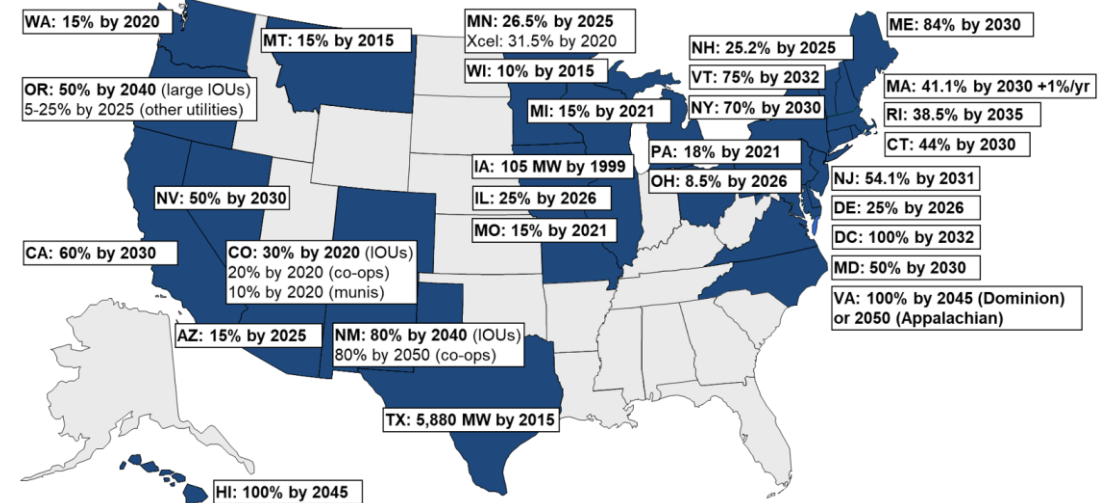
Many states mandate electric utilities to supply a certain percentage of their load from renewable / clean energy within a certain timeframe, which often is accompanied by a tradeable REC market

Projected demand from State Renewable Portfolio Standards to more than double over the next 30 years



Source: [Berkeley Lab](#)

State by state RPS: variation from no ambition to massive increases by 2030

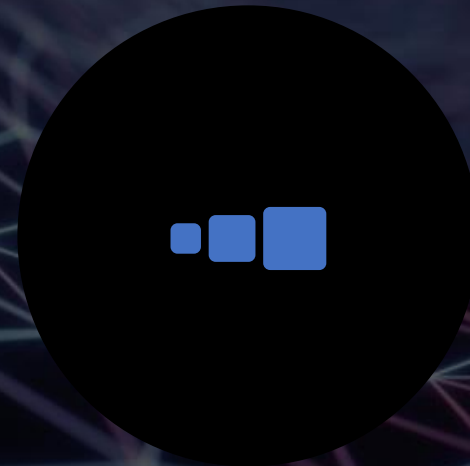


NE States – Aggressive Carbon Goals

Decarbonizing the Grid



REACH ZERO EMISSION GRID BY 2040



STRICT RENEWABLE CAPACITY INCREASES
WITHIN THE NEXT 5-15 YEARS

Price Map

Price Map

Demand Chart

Zones

15,629 MW
SYSTEM DEMAND

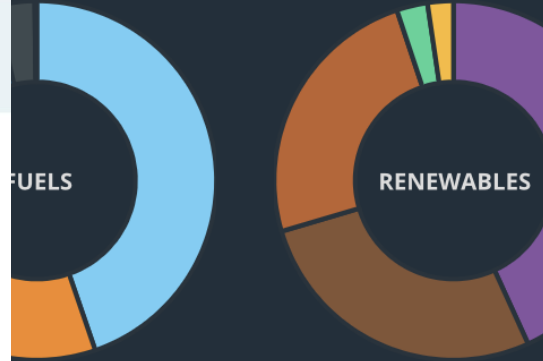
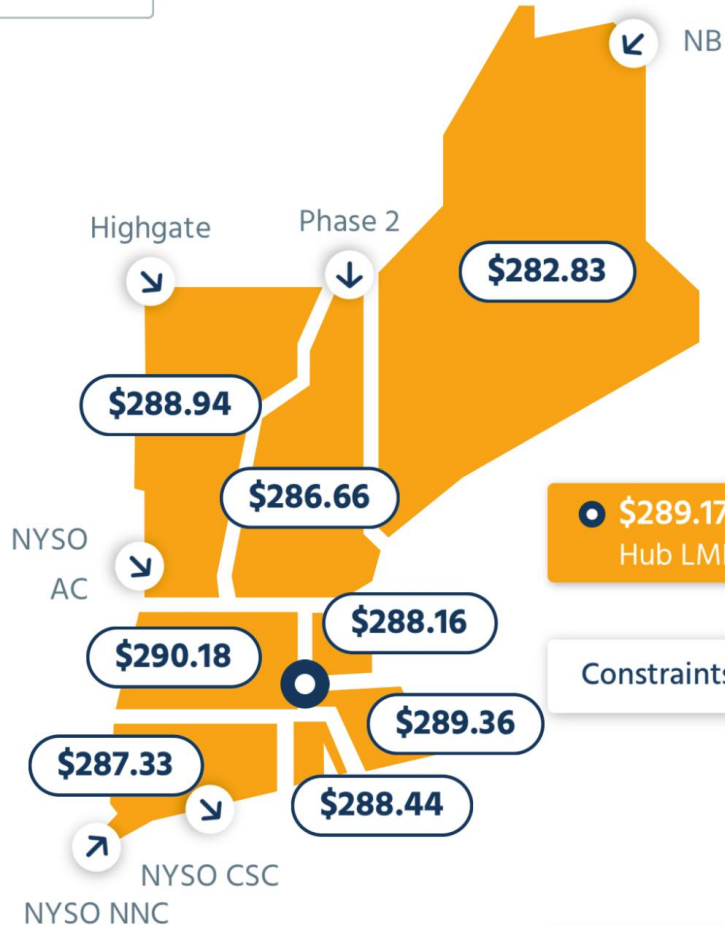
\$287.74
NE ENERGY

Normal
SYSTEM STATUS

REAL TIME

Real-Time

Day-Ahead



- 43% WIND
- 27% REFUSE
- 24% WOOD
- 3% LANDFILL G
- 2% SOLAR

23,014

AVAILABLE CAPACITY (MW)

17

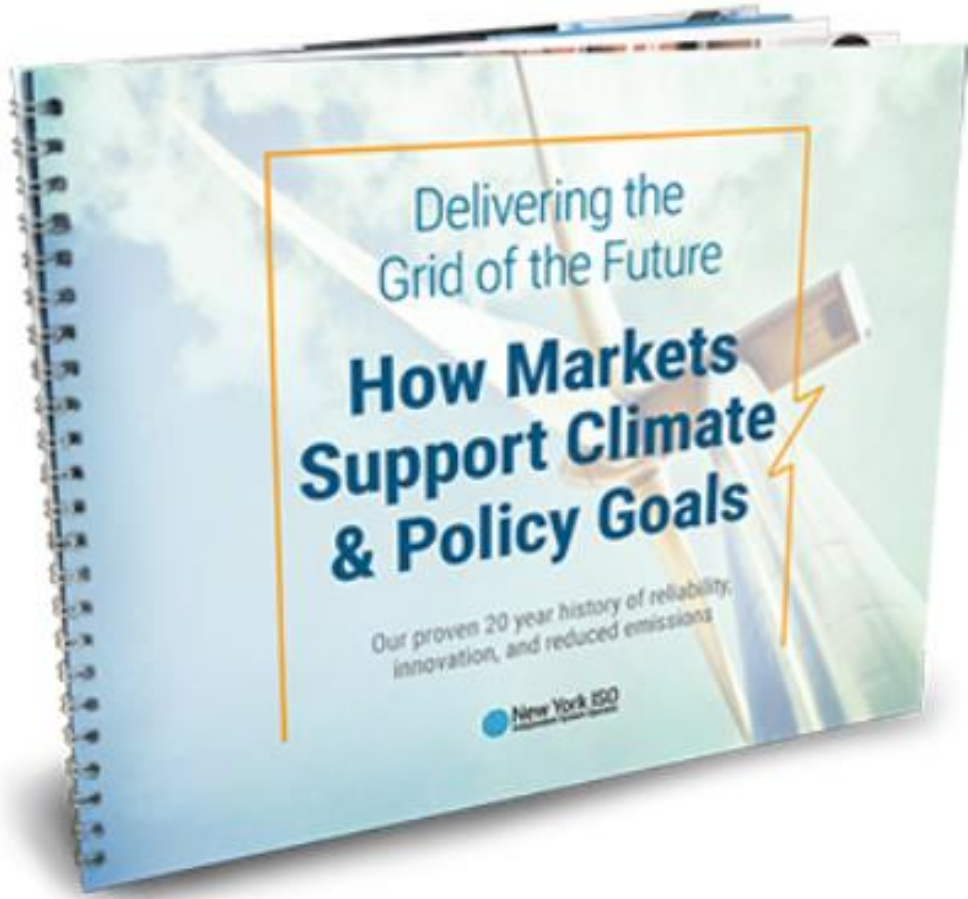
FORE DEM

Fast Stats

- 99%, 78%, and 42% decrease in annual regional emissions between 2001 and 2019 for sulfur dioxide (SO₂), nitrogen oxides (NO_x), and carbon dioxide (CO₂), respectively
- 60% decrease in coal-fired generation, between 2018 and 2019
- 69% decline in oil-fired generation from 2018 to 2019
- 13% increase in production from solar and wind resources, combined, between 2018 and 2019

0

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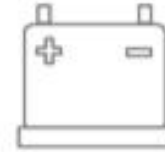


Key findings

1. The variability of output from wind and solar resources presents a fundamental challenge to meeting electricity demand.



2. Battery storage resources help to fill in voids in renewable resources output, but extended periods rapidly deplete storage capabilities.



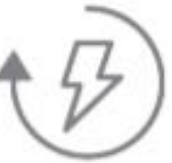
3. Dispatchable, emission-free resources are needed to balance renewable intermittency on the system.



4. It will also be necessary to expand transmission throughout the state in order to maximize the access to renewable resources.



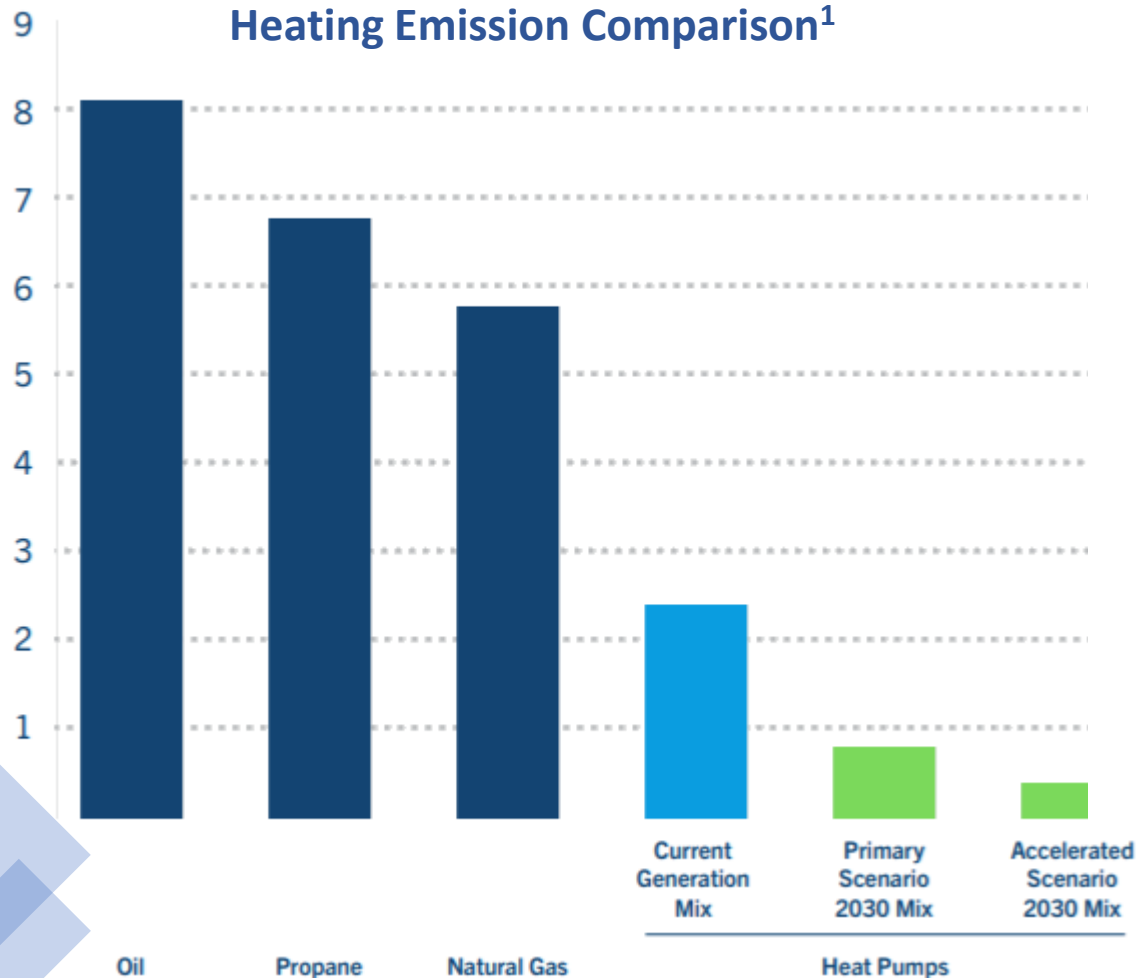
5. Overall, the key reliability challenges identified in this study relate to how the resource mix evolves in compliance with the CLCPA.



6. Climate change will impact meteorological conditions and events that introduce additional reliability risks.

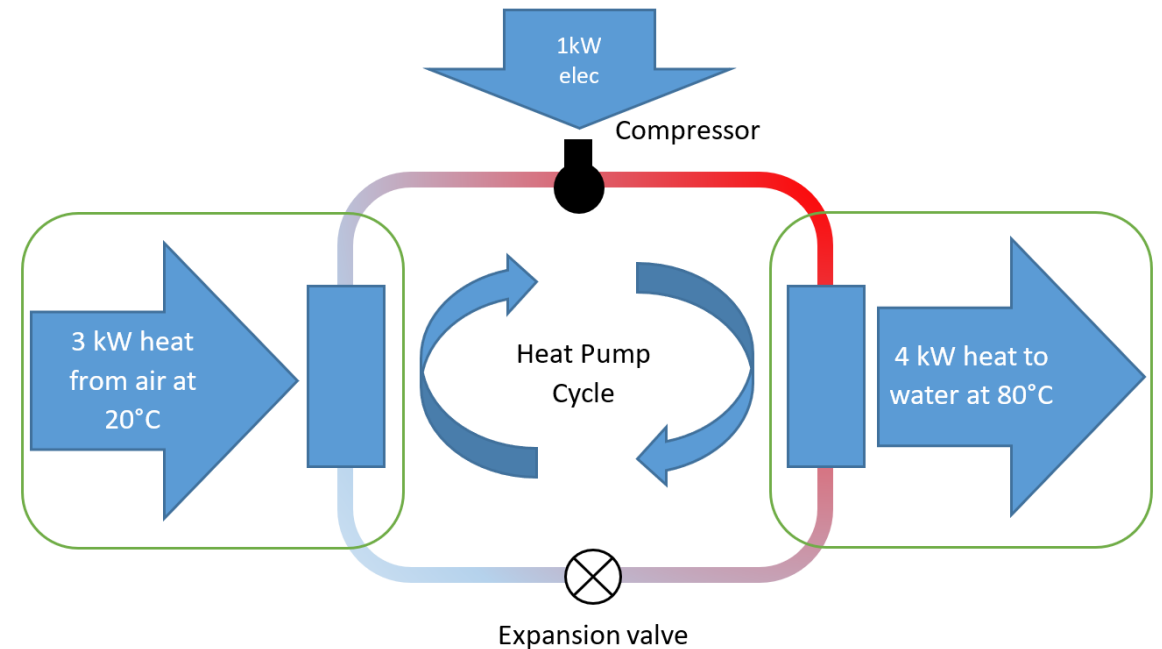


Electrification at Water Utilities: lower carbon emissions + drastically increase efficiency (without increasing costs)



¹From Acadia Center's EnergyVision2030

Heat Pumps achieve efficiencies of over 400%



- Water source heat pumps can be used to recover/dump heat from/into process stream for heating/cooling spaces
- Air source heat pumps use the heat within outdoor air and can operate down to temperatures of -17°F
- Ground source heat pumps use the heat from underground to heat spaces

The push towards strategic electrification

*“powering end uses with electricity instead of fossil fuels in a way that **increases energy efficiency** and **reduces pollution**, while **lowering costs** to customers and society”*
-NEEP

In 2020 alone...

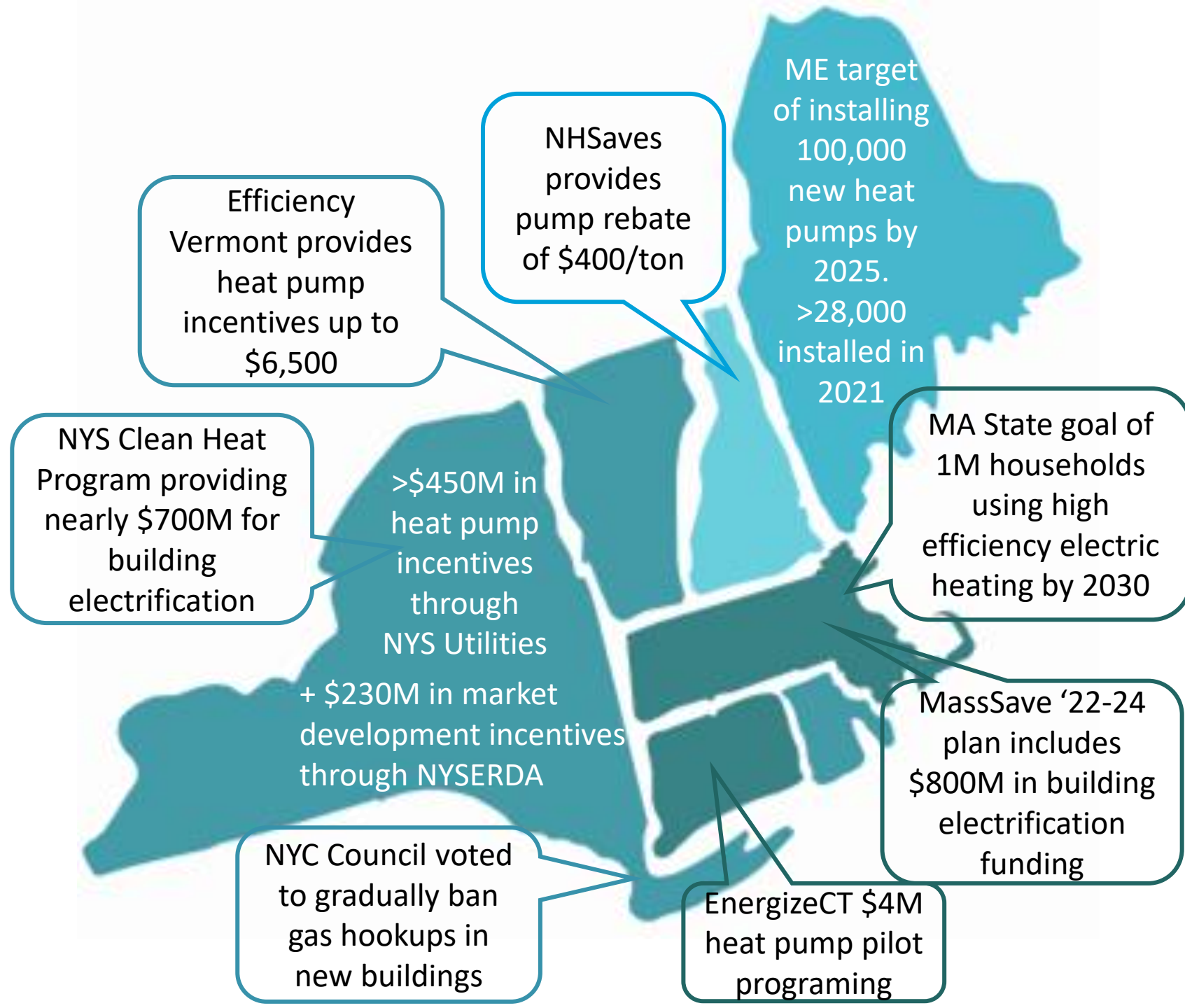
Seattle's mayor...
Two MA m...
cc petitions tl...
cc petitions tl...
towns to...
appliances...
if/when supported by the state...
Maine's state climate action plan called for installation of at least 45,000 heat pumps by 2025 if/when supported by the state legislature

widespread...
nny
electrification...
ill-
residential heating...
30
sales by 2030 to meet the state's goals

2020 Priorities for Building Electrification

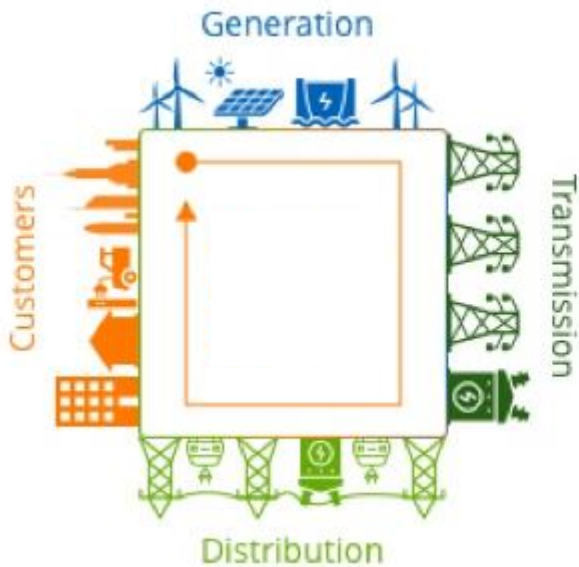
Most noteworthy state actions on building electrification this year.
AND MORE!

Electrification funding and ambition in the Northeast is only one regional example of the national opportunity to ride the electrification wave

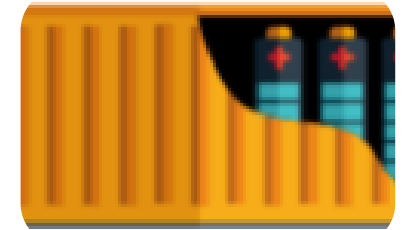


Part of the Grid: water utilities as a distributed energy resource

The grid of the future is *decentralized*, and water utilities are well-positioned to *respond to grid needs* by developing and deploying a variety of resources



Renewables



Batteries



Demand response



Efficiency

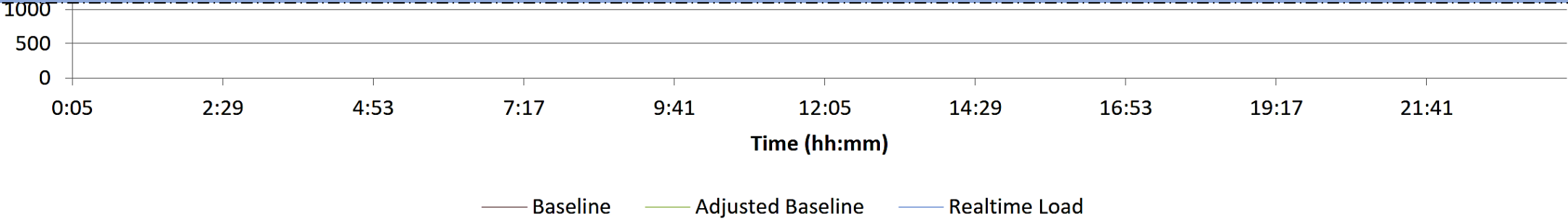
Demand Response Programs



Option to also claim carbon offsets associated with reduced grid emissions due to load curtailment

Average Baseline (kW)	Average Realtime (kW)	DR Performance (kW)
3301	1732	1569

"TOU rate designs are being developed that give customers price signals to adopt new technologies that serve changing system demand"



Billed Demand Charges & Off-Peak Hours

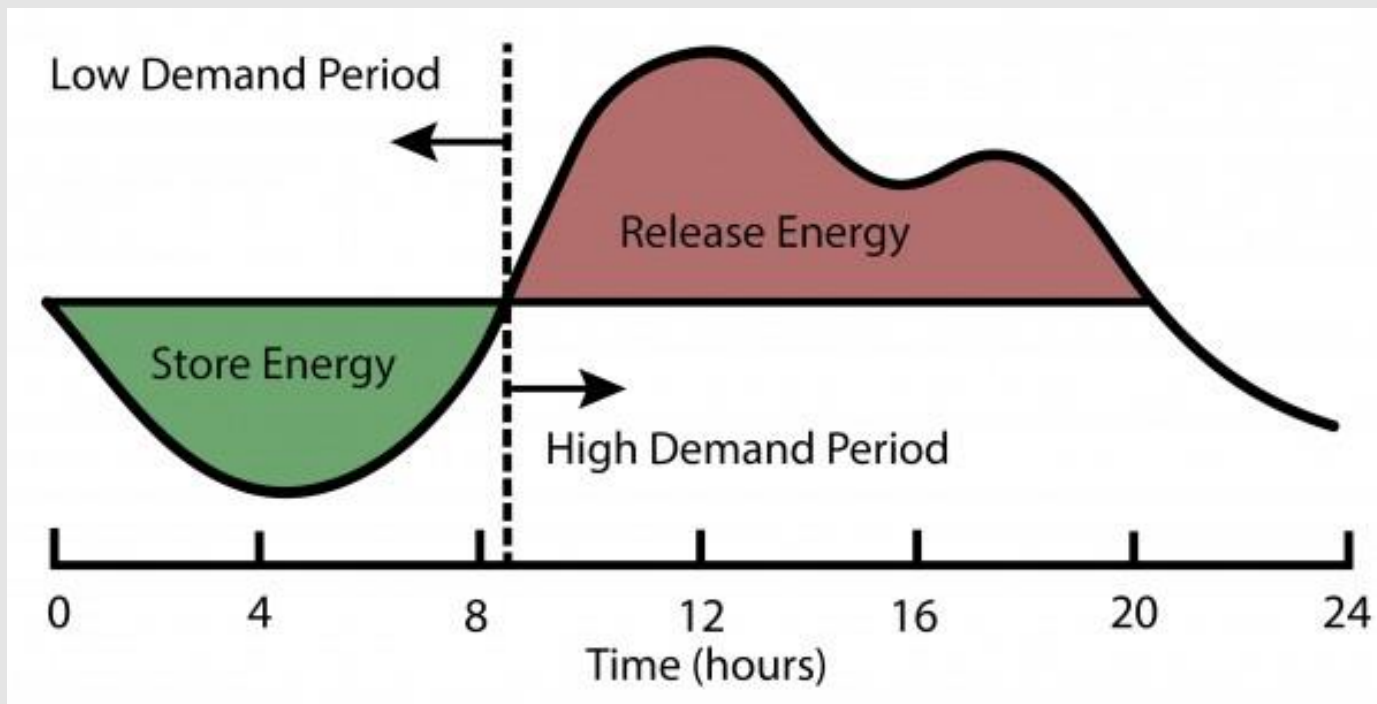
- Example:
 - 2, 75 HP high lift pumps operate ~7 hours per day
 - Pump during off-peak hours from 12am – 10am
 - Max annual on-peak demand: 84 kW
 - Max annual off-peak demand: 3 kW

Mov
grid
dem

Total Charges for Electricity		
Supplier		
DIRECT ENERGY BUSINESS		
Service Reference: 783981002		
Generation Srvc Chrg**	16535.00kWh X \$0.07370	\$1,218.63
Annual Savings: \$16,404		
Trans Chrg per kWh Off-Pk	16086.00kWh X \$0.00571	\$91.85
Distr Cust Srvc Chrg		\$44.00
Distribution Dmd Chrg	0.90KW X \$13.30000	\$11.97
Electric Sys Improvements***	0.90KW X \$0.32000	\$0.29
Revenue Adj Mech On-Pk	449.00kWh X \$0.00181	\$0.81
Revenue Adj Mech Off-Pk	16086.00kWh X \$0.00181	\$29.12
CTA Demand Chrg	0.90KW X \$-0.18000	-\$0.16
FMCC Delivery Chrg On-Pk	449.00kWh X \$0.01925	\$8.64
FMCC Delivery Chrg Off-Pk	16086.00kWh X \$0.00429	\$69.01
Comb Public Benefit Chrg*	16535.00kWh X \$0.00754	\$124.67

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Battery Storage



- Clip load during high-cost kWh times and charge from the grid during low-cost kWh times
- Participate in previous demand response programs + additional with more frequent events
- New England Utilities Daily Dispatch Program: \$200 - \$300/kWh; up to 60 summer events
- NYSERDA offers upfront commercial storage incentives paired with renewables

A LIVABLE CLIMATE

VOLUME 7 OF 9

New York City will lead a just transition to achieve carbon neutrality and adapt the city to withstand and emerge stronger from the impacts of climate change.

NYC

Spotlight: NYC DEP

“The City will continue to implement deep energy-saving measures, increase the production of renewable gas through digestion of wastewater and organic waste, and generate renewable electricity to reach net-zero energy for treatment of wastewater by 2050”

Proposed Concrete CO₂ Limits

Values are based on compressive strength, except for flexural strength mixes, Ready-Mix Only

❖ These values are compared to A1 EPD CO₂ or raw mix constituent factors

Port Authority of NY & NJ Ready-Mix Concrete A1 GWP Limit			
PSI Range	lbs CO ₂ e/cy	kg CO ₂ e/m ³	kg CO ₂ e/cy
Flexural	445	250	400

CLEAN
CONSTRUCTION

NYC Executive Order 23:

- Best effort to incorporate low carbon concrete
- Requirement to submit Environmental Product Declarations
- Incorporate low emissions vehicles
- Capital project agencies must submit action plans to reduce embodied carbon by Oct 2023

Frederick Toning

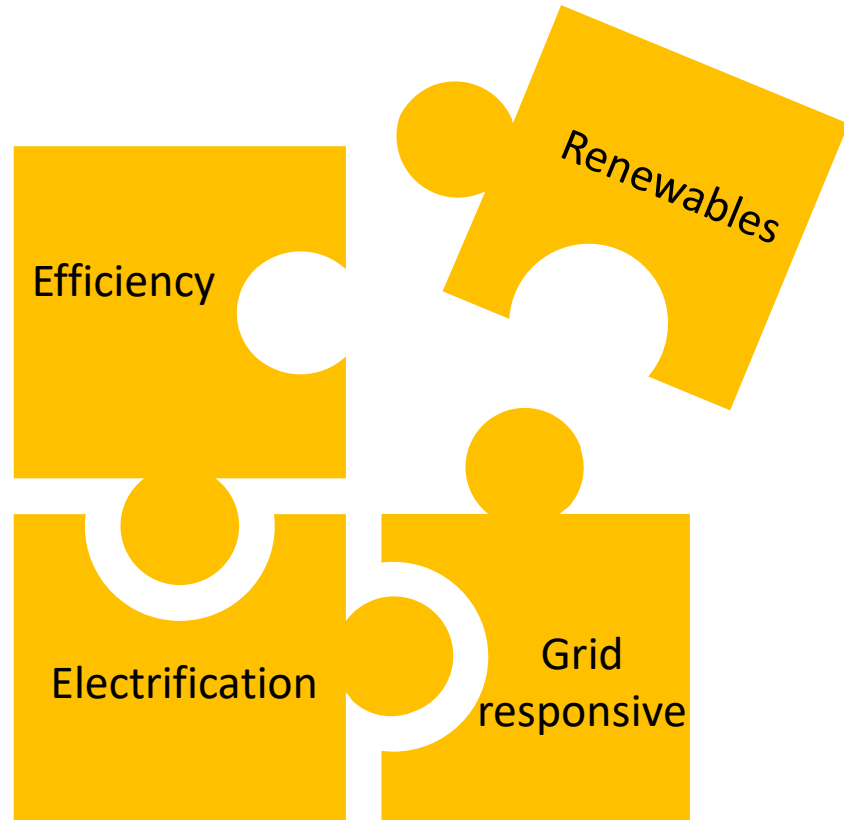
ftg@panynj.gov

7-334-3401

\$-18,608

3,415 kgCO₂e

Our Role in the Climate Challenge



Educate

Educate others on this issue



Advocate

Vouch for these opportunities



Implement

Make these projects happen



Share

Share successes to inspire others



Part of the Change

&

Part of the Grid

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