

# Empire State Building

- New York City
- 2.85 million SF
- 102 stories commercial
- office building built in 1931



# New York City icon reaches for Net Zero by 2030

## Project Team:

**EMPIRE STATE**  
REALTY TRUST

**BURO HAPPOLD**

LUTHIN  
ASSOCIATES



**Quest**  
energy group

The **Empire State Building** has been an integral part of the NYC skyline since 1931. The 102-story art deco structure is heated by district steam.

Following up on a deep energy retrofit initiated in 2009, Empire State Realty Trust (ESRT) has taken a step further with *ESB 2.0*, a 21<sup>st</sup> century plan to bring the iconic building to Net Zero.

Through this plan, ESRT will prove the technical and economic business case for investing in deep energy retrofits and share findings to drive market change within the high-rise office building landscape.

The phased approach strategically deploys energy conservation measures through 2035. ESRT will optimize existing systems, maximize energy recovery and enable heat pump integration to decrease steam and electricity consumption.

<b>NYSERDA Investment</b>	<b>Private Investment</b>
<b>\$5 Million</b>	<b>\$40 Million +</b>

Disclaimer: The project plan outlined in this presentation is in its early design stage and can be subject to potential changes in the future.

# Empire State Building will demonstrate phased decarbonization in a fully occupied landmarked building



## Learn more about the Empire State Building project

- [ESB: Energy Efficiency and Sustainability](#)
- [ESRT Shares New Guide in Empire Building Playbook](#)
- [Empire Building Playbook: ESRT Case Study](#)
- [How the Empire State Building Became a Green Icon](#)

## Optimization: ensure existing systems are operating automatically and efficiently

By enabling automation of heating and cooling systems, upgrading to high performance sequences of operation, and integrating zones throughout the building onto the base building BMS, the functionality and efficiency of current systems are maximized, and simultaneous heating and cooling is eliminated.

## Heat Recovery: recaptures thermal energy that would otherwise be wasted

Water source heat pump(s) will recover heat from the condenser water loop to displace steam usage and energy recovery ventilators (ERVs) will retain and utilize heat from the building's exhaust ventilation system.

## Heat Pump Integration: install new centralized hydronic heating loop to enable the use of heat pump technology

The team is replacing steam coils in core air handling units with low temperature hot water coils supplied by air source heat pumps.

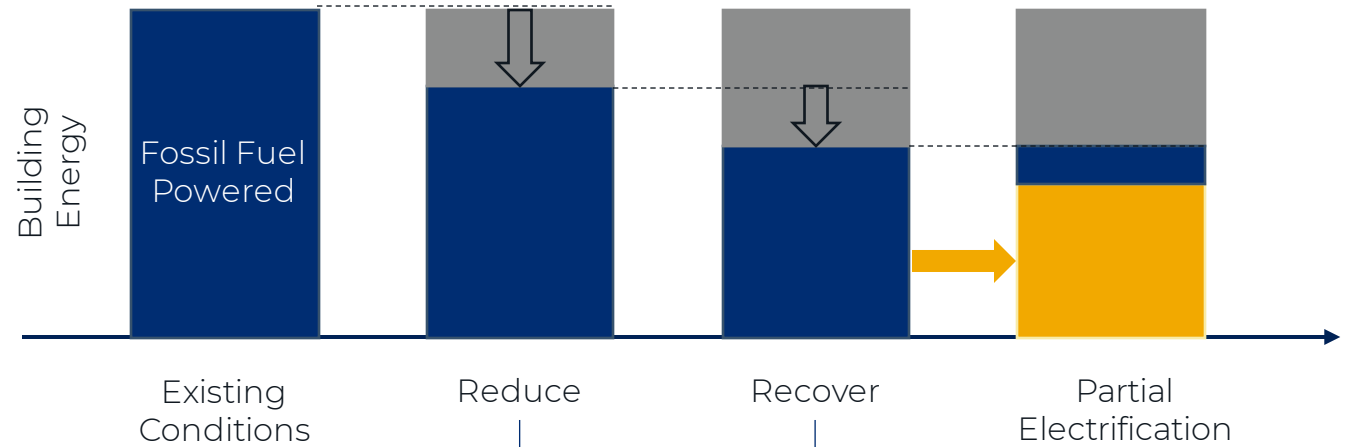
2019 Baseline	Expected by 2035	
84 kBtu/SF/yr	50 kBtu/SF/yr	↓ 40%
35% District Steam + 63% Electricity	16% District Steam + 82% Electricity	
15,640 tCO <sub>2</sub> e/yr	3,986 tCO <sub>2</sub> e/yr	↓ 75%
\$933,000 /year of LL97 fines starting in 2035	\$0 LL97 fines starting in 2035	



# Resource Efficient Decarbonization (RED):

An incremental methodology and integrated design process combined with strategic capital planning creates a path towards carbon neutral buildings.

A holistic approach and phasing can make decarbonization technically and economically feasible.



**Reduce Energy Load**

- **Cooling plant optimization:** connect the chilled water zones with heat exchangers to share load, optimize shoulder season usage, and increase resiliency
- **Retail Loop Condenser Water Control:** retro commission the CW loop to enable heating mode on existing tenant WSHPs
- **Air Source Domestic Hot Water Heaters Pilot:** replace existing electric water heaters with ASHP
- **Steam System Optimization and Improvements**
- **Airside Sequence of Operations:** implement high performance sequence of operations to enable static pressure and temperature resets and eliminate simultaneous heating and cooling.

**Recover Wasted Heat**

- **Energy Recovery Ventilator (ERV) Pilot:** install ERVs in tenant MERs to recover heat from AHU exhaust, temper incoming outdoor air, and address freeze risk
- **1st Floor Lobby Reheat via Waterside Heat Recovery:** Replace lobby AHU steam coils with hydronic heating coils supplied by WSHP that recover heat from the building condenser water loop to enable electrified heating and reheat. Recover heat from the steam condensate system to provide resiliency during the heating season.

**Partial Electrification**

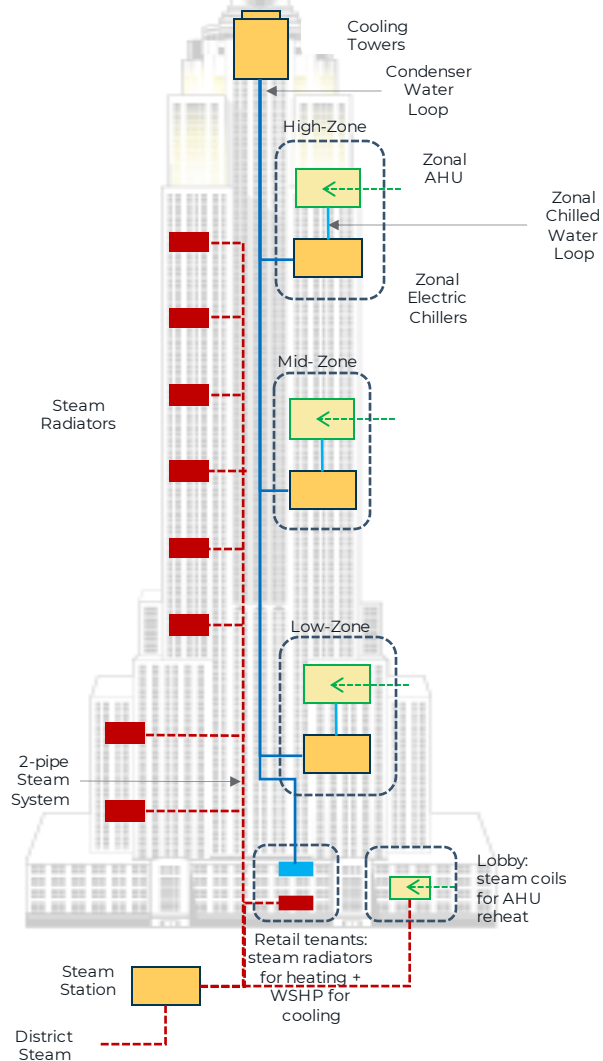
- **Steam Phase-Out Enabling Step:** Eliminate steam usage for airside heating with new low temp. HHW riser (120F) supplied by central ASHP

# Empire State Building Decarbonization Plan

Heating  
Cooling  
Ventilation

**Key Takeaways:** Reduce district steam usage, decouple core ventilation heating load and perimeter heating, optimize operation of cooling plant, enable heat recovery

BEFORE



2022:

**Central Cooling Plant Optimization**

Connect the chilled water zones with HX to share load and optimize shoulder season usage

**1<sup>st</sup> Floor Lobby Reheat via Waterside Heat Recovery**

Replace AHU steam coils with hydronic supplied by WSHP

**Retail Loop Condenser Water Control**

3-port valve to independently control the retail loop from the building condenser loop and enable heating mode on tenant WSHPs

2023:

**Steam Phase-Out Enabling Step: Hydronic Riser + ASHP**

Eliminate steam usage for airside heating: new low temp. HHW riser (120F) supplied by central ASHP + replace zonal AHU steam coils with hydronic coils

**Steam System Optimization and Improvements**

Automating start-up practices, convert medium-pressure to low-pressure steam, etc.

2024:

**Energy Recovery Ventilator (ERV) Pilot**

ERV on floor outdoor AHU for select floors

**Air Source Domestic Hot Water Heaters Pilot**

Convert existing electric water heaters to ASHP

**Airside Sequence of Operations**

Implement static pressure and temperature resets; Optimize chilled water dT

AFTER

