



Driving Change: BNL's Commitment to Emission Reduction

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Outline

- **BNL's Strategic Energy Objectives**
- **Optimizing Site Operations to Reduce Greenhouse Gas (GHG) Emissions**
- **BNL's Emissions Reduction Targets**
- **Implementing Studies to Forge a Path Towards Emissions-Free Operations**

BNL's Strategic Energy Management Objectives

- 1. Minimize our energy consumption and the associated Greenhouse Gas Emissions.**
- 2. Be a good “grid-neighbor” – reduce load during peak demand periods on LI.**
- 3. Achieve 100% Carbon-Free electricity targets.**

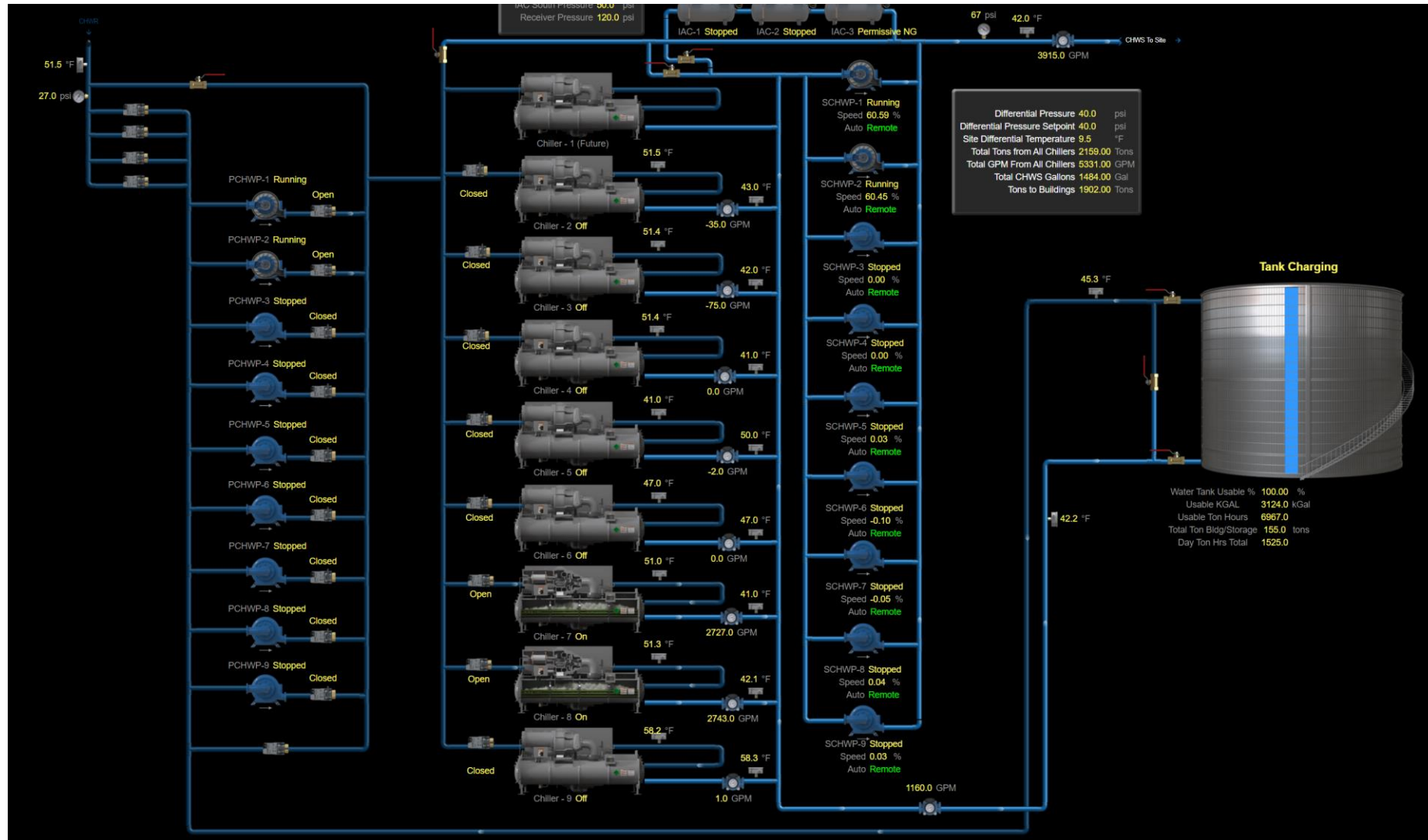
The increased electric demand and consumption of the Electron-Ion Collider (EIC) and other anticipated growth starting in 2029 will make these objectives challenging, but we are planning for that future challenge now...

The campus deploys several strategies to reduce GHG emissions...

- **Load Shifting** – Utilize energy storage to shift energy consumption to periods when the grid is more efficient
- **Load Shedding** – Reduce non-mission critical operations when the grid is operating with high GHG-emitting power generation equipment
- **Energy Optimization** – Improve the efficiency of energy consuming equipment, incorporate renewable energy sources into energy procurements, leverage advanced control systems to better manage site demand

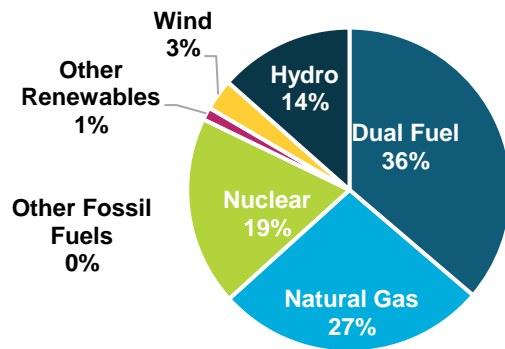


Load Shifting with Thermal Energy Storage



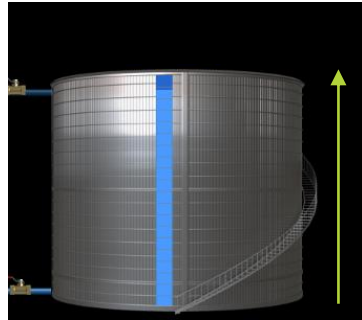
Load Shifting to reduce GHGs How it works...

Off Peak Fuel Mix
July 2023

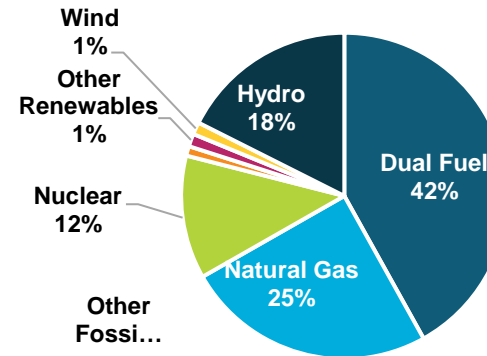


0.128 Tons CO₂ / MWh

Increase energy usage
to charge the tank.

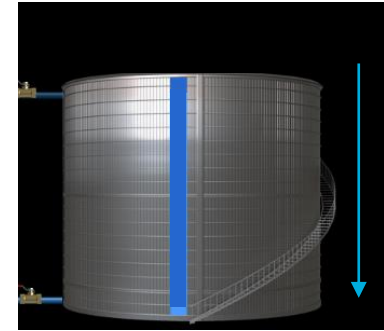


Peak Fuel Mix
July 2023



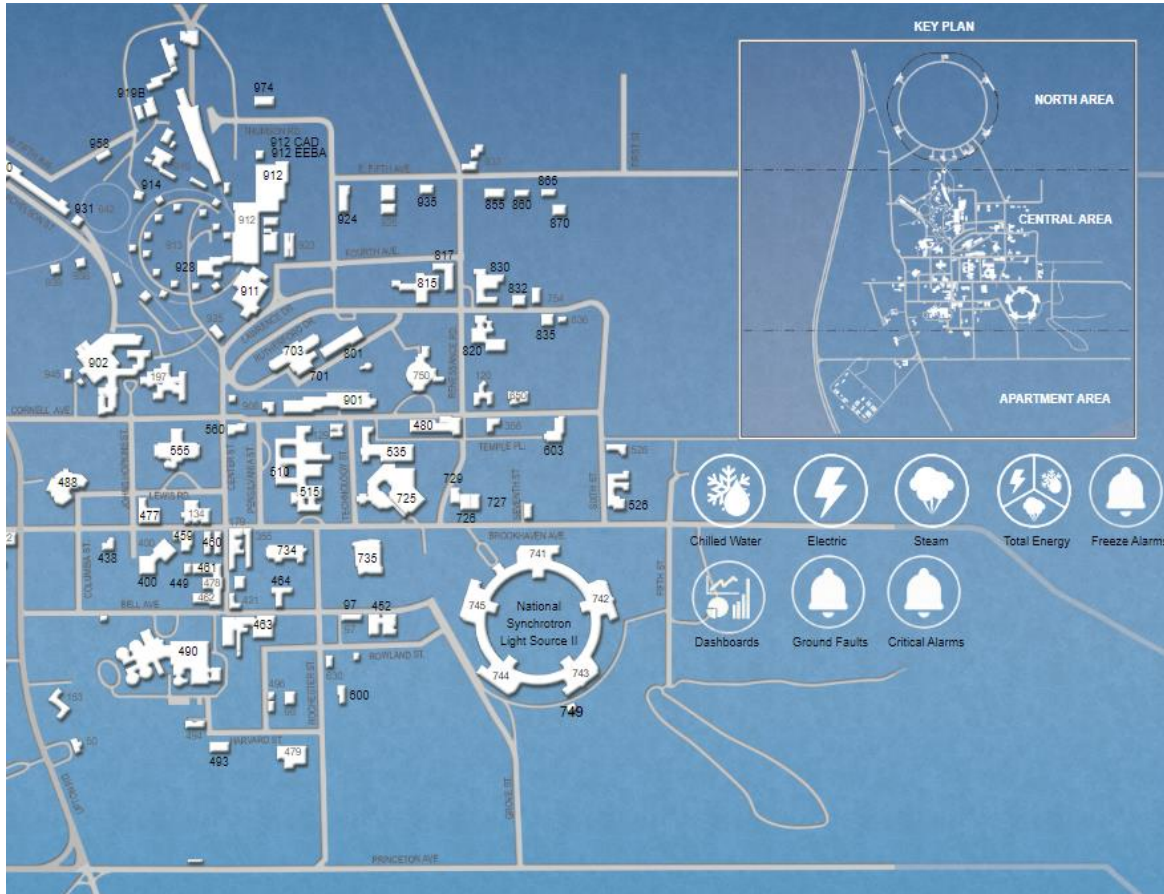
0.141 Tons CO₂ / MWh

Decrease energy usage
by discharging the tank



- The Central Chilled Water Facility operators checked this data daily and shifted the load to minimize GHG emissions.
- During a week-long heat wave in July 2023 LIPA needed to operate less efficient gas turbines to maintain the local grid, increasing the carbon footprint to prevent brown outs / black outs.
- BNL was able to utilize its chilled water storage tank ‘battery’ to power off two chillers for **8 hours**. **The storage tank was then charged at night when these turbines were no longer in use eliminating approximately 2 tons of CO₂.**

Load Shedding with our Energy Management Control system



Site Building Demand

Site Demand Meter

2520
kW

Building Demand

Load Shed Auto/Manual Manual ▾

| | |
|------------------|----------------|
| Building 400 | No Load Shed ▾ |
| Building 463 | No Load Shed ▾ |
| Building 463 SB | No Load Shed ▾ |
| Building 480 | No Load Shed ▾ |
| Building 490 | No Load Shed ▾ |
| Building 490A | No Load Shed ▾ |
| Building 490 ITF | No Load Shed ▾ |
| Building 510 | No Load Shed ▾ |
| Building 515 | No Load Shed ▾ |
| Building 515 Net | No Load Shed ▾ |
| Building 535 | No Load Shed ▾ |
| Building 555 | No Load Shed ▾ |
| Building 703 | No Load Shed ▾ |
| Building 725 | No Load Shed ▾ |
| Building 734 | No Load Shed ▾ |
| Building 735 | No Load Shed ▾ |
| Building 801 | No Load Shed ▾ |
| Building 815 | No Load Shed ▾ |
| Building 911 | No Load Shed ▾ |
| Building 741 | No Load Shed ▾ |
| Building 742 | No Load Shed ▾ |
| Building 743 | No Load Shed ▾ |
| Building 744 | No Load Shed ▾ |
| Building 745 | No Load Shed ▾ |

Chilled Water Plant

Chilled Water Flow to Bldgs **4005.00** gpm
Tons to Bldgs **1674.00** tons

43.0 °F
92 %

Chilled Water

Electric

Steam

Total Energy

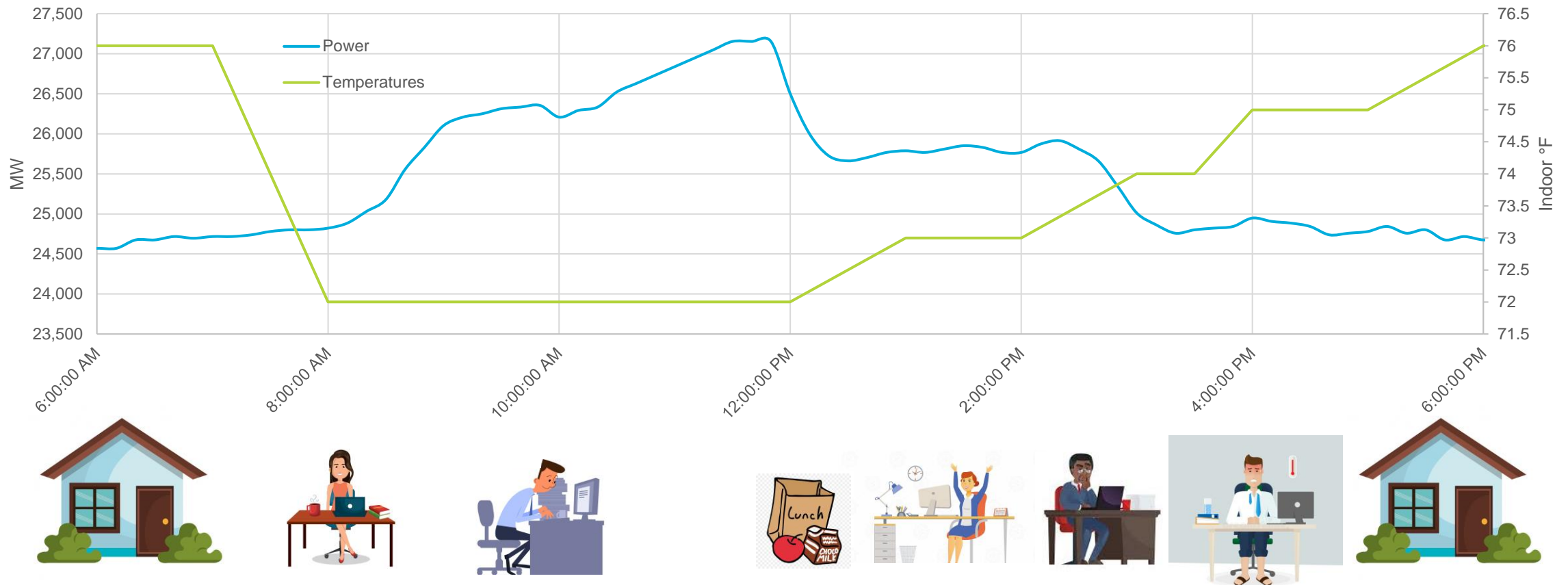
Freeze Alarms

Dashboards

Ground Faults

Critical Alarms

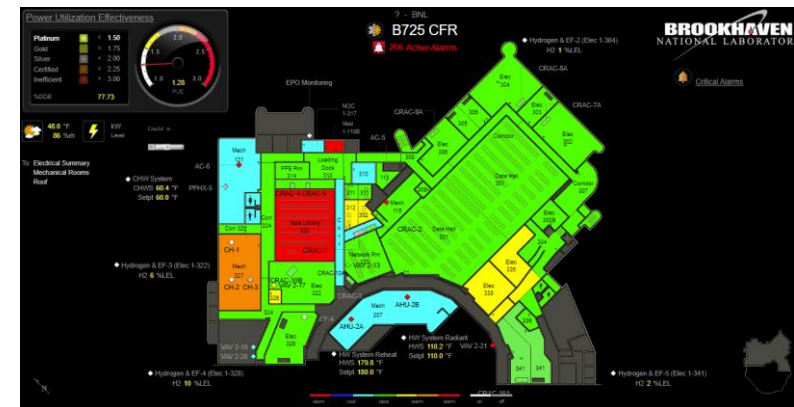
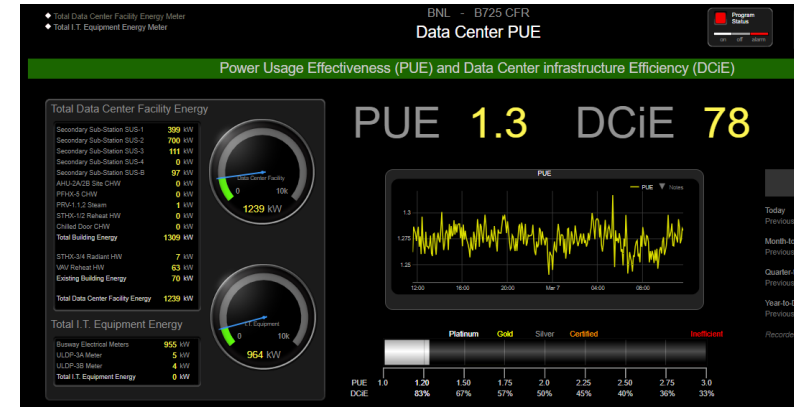
Load Shedding Energy Management Control System (EMCS)



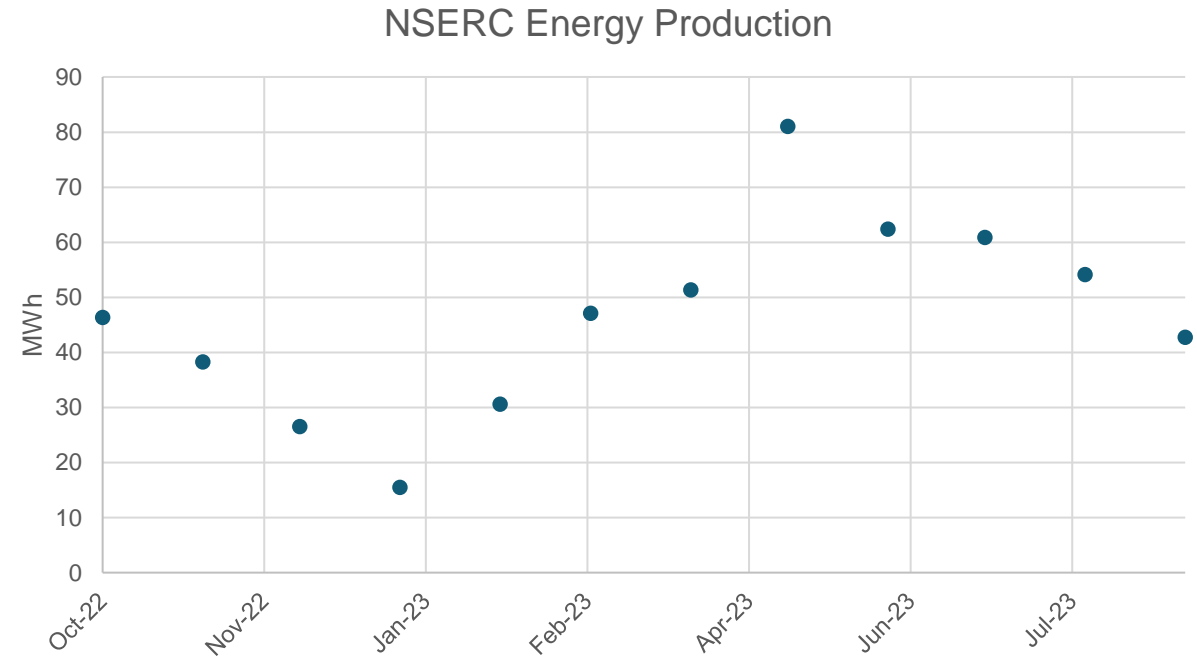
- On this August 2023 day in just five hours - we sweated a little- but we saved 9 MWh of electric load avoiding 1.27 metric tons of CO₂ emissions

Energy Optimization through automation and energy efficiency technology

- The Energy Management Control System (EMCS) allows users to set schedules, preventing wasted energy consumption on nights, weekends, and holidays
- Occupancy controlled thermostats throughout the site shut equipment down when they sense office areas are unoccupied.
- EMCS also monitors usage and notifies use when energy higher than expected
- Variable frequency drives slow our motors down so they only spin as fast as required to do the work the need to do, reducing the power consumed by motors across site.
- Stack economizers recover heat from our boiler stacks increasing the efficiency of our central steam facility, reducing emissions by 1%.



Energy optimization with on-site renewables





- Northeast Solar Energy Research Center (NSERC) is a 960 kW solar array owned, operated, and maintained by BNL's Energy and Utilities Division
- In 2023, 556 MWh of energy was produced avoiding 110 metric tons of CO₂ emissions

Future Emissions Targets

Federal

2030

- 100% Carbon Free Electricity (CFE) procurement  must comply
- 65% Emissions reduction in federal operations  part of large compliance picture

2045

- Net-zero emissions building portfolio  must comply

2050

- Net-zero emissions from federal operations  must comply

New York State

2025

- 6,000 MW of in-state solar energy production  hosting 32MW LISF supports the State's goal

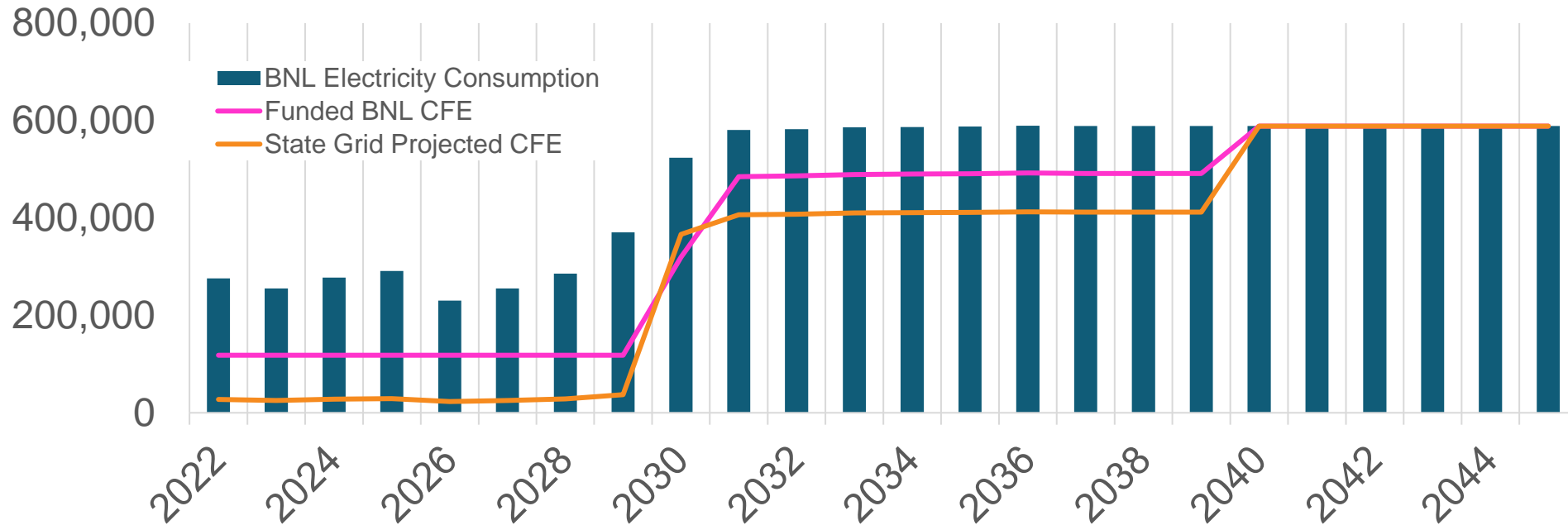
2030

- 70% Carbon Free Electricity  will benefit from the State's goal

2040

- 100% Carbon Free Electricity  will benefit from the State's goal

The Carbon Free Electricity Challenge

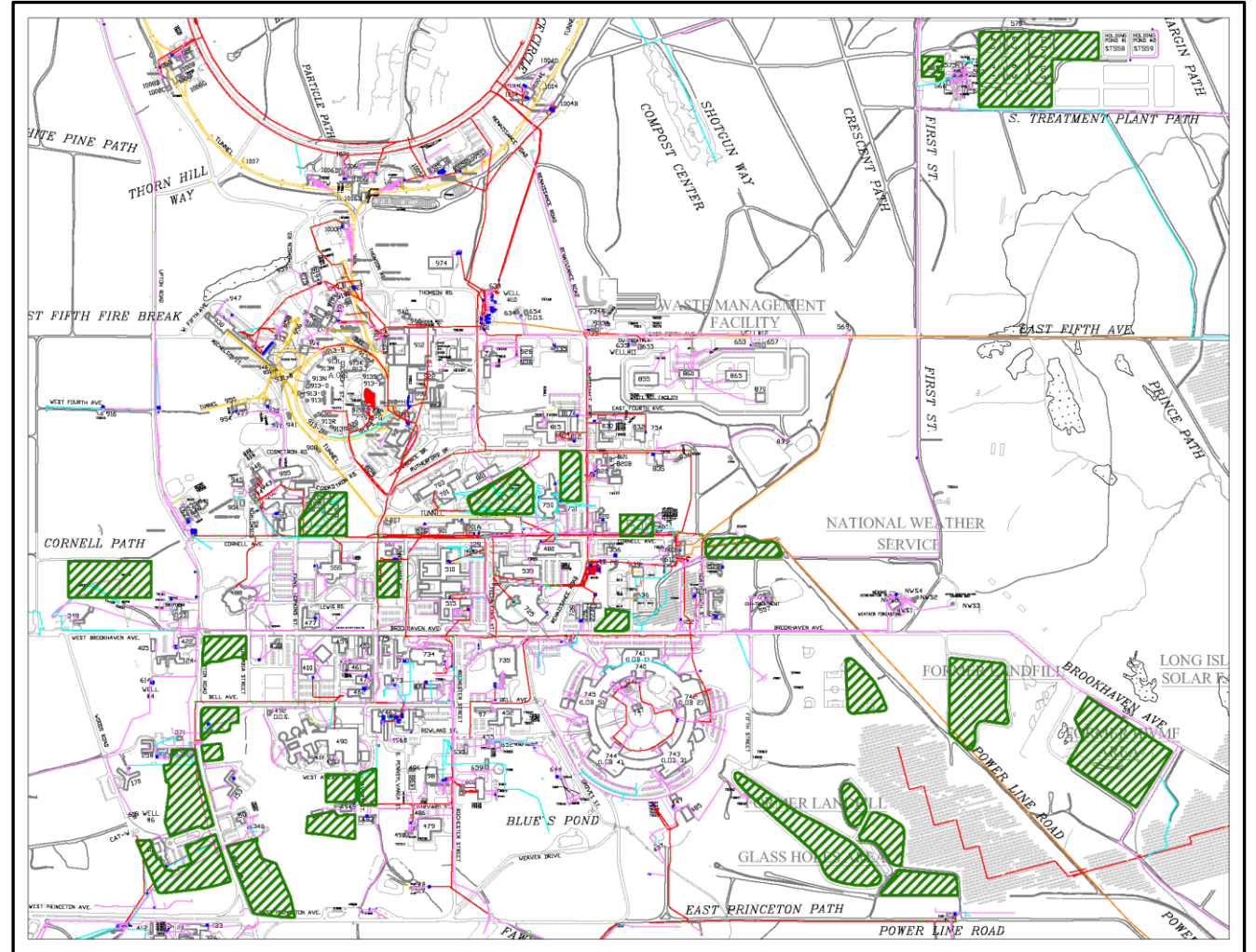


- New York State's goal for 100% CFE is **2040**; BNL's target is a decade more aggressive **2030**
- BNL will require significant additional on-site renewable energy to meet this goal, we are currently working on technical feasibility studies to see how we can do this in an environmentally responsible way
- Load growth shown 2029-2031 is from EIC startup....adds to the CFE challenge

Open Space Solar Feasibility Study

A FY 24 solar feasibility study will include...

- The study of parking lots to understand cost and potential of developing solar over BNL parking lots.
- The study of the site's open spaces noted on the map to understand cost and potential of developing ground mounted solar arrays.



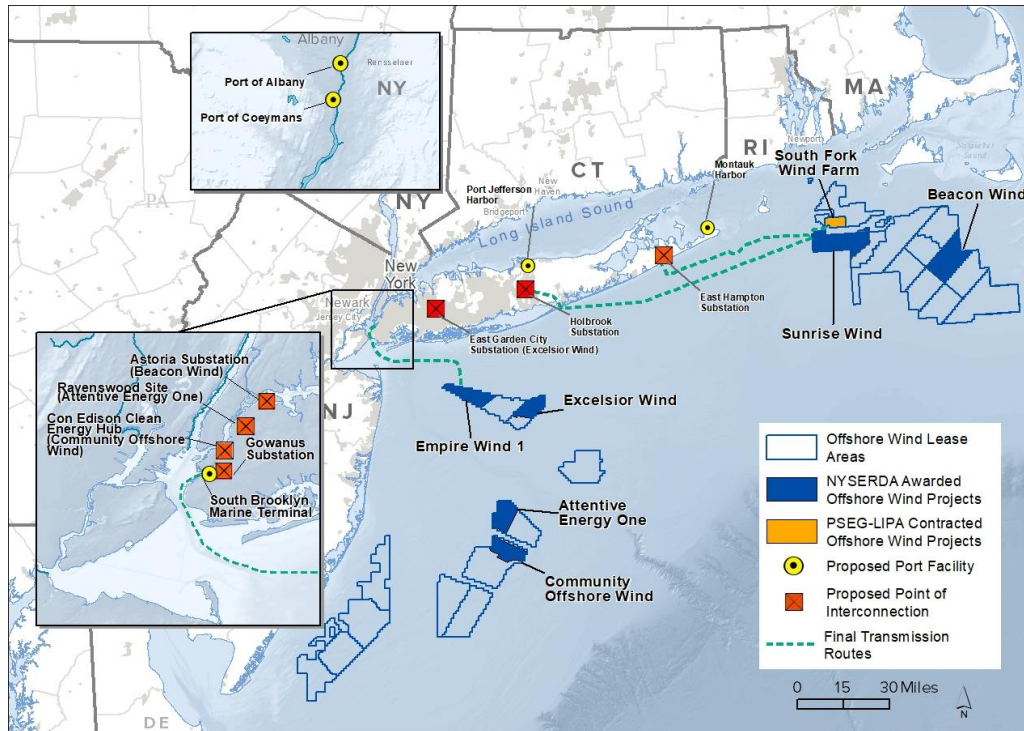
The Future of Solar Energy at BNL

Modernization of 1 MW Northeast Solar Energy Research Center (NSERC)

- Currently exploring options to upgrade BNL-owned NSERC solar array:
 - Existing array is 1 MW and nearing its end of service life.
 - Modernization with high output panels will double the output of the array.



The Future of Wind Energy at BNL



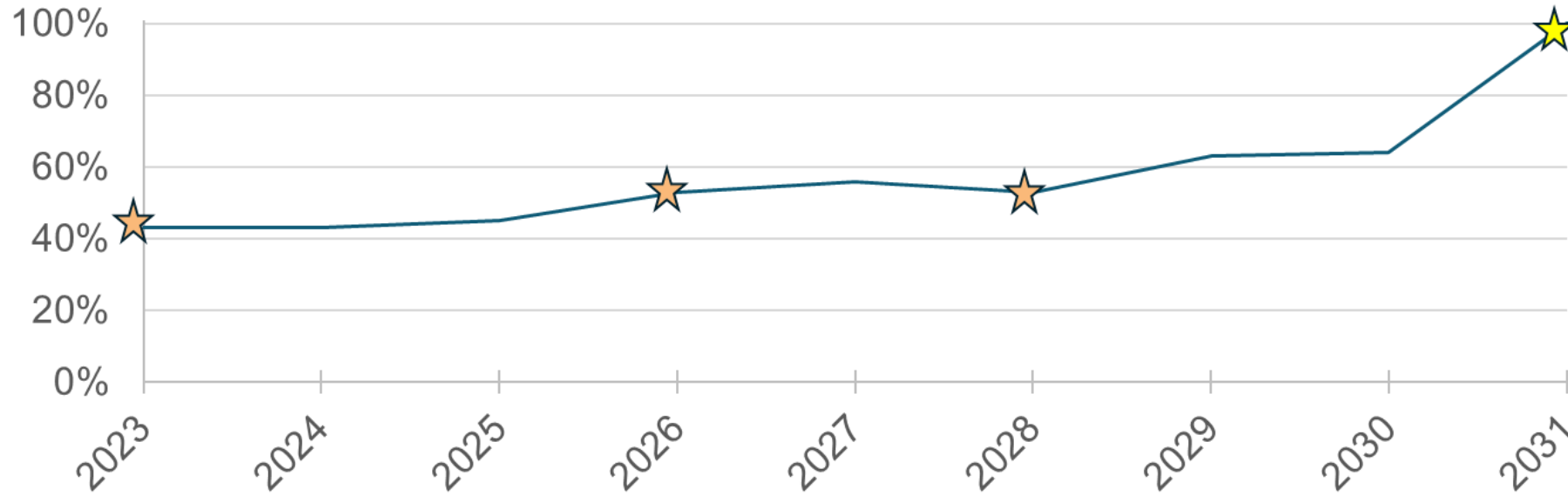
On-Site Wind: Previous studies have ruled out on-site wind generation due to low wind flux and regulatory issues on turbine height due to a neighboring airport.



Off-Shore Wind:

- New York State is developing large scale offshore wind generation to support its goal of 70% grid CFE by 2030 and 100% grid CFE by 2040
- BNL may be able to access a portion of this generation when available.

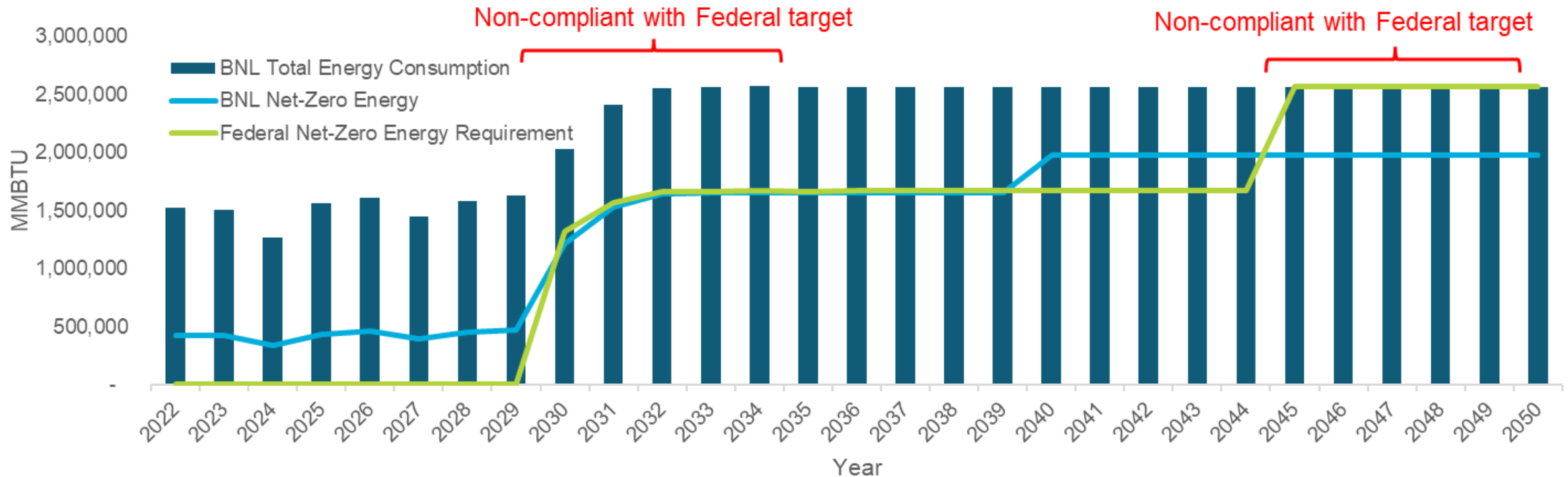
Site Carbon Free Electricity Projections



- ★ **2023** 43% CFE is coming from on site generation and existing power contracts
- ★ **2026** 56% CFE assumes the installation of 30 MW of solar
- ★ **2028** 68% CFE assumes the installation of 20 MW of on-site solar generation to be identified in a proposed solar investment grade audit of campus
- ★ **2031** 100% CFE assumes 60 MW of on-site generation is commissioned in FY30

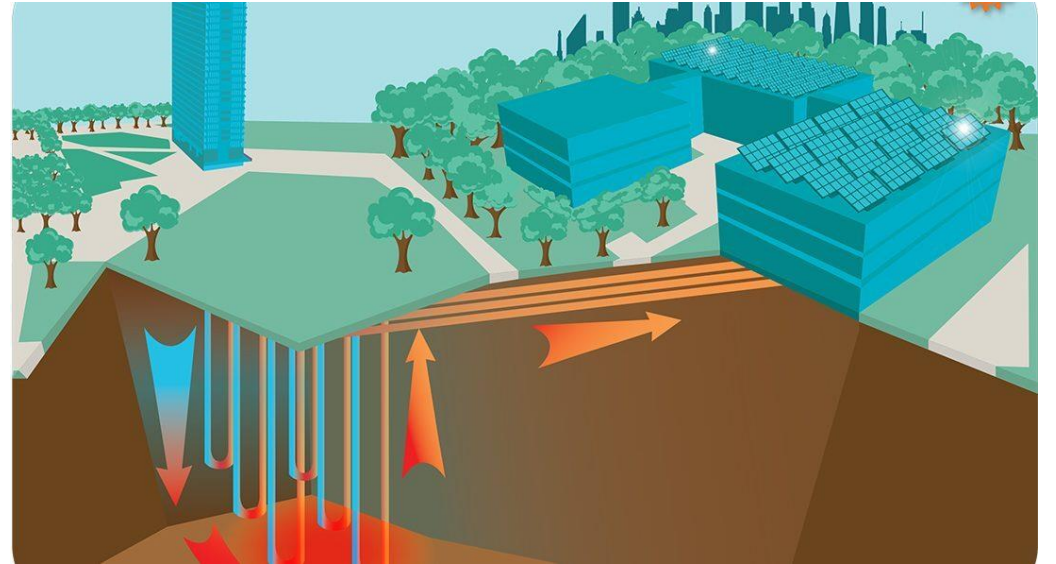
Net Zero Emissions

Net-Zero Emissions Goals



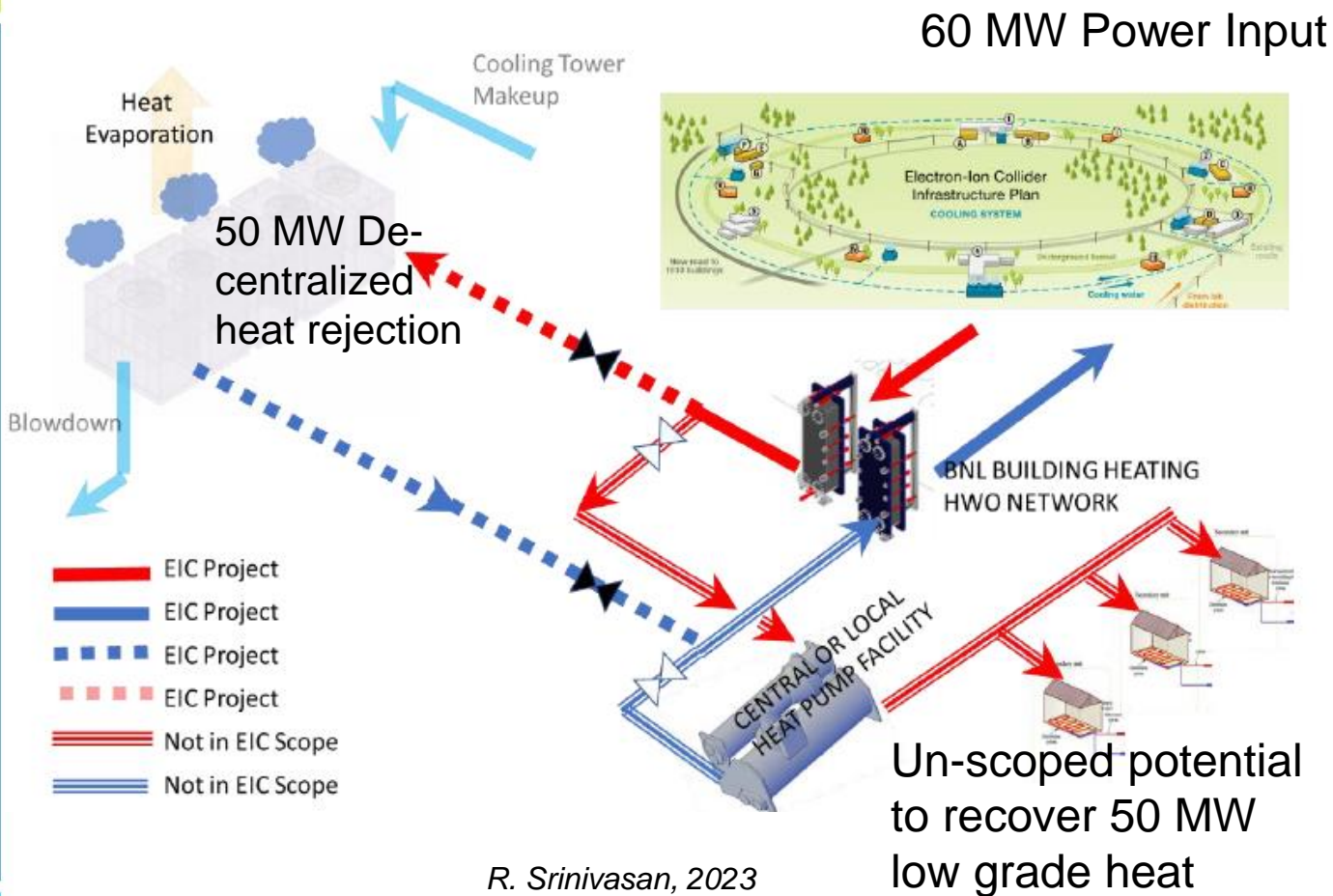
We are actively working on defining the path to get to net-zero emissions by 2045.

Geothermal Feasibility for Discovery Park



Study will be intended to inform BNL and future developers how geothermal energy can support a Discovery Park that does not use fossil fuels for space conditioning.

AFFECT Grant to study heat recovery from EIC to reduce emissions



- BNL was 1 of 3 National Laboratories to be awarded an Assisting Federal Facilities with Energy Conservation Technology (AFFECT) grant.
- The award was for \$100,000 to study heat recovery from the future Electron Ion Collider.
- Study aimed to investigate if and how heat can be recovered from EIC and redistributed to the site during the winter to offset emissions from the Central Steam Facility.

Thank you!

Questions?