CHP Alliance - Northeast Chapter

Memorial Sloan Kettering Cancer Center's CHP Story

Bob Berninger, Memorial Sloan Kettering Cancer Center

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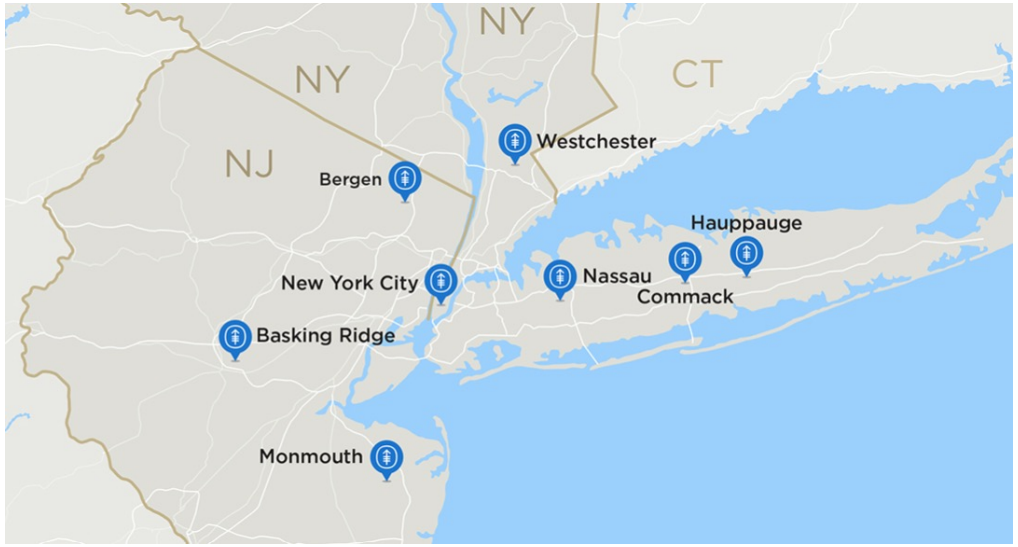
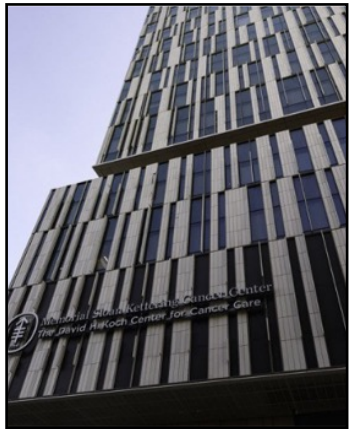
MSK At a Glance

Memorial Sloan Kettering Cancer Center (MSK) is the worlds oldest and largest private cancer center devoting more than 130 years to exceptional patient care, innovative research, and outstanding educational programs.





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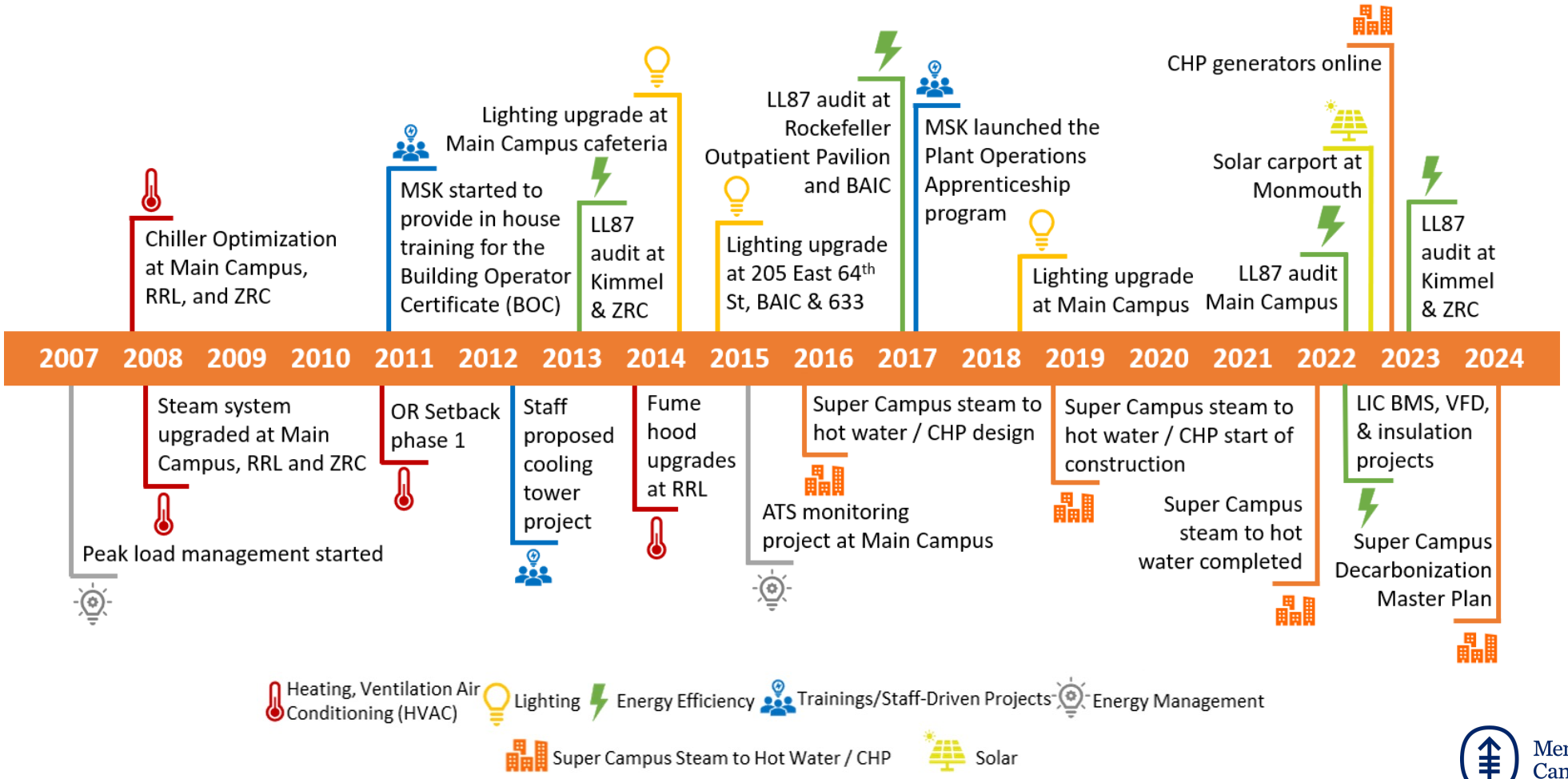
MSK's 15+ Years of Energy Efficiency

- MSK has invested over $143 million in energy projects and avoided $88 million in energy costs since 2007
- **MSK has reduced GHG emissions 58%** (EUI per sq ft for NYC portfolio in alignment with the NYC Carbon Challenge)



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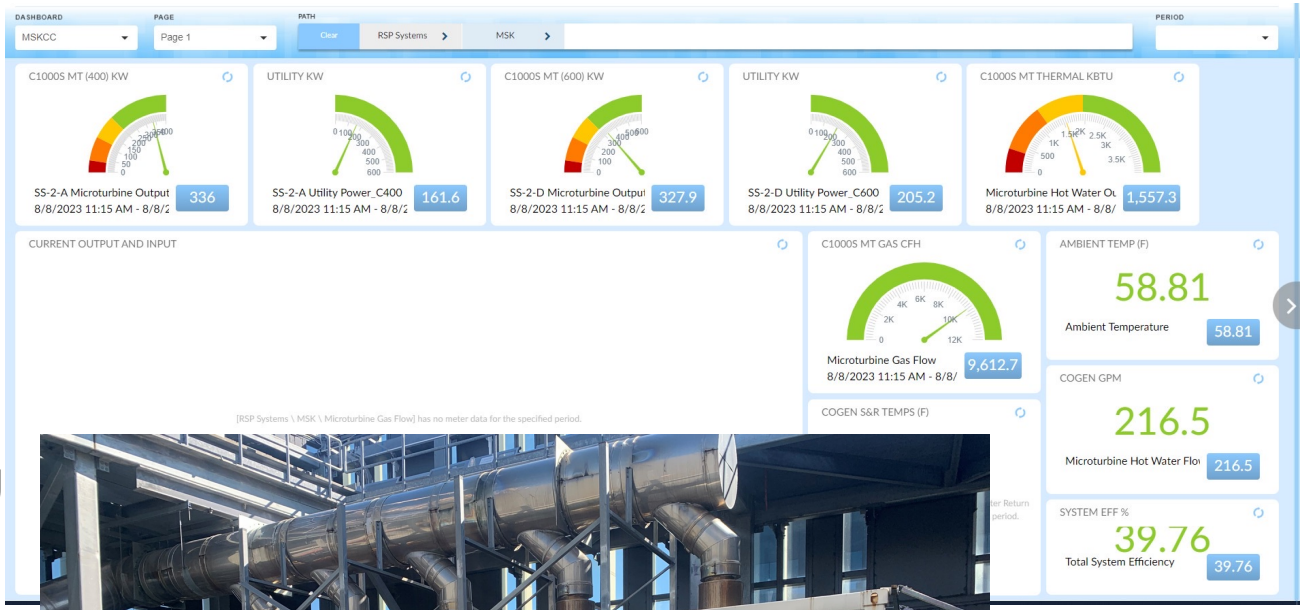
MSK's David H. Koch Center for Cancer Care Project

- Located on the Upper East Side.
- The site is 775,000 sq. ft.
- 1 MW (400 kW and 800 kW)
- Resiliency features
  - Black start capabilities
  - Avoided another emergency generator for cooling



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MSK's Super Campus Project

- Located on the Upper East Side. The Super Campus is 2,490,355 sq. ft.
- **Main Campus** - 7 interconnected buildings of various vintages and renovations 1,405,310 sq. ft.
  - Memorial Hospital – 1976
  - Bobst Building – 1938
  - Howard – 1947
  - Schwartz – 1948
  - Haupt – 1970
  - Radiation Oncology – 1971
  - Infill – 2006
- **Rockefeller Research Lab** – 1986, 287,202 sq. ft.
- **Zuckerman Research Center** – 2006, 728,239 sq. ft.

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MSK's Super Campus Project

Project Timeline

- 2010: Feasibility study and project proposal to MSK senior leadership
  - Discussed CHP
- 2016: MSK's CFO circled back to Plant Ops team
- 2016: Design phase launch
  - CHP confirmed
- 2019: Construction

Why CHP

- Resiliency
  - Prior to CHP, existing generators did not provide cooling to the hospital and research facilities
  - The ability for black start
  - Tied to electric chillers to provide cooling resiliency
- Financial savings
- Avoided additional emergency generators

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MSK Energy Transition Impetus

Phase 1: Steam to Hot Water Conversion / CHP

- Issues with an aging high temperature and high-pressure steam system
- Replace with Low Temperature Hot Water system in an Operating hospital and research center
- Programmatic goals:
  - Improve efficiency and reduce utility costs
  - Reduce net emissions
  - Infrastructure resiliency
  - Pathway to decarbonization

Phase 2: Decarbonization Master Plan

- Continue to reduce energy usage, costs and GHG emissions
- Drive Hot Water operating temperatures as low as possible
  - Preheat & Reheat Systems
  - Operating Temperatures & Pumping Pressures
- Innovate Direct Heat Recovery Systems to minimize electric need
- Implement high efficiency heat pumps
  - Identify heat recovery sources
  - Exhaust, Effluent, Tower Rejection, etc.

Phase 1 Project Scope

- Steam to hot water conversion
  - Design the hot water source for current 180°F load requirements
  - High Efficiency Condensing Boilers
  - Steam to remain for sterilization and summer steam turbine chillers
- **Combined Heat and Power (CHP) Generators**
- Design new HW Loads to operate at **lower** temperatures
- Complete the project in an operating hospital and research center

High Efficiency Condensing Boilers

Phase 1 Hot Water Source
Main Campus Boiler Room

- Modular mechanical room
- Twelve (12) new condensing hot water boilers
- Four (4) boilers capable of dual fuel operation
- Four (4) distribution pumps with VFDs
- **Two (2) CHP High Temp cooling HEXs**

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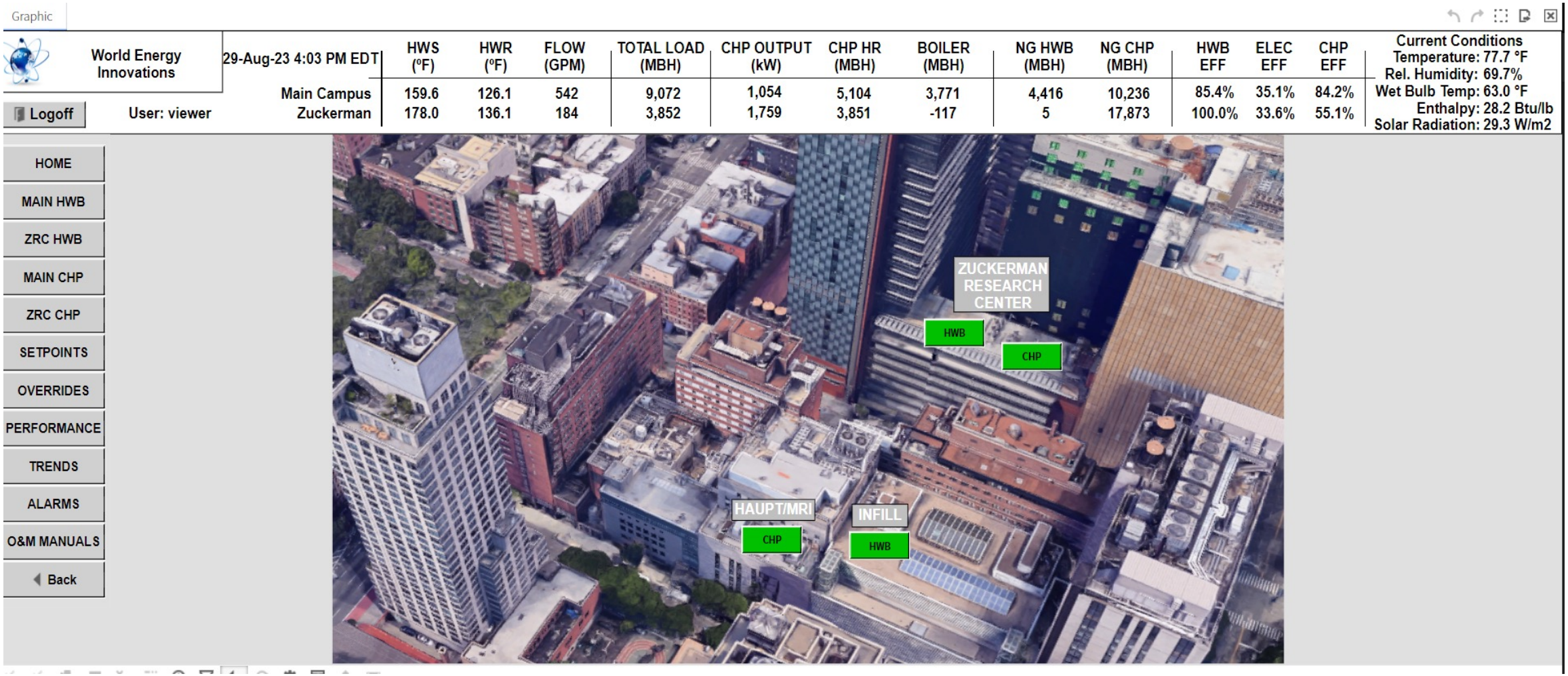
MSK Super Campus CHP



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Hot Water Source
Main Campus CHP Generators

- (2) 480V 557KW Reciprocating Engine Generator System
- High Temperature and Low Temperature Radiators
- High Temperature heat rejected to the Boiler System
- Integration to the Building Electrical Distribution System

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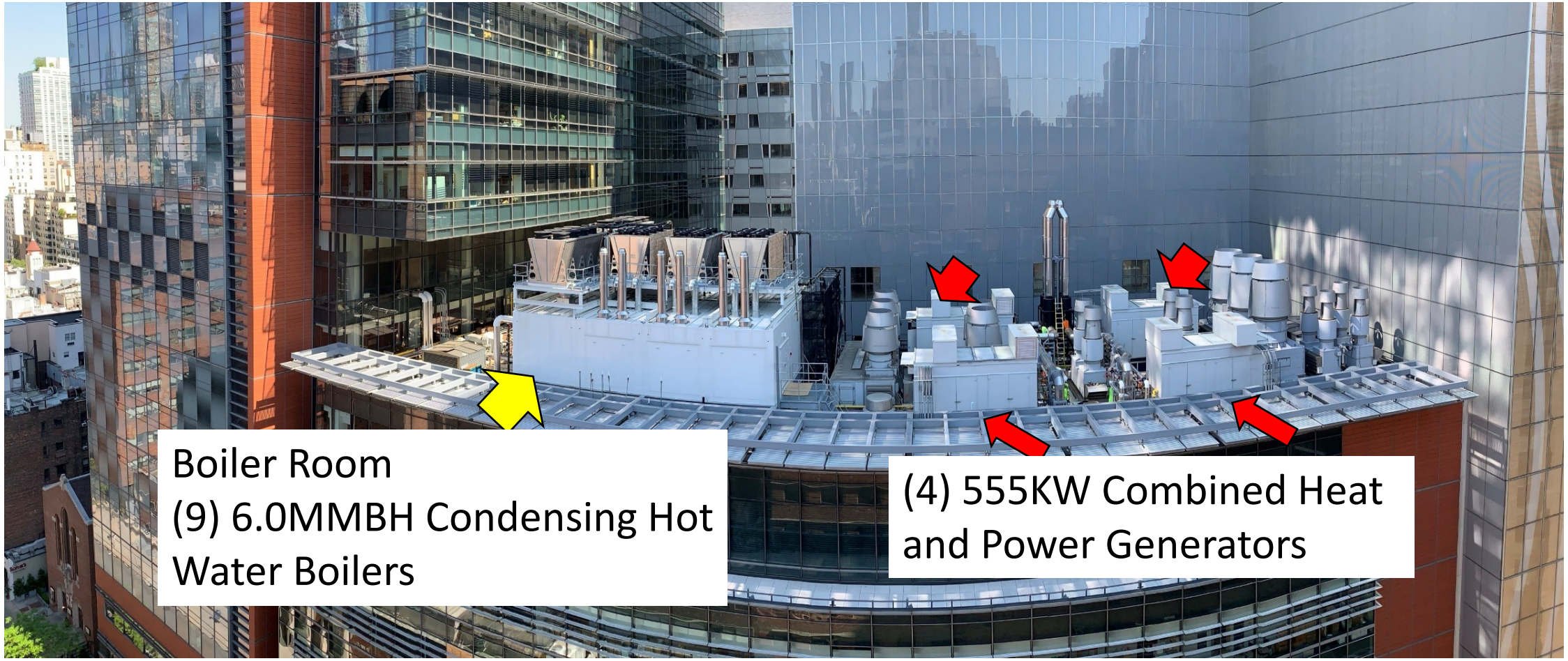
Hot Water Source
Zuckerman Boiler Room & CHP Generators



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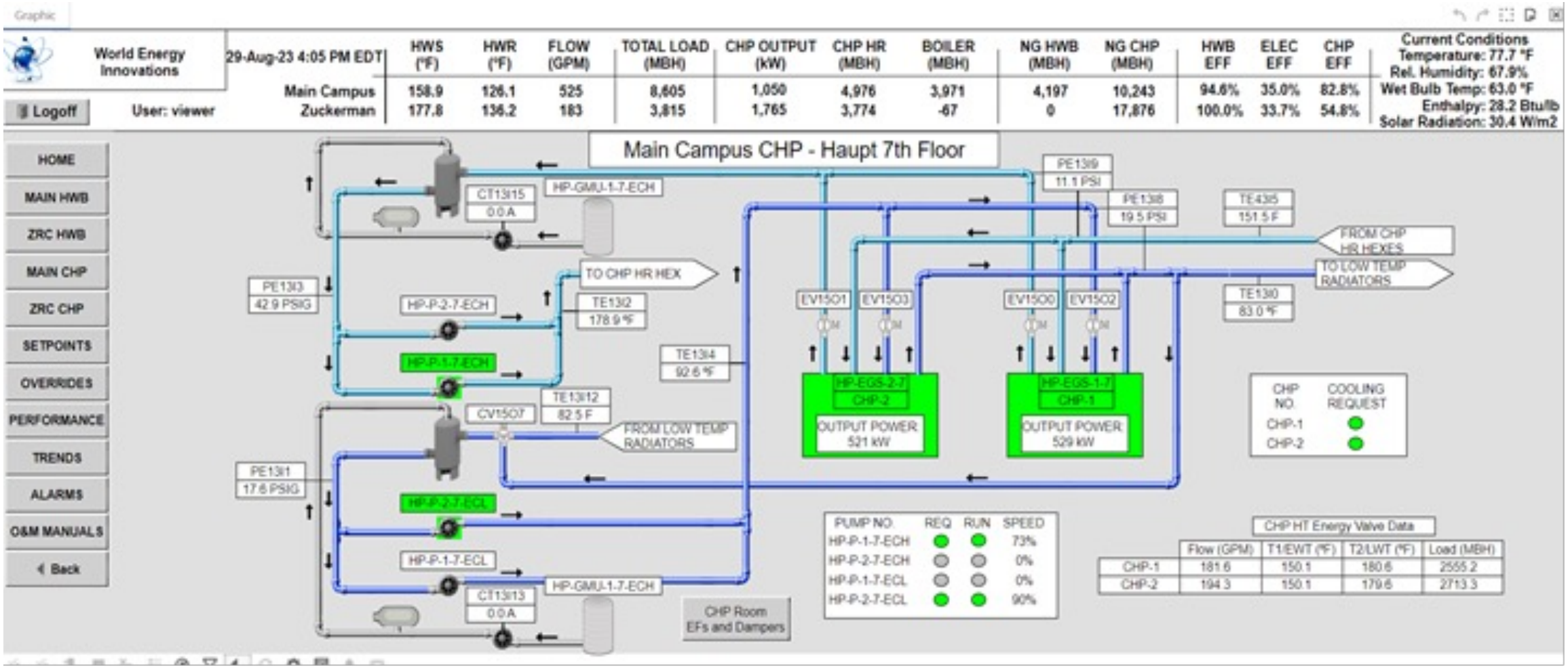
Main Campus CHP



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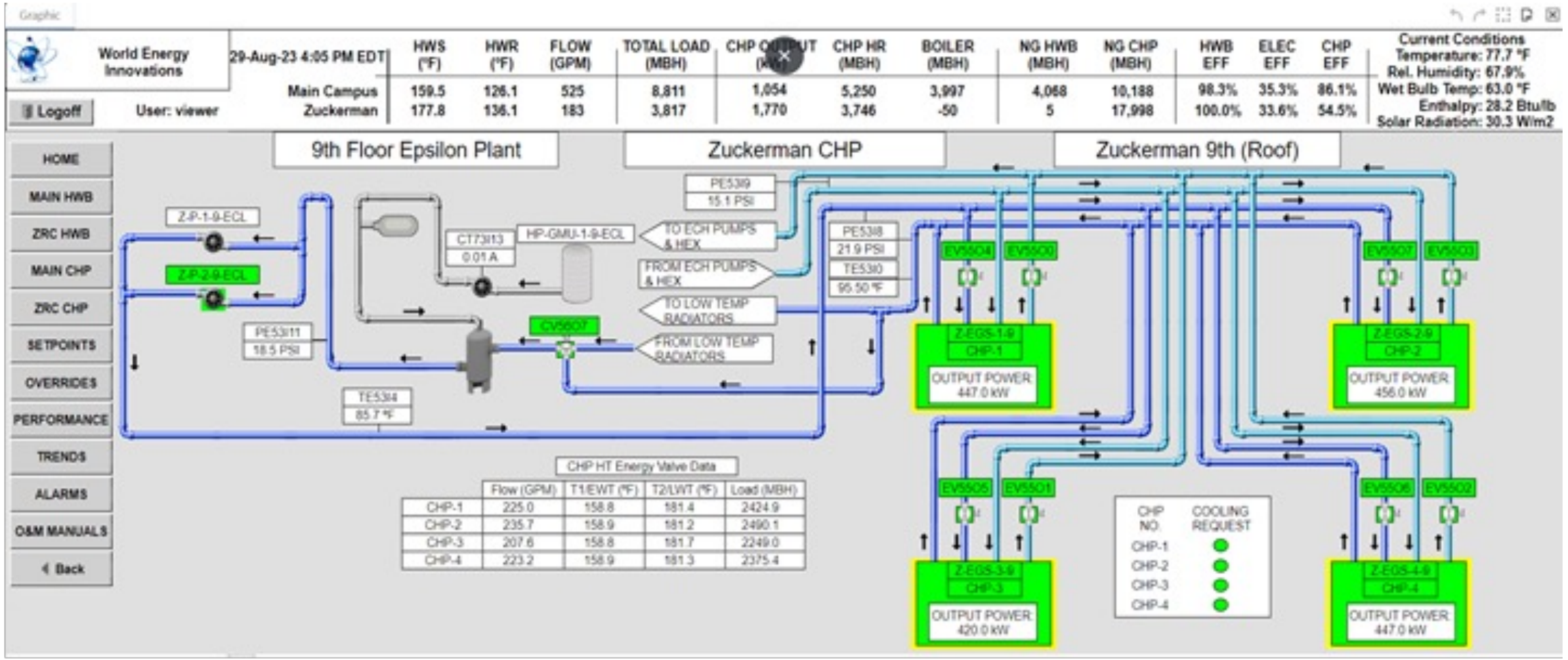
Zuckerman Research Center CHP



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Phase 1 Results: Large Scale Project with Large Scale Savings

Heating and Greenhouse Gas (GHG) emissions reductions across the MSK Super Campus from 2020 to 2022

- 86,055 mmbtu (23%) reduction in heating energy usage
- $7.9 million in utility cost savings annually
- 34% reduction in GHG emissions
- Chilled Water generation reduced 20%
  - 2020 chiller generation: 31,124,566 ton-hrs
  - 2022 chiller generation: 25,001,196 ton-hrs

*numbers do not include CHP (Q2 2023)

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Phase 2…What's Next?

- MSK currently completing a Decarbonization Master Plan for the Super Campus
- Pursing all options and technologies to lower energy usage and GHG emissions
- Pursuing if CHP can utilize hydrogen / alternative fuels as the grid modernizes

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Questions?

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