

High Rise / Low Carbon: Nimble Brains for Complex Buildings

As buildings transitioned from analog to digital systems, controls were dominated by platforms with high financial and educational entry thresholds. But with a movement towards relying on natural energy flow and the emergence of ubiquitous, sophisticated software, low-cost sensors and compute devices, and reliable wireless communication, our ability to orchestrate complex systems in buildings has transformed. It is now possible to capture and redeploy heat throughout a building, continually optimizing this thermal dispatch model in real time and keeping HVAC systems running at the highest possible level of performance, without cumbersome hardware.

During this High Rise / Low Carbon series program, hear from experts who are deploying these technologies and utilizing Resource Efficient Decarbonization strategies to optimize performance in low-carbon retrofits.

Opening Remarks

Thomas Yeh, RTEM Advisor, NYSERDA

Moderator

Nyla Mabro, Head of Strategy & Marketing, The Clean Fight

Presenters

Matt Sheridan, Energy Manager – Rockefeller Center, Tishman Speyer

Thomas Walsh, General Manager – Manhattan West, Brookfield Properties

Panelists:

Neil Breen, Vice President, Energy Services, Ramboll

Javier Aleman, Principal, AXC Automation

November 30, 2022 | 9 to 10:30 am | 1.5 AIA LU|HSW
Building Energy Exchange | be-exchange.org



NYSERDA

be
ex

building
energy
exchange



TISHMAN SPEYER

Nimble Brains for Complex Systems

Rockefeller Center



Contents

Path to Electrification

- Rock Center Energy Systems
- Domestic Hot Water
- Perimeter Heating
- Heat Sources

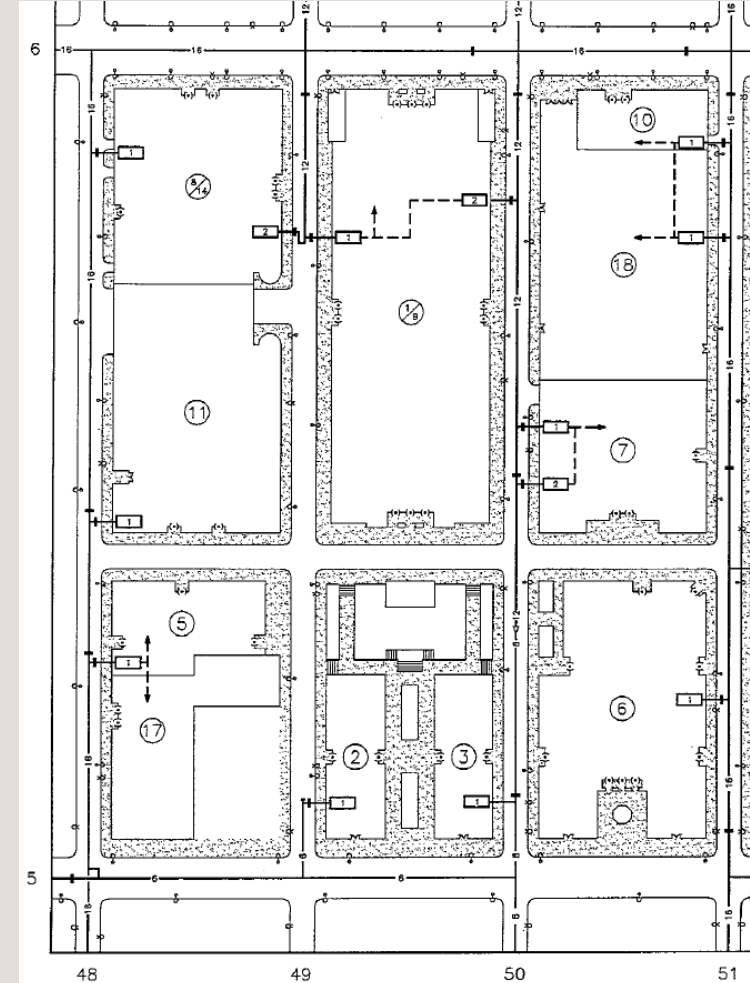
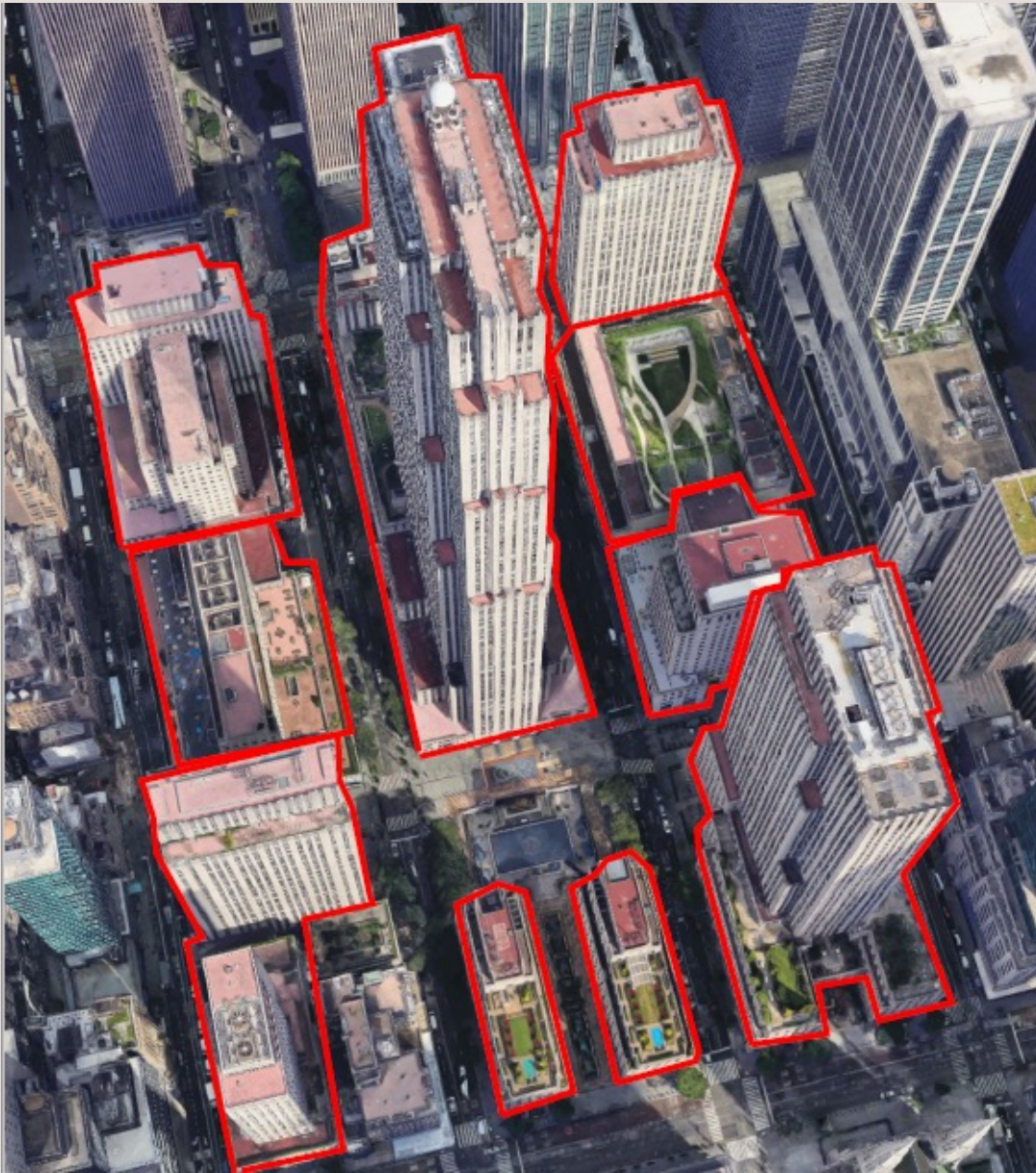
Path to Grid Interactive Buildings

- Real Time Energy Management System
- Demand Response
- Future Controllable Loads

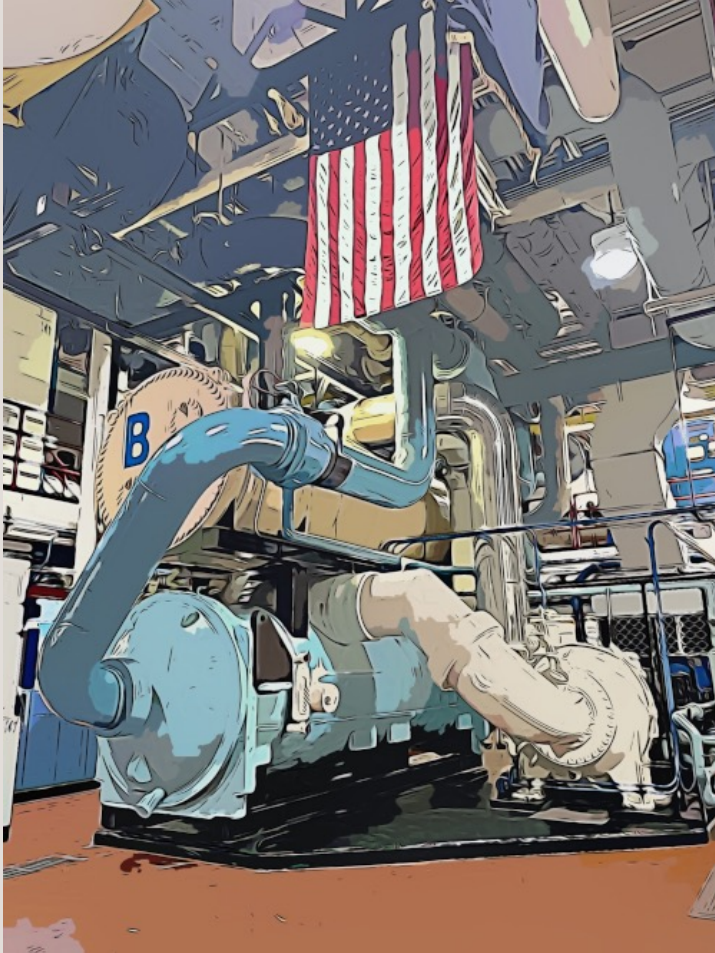
Rock Center Energy Systems



Coned Steam: No Gas Boilers



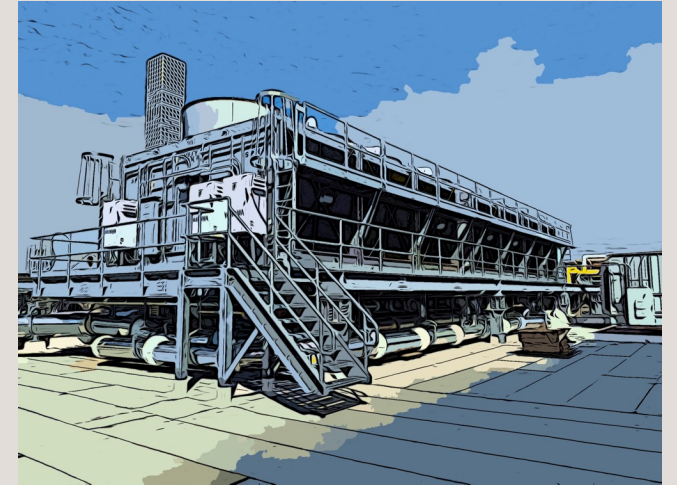
Electric Chiller



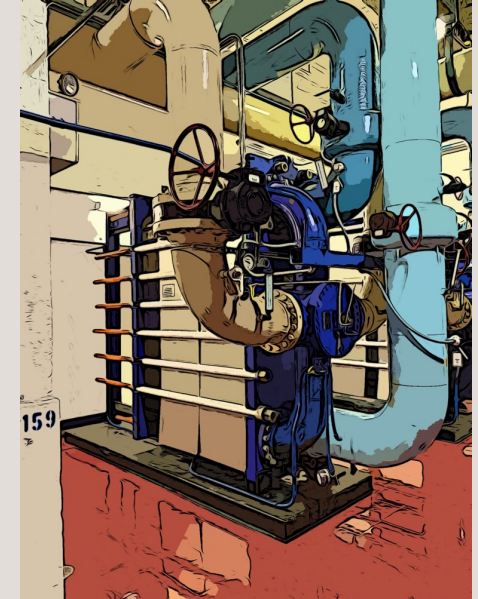
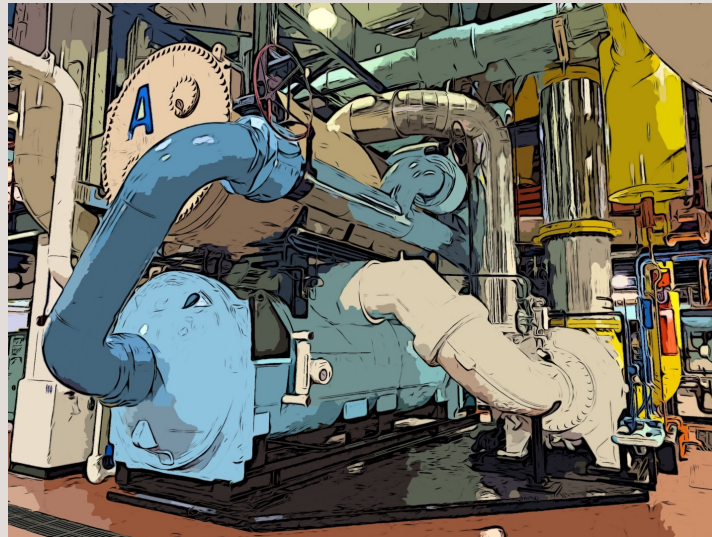
Ice Storage



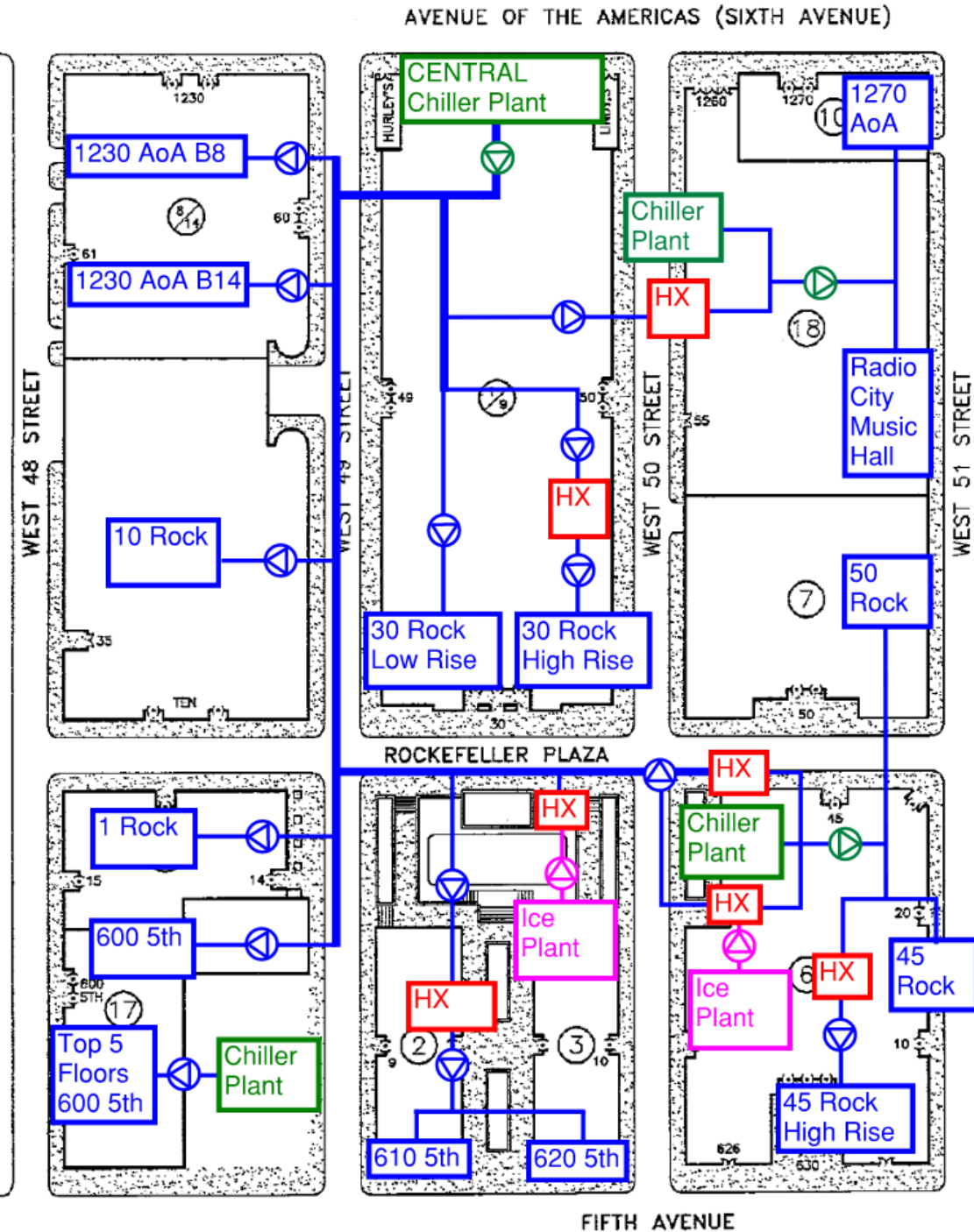
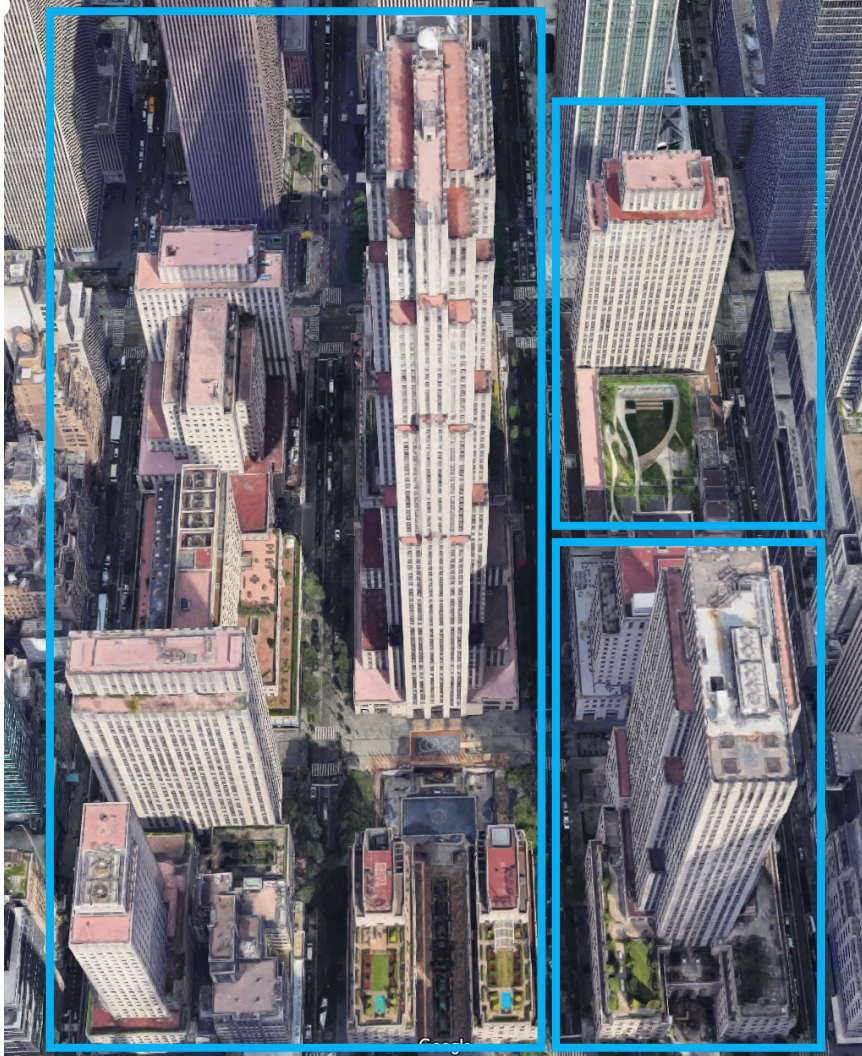
Free Cooling



Steam Driven Chiller



Chilled Water System



Electrify Domestic Hot Water



Domestic Hot Water

Existing

- Instantaneous Steam
- Electric

Issues

- Steam pressurized year round
- Electric Resistance is Expensive
- Increased electric service
- Energy not submetered to tenant



No Good Location
For Air Source

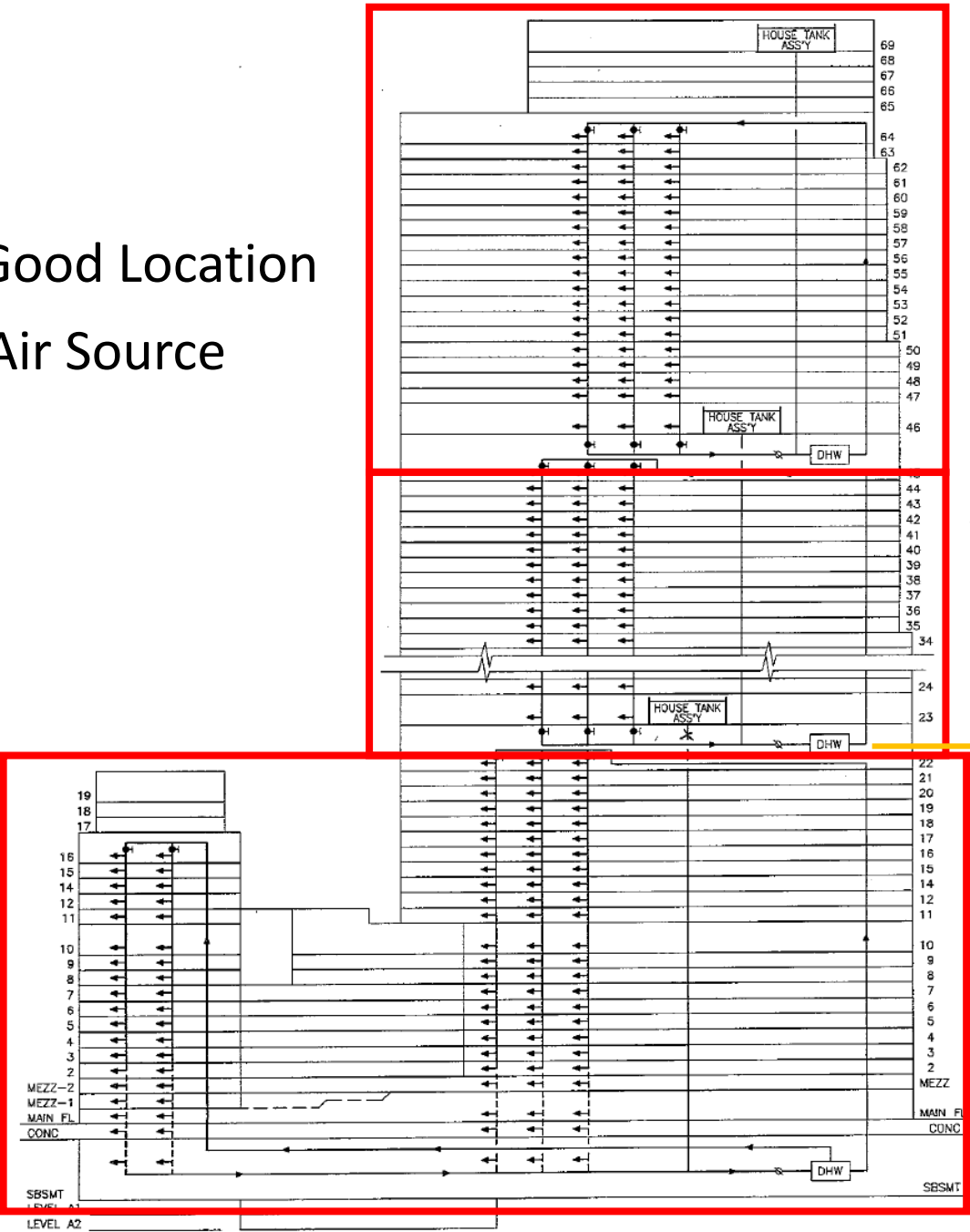


Figure 3b: DOMESTIC HOT WATER SYSTEM

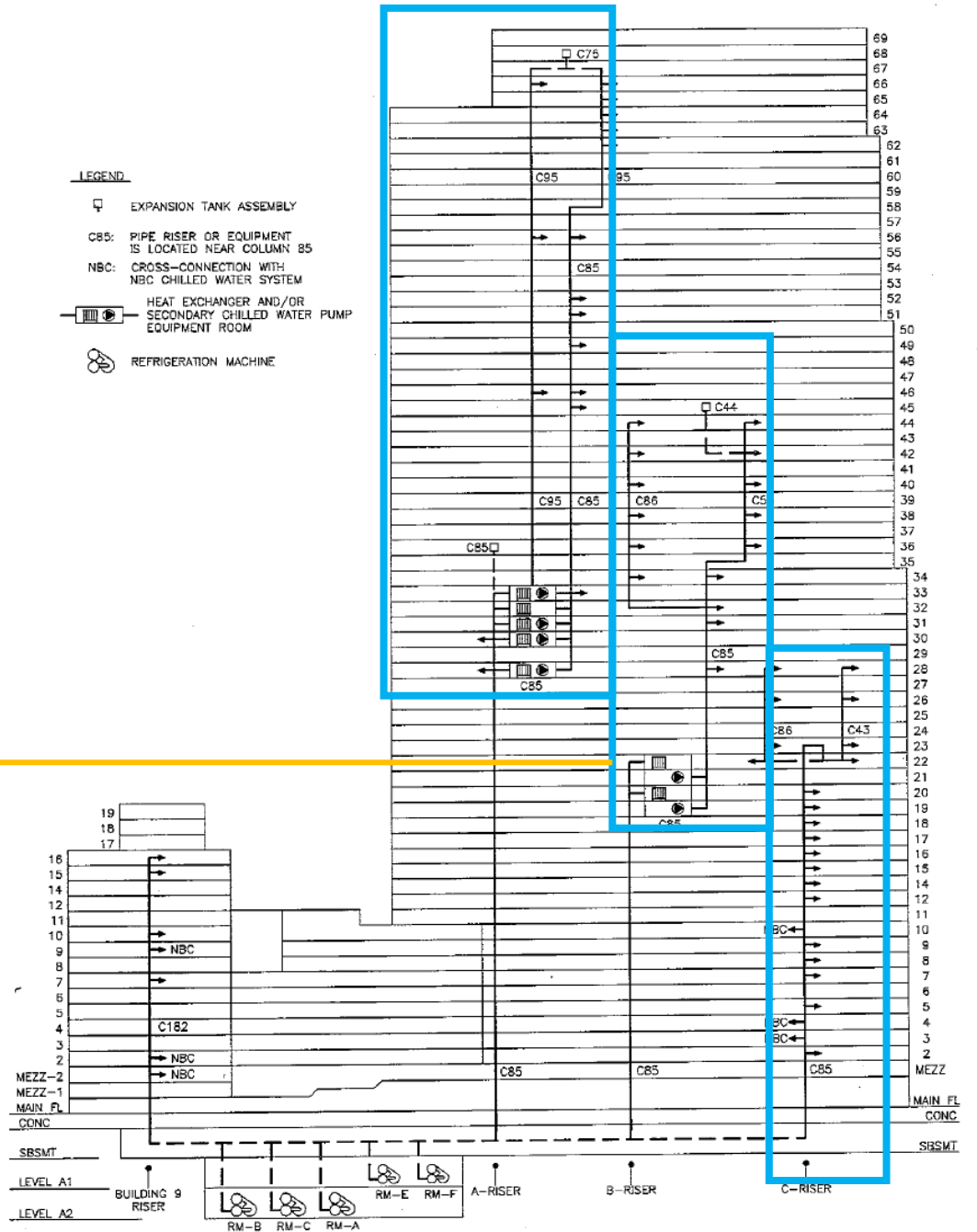
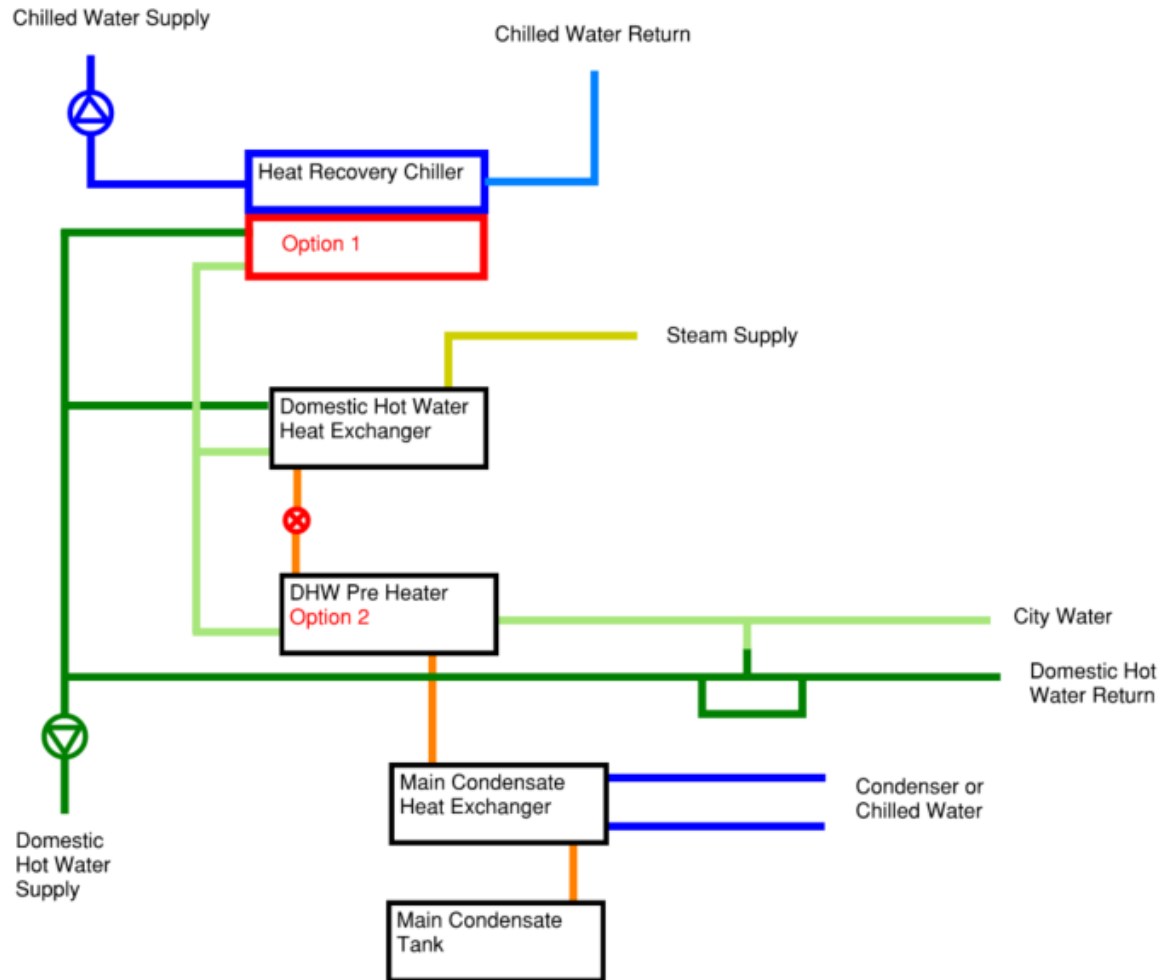


Figure 6c: CHILLED WATER RISERS

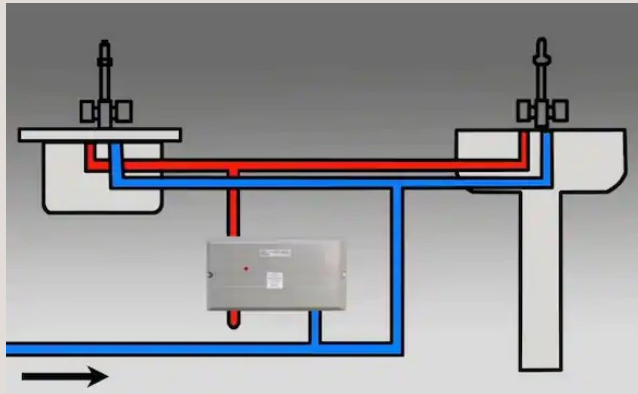
Small Heat Recovery Chiller



- Carrier Aquasnap
- Multistack
- Trane Artic Heat Pump
- Nyle
- Colmac



Bathrooms



Kitchens



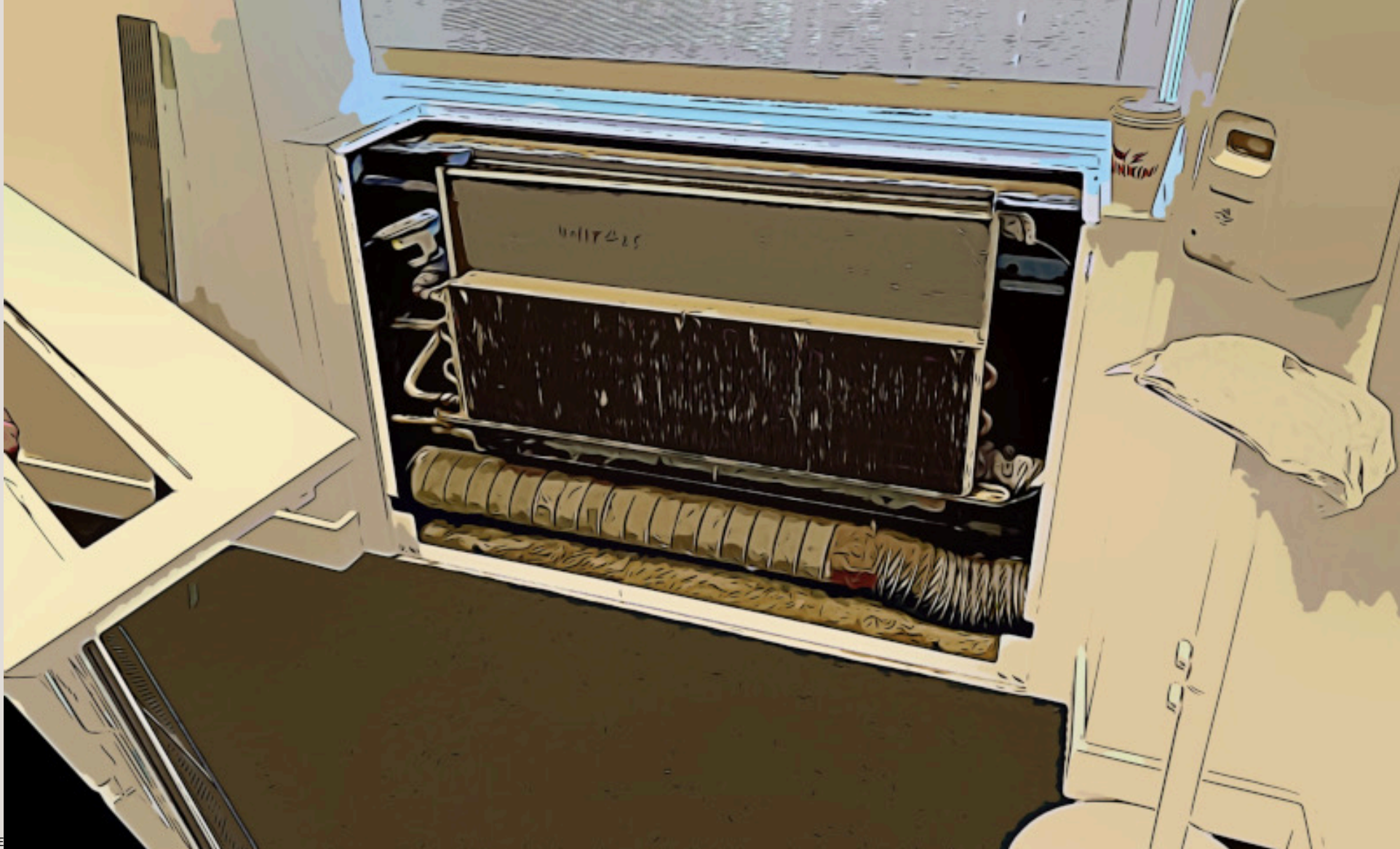
Offices



Electrify Perimeter Heat



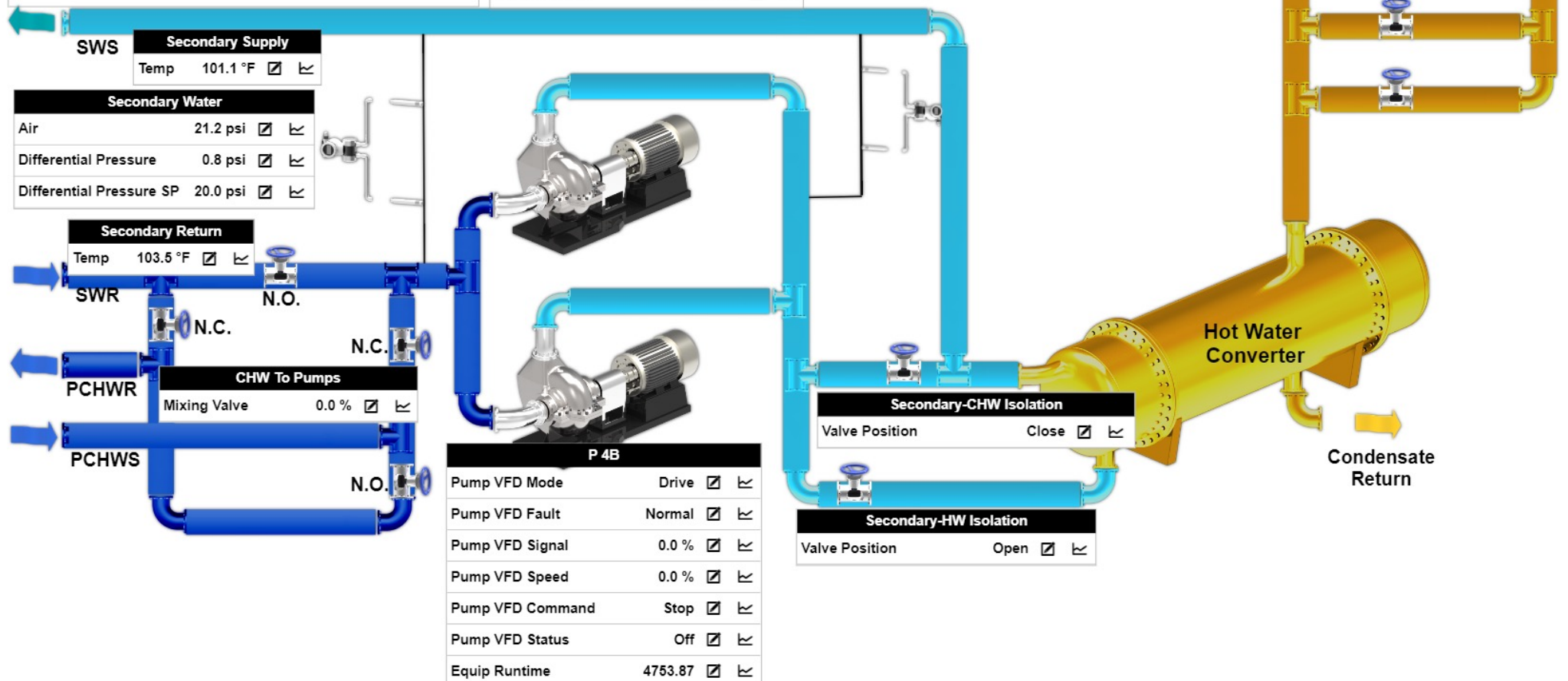
Induction System



Building 14 - SECW 087 - South Zone

Summer/Winter Mode	WINTER	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Summer SP	63.0 °F	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Winter Day SP	107.2 °F	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Winter Night SP	75.0 °F	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Main Swtch	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>
ACS 084 Fan Status	Off	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lead Pump	Pump_4B	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Rotate Pumps	<button>Trigger</button>		

P 4A			
Pump VFD Mode	Drive	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pump VFD Fault	Normal	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pump VFD Signal	0.0 %	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pump VFD Command	Stop	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pump VFD Status	Off	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pump VFD Speed	0.0 %	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Equip Runtime	4441.66	<input checked="" type="checkbox"/>	<input type="checkbox"/>

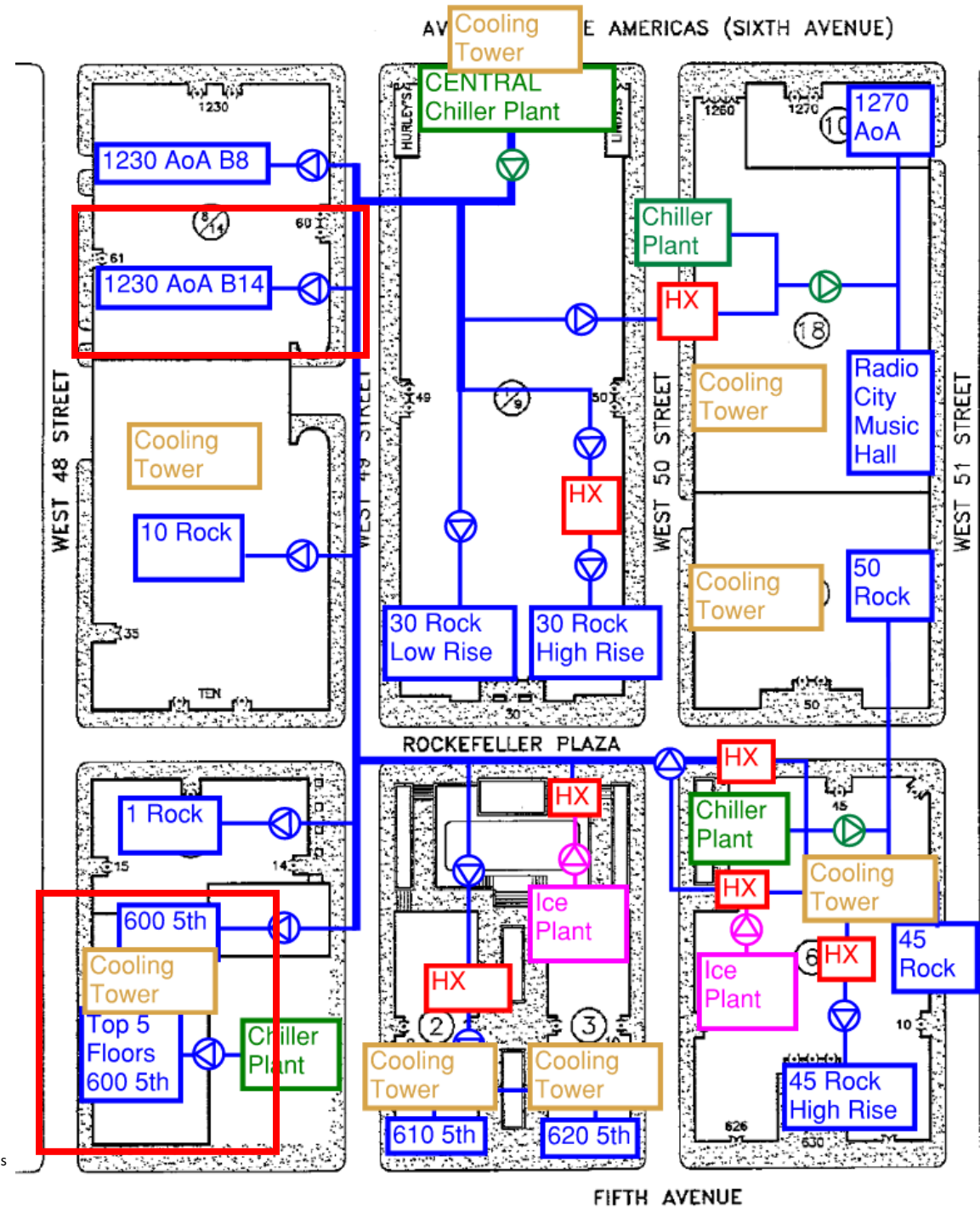


Distributed

- 1 chiller per zone heat exchanger
- 1 chiller per building, new hot water riser

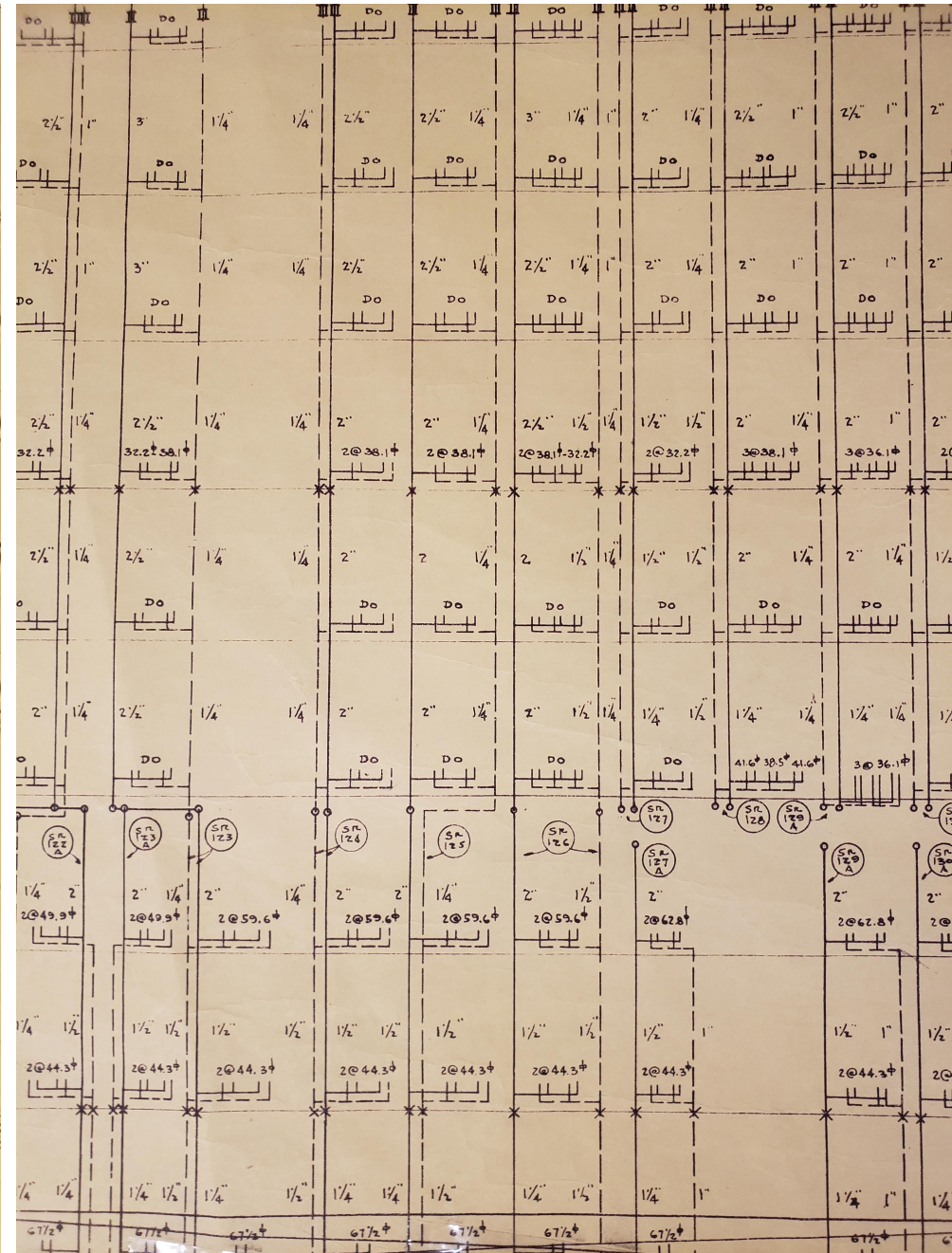
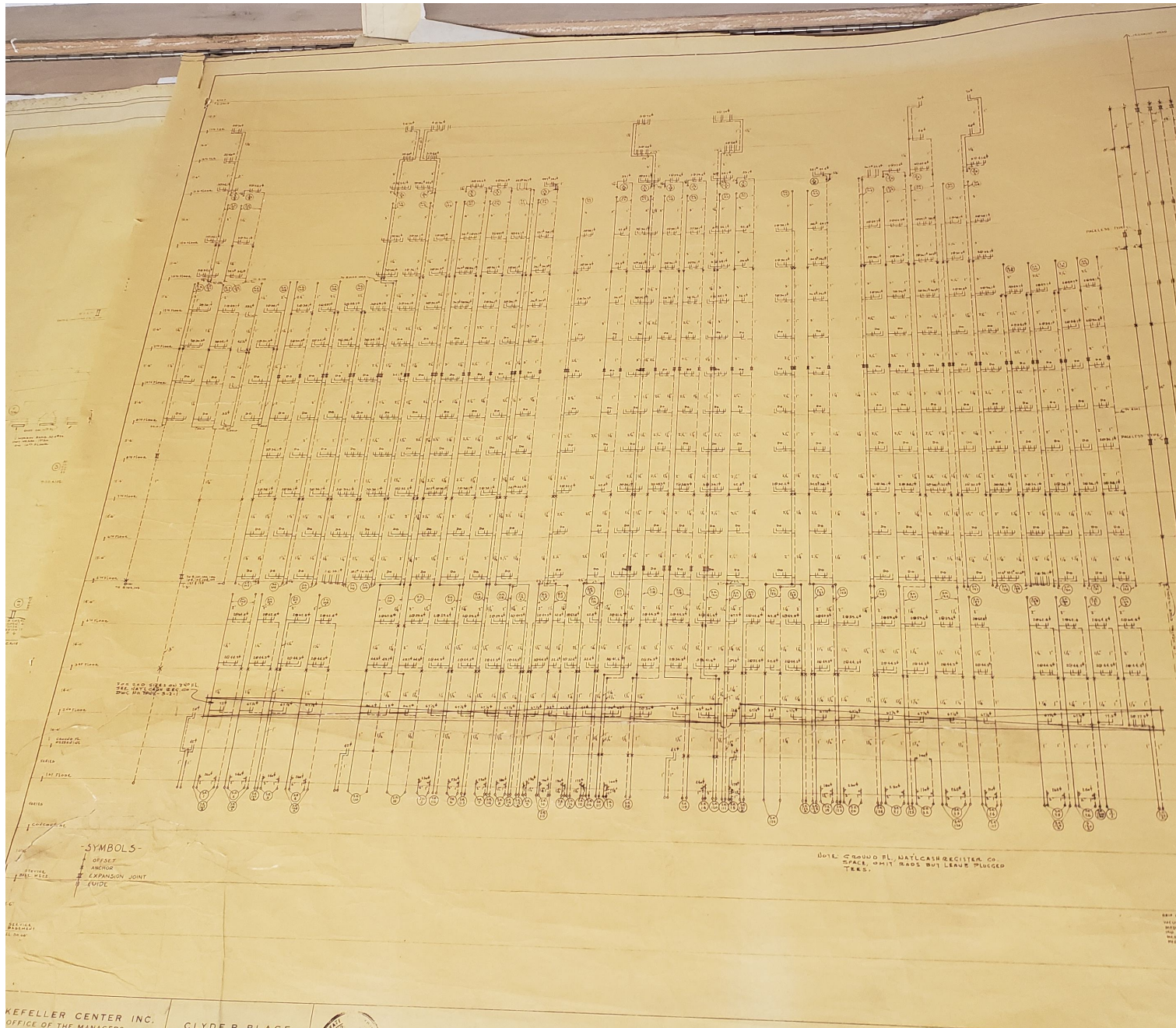
Central

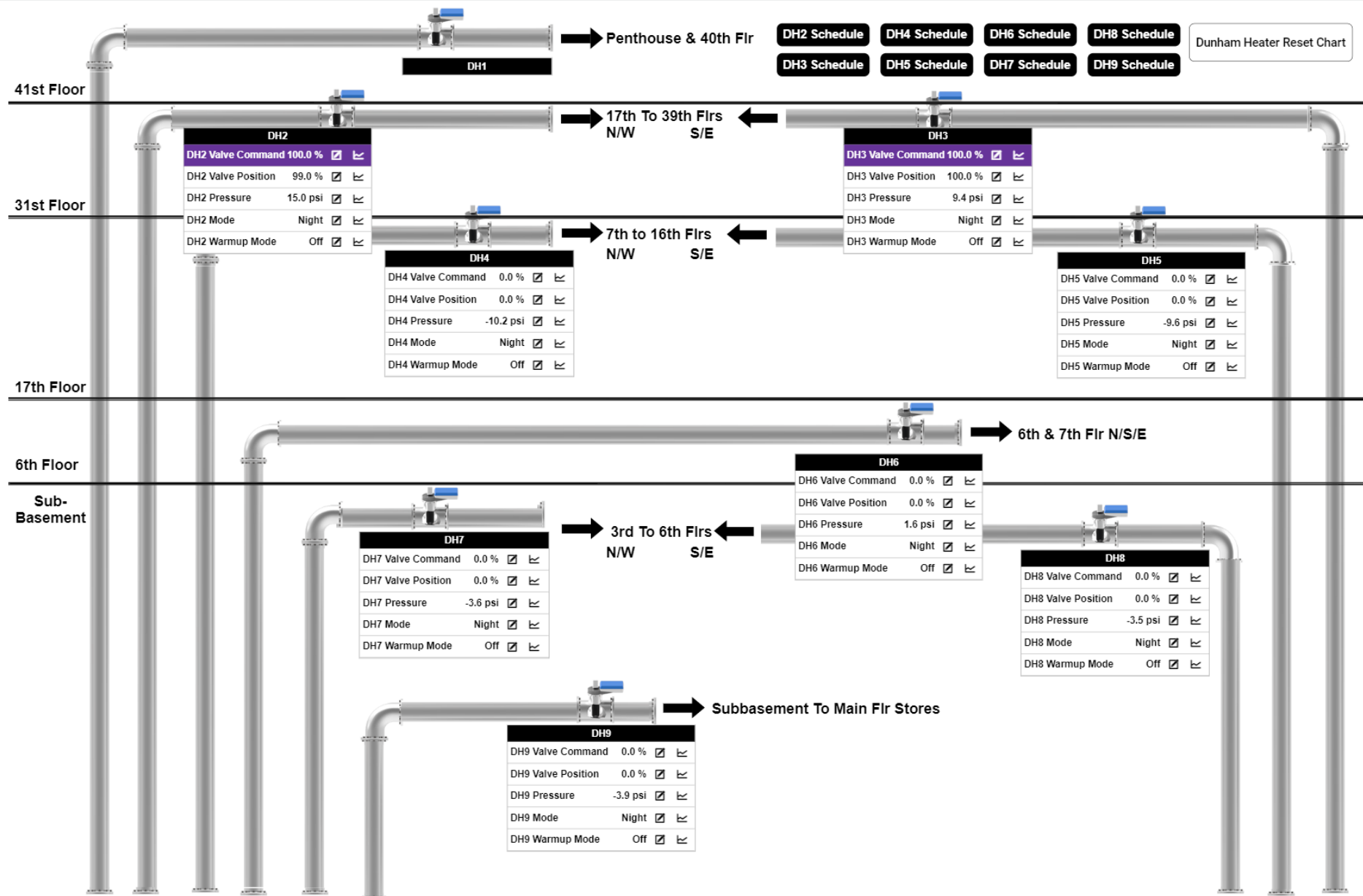
- Run new hot water pipes to induction unit builds, add heat recovery chiller to central plant



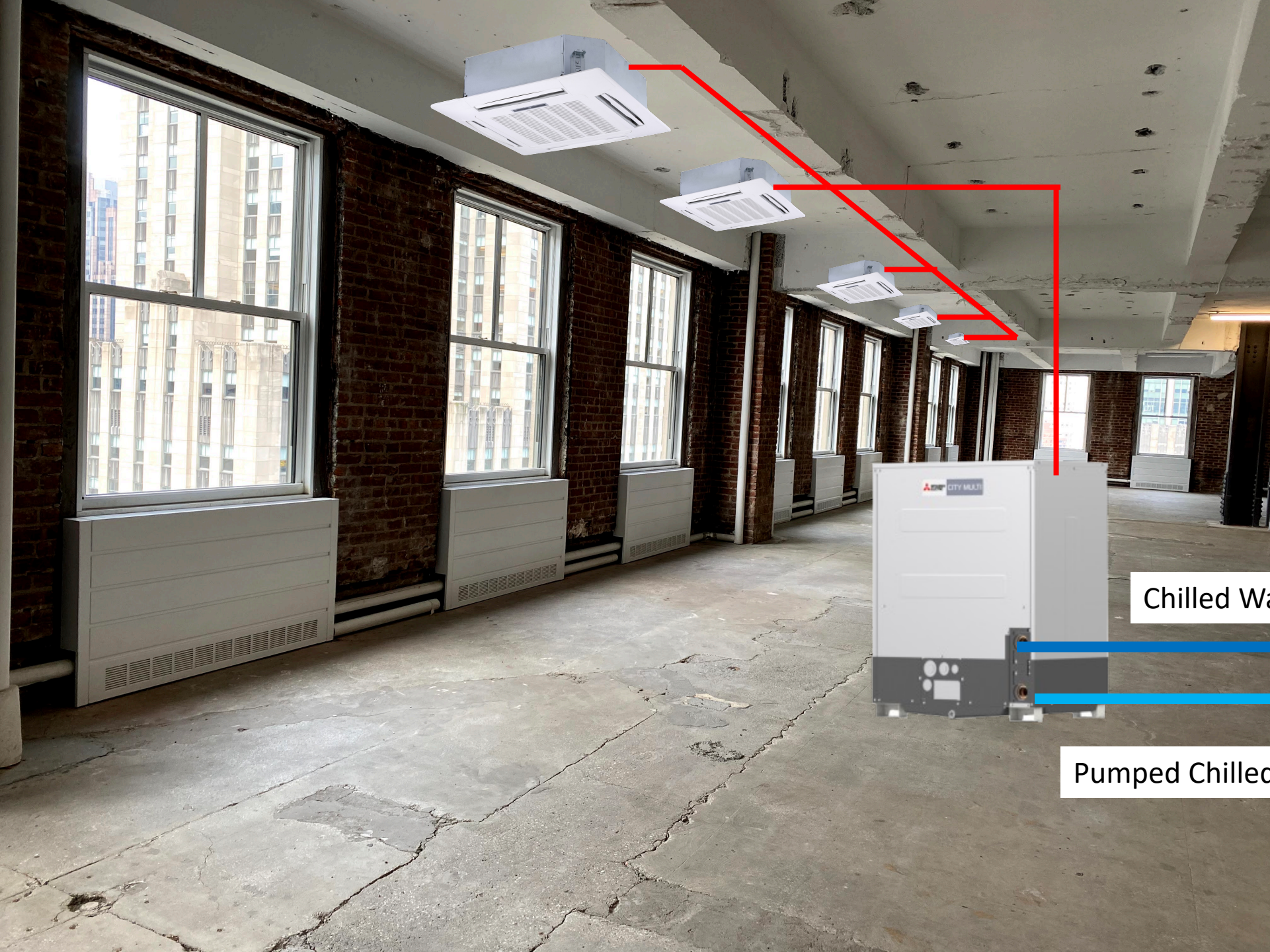
Perimeter Heat











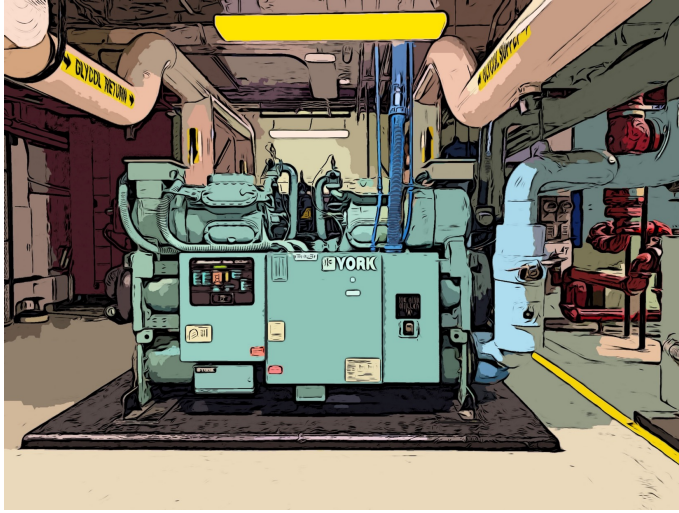
Chilled Water Supply

Pumped Chilled Water Return

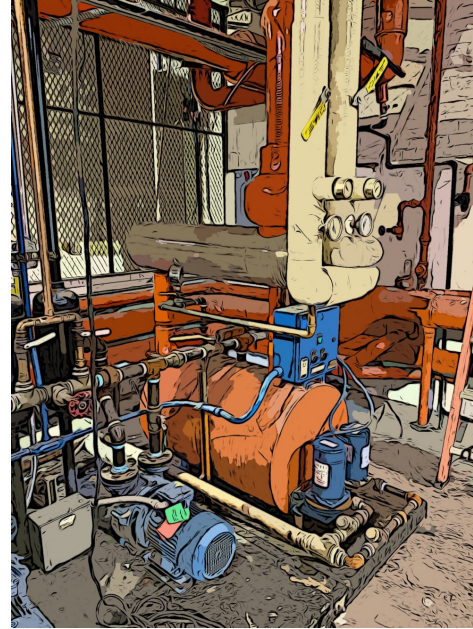
Heat Sources

- Recovered Heat
- Air and Ground Source
- Ice Heating

Skating Rink



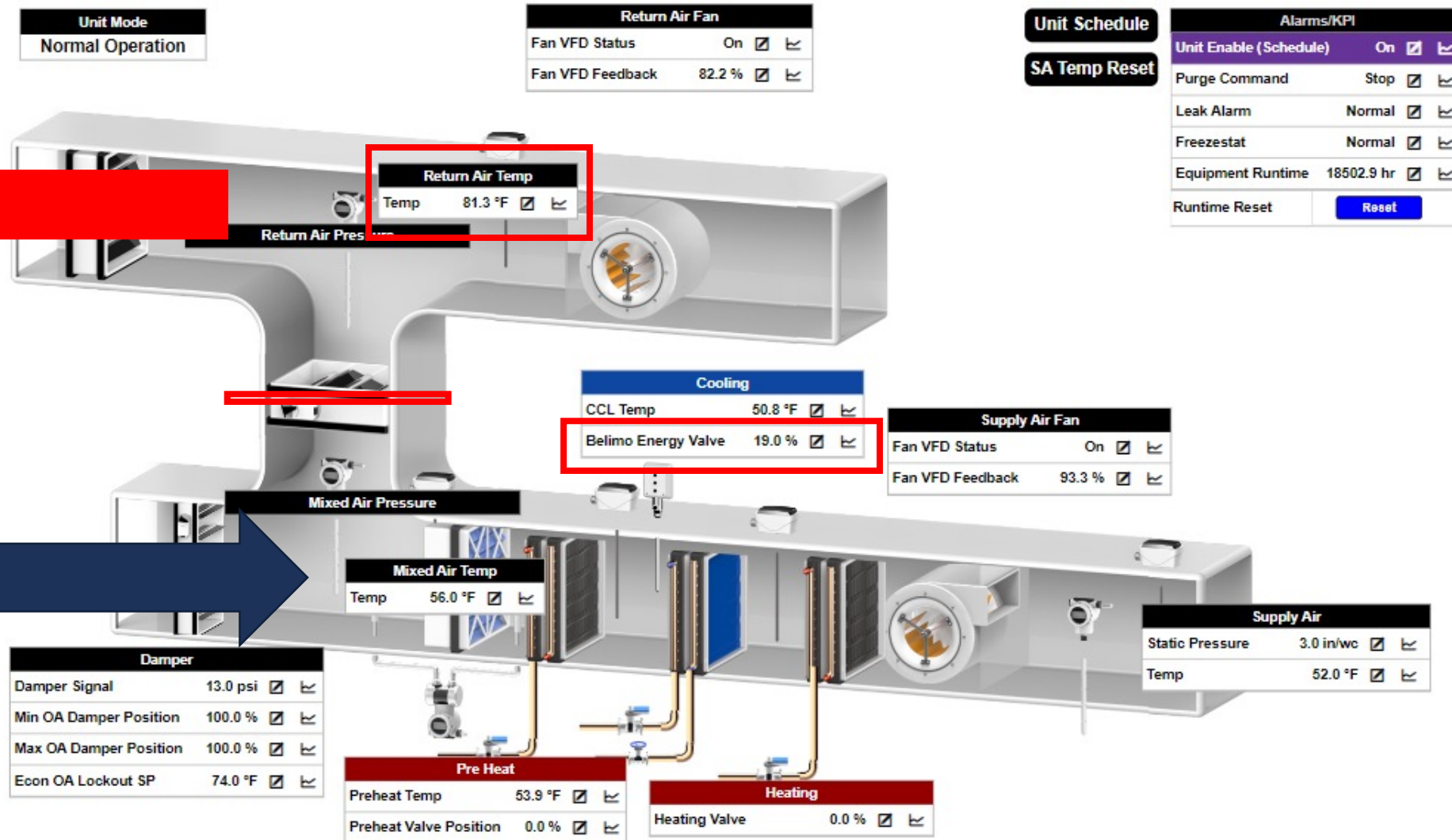
Heat from Condensate



Cool Server Rooms, Cool Exhaust

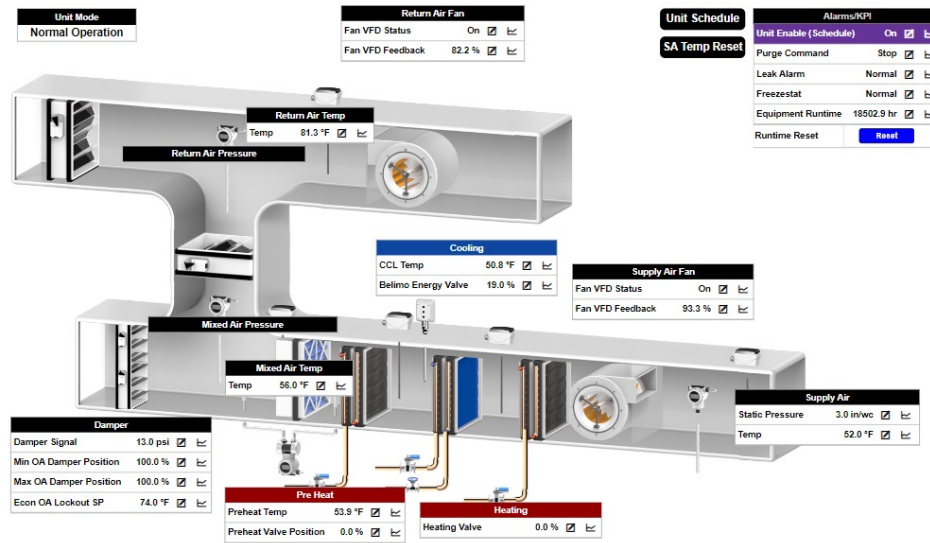


Stop Free Cooling – its really heat going out the building

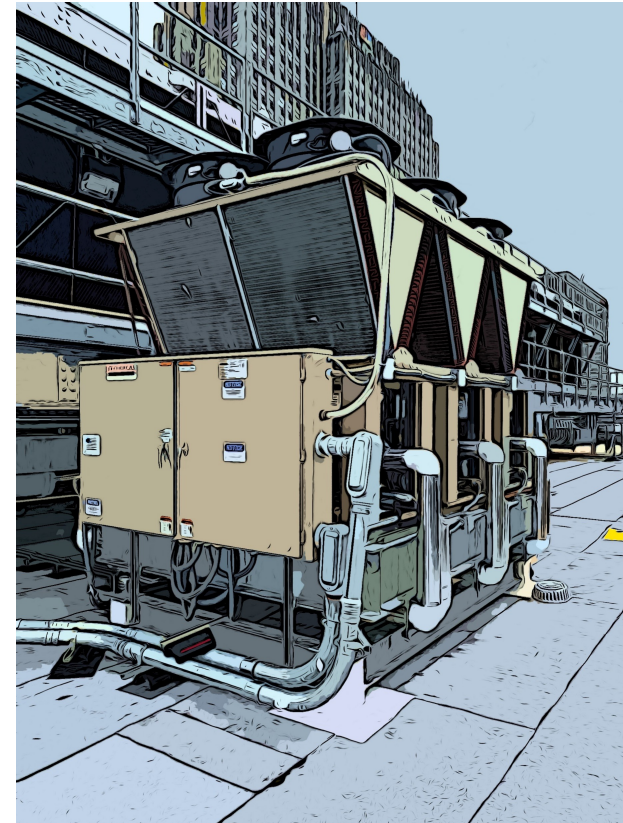


Free Cooling

45F Chilled Water

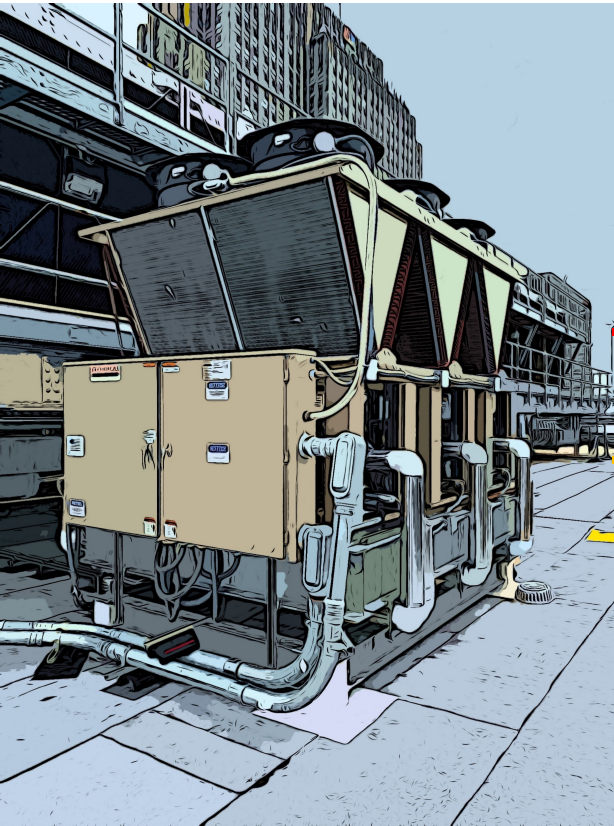


15F OA



15F OA

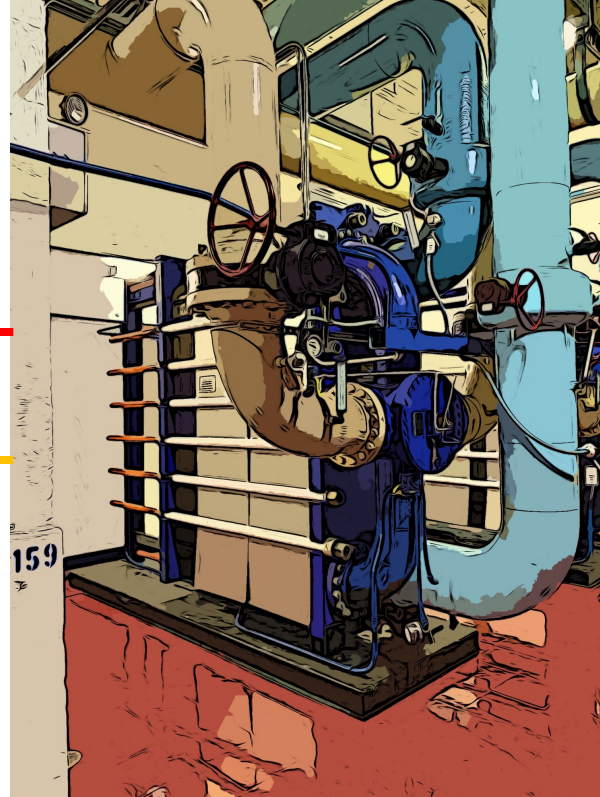
Air Sourced Heat Pumps – Cascade with Heat



60F



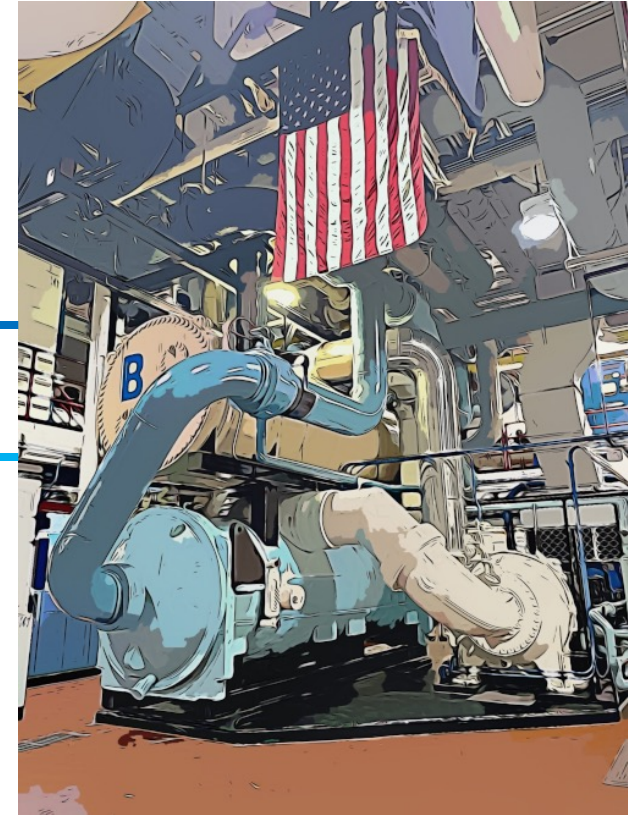
50F



45F



55F



130F



110F

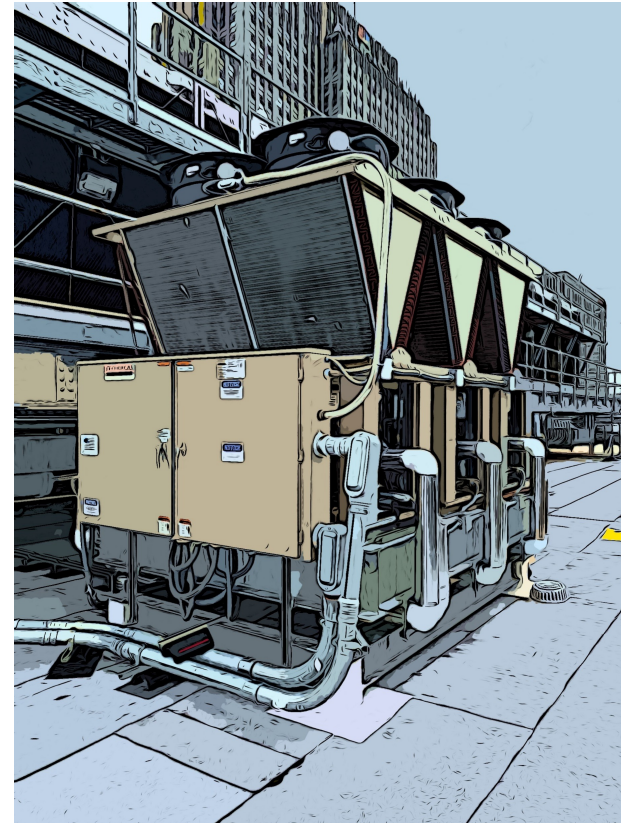


Ice Heating

32 - 50F

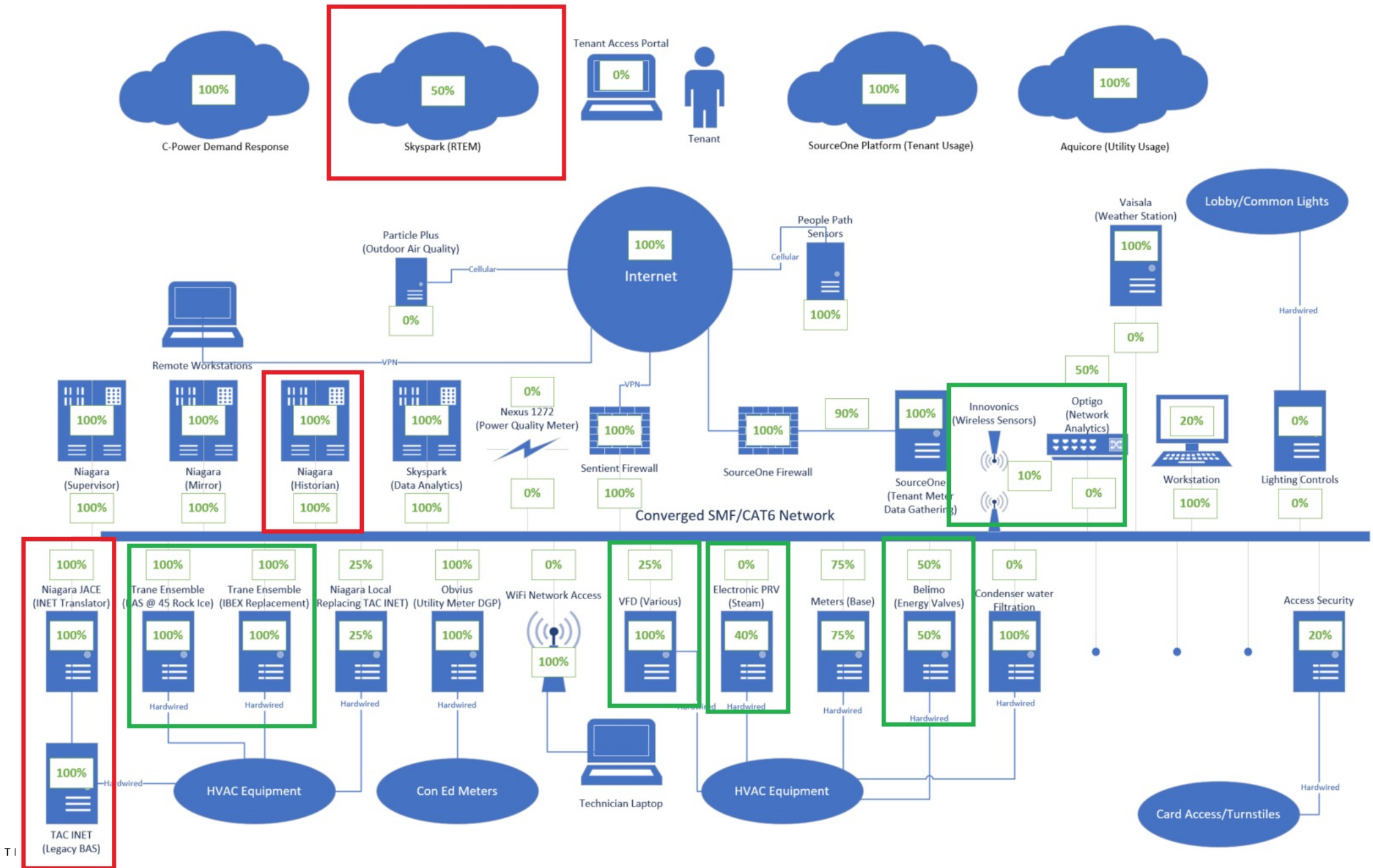


















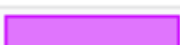





15F

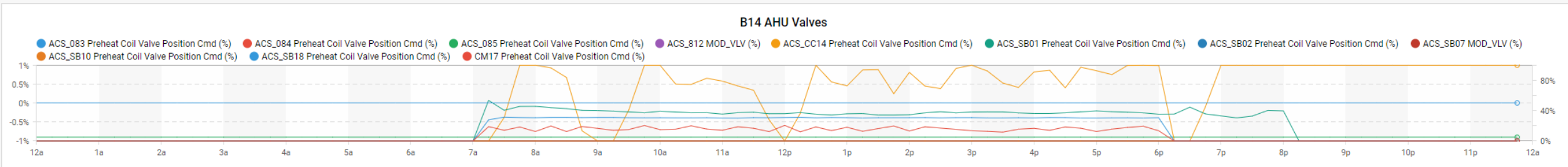
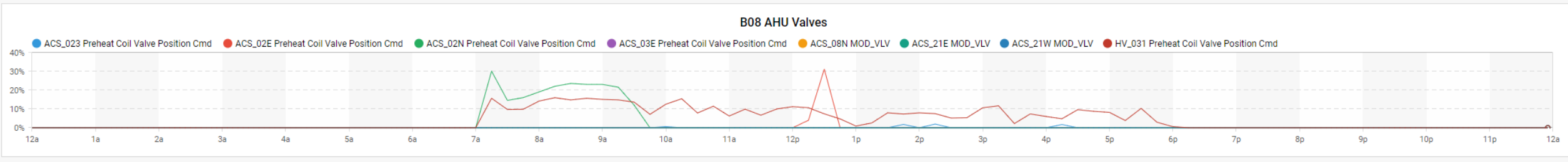
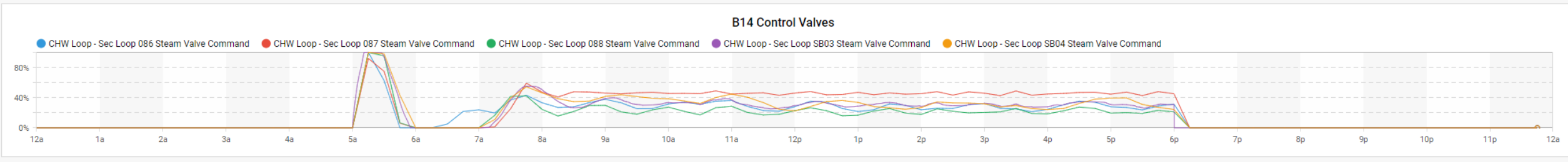
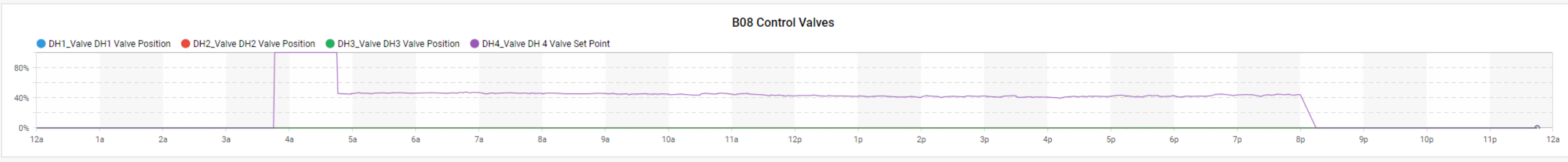
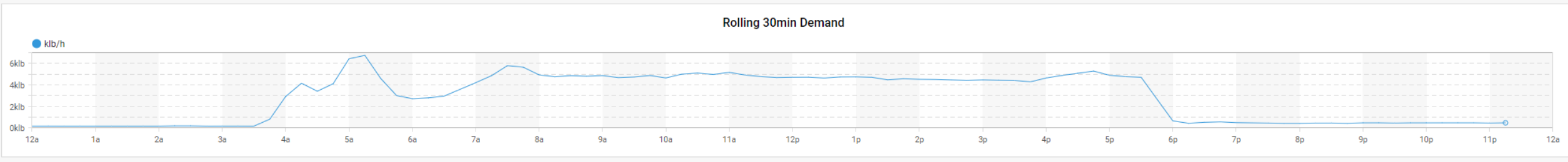


Path to Grid Interactive Buildings





Equip		Rule	Duration	3a	6a	9a	12p	3p	6p	9p
ACS_08N	>	① Supply Air Setpoint not met	 13.75hr							
		① Unrealistic Mixed Air Temperature	 13.75hr							
ACS_09S	>	① Unrealistic Mixed Air Temperature	 12.75hr							
ACS_10S	>	① Static Pressure Setpoint not met	 4.75hr							
		① Unrealistic Mixed Air Temperature	 11.25hr							
ACS_12N	>	① Simultaneous Heating and Cooling	 18hr							
		① Static Pressure 2/3 below 0.75 inch	 12.75hr							
		① Supply Air Setpoint not met	 12.75hr							
ACS_12S	>	① Simultaneous Heating and Cooling	 18hr							
		① Static Pressure 2/3 below 0.75 inch	 12.75hr							
		① Supply Air Setpoint not met	 12.75hr							



Peak Demand So Far

All Months

8am to 10pm, Monday - Friday

7357kW

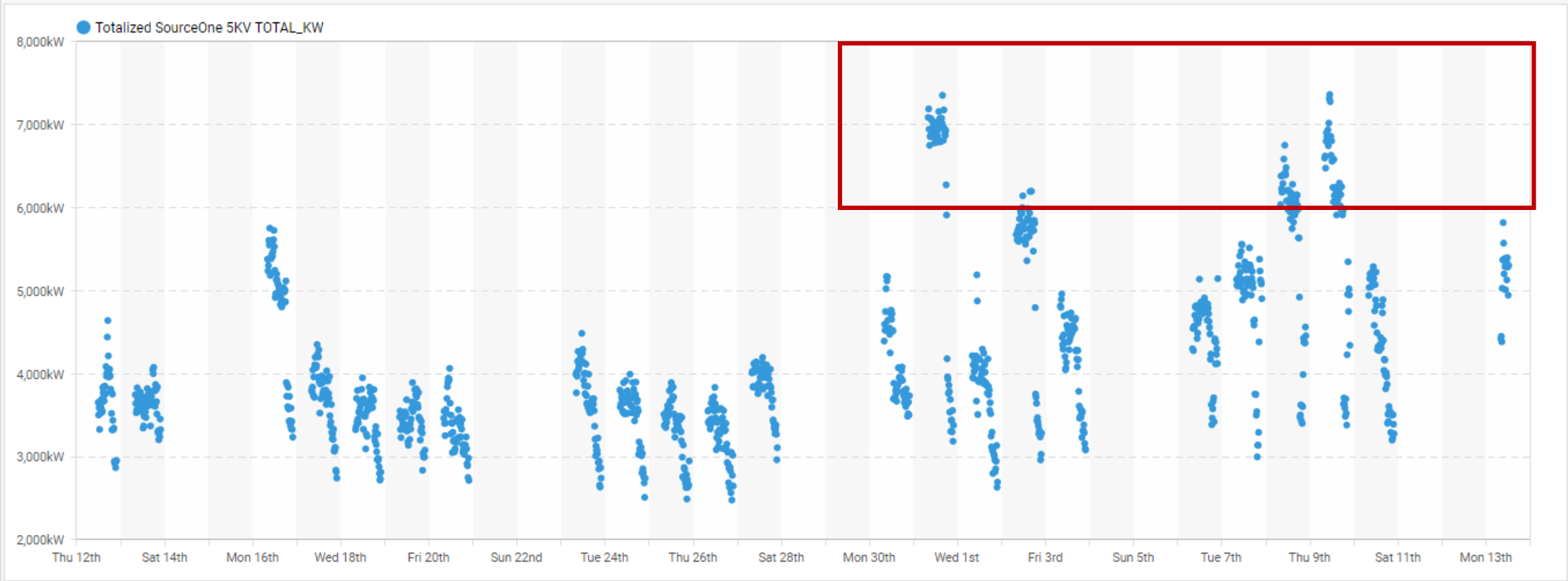
Goal is **6500KW** from May 12th 2022 and ends at noon on June 13th 2022

G&T Demand So Far

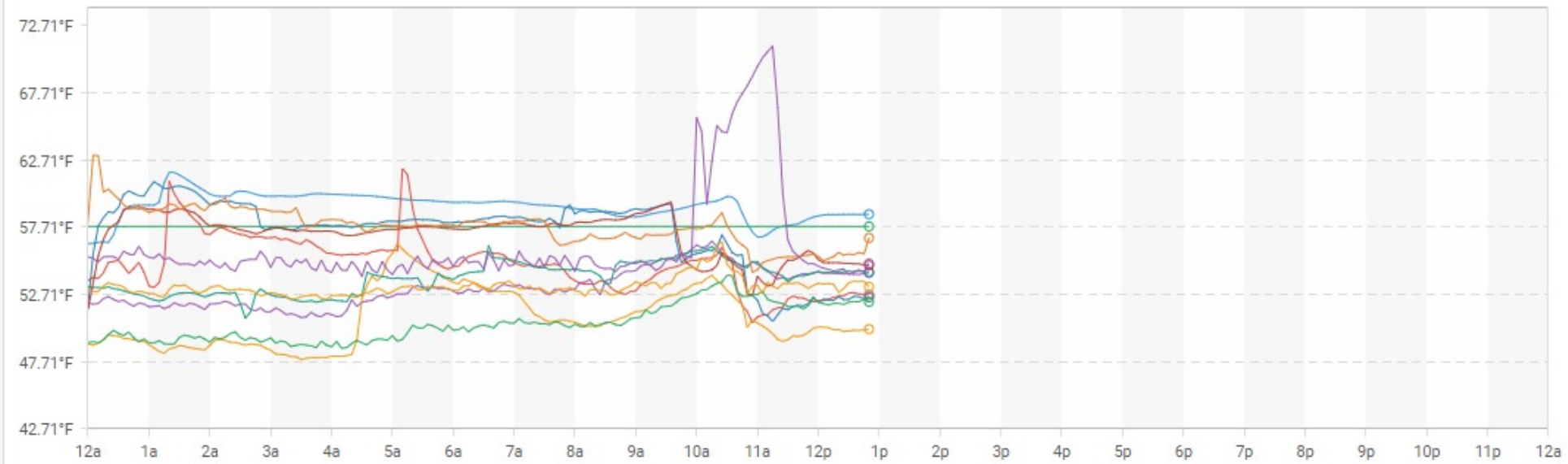
June, July, August, September

8am to 6pm, Monday - Friday

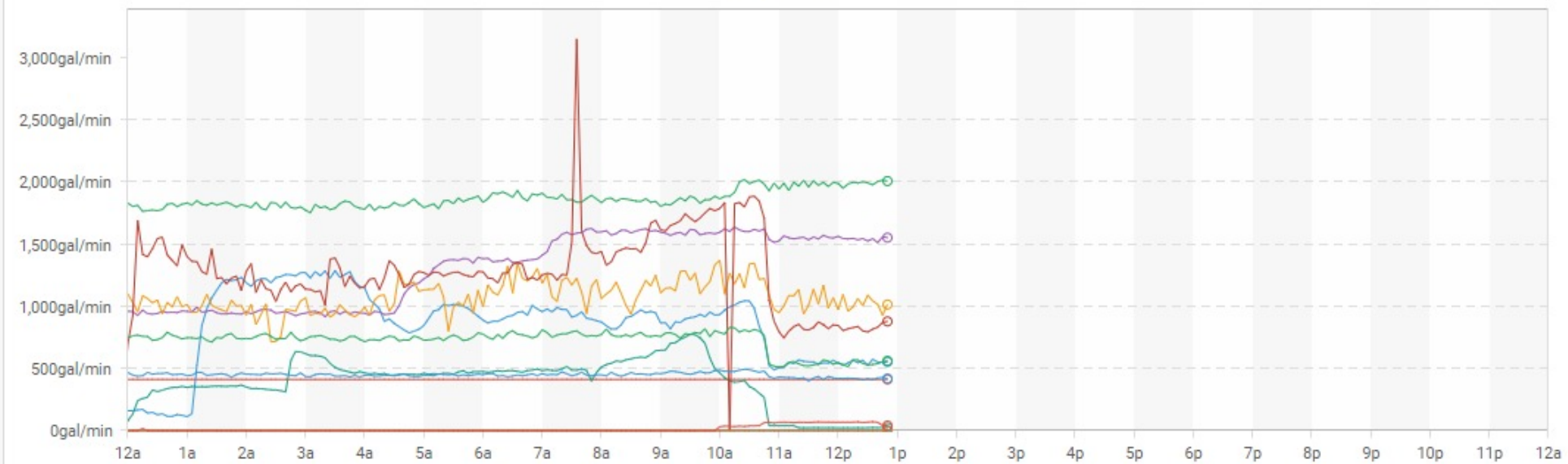
7357kW



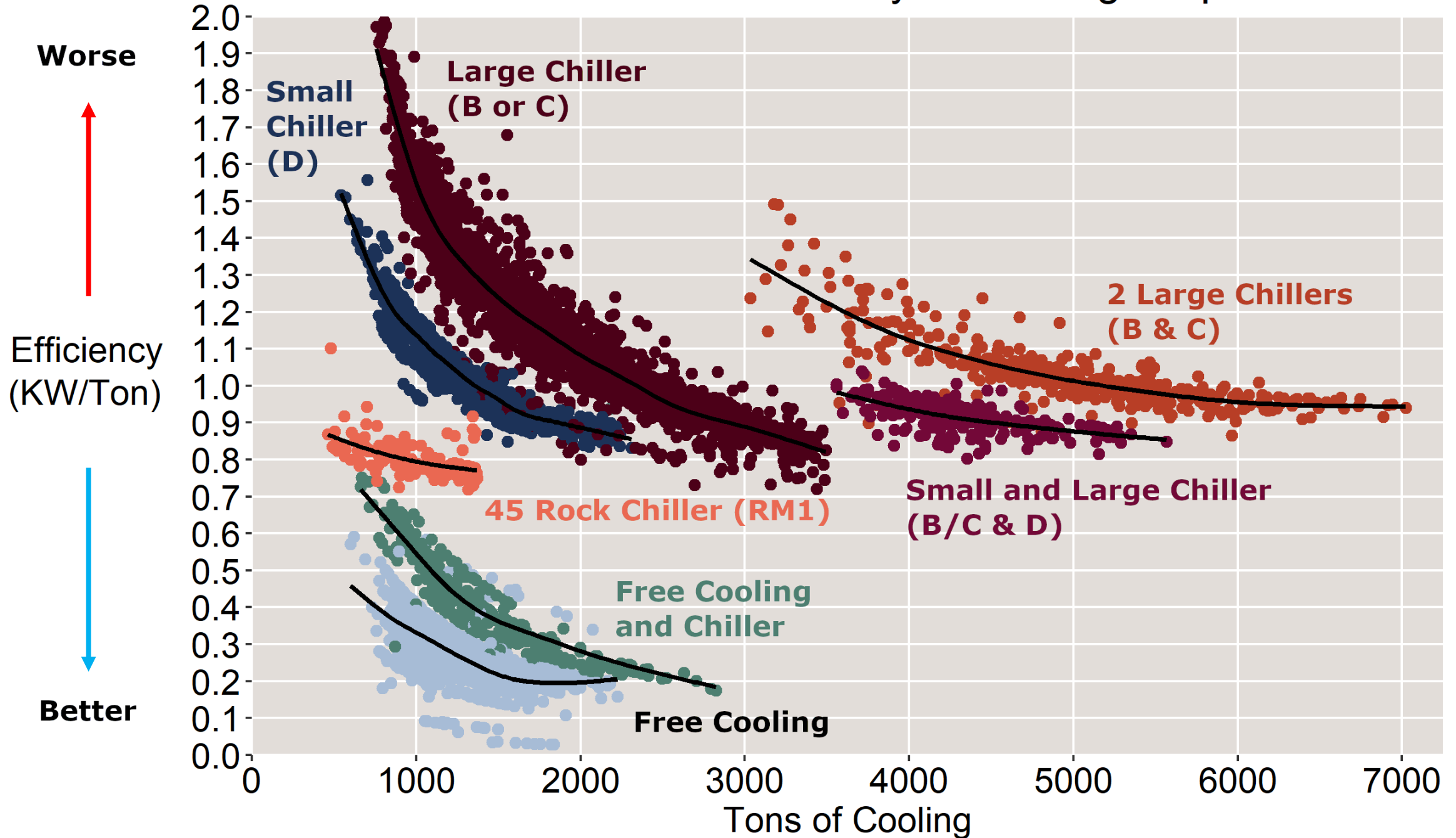
CHW Return Temp



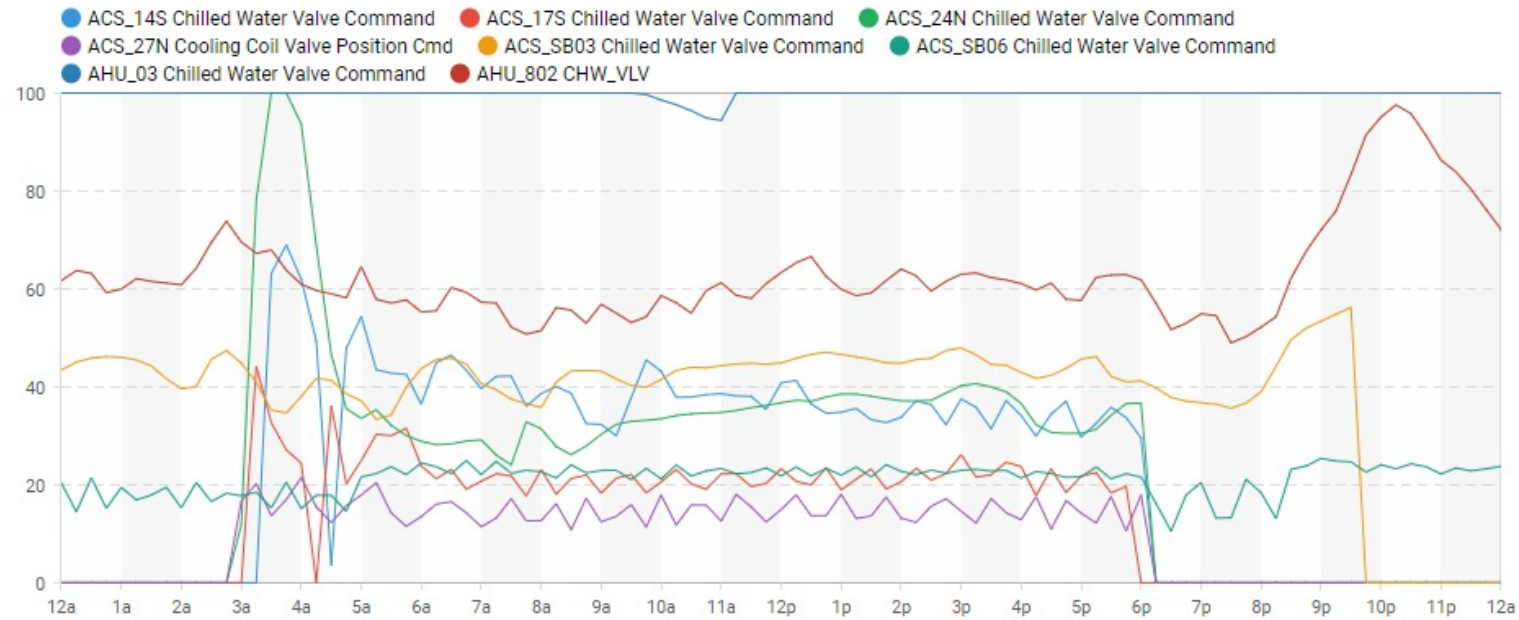
CHW Flow



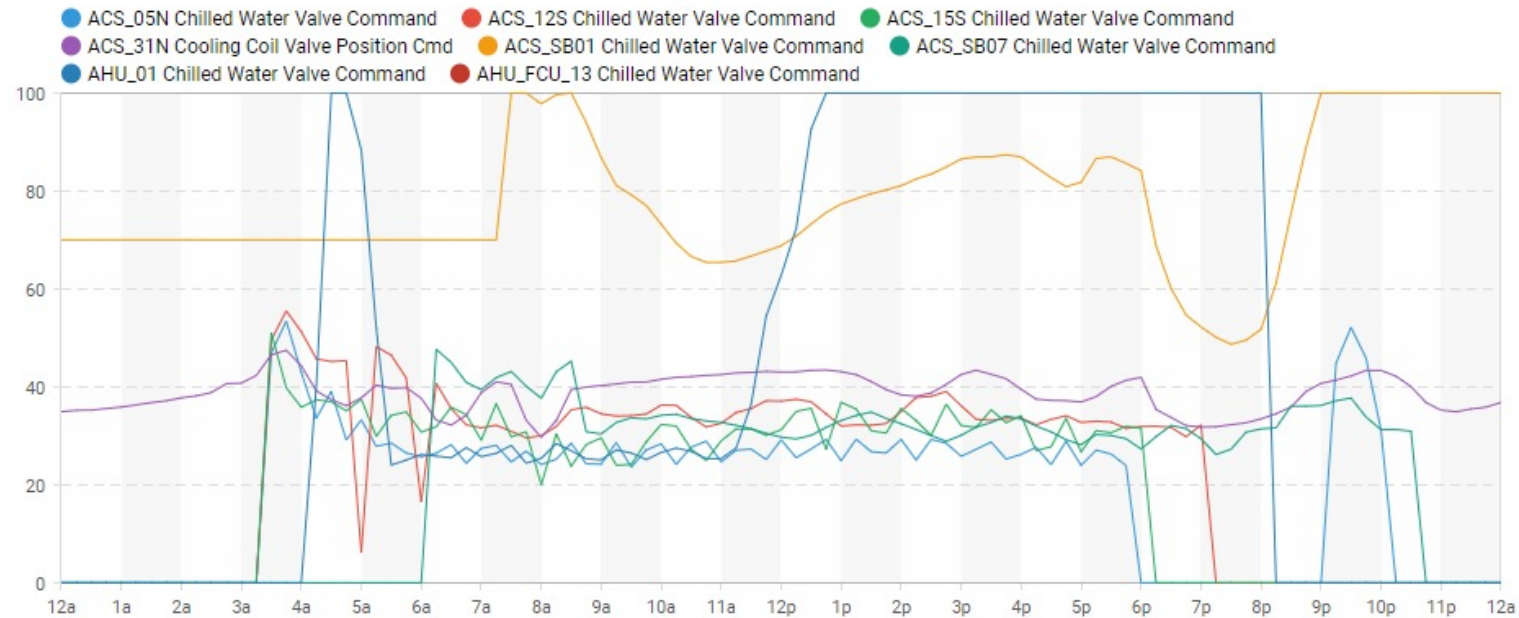
Chiller Plant Efficiency vs Cooling Output

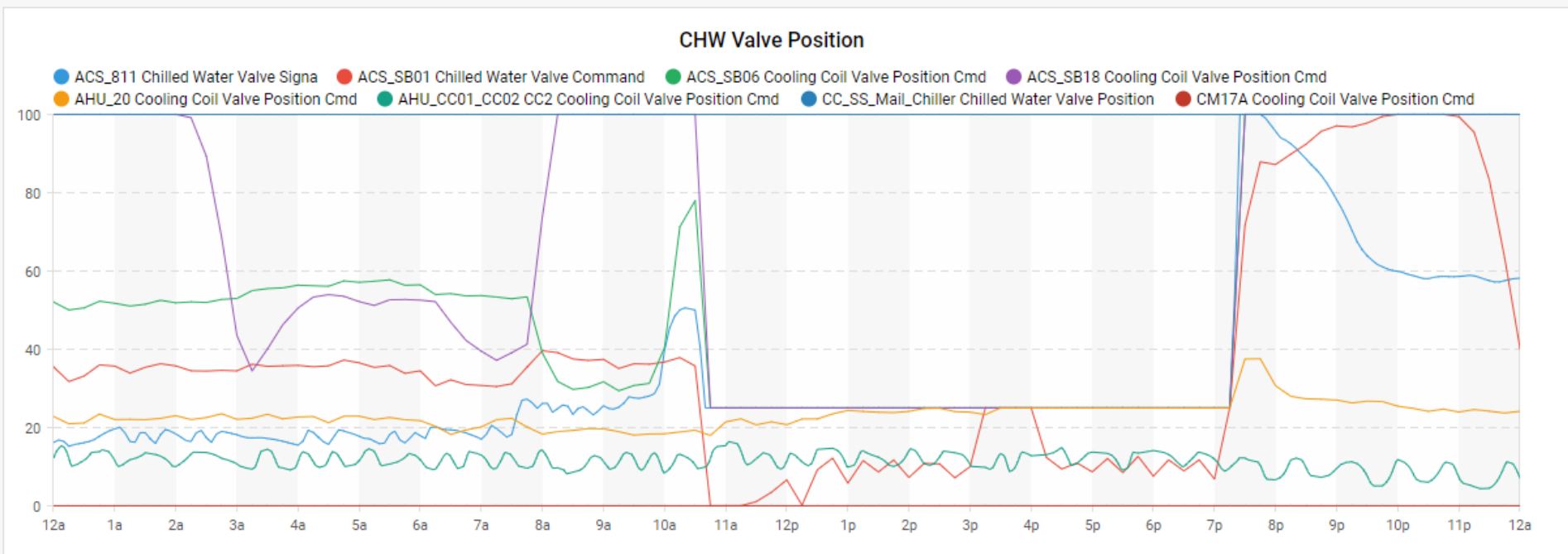
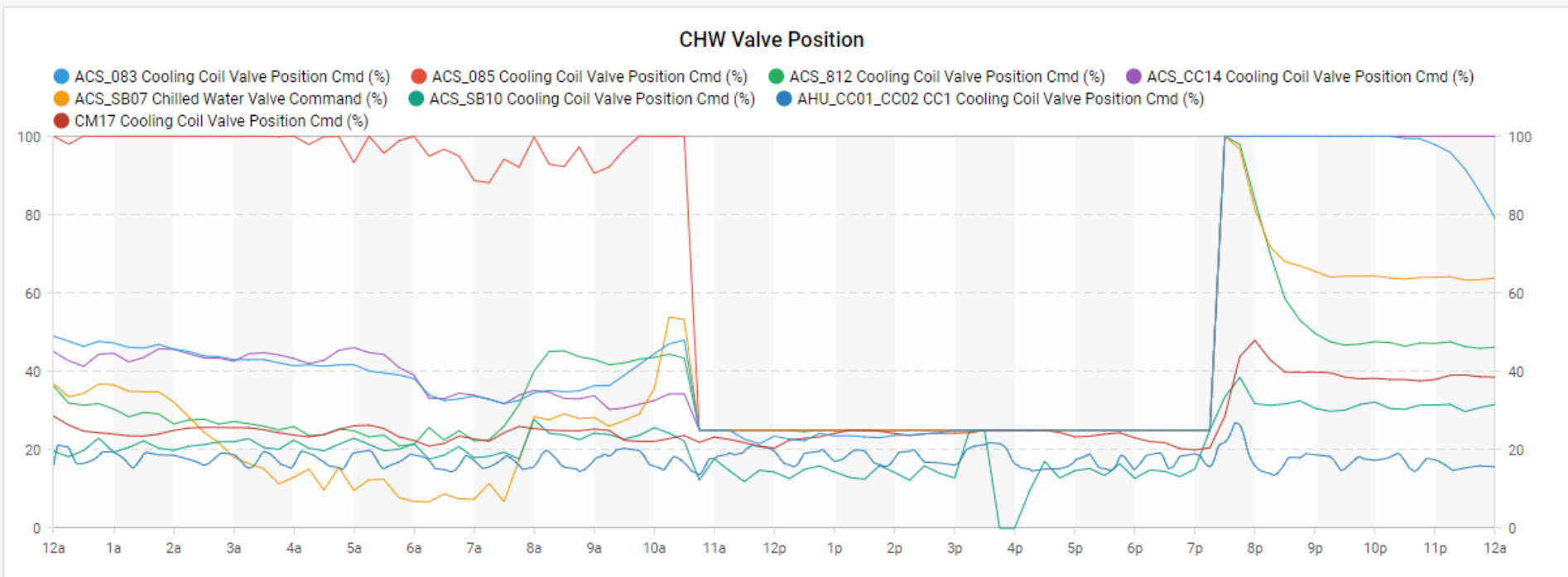


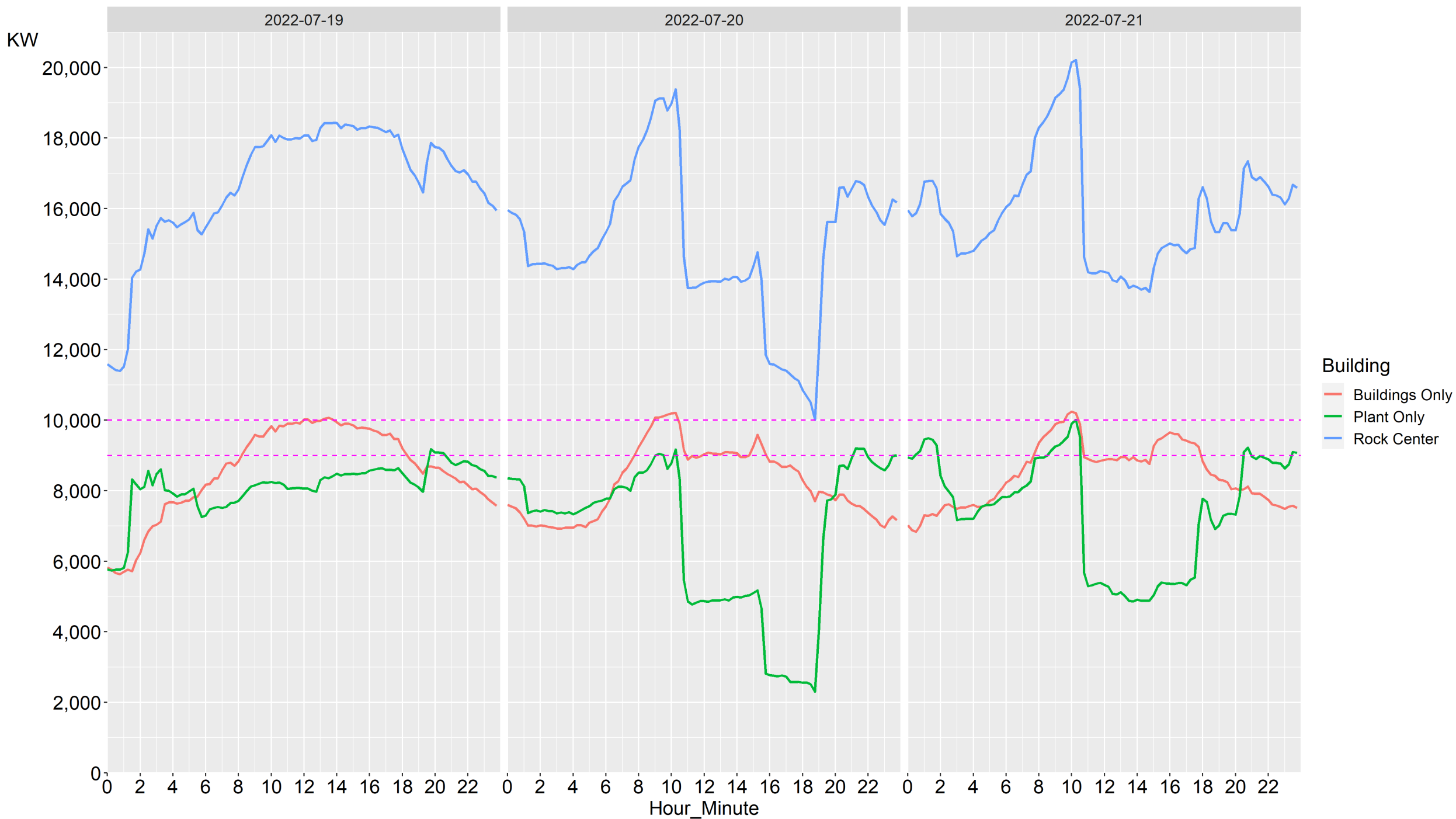
CHW Valve Position

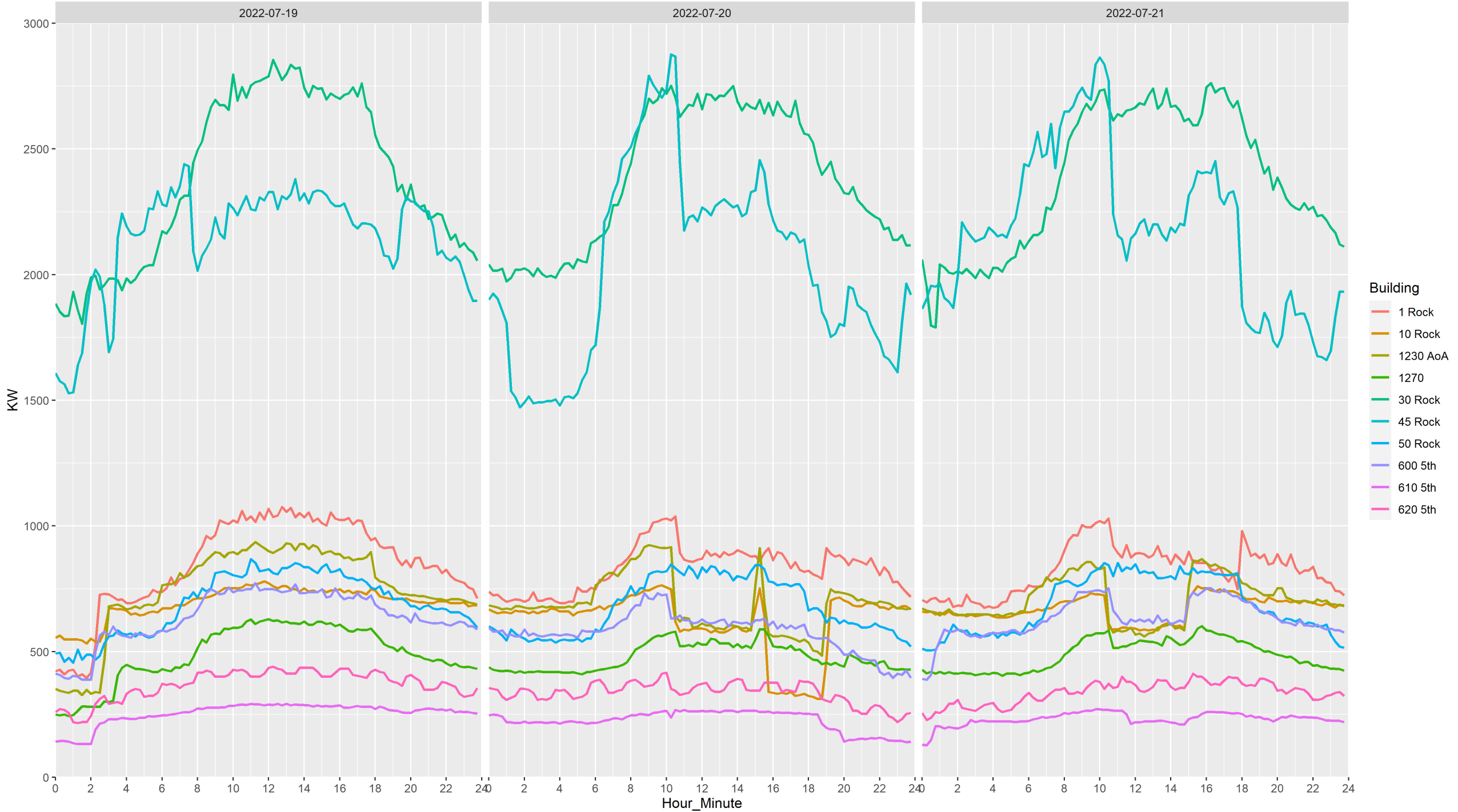


CHW Valve Position









What's missing?

- Perimeter Precooling and Temperature setback
- Lighting
- Plug loads – monitors, water machines, TVs and conference rooms
- Processes – Elevators, Servers, air compressors, fountain pumps, electric domestic hot water, trash compactors, control systems

Decarbonization Case Study – One Manhattan West

Thomas Walsh, General Manager Manhattan West

November 30, 2022



One Manhattan West to be Powered by 100% Renewable Electricity

Brookfield Renewable - New York State Hydropower Plant.

Largest renewable energy agreement for a single building in New York State.

Brookfield Renewable will provide energy from its hydropower facilities in NY State, underscoring Brookfield Properties unwavering pledge to net zero emissions by 2050 or sooner.

Energy usage at One Manhattan West is tracked via block chain technology which confirms:

- Renewable energy credits are not overstated or double counted
- Provides evidence of authentic carbon reduction
- Improves ESG reporting

Brookfield will provide digital dashboards to all 1MW tenants to monitor real-time energy consumption and support tenants own carbon reduction objectives.

BROOKFIELD RENEWABLE



One of the World's **Largest** Publicly Traded Renewable Power Platforms



Owns and operates more than **70 hydropower plants** in New York



Brookfield Renewables' hydropower facilities and wind farms in NY could power **440,000 homes** a year.

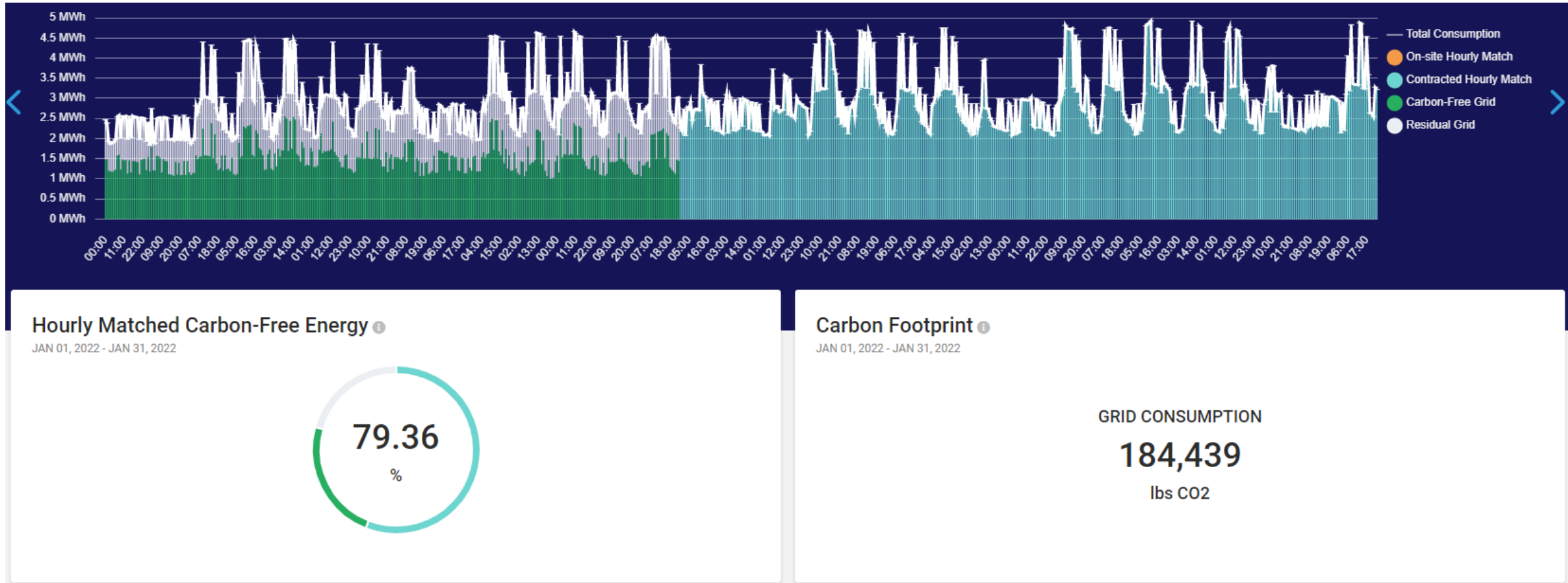
Carbon Emissions Measurement Tech

The property's electricity consumption is tracked and matched to renewable energy sources every hour of each day using ClearTrace, a blockchain-based carbon accounting platform.

- Provides auditable hourly record of electricity consumption matched with specific generating site data
- Creates tenant electricity usage dashboard to support their ESG goals and reporting requirements



Carbon Emissions Measurement Tech



Commercial office tenants play a **critical role** in achieving lasting reductions in a building's overall demand, energy intensity, and **carbon footprint**.

WillowTwin™: Digital Replicas of the Built Environment



Data Sets



Spatial Data

2D Drawings, 3D Models, GIS Maps, Etc.



Static Data

Equipment meta data, O&M Manuals, Warranties etc.,



System & Device Data

BMS, Lifts, Access and IoT etc.



External Data

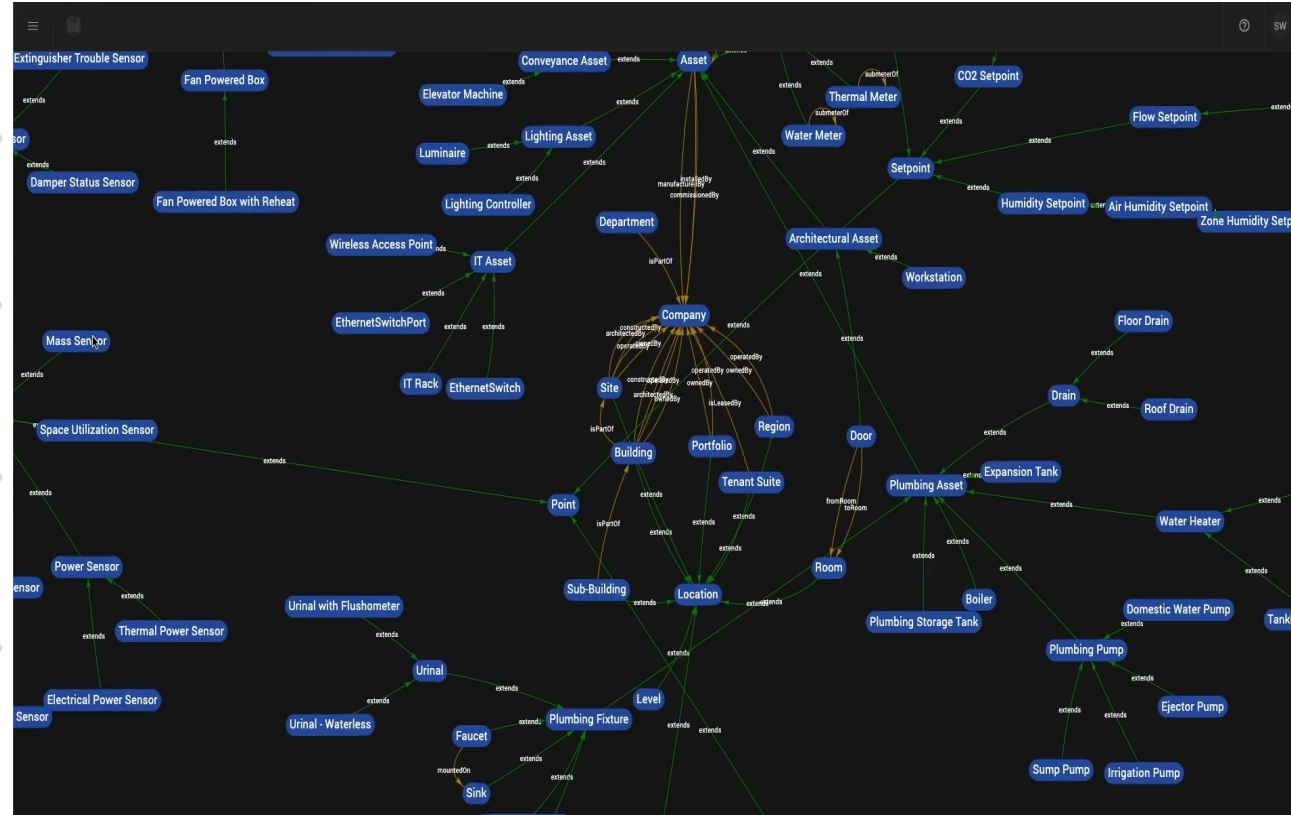
Weather, traffic, market and public data etc.



Business Data

Lease admin, CMMS, Tenant Service Requests, etc.

Graph Data Model



Use Cases

Design & Construction

Handover & Commissioning

Operational Efficiency

Energy & Sustainability

Occupant Experience

Space Utilisation

WillowTwin™ is a leading and differentiated SaaS solution



A complete digital twin solution is a data integrator that combines rich and complex data from a wide variety of sources into a consistent model that covers six key elements:

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IoT Data

- Endpoint devices such as operational technology equipment, appliances, vehicles, or factory machines that connect, interact and exchange data
- Devices that aggregate, process & provide gateway capabilities for IoT endpoints
- Capture telemetry, and enable command and control



Structure

- Industry and domain specific ontologies: RealEstateCore, ETS | NGS-LD, IEC, CIM, ...
- Topology of modeled entities interconnected as a graph
- Brought to life with real time data from sensors and other data sources
- Always up to date representation of operation state



Geometry

- Abstract geometry
 - Maps & Layouts
 - 2D/3D Design Geometry
 - CAD
 - Building Information Modeling (BIM)
- Real Geometry
 - Spatial anchors for AR/MR applications
 - Spatial Reconstruction scans



Behavior

- Physical models – enabling simulation, behavior and performance of a system under different physical conditions and constraints
- Heuristic models – enabling advanced forecasting and optimization
- AI – Deep reinforcement learning



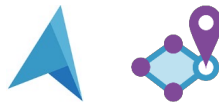
Time

- Data history – capture and process time series data for all signals flowing through and being processed by the model
- Topological history – capture how the structure evolves over time, ability to replay
- Business intelligence and predictive analytics

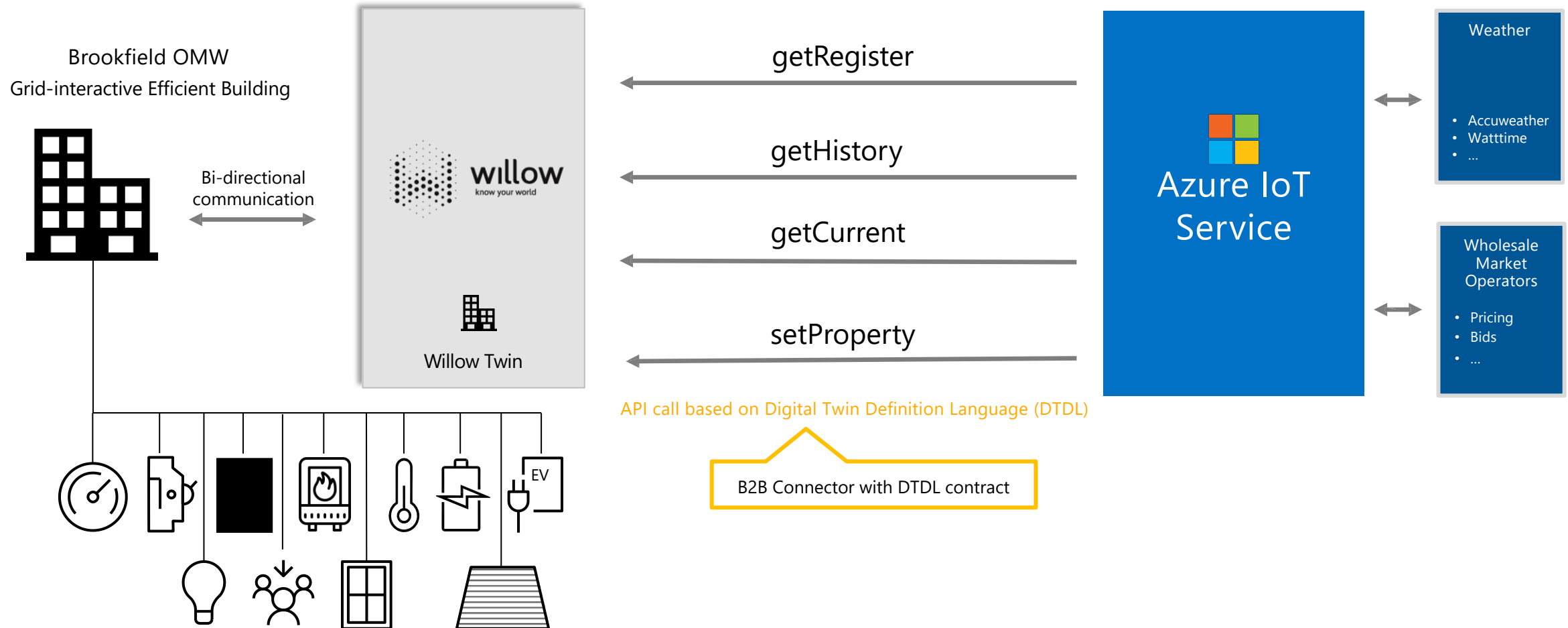


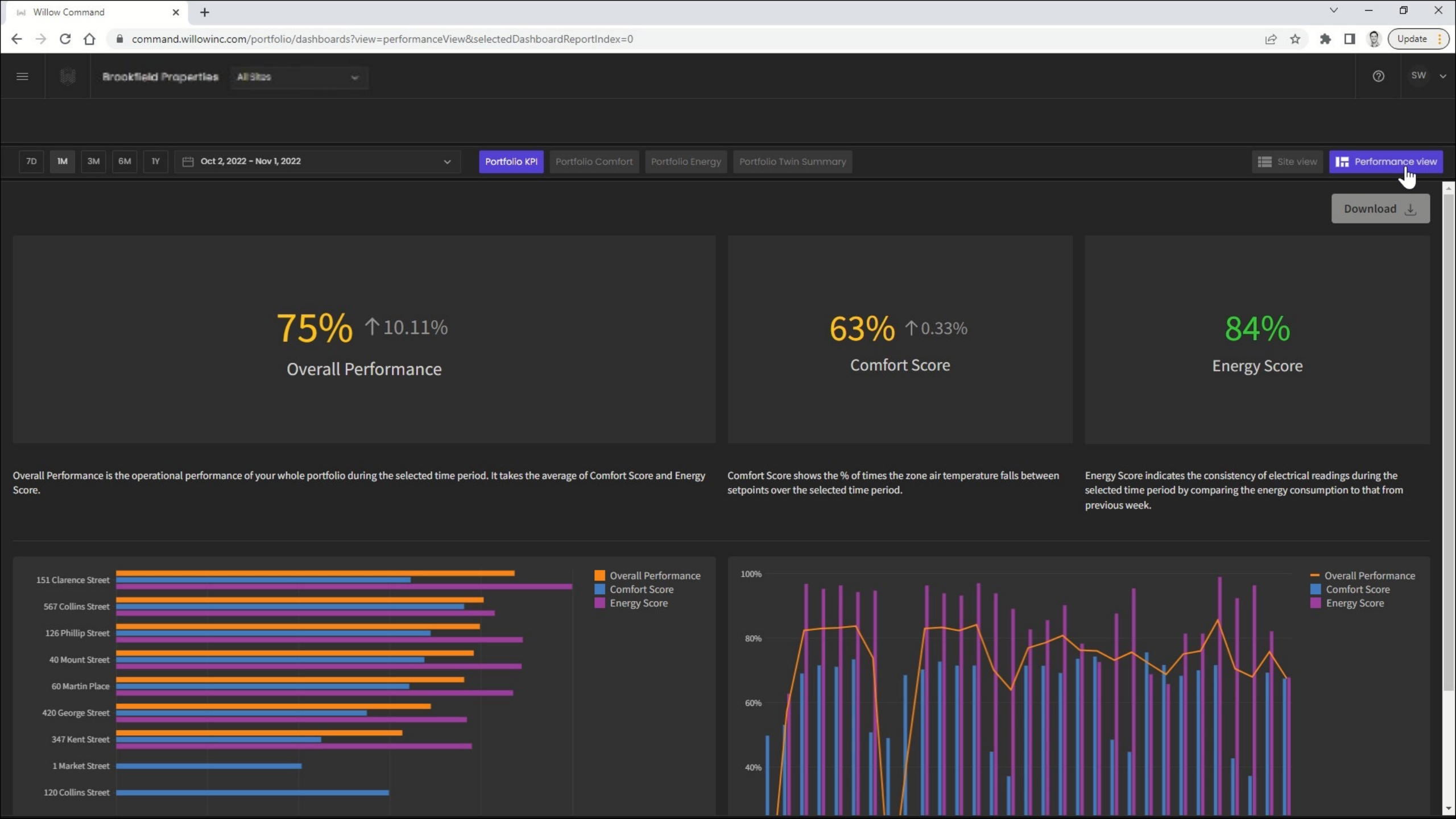
Business Data

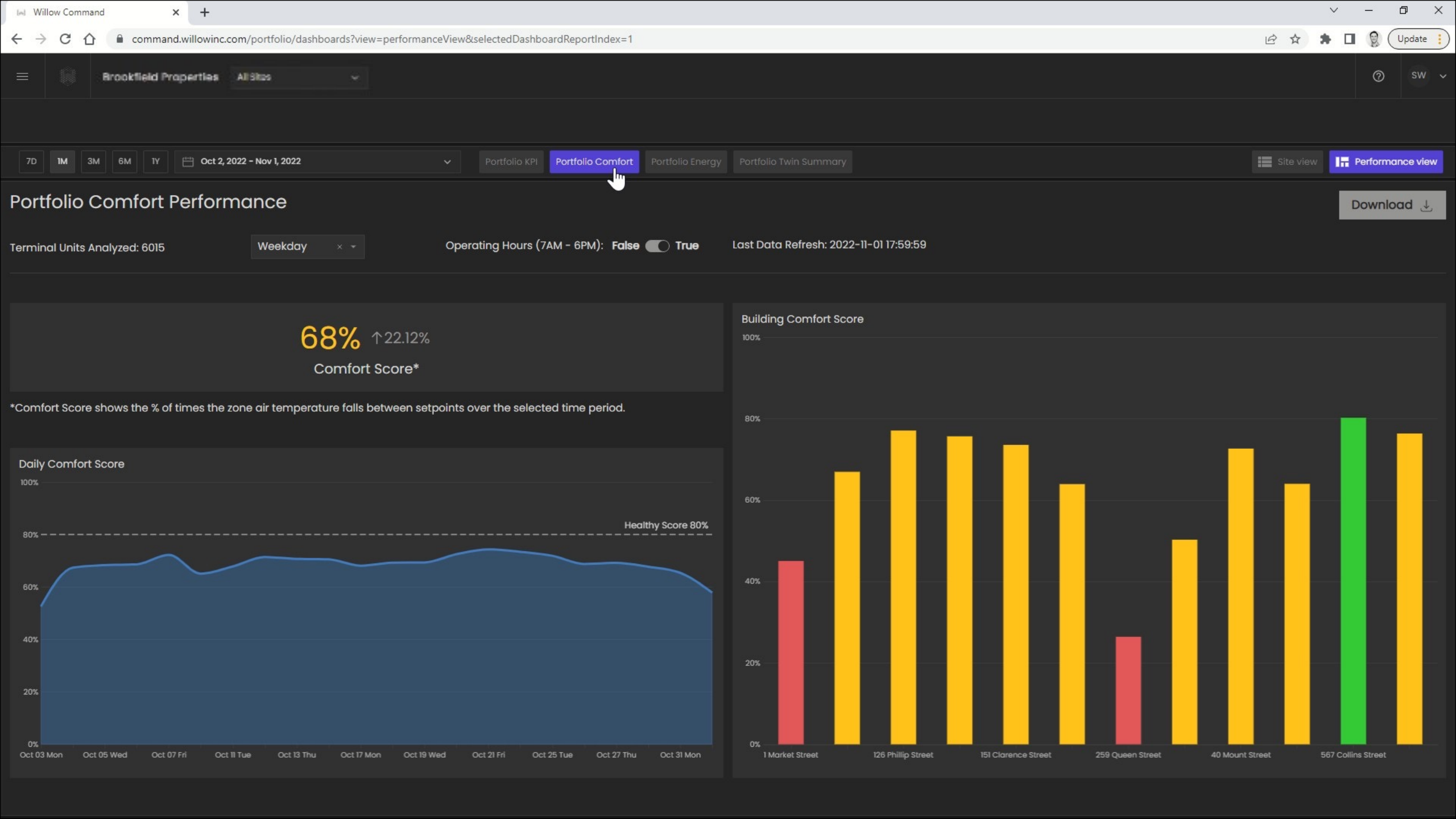
- Information stored in traditional LOB systems (systems of record)
- Live connections (vs. static imports)
- People and business processes
- Warranty & maintenance service records
- Equipment & system manuals

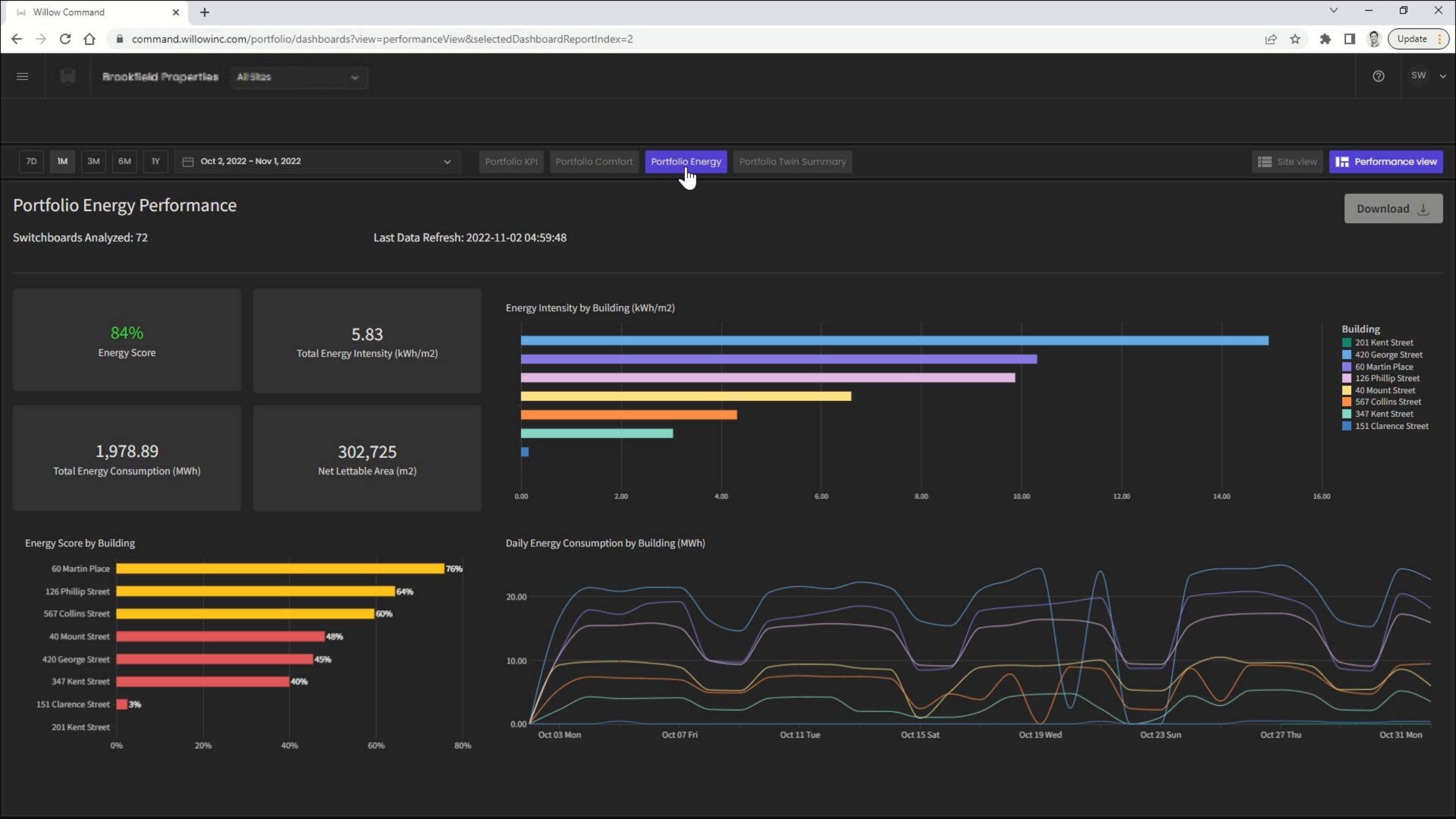


Integration with Willow for Brookfield OMW









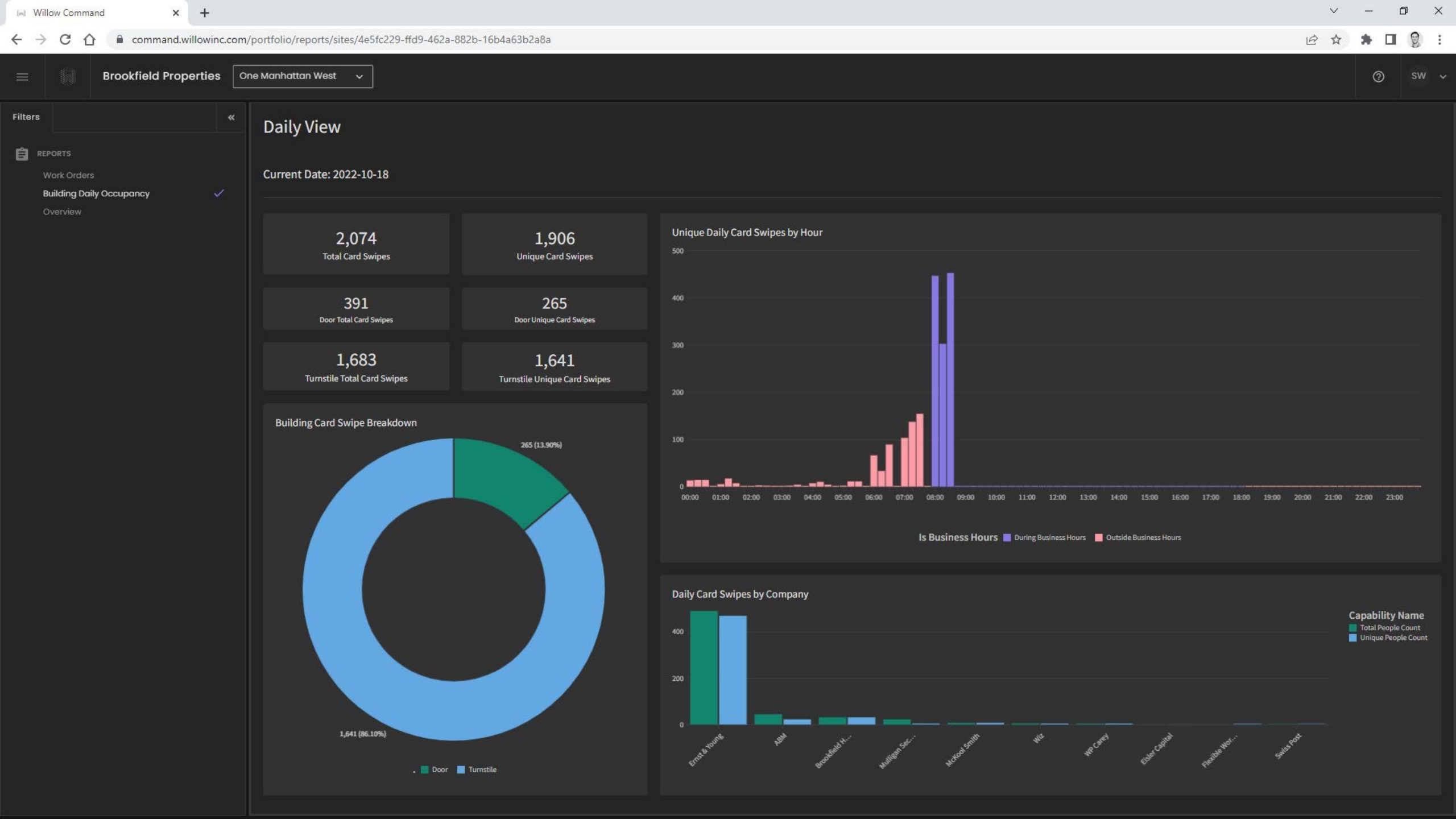
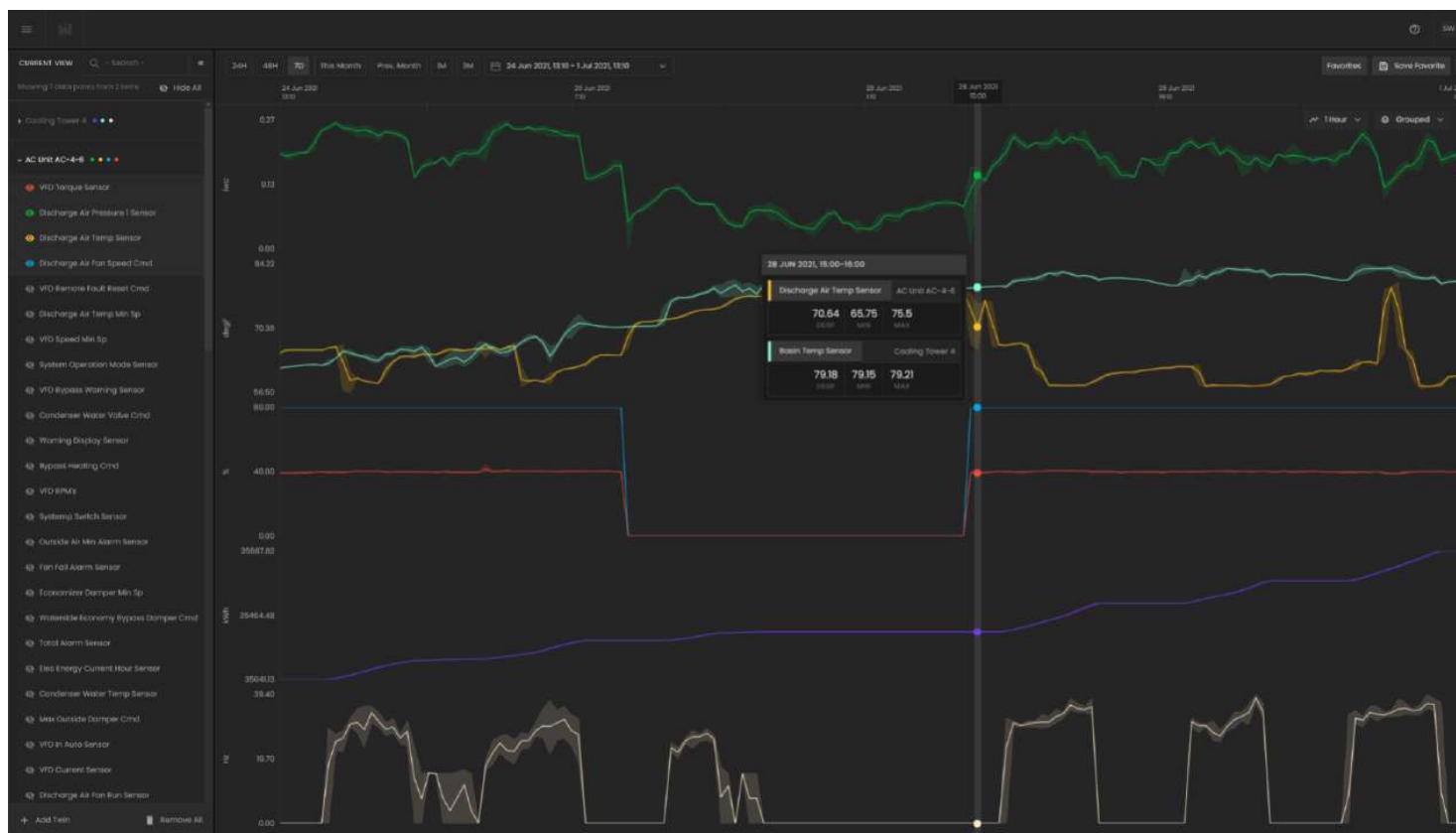




Figure 16: Time Series



Time Series in use:

As part of a larger project, a building manager is looking to improve the operational lifespan of HVAC units. To determine the best course of action they perform a test and take actions (such as additional maintenance) on one of the units. To confirm their actions are having a noticeable effect, they compare the performance of this unit to another unit, which did not have additional maintenance, within Time Series. They then determine whether the additional maintenance was worth the performance increase and potential lifecycle increase and use this to inform their long-term strategy.



04 Rules Engine

The WillowTwin Rules Engine is a real-time, ontology-driven, event-based rules engine. Rules are defined and configured together with your Willow Customer Success Manager and can relate to any data points for an equipment item or system. The Rules Engine automatically finds all matching equipment in the WillowTwin and applies the rule without manually specifying each instance. Rules Engine will automatically adapt the rule to fit the situation, including variation in tagging and in units of measure. Rules may be created using any criteria including energy, comfort, and occupancy. When a rule is triggered, it creates an insight and will continually update the insight to show the duration of the fault or the number of times it has occurred.

Rules can be set portfolio-wide or to individual buildings. Each rule is based on a template which defines the general logic in how it evaluates and processes telemetry against a set of parameters. There are four base rule templates as follows:



CUMULATIVE

detects whether a binary value or expression has occurred for a defined percentage of the time window.



REPEATED

detects whether a binary value or expression has occurred too often within the time window.



CONTINUOUS

detects whether a binary value or expression is stuck and has not changed during the time window.

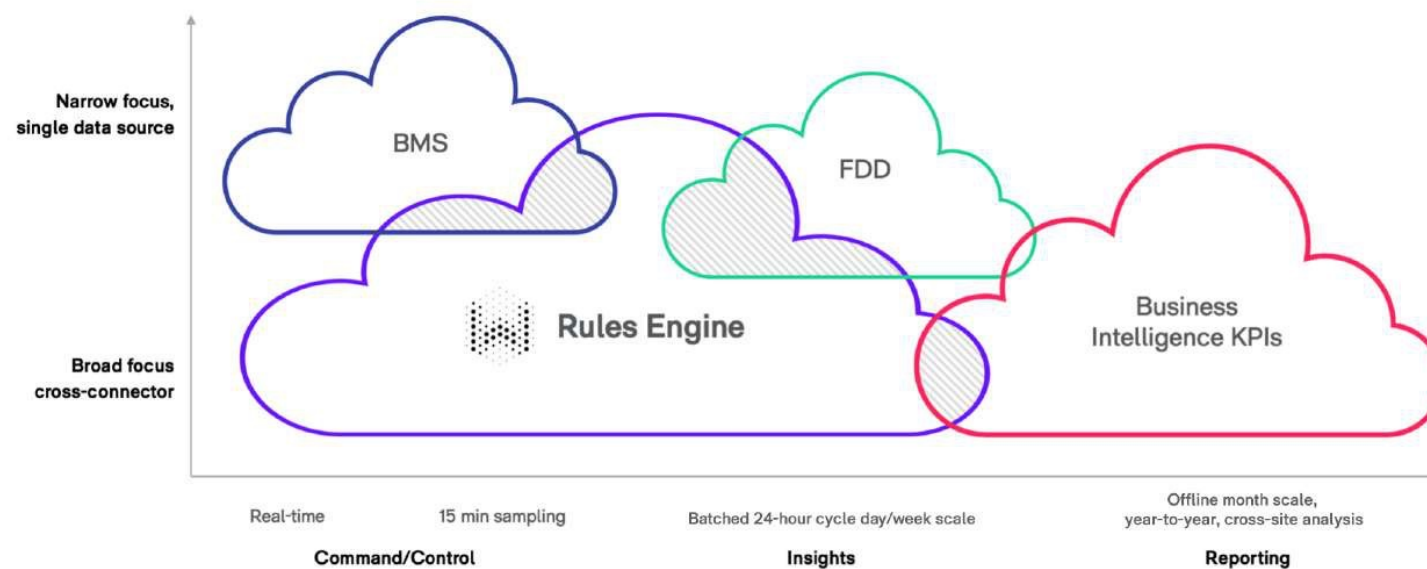


OUTSIDE RANGE

detects whether a high and or low threshold has been exceeded for a defined percentage of the time window.



Figure 7: Rules engine focus and capabilities



Rules Engine in use:

A portfolio or building manager works with Willow to configure the rules for the portfolio or building. When the conditions of a rule are met, Rules Engine creates an insight.

An example of a range rule is When Room Temperature is below 65F or above 75F for more than 20% of the past 24 hours, create Insight. In this example, a facilities manager can be alerted to a temperature anomaly, and then make an informed decision on how to respond, as the insight presents the rule in context, including severity. The facilities manager may choose to create a scheduled ticket, investigate deeper in Time Series, or immediately perform an equipment check.

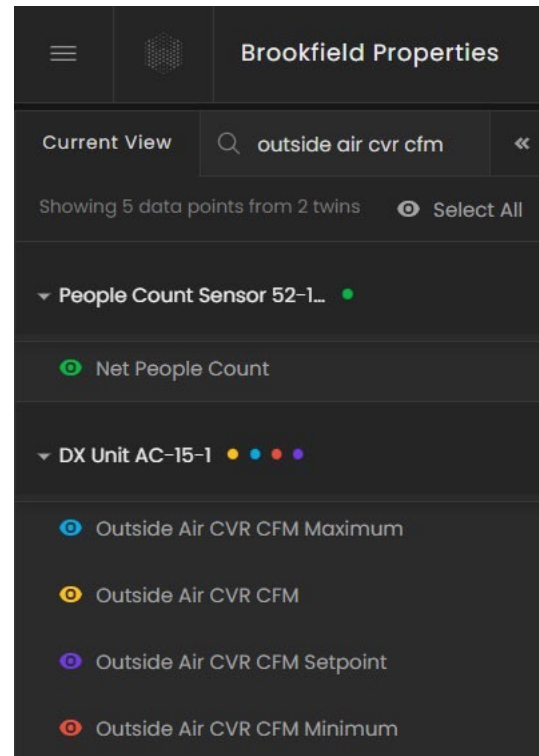
Occupancy-Driven Energy Savings: Outside Air CFM Per Person



Opportunity: Inform whether Brookfield can reduce base building energy consumption by optimizing outside air brought into the building

Willow to calculate Outside Air CFM per Person by dividing each DX Unit's Outside Air CFM data point by the number of occupants on the floor at that time. This will be compared to the design minimum Outside Air CFM, which is likely much higher than required because it was based on the gross area of the floor and maximum occupancy.

Input needed: ASHRAE's recommended Outside Air CFM per Occupant for office spaces is 17. Willow can trigger an Insight when the calculated point enters/leaves a specified range.?



Willow will create a new calculated point, **Outside Air CVR CFM** divided by **Net People Count**



discuss.

Moderator:

Nyla Mabro, Head of Strategy & Marketing, The Clean Fight

Panelists:

Neil Breen, Vice President, Energy Services, Ramboll

Javier Aleman, Principal, AXC Automation



NYSERDA

**be
ex**

building
energy
exchange

thank you.



NYSERDA

be
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building
energy
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