

Optimizing Heat Pumps in Commercial Buildings: Lessons from the Atrium

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THE ATRIUM

- \cdot Built in 2010
- · LEED Gold certified
- · 100% electric





ORIGINAL HVAC SYSTEM

- Air to water heat pump with electric boiler back-up
- Variable air volume (VAV) system with hydronic reheat coils





PERFORMANCE ISSUES

- The original system performed well in shoulder seasons but couldn't keep up with higher demands
- Equipment breakdown issues
- Issues kept compounding until the system reached its end of serviceable life after 12 years





PROJECT GOALS

- Occupant comfort
- · Reliability
- · Resiliency
- Energy savings





PROJECT ORIGINS

- Not a simple like-for-like replacement
- Step 1: talked to the contractor
- Step 2: brought in a consultant
- Jawl's approach: find and work with trusted partners





INTEGRATED PROJECT TEAM

- · Jawl Properties
 - » Operations and Construction Management
- Consulting Team
 - Mechanical (SES), Structural (Skyline), Electrical (E2)
- Contractors
 - » Island Temperature Controls (refrigeration and controls)
 - » ERB Technical (Plumbing)
 - » Belltech (Electrical)
- Major Equipment Suppliers
 - » Olympic International (AERMEC ASHP)
 - » Trane (Chiller)

















PROJECT EVOLUTION

Timeframe	Project Phase
May 2021	Project Team Assembled
Dec 2021	Pre-Design Study
Mar 2022	Design
Apr 2022 → Mar 2023	Construction
Spring + Summer 2023	Commissioning Phase 1
Fall 2023 – Winter 2024	Commissioning Phase 2 – Performance Testing
Ongoing	Whole Building RCx / COp



PROJECT SCOPE

- · Removal of old ASHP
- New heating and chilled water piping
- New heating and chilled water buffer tanks
- New ASHP with heat recovery capability
- New high efficiency air cooled chiller



Heating and Cooling Load



Heating and Cooling Energy





EQUIPMENT SELECTION

- Considerable time spent during design on sizing and selecting equipment
- Surprise!
 - » Equipment had greater
 pressure drop than expected
 - » System temperature outputs less than advertised (47C vs 52C)





COMMISSIONING

- Lengthy commissioning process
- Lockouts on heating mode found to be a little too aggressive
- Troubleshooting cold zones identified numerous VAV boxes with faults
- Electrical demand charges higher than expected



Managing Demand

Hourly consumption for Nov 26, 2024



Hover over the bar graph for details. Click on a bar in the graph to view 5 minute consumption.

Managing Demand





SES HYBRID PLANT DEMAND MANAGEMENT

- · Heat pumps don't like cold
- Use boilers to "jump start" heating on cold days
- Eliminate "warm up"
- System designed to allow boilers to supplement
- Different strategies for different seasons





PROJECT OUTCOMES

The new system has been operational for 2 years and so far, so good:

- During cold snap, down to -12*C, the system kept up
- $\cdot\,$ On time and under budget
- Most importantly: tenants are happy!



ENERGY SAVINGS

350,000 300,000 250,000 200,000 150,000 100,000 50,000 0 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Average of 2016-2019 (Pre-Retrofit) 2024

Monthly Hydro Usage (kWh)

ENERGY SAVINGS



What Worked



Integrated project team from day 1 – no conventional procurement process*

* Can't do IPD? The <u>B2E</u> <u>Commercial Building Electrification</u> <u>Guide</u> provides advice on integrating elements and principles



Use actual building data to design and size equipment



Commission, commission, commission through all seasons

Lessons Learned



Really grill the vendor on equipment performance



Try to talk to a technical expert with the manufacturer, not just the salesperson!



Know your critical design points (e.g. water flow) and over-design these



Thank you!

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