A story about the Morse Institute Library

Green Communities Summit, November 2024

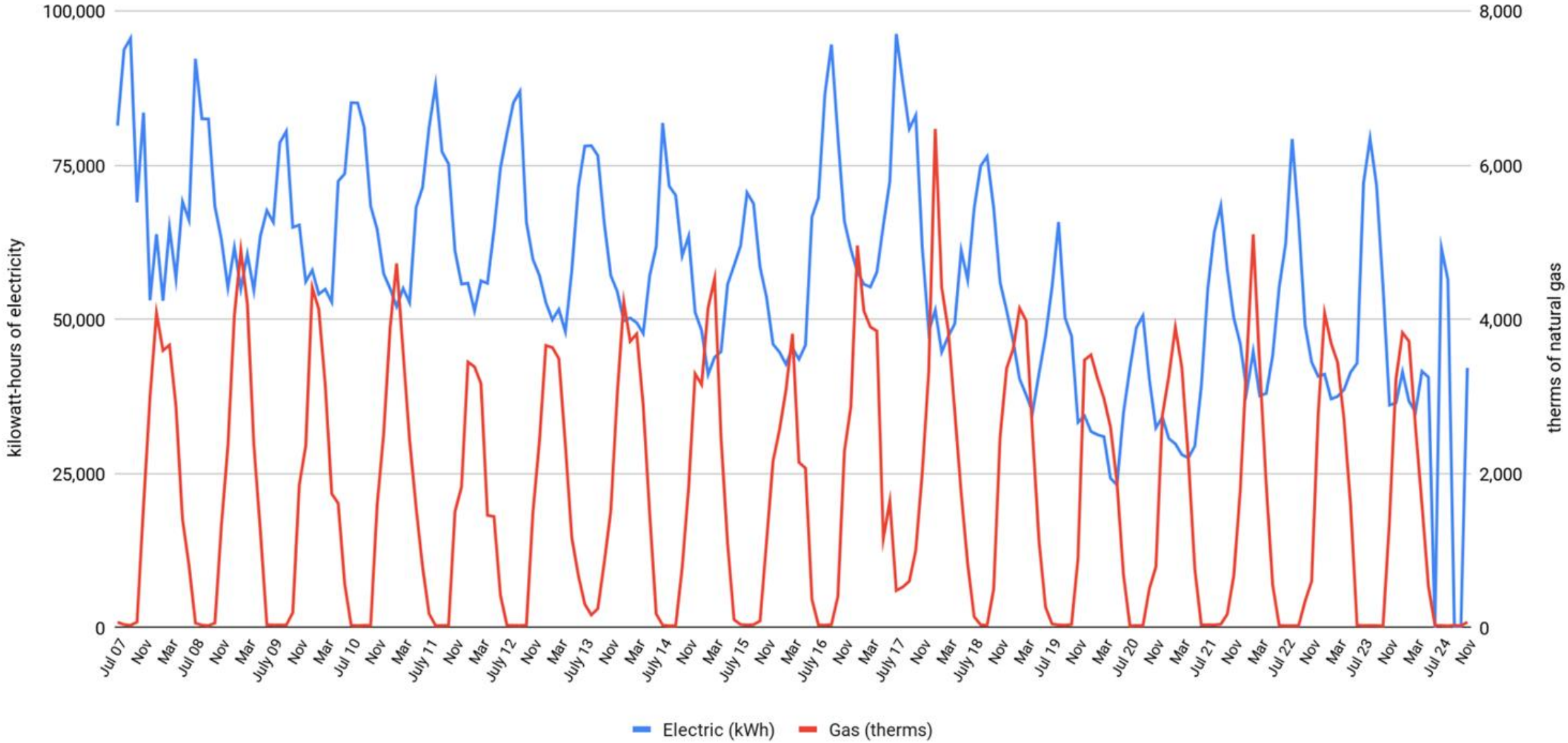
Photo Source: Natick Historical Society

Photo Source: Tappé Architects

Photo Source: Morse Institute Library

Photo Source: Morse Institute Library

Morse Institute Library, Energy Use Over Time



Zero Over Time

"A [net] zero-over-time (ZOT) approach focuses on cost-effective energy efficiency and renewable energy by prioritizing projects that pay back quickly in the short term, while aligning larger energy efficiency projects with major building life-cycle events, like equipment upgrades."

1 Independent Energy Conservation Measures

No-cost or low-cost measures such as:

- Adjusting mechanical and lighting schedules
- Adjusting heating and cooling so consistently unoccupied zones aren't conditioned
- Behavioral use

2 Load Reduction Measures

Capital investments with short-term paybacks, such as:

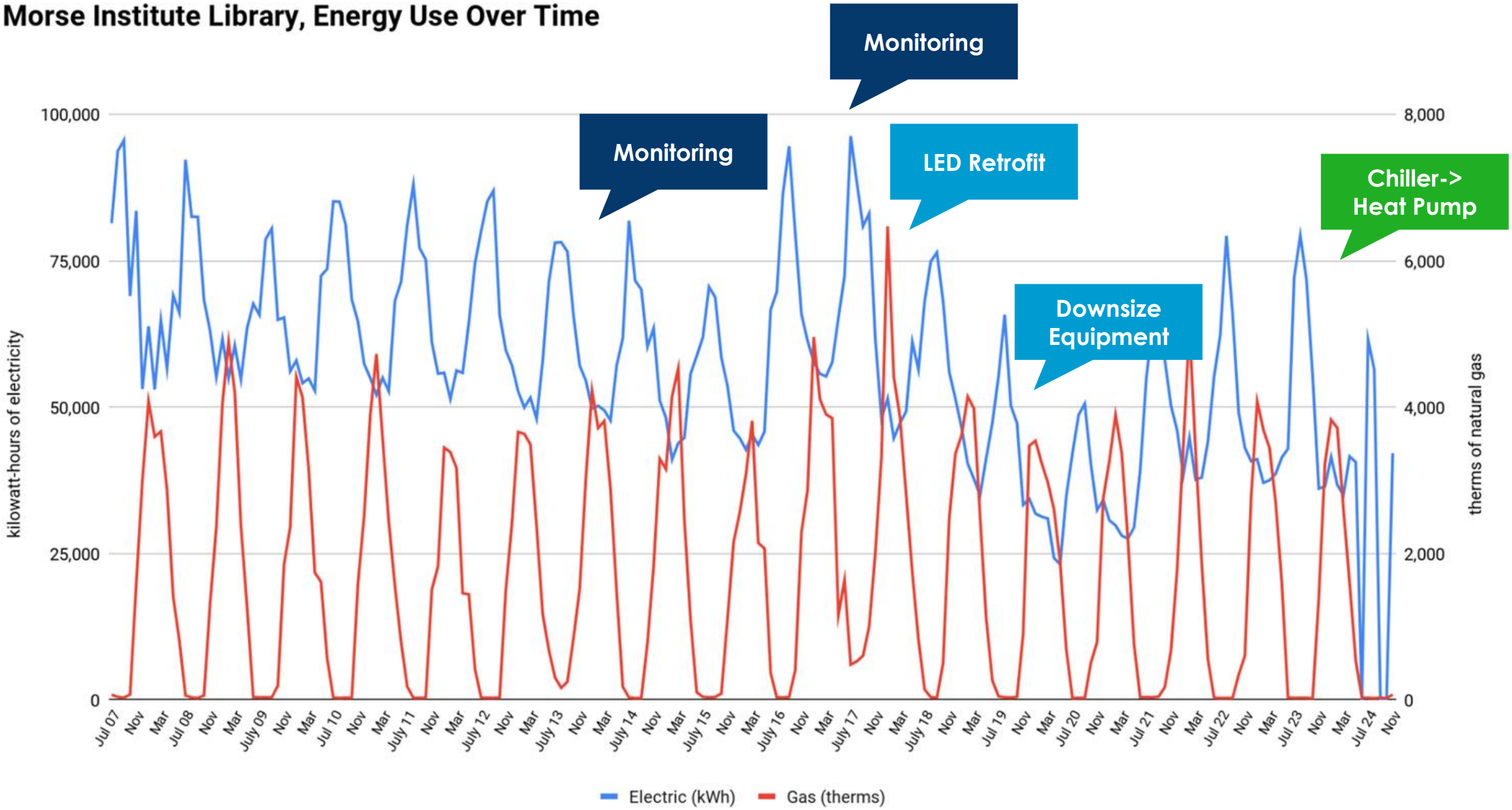
- Lighting upgrades
- Equipment upgrades

3 HVAC Upgrades

Major equipment replacements that result in:

- Downsizing
- Fuel switching

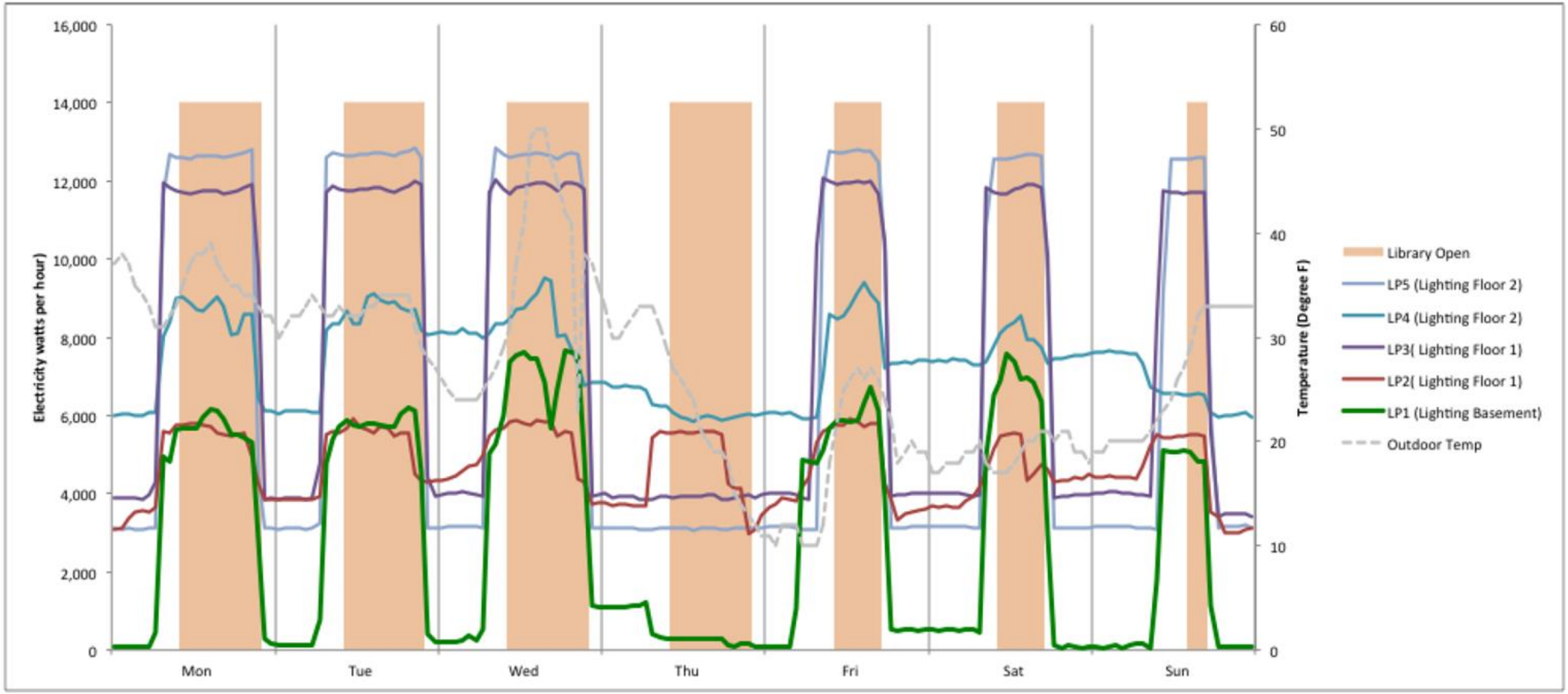
Morse Institute Library, Energy Use Over Time



2013-14 Energy Monitoring - Recommendations

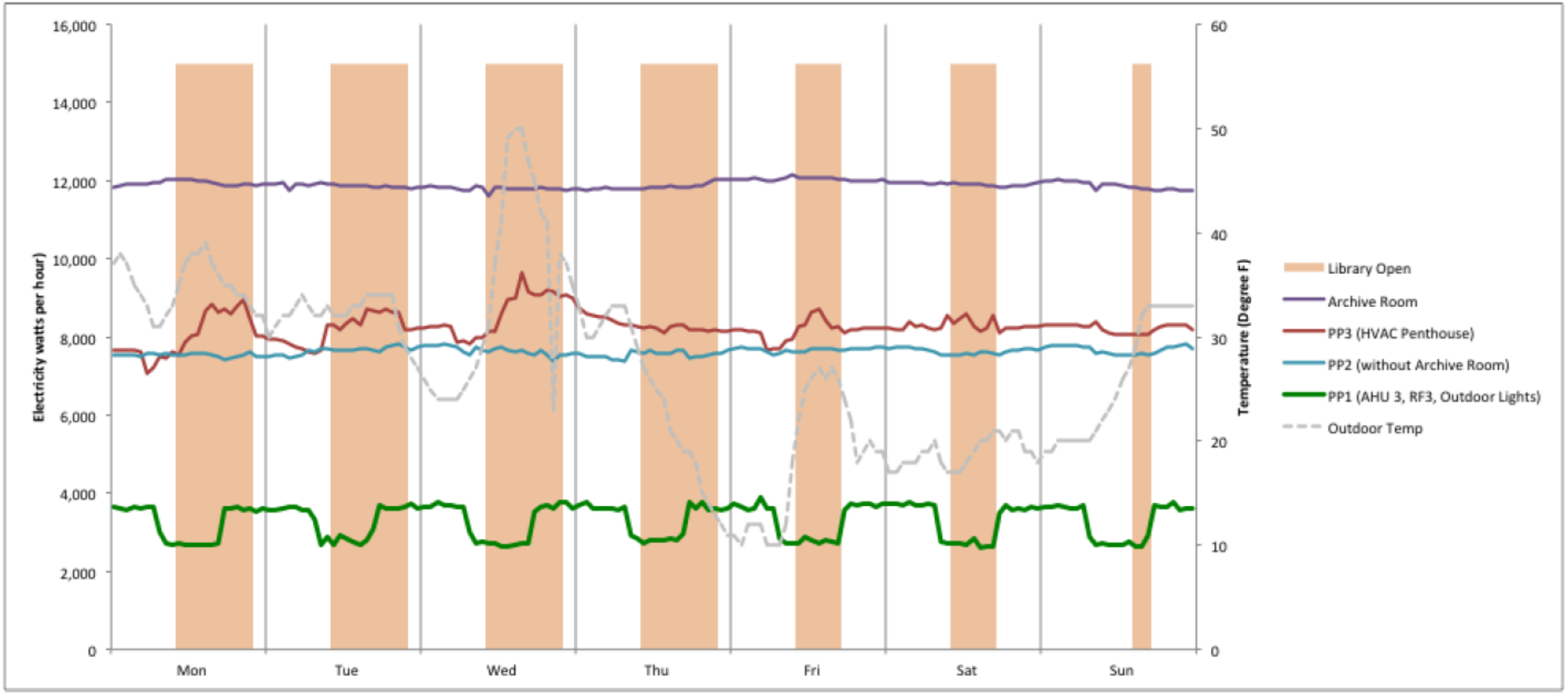
Recommendations	Savings (kWh/ Year)	Savings (therm/ Year)	Notes
Reduce Archive Room HVAC equipment runtime	25,628		Assumes 25% savings from current electricity use (see p. 4)
Reduce central HVAC operating hours	9,360		Assumes 12 hours per week of reduced HVAC equipment run time when building is unoccupied (see p. 5)
Turn computers off when the building is unoccupied	5,460		Assumes 50% savings when building is unoccupied (see p. 8)
Turn lighting off when the building is unoccupied	1,124		Assumes 20% savings when building is unoccupied (see p.6)
Reduce VAV box runtime when the building is unoccupied	545	27.5	Assumes 2 hours per week less runtime for an estimated 5 VAV boxes (see p. 5)
Turn off cooling equipment breakers in the winter	343		Assumes 100% savings during 20 weeks of the heating season (see p. 4)
Total	**42,460**	**27.5**	

2017 Energy Monitoring - Lighting



2017 - LED Retrofit

2017 Energy Monitoring - Archive Room



2019 - VFDs & Liebert Replacement

Chiller to Heat Pump Conversion+++ 2023

Failing Chiller

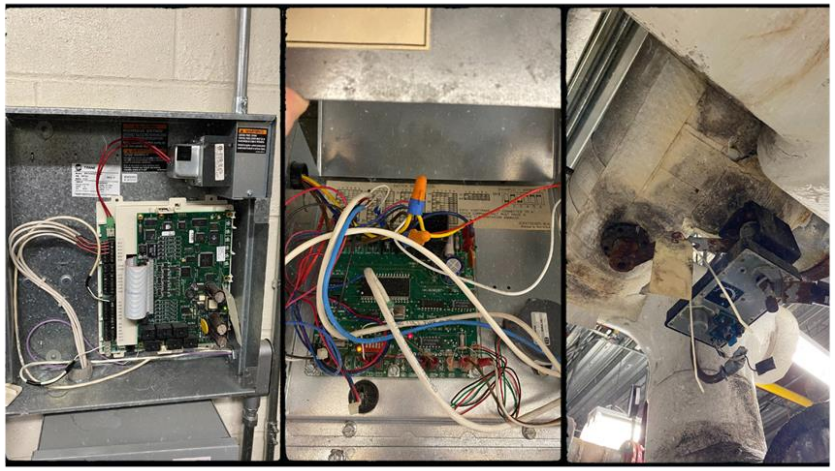
Ice Storage Tanks with Failing Pipe Insulation

Chilled Water Pumps

New Heat Pump

Ice Storage Tanks with New Insulated Pipes

New Chilled Water Piping and Pump Layout



Original Controls

Original Controls

Failed Insulation

New Controls

New Controls

Variable Frequency Drives

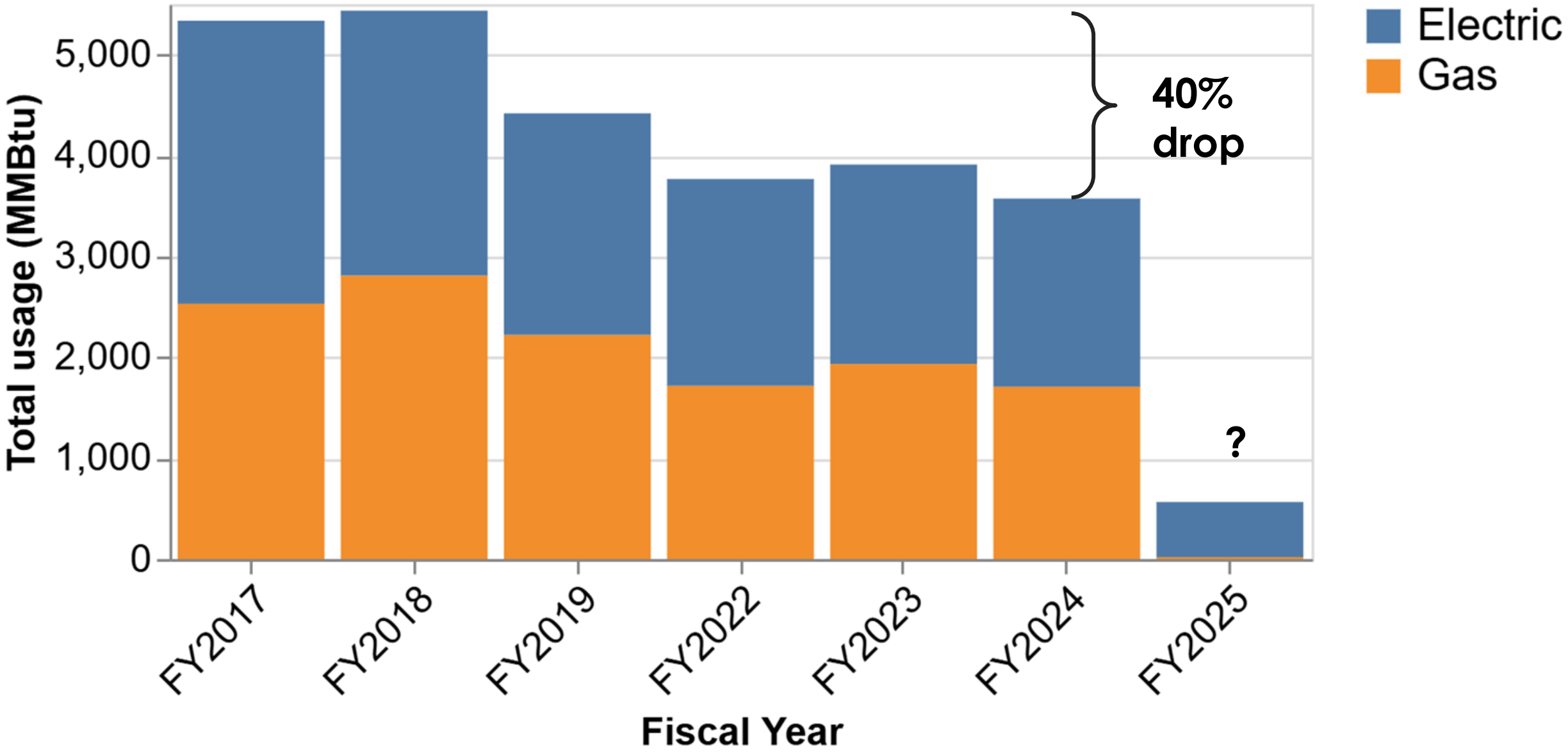
Chiller to Heat Pump Conversion+++ 2023

Grant Support

GREEN COMMUNITY DESIGNATIONS REACH 295

MA Green Communities	Designation Date / Award Date	Designation / Competitive Grant Award	Grant Project Summary	100% Done	Population
Natick	May-10	$173,526	to fund a solar PV power purchase agreement at the middle school, the incremental cost of a hybrid vehicle, and for carbon dioxide sensors at town hall.	X	36,272
	Jul-13	$126,662	to fund energy conservation measures, retrocommissioning, HVAC upgrades and controls, electric heater data points, and variable frequency drives on well pump, in municipal facilities including Morse Library, Police & Fire Headquarters, Recreation Center; Springvale Water Treatment Facility, and Captain Tom's Hill well	X	
	Jul-14	$239,092	to fund monitoring-based commissioning and analysis of four facilities and energy conservation measures in Bennett Hemenway School, Morse Library, the Senior Center, and the Cole Recreation Center	X	
	Jul-15	$230,004	to fund energy conservation measures, behavioral dashboards, EV vehicle, EV charging station, DC ventilation, HW pump/ fan controls, variable frequency drives, circuit monitoring, and controls upgrades, in municipal facilities including Brown, Ben-Hem, and Lilja Elementary Schools, Wilson Middle and Natick High Schools, DPW office, and Police-Fire Station	X	
	Jul-16	$250,000	to fund energy conservation measures, EVc vehicles, EV charging station, exterior lighting, energy analytics, retro-commissioning, in municipal facilities inclulcing two facilities and four schools	X	
	Jul-17	$155,905	to fund energy conservation measures, HVAC occupancy sensors, motor replacements, interior and exterior LED lighting retrofit, hot water heat pump, electric vehicle charging station, and hybrid vehicle upfit, in municipal facilities including Morse Institute, East School, Memorial Elementary School, and Senior Center	X	
	Jul-18	$245,142	to fund energy conservation measures, LED lighting, VFDs for rooftop units, and ductless mini-split replacement, in municipal facilities including Eliot School, DPW EM Garage, DPW Administration, Police and Fire Stations, and Morse Institute Library	X	
	Aug-19	$150,622	to fund energy conservation measures, LED lighting, in municipal facilities including Johnson Elementary, Community Senior Center and Central Fire	X	
	Aug-20	$100,000	to fund energy conservation measures, LED lighting, interior and exterior and retro-commissioning, in municipal facilities including Police and Wilson Middle School	X	
	Jul-21	$25,000	to fund energy conservation, reversible chiller design bid package, in municipal facilities including Morse Institute Library	X	
	Jan-22	$500,000	to fund energy conservation measures, heating electrification and controls upgrade, in municipal facilities including Morse Institute Library		
Needham	Feb-20	$148,143	to fund energy conservation measures, lighting, in municipal facilities including Pollard Middle, Mitchell, and Newman Schools	X	32,114
New Bedford	Feb-17	$604,305	to fund energy conservation measures, lighting retrofits, in municipal facilities including Ashley Elementary School, Carney Elementary School, and Swift Elementary School	X	100,682
	Aug-19	$250,000	to fund energy conservation measures, lighting, in municipal facilities including Wastewater Treatment Plants, Elizabeth Carter Brooks Elementary, Elwyn G Campbell Elementary, and Carlos Pacheco Elementary Schools	X	

Facility energy usage over time (MMBtu)



Advice

Know your buildings

Find a tech partner

Explore solutions together

Be nosy, but nice

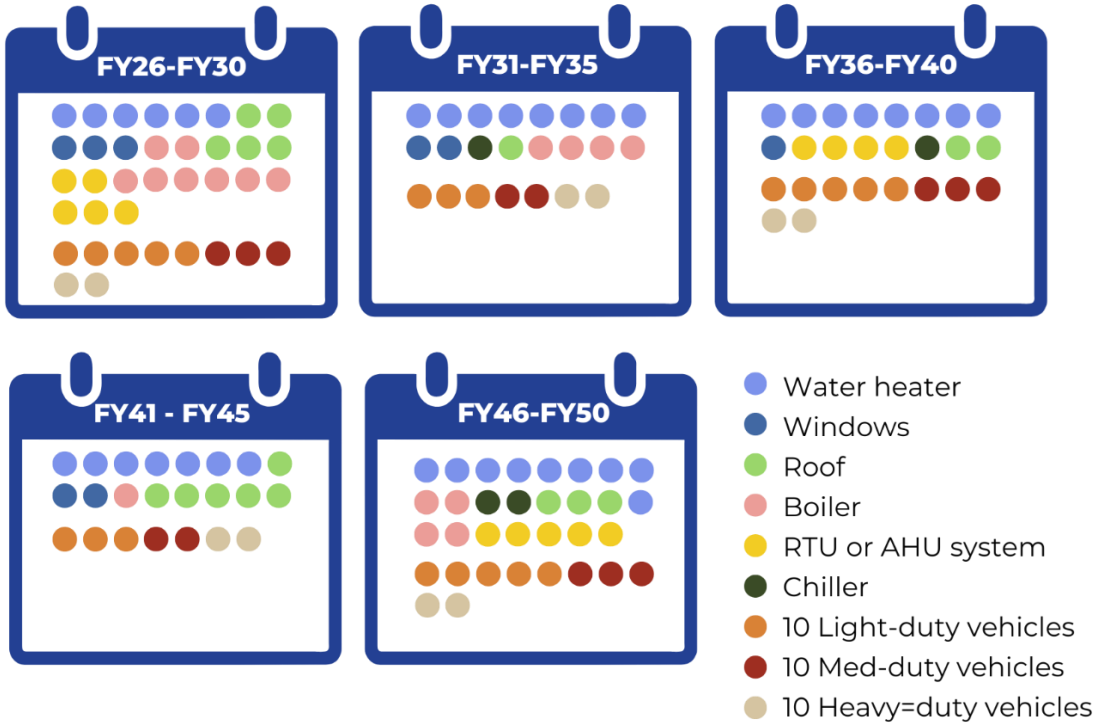
Be patient

What's Next? Step & Repeat

Natick's Top Building Emitters

Building	Emissions	% of Total	EUI
Natick High School	720	17.7%	45
Ben-Hem Elementary School	**388**	**9.5%**	**84**
Wilson Middle School	**367**	**9.0%**	**47**
J F Kennedy Middle School	333	8.2%	39
Brown Elementary School	**282**	**6.9%**	**78**
Police & Fire Headquarters	**271**	**6.6%**	**85**
Morse Institute Library	**229**	**5.6%**	**62**
Memorial Elementary School	228	5.6%	62

Trigger Event Calendar based on end-of-useful life standards



Thank You!

Jillian Wilson Martin
Town of Natick
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Max Kasper

Facilities Director

Town of Swampscott/

Swampscott Public Schools

Swampscott Elementary School

- 900 Student K-4 school combining 3 existing elementary schools funded through MSBA
- Project completed Summer 2024 and is currently open
- Fully electric building with over 80 geothermal wells
- Model EUI of 25.9 and anticipated LEED Gold Certification
- Mass Save Path 1-ZNE Project

Sustainability Starts Early

- Sustainability should be a priority of your project from an early stage and incorporated into procurement documents*
- Swampscott created a sustainability subcommittee as an offshoot of the School Building Committee
- Solicited input from the Renewal Energy Committee, Conservation Committee, Open Space Committee and the Town Conservancy; all of which contributed to our sustainability conversations
- Leaned heavily on the Design Team at an early stage to provide detailed information on technical project decisions*

The Geothermal Decision

- Ground Source Heat Pumps pushed the project into the desired EUI range and maximized incentives
- Long term cost of geothermal was comparable to other options
- Reliability of ground source in extreme weather conditions was also a consideration
- Site Constraints and number of wells need to be a consideration*

Incentives

- Our project was one of the first under Mass Save Path 1 New Construction
- Our total anticipated incentives from Mass Save/National Grid are over $1.6 Million
- The Ground Source Heat Pump Adder is significant, contributing to over $900K of our incentive package
- We are also in the process of navigating the IRA Direct Pay benefit and are anticipating significant funding from this, around $2,000,000*

More Lessons Learned

- Get things in your project early and fight for them through the process. VE can be intense and Change Orders are expensive
- Foster a relationship with your MEP engineers
- You need people from the municipality to be intimately involved with the project to help drive the schedule and advocate for the best interests of the municipality
- Understand the building Controls as much as possible
- If you just keep doing the right things sometimes you are rewarded: NG Incentives, IRA Direct Pay, MSBA

DECARBONIZING OUR COMMUNITY SCHOOL

……AND A FEW OTHER BUILDINGS WHILE WE WERE AT IT

WARWICK MA: A SMALL TOWN WITH ENGAGED CITIZENS

POPULATION 780

OVER 50% STATE & TOWN FOREST

TOWN HALL SOLAR ARRAY, 2010

ALMOST FREE!

BEFORE DECARBONIZATION WAS A WORD

- In 2007 the Town wanted a buildings advisory committee.
- Trades people volunteered, under the condition we look at energy use.
- The Warwick Buildings & Energy Committee was born!

one Carpenter

one Electrician

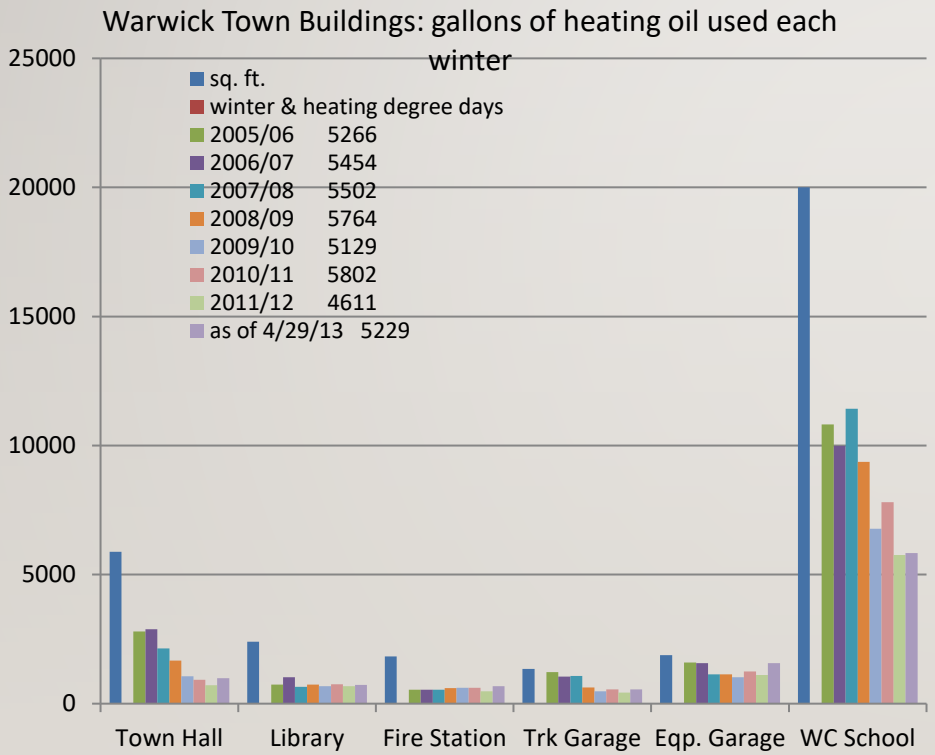
one Auto Mechanic

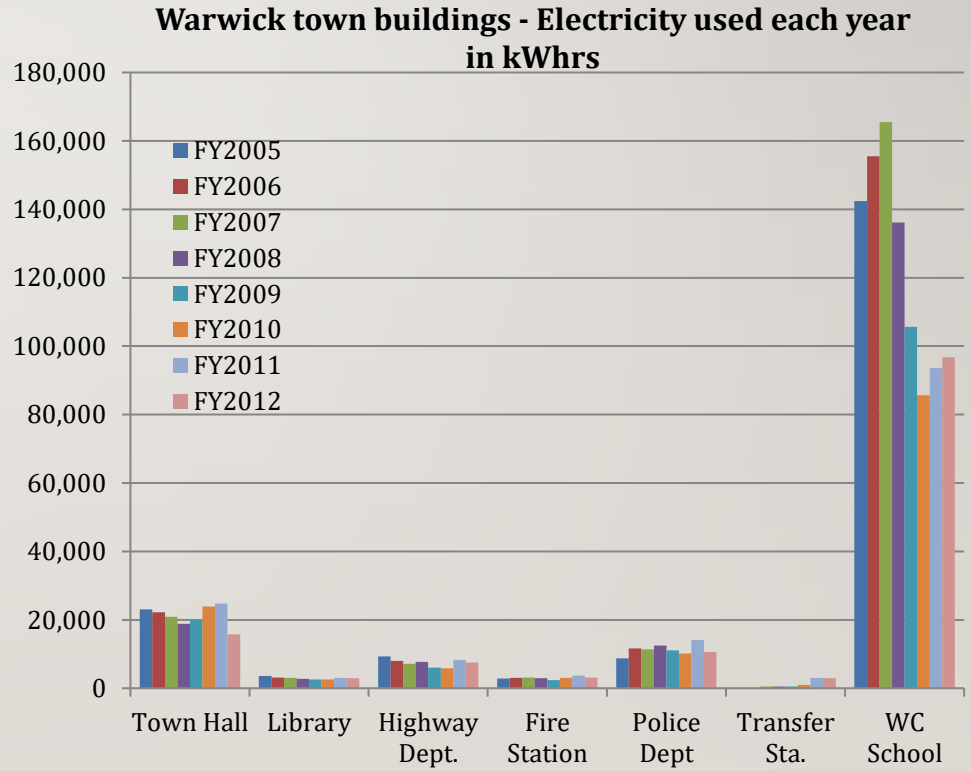
one Civil Engineer

one Historic Window Rebuilder

one Software Engineer

OUR ELEMENTARY SCHOOL WAS THE ELEPHANT, BUT IT WAS NOT OURS TO FIX – WE WERE PART OF A DISTRICT





OUR BEAUTIFUL 20K SQ. FT WARWICK COMMUNITY SCHOOL – BUILT IN 1999

- Volunteers were very involved designing the building and raising funds to add a gym and stage.

BUT THERE WERE SOME ISSUES

INADEQUATE INSULATION & AIR SEALING

AIR GAPS BETWEEN CEILING PANELS ON GYM

FAST FORWARD - SOME ENERGY CONSERVATION PROJECTS

- 2014 – GC designation grant – **weatherize** most buildings + a few mini-splits
- 2018 - weatherization, motors, drives at WCS & Pioneer Valley Jr-Sr high school
- 2020 – Pioneer closed our school but the building still open for community use. Installed Energy Management System (EMS)
- 2022- half the school gets mini-splits & window inserts (winserts)
- 2023 – Divorce is final, school reopens - other half gets mini-splits & winserts. Fire station gets air-water heat pump for slab

WHY GO ELECTRIC ?

IT'S THE MONEY $$$

- 25% discount on electricity for 25 years
- Current elec. credit at WCS: -$27,800
- Oil burners at the end of service life

IT'S THE COMFORT

- Now we have AC!!
- Even heating and cooling
- Dehumidification
- Users familiar with mini-splits

WHY GO ELECTRIC?

IT'S THE CONVENIENCE

- Easy to schedule, easy to use
- Wi-Fi connected units
- Remote monitoring
- Individual room control

IT'S THE CLIMATE

- We can green up our electricity supply
- Emissions are more manageable offsite (at the power plant)
- Carbon reduction
- It's the right thing to do

WHAT COULD POSSIBLY GO WRONG?

- Trained staff drift away
- Untrained staff mess with it
- Frequent power outages
- Single phase power limits options

Warwick Elementary School

View : AHX_1

MC Office #: 978-856-786

OA Temp : 46.3

OA Hum : 62.8 %

Enthalpy : 30.0 BT

19-Nov-24 9:33 AM

Logoff | Home | East Floorpla | West Floorpla | Gym Floorpla | Boiler Plant | Schedules | Alarms | Histories | Audit History | Back

Monitor | Setpoints | Histories

Unit Tag: AHX-1

Unit Serves: West Side Classrooms & Cafe

Controller Status: {ok}

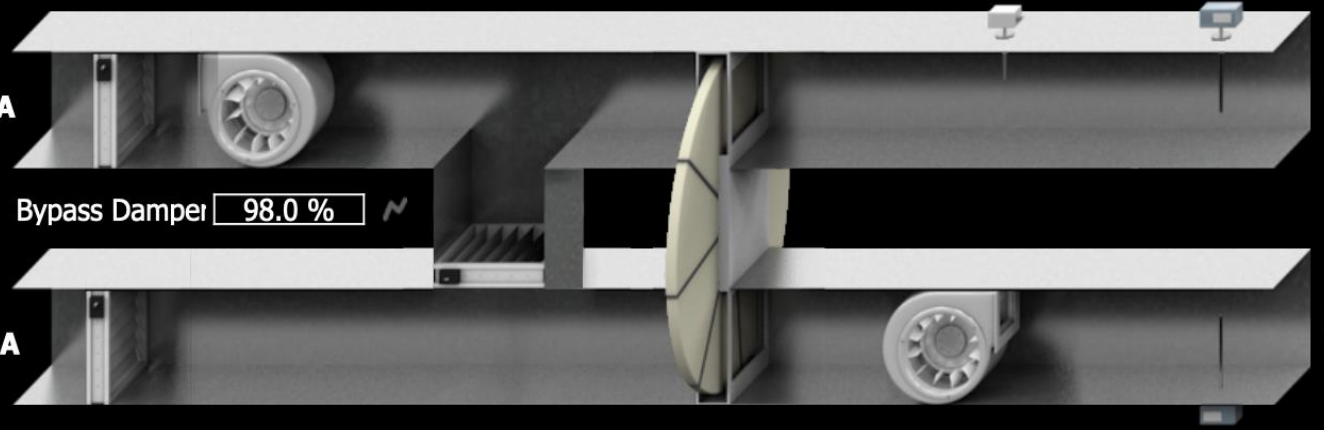
Exhaust Fan Enable: Off

Exhaust Fan Status: Off

Exhaust Fan Failure: Ok

Return Air Co2: 523 ppm

Return Air Temp: 71.57 °F



Exhaust Dampe: 2.0 %

Bypass Damper: 98.0 %

Outdoor Dampe: 2.0 %

Building Pressure: 0.001 in/wc

Bathroom Slab Ten: 70.56 °F

Outdoor Dewpoint: 34.31 °F

Wheel Enable: Off

Wheel Cooling: Off

Wheel Heating: Off

Supply Fan Enable: On

Supply Fan Status: On

Supply Fan Failure: Ok

70.71 °F Supply Air Temp

Space Overview

Min Space Temp	65.2 °F
Min Zone	HWC1
Avg Space Temp	72.4 °F
Max Space Temp	77.1 °F
Max Zone	HWC13

Occupancy Control

Occupancy Command	Occupied
Effective Occupancy	Occupied
Night Purge Mode	Off

Misc Control

Unit Disable	Auto
Disable Purge Mode	On
Manual Purge Mode	Off

WHAT'S NEXT?
SOLAR SOLAR SOLAR