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LAVALLEE BRENSINGER ARCHITECTS

SparhawkGroup
Engineered Building Performance

BUILDINGENERGY® BOSTON

MARCH 20-21, 2025 • WESTIN BOSTON SEAPORT DISTRICT • NESEA.ORG/BE25

Conference + Trade Show of the Northeast Sustainable Energy Association (NESEA)

3.21.25

Bringing New Life to Old Buildings via Air Sealing:
2 Housing Facility Case Studies

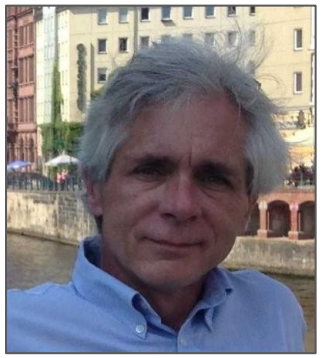
Agenda

- Today's speakers
- What we're focused on today
- Air sealing key points
- Hetzel Hall: building envelope air sealing case study
- Jaycee Place: duct air sealing case study
- Q & A/discussion

Today's Speakers

Bill Shadid
Aeroseal
Strategic Marketing Leader

Sean Landry
Lavallee Brensinger Architects
Higher Ed Studio Leader



Tom Holmes
Aeroseal
Bus. Develop. Mgr. Northeast

Matt Holden
Sparhawk Group
President

What We're Focused On Today

Using Existing Buildings vs. Building New Buildings is a Great Idea

Less Carbon

Less Waste

Good Buildings

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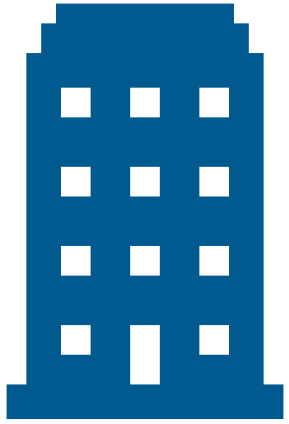
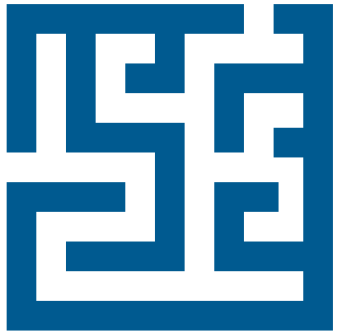
Then Why Don't We Continue Using Existing Buildings More Often?



Older Building With Performance of a New Building?



Perceived Complexity

Perceived High Cost

Today's Focus:
New Life for 2 Existing Buildings

aerobarrier®

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Air Sealing Key Benefits

Air Sealing Key Benefits for the Building Envelope & Ductwork

Benefits of Air Sealing – 1						
Air Sealing Type	Reduced Energy Use & Costs	Increased Comfort	Reduce Moisture in the Ext. Wall	Increased Indoor Air Quality	Reduce Outside Noise	Reduce Insects & other Pests
Building Envelope	👍	👍	👍	👍	👍	👍
Ductwork	👍	👍		👍		

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Air Sealing Key Benefits for the Building Envelope & Ductwork

Benefits of Air Sealing – 2					
Air Sealing Type	Smaller HVAC System	Increased HVAC System Efficiency	Building Code	High Performance Standards	Gain $ Incentives
Building Envelope					
Ductwork					

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Hetzel Hall: Building Envelope Air Sealing Case Study

Univ. of New Hampshire Hetzel Hall

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Why Renovate?

- Preservation of History
  - Celebrating 100 years
- University's commitment to sustainability
- Embodied Carbon

Challenges

- Predictability
  - Schedule
  - Cost $$$

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Hetzel Hall: Project Overview

- Building originally constructed in 1925 by EF Huddleston
- Concrete foundations, multi-wythe masonry / terra cotta exterior load bearing walls, wood framed roof
- Cast-in place concrete floor and joist system with steel girders and columns
- Design-build 33,500 sf gut demolition and reconstruction
- 140 beds; 60/40 ratio, singles to doubles
- Issued 4 bid backages in 7 months

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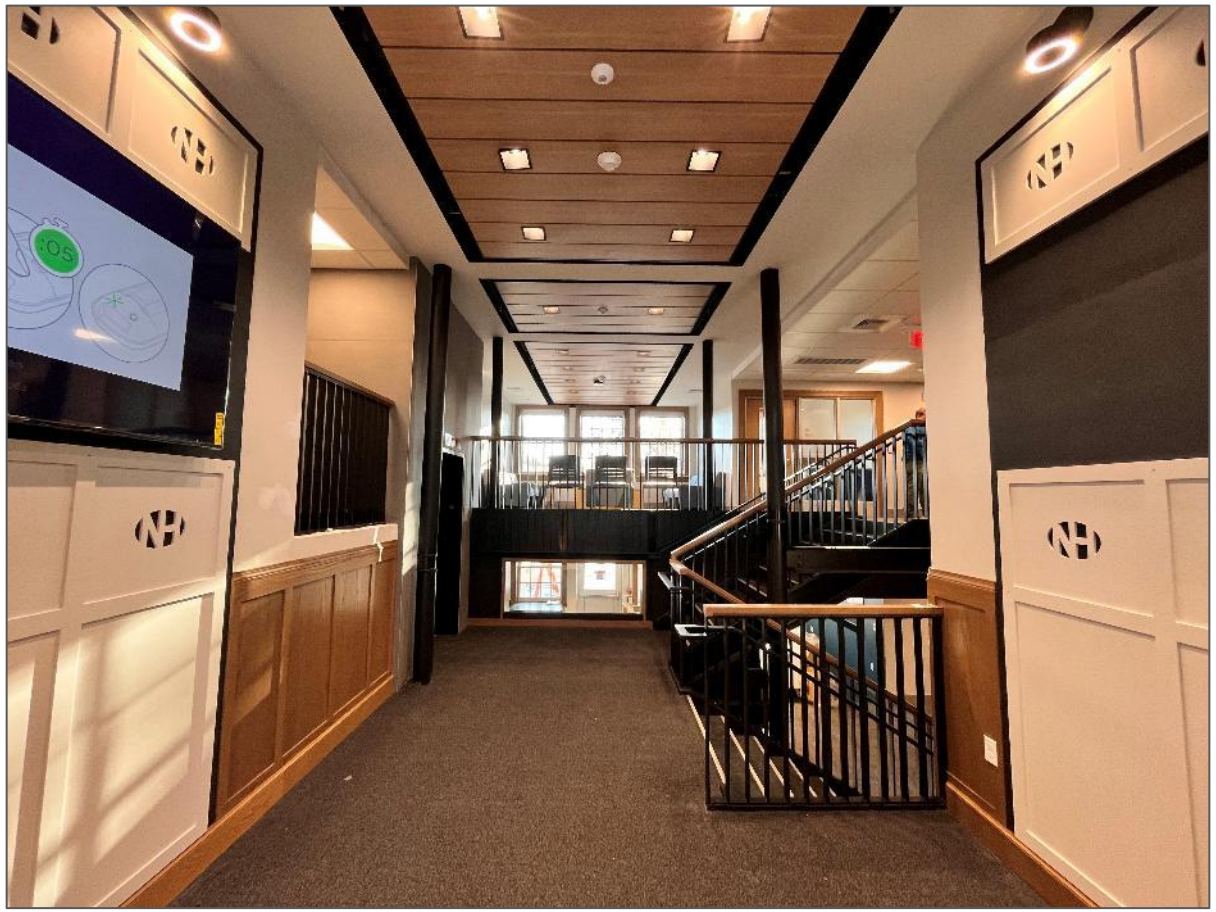
Balancing the Past and the Future

Before



After

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Balancing the Past and the Future

Before

After

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Balancing the Past and the Future

Before

After

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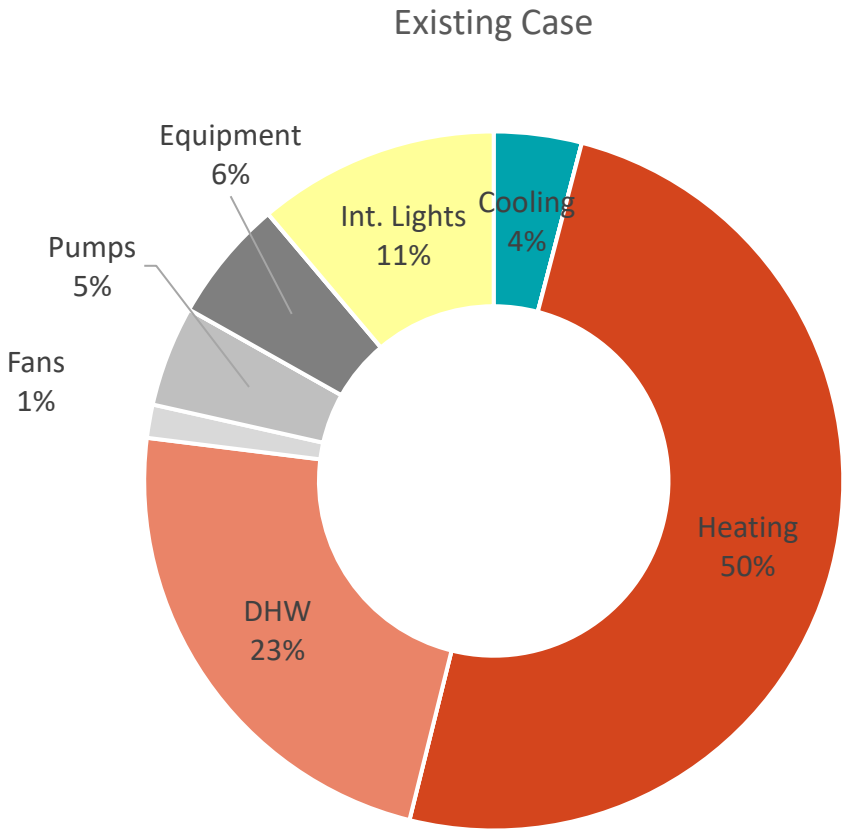
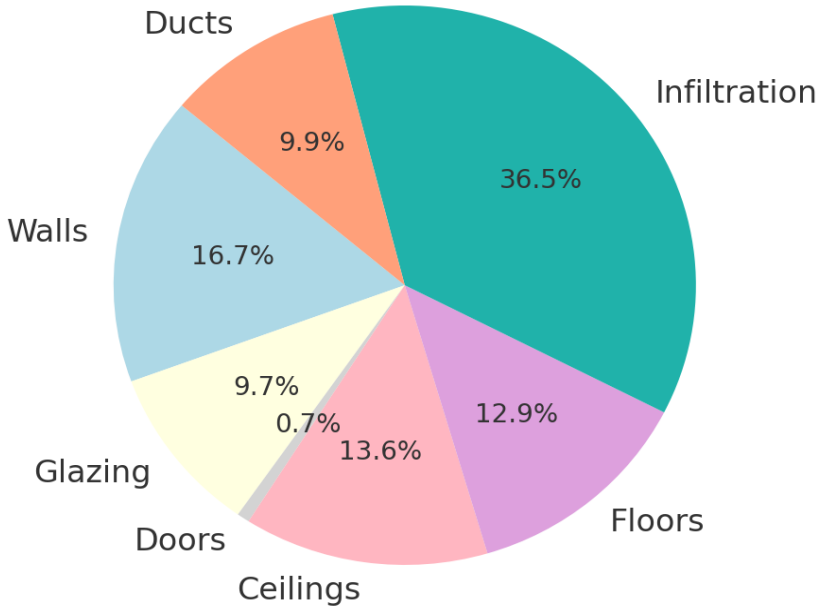
Prioritization of Energy Conservation Measures





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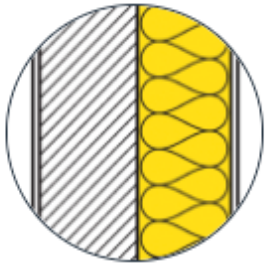
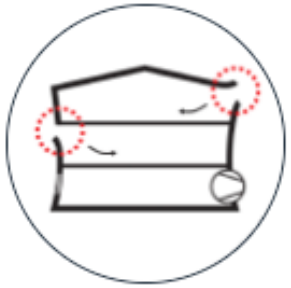
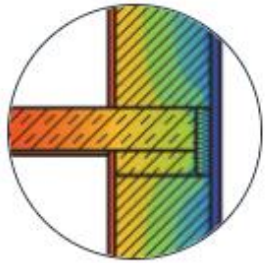
Exterior Envelope Goals



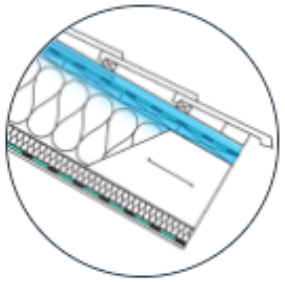
High-Performance Enclosure



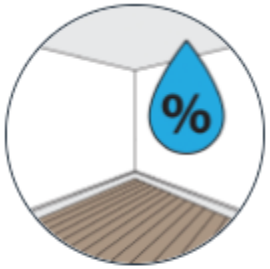
Airtightness



Thermal Bridge Elimination



Material Moisture



Air Humidity

High Performance Glazing

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Condition of Interior After Demo & Before Exterior Air Sealing

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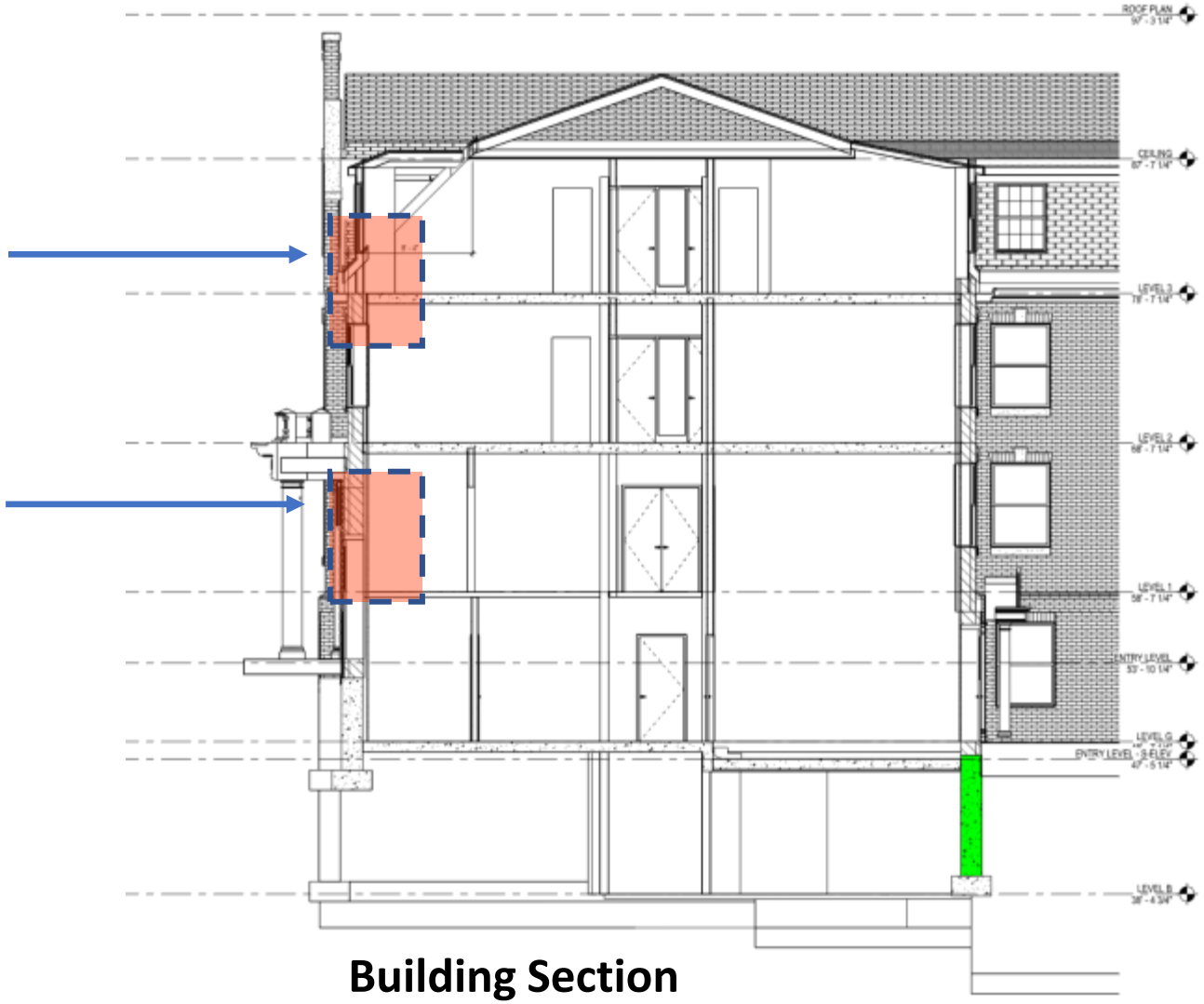
Exterior Wall Improvements Considered

Case 1: SINGLE WYTHE MW + SMART VAPOR BARRIER

and

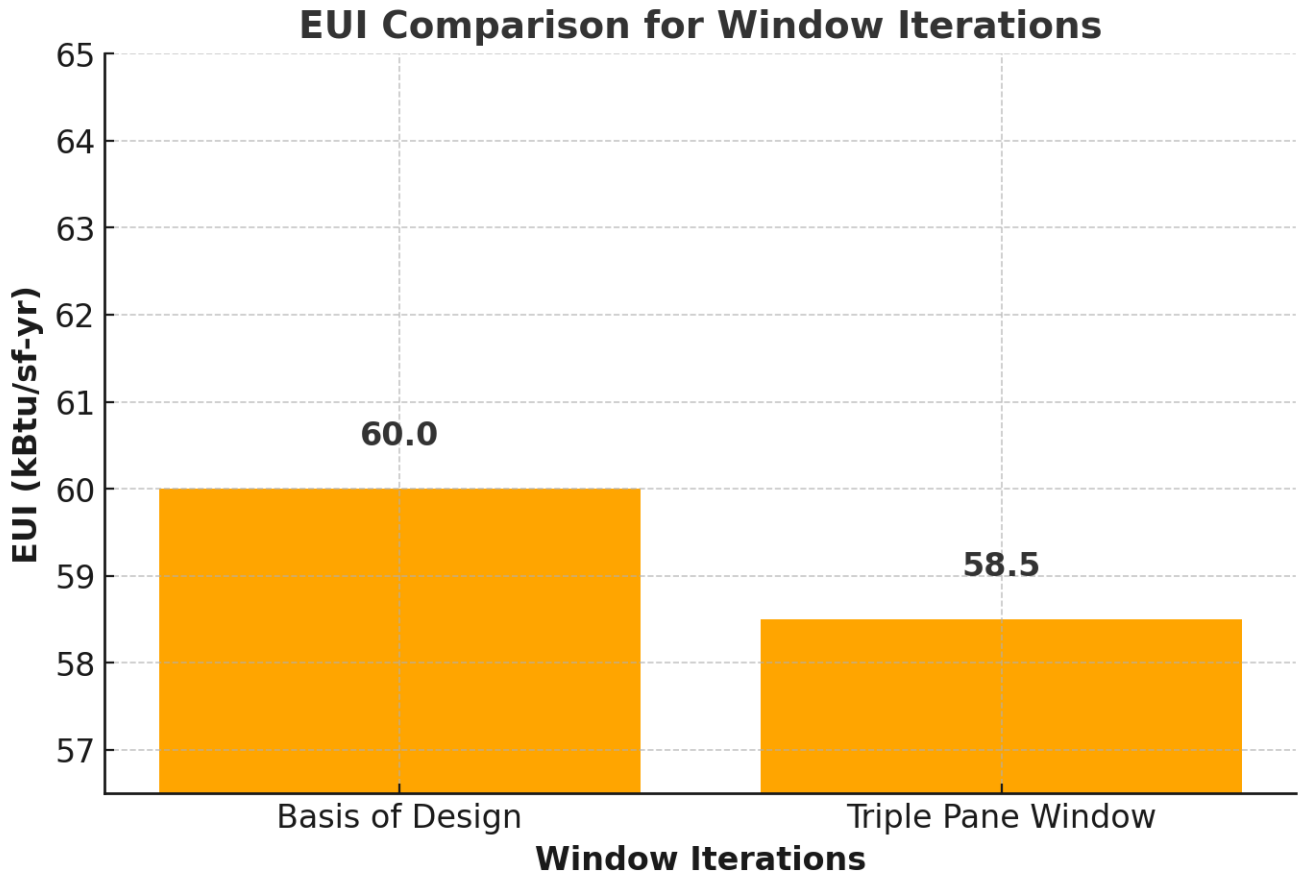
Case 2: SINGLE WYTHE MW + NO VAPOR RETARDER

Case 3: DOUBLE WYTHE MW + SMART VAPOR BARRIER



Building Section

Window Replacement for Thermal & Air Leakage



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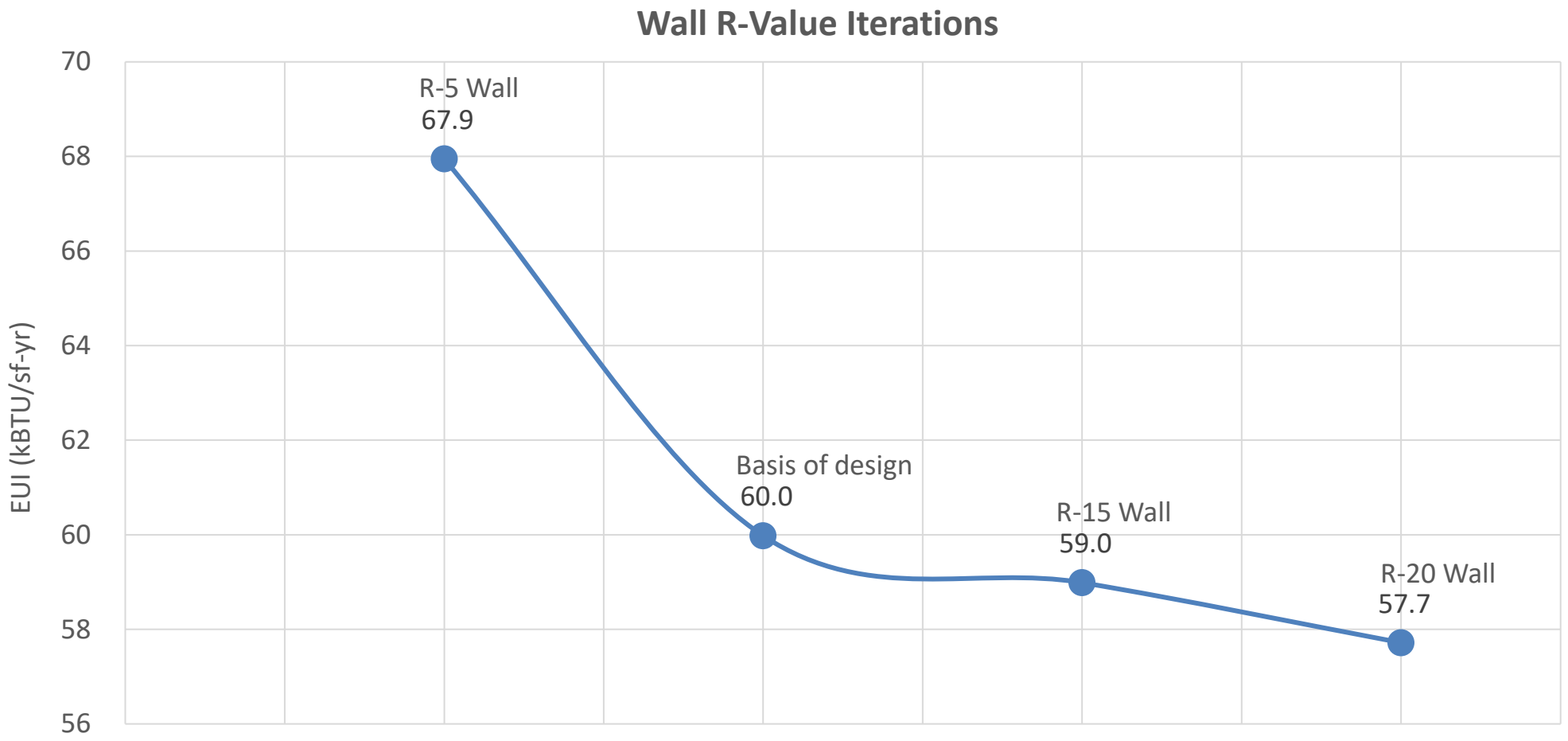
Exterior Wall Optimizations Studied



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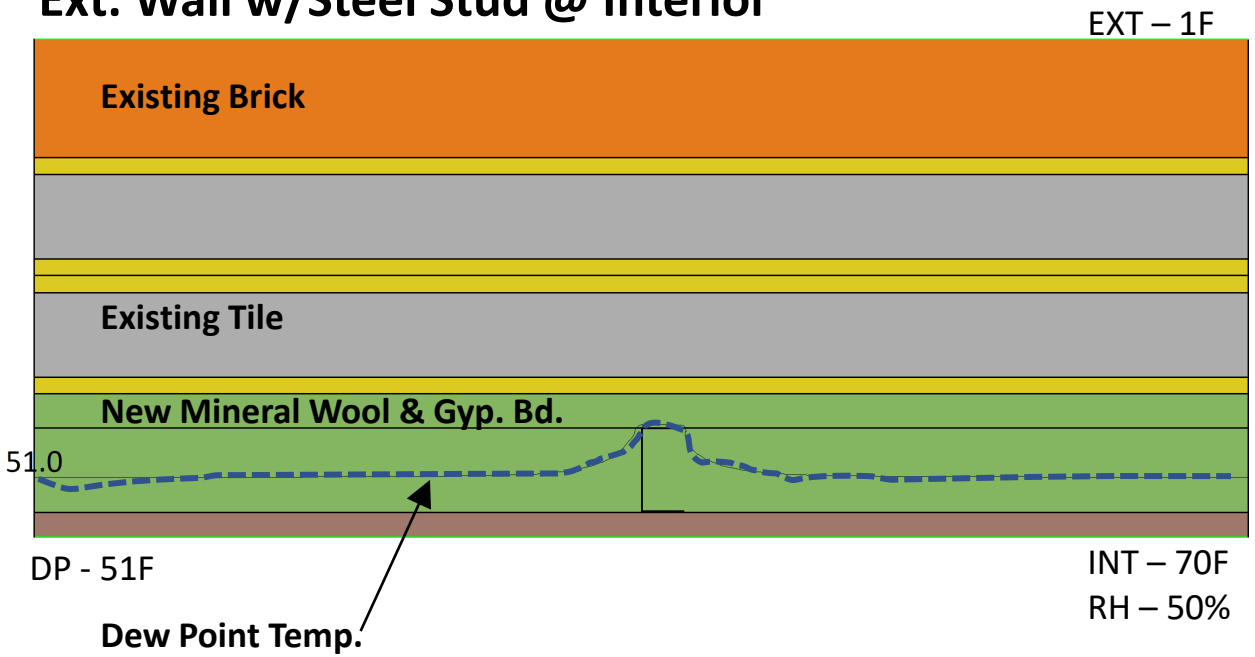
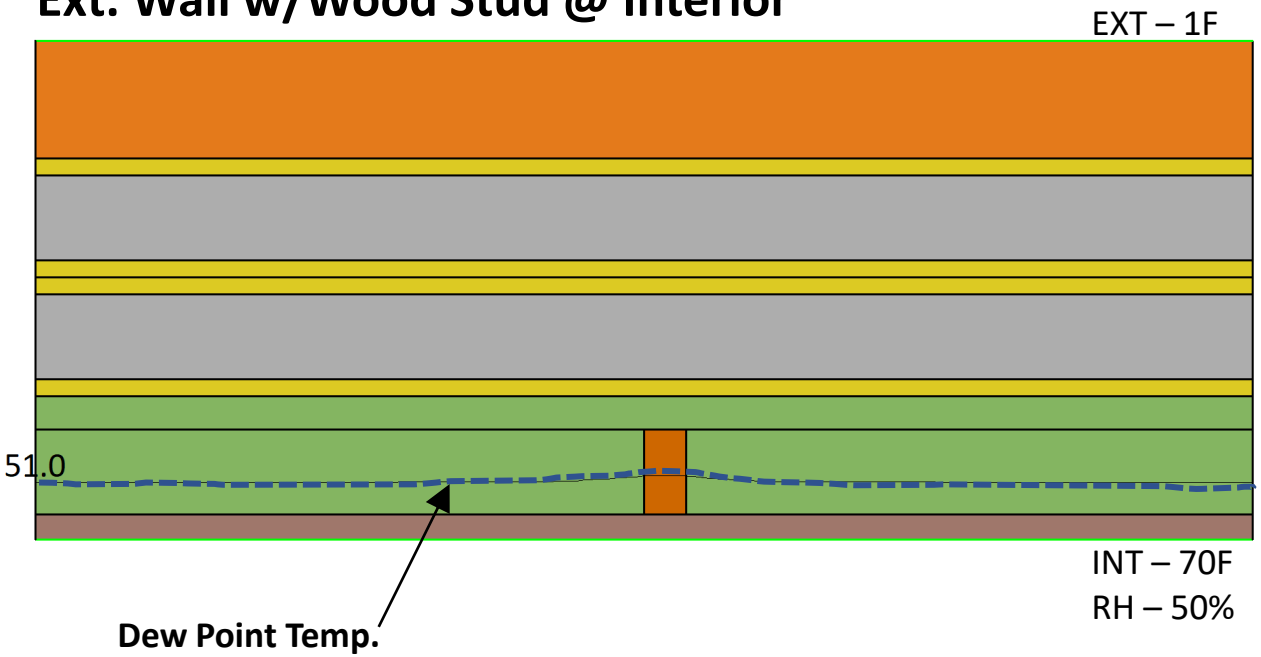
Metal vs. Wood Stud Exterior Wall Comparison

Ext. Wall w/Steel Stud @ Interior



Ext. Wall w/Wood Stud @ Interior



Plan View

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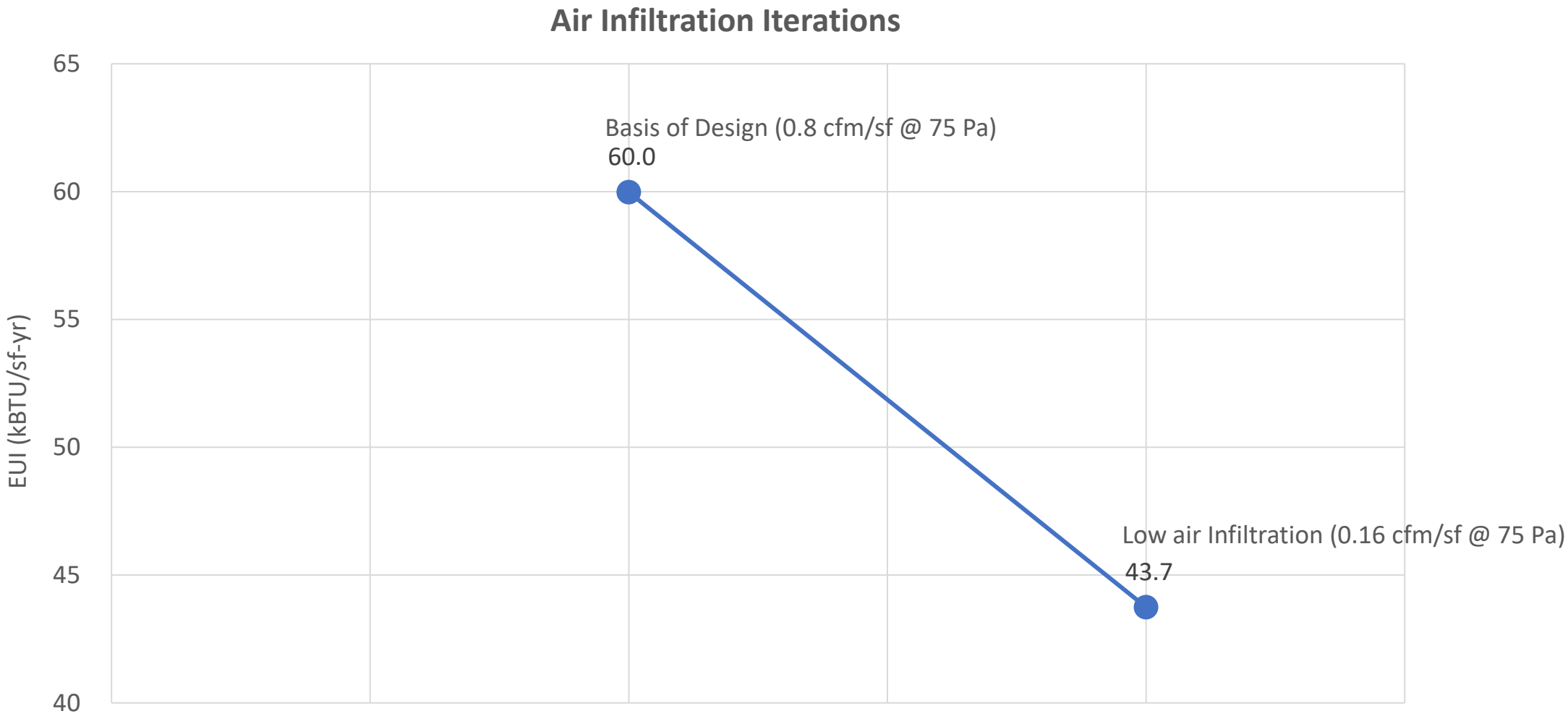
Reducing Infiltration: What We Wanted to Accomplish



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Exterior Envelope Air Sealing Strategy

Parameters

- No changes to building exterior
- Significant reduction in air leakage needed
- Methods and materials to work with existing masonry construction with very small leaks not able to be seen
- Time and cost were important considerations
- Verification of air tightness needed

Primary Solution: AeroBarrier

- Seals from the interior
- Proven effective with immediate verification
- Pressurized application with blower door finds and seals even the smallest leaks
- Automation saves time & is cost neutral
- Air tightness known immediately

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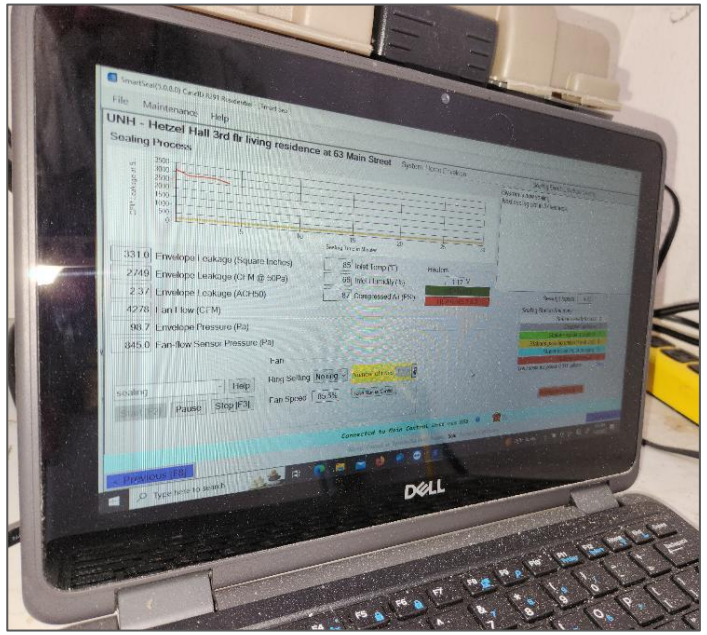
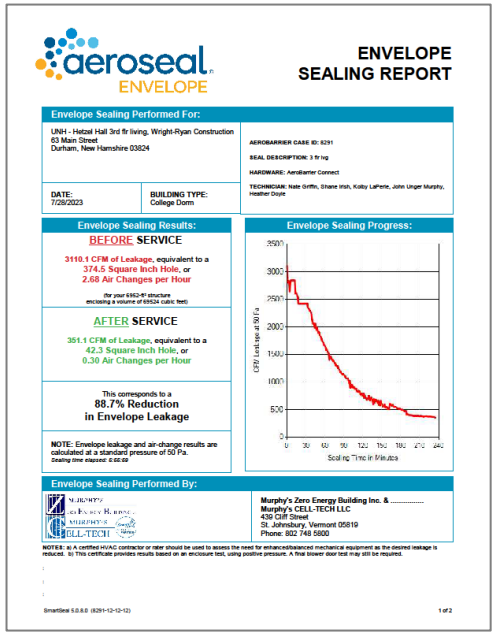
AeroBarrier Overview

Uses Higher Pressure Inside

Blower Door Directed



Computer Automated



Immediately Verified

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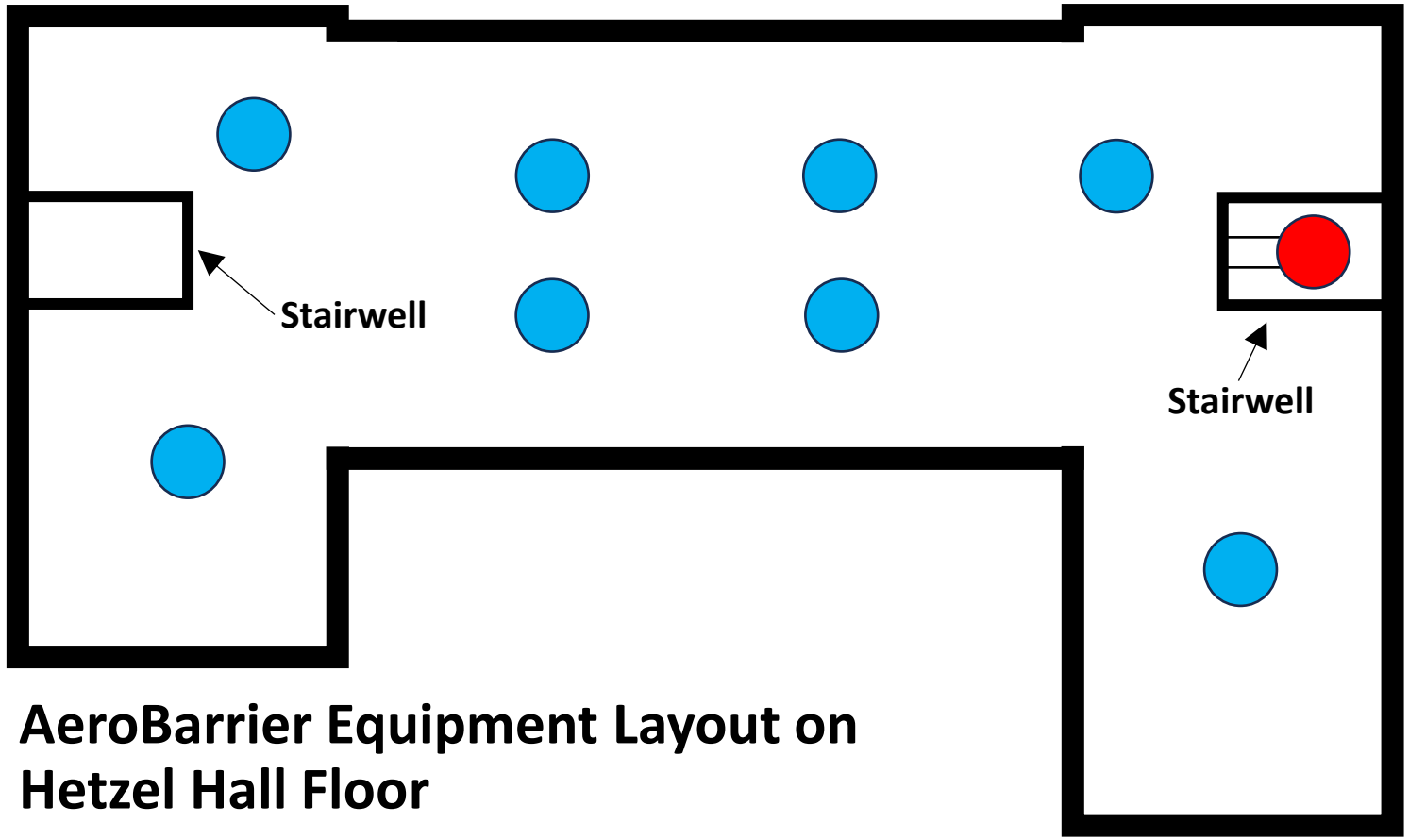
Hetzel Hall AeroBarrier Application: Sealing Station Placement



AeroBarrier Equipment Layout on Hetzel Hall Floor

Sealing Station Spraying Sealant Fog

= AeroBarrier Sealing Station

= Blower door, fan, main control unit

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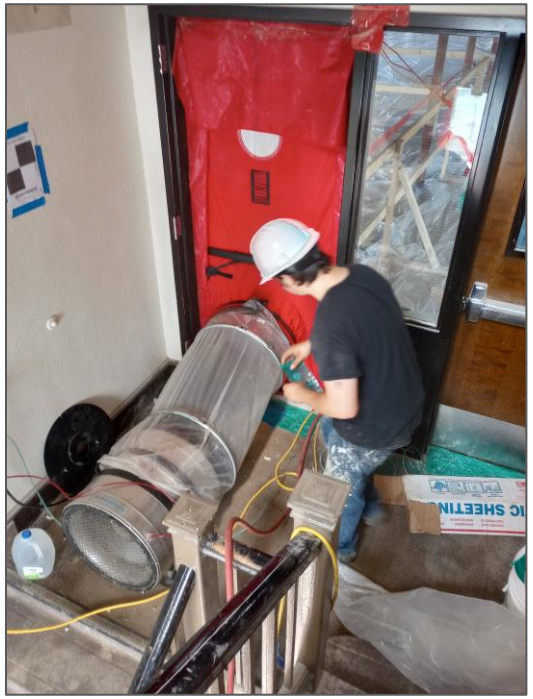
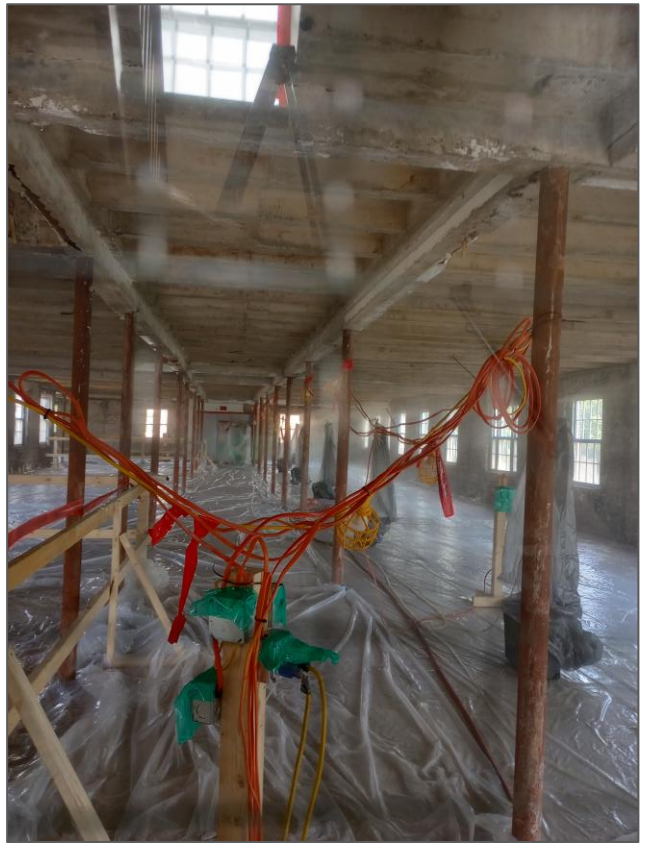
AeroBarrier Application at Hetzel Hall



Blower Door & Fan Installed in Stairwell

Technician w/Laptop Running the Seal



Sealing Stations Spraying Sealant Fog

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Scheduling Was Critical

Key Factors

- Tight construction schedule
- Sealing done in 4 mobilization phases
- AeroBarrier done on weekends when other trades not on job site (work can be done with other trades on site)
- Each floor ready for work by other trades on Monday morning

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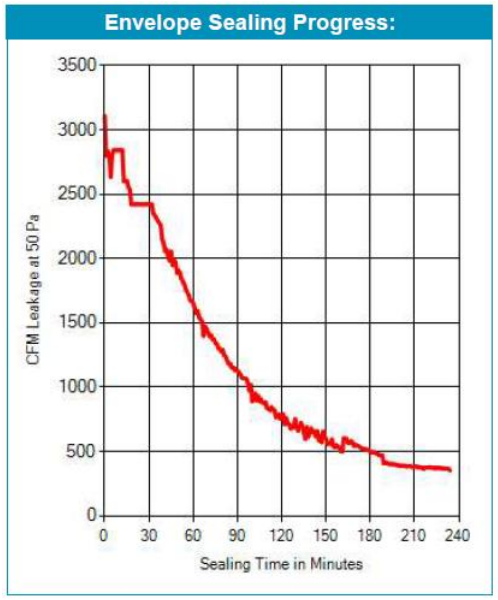
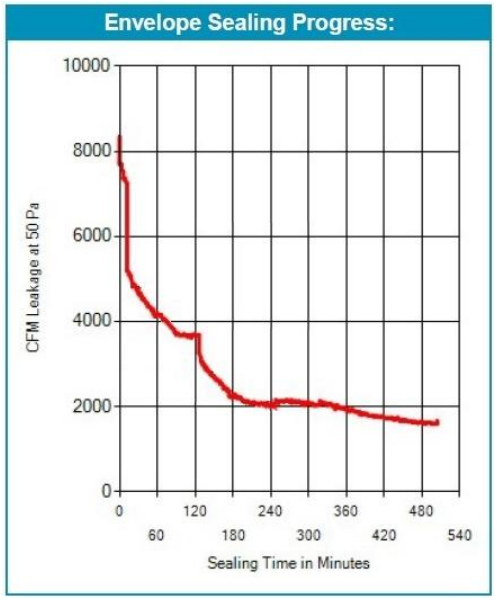
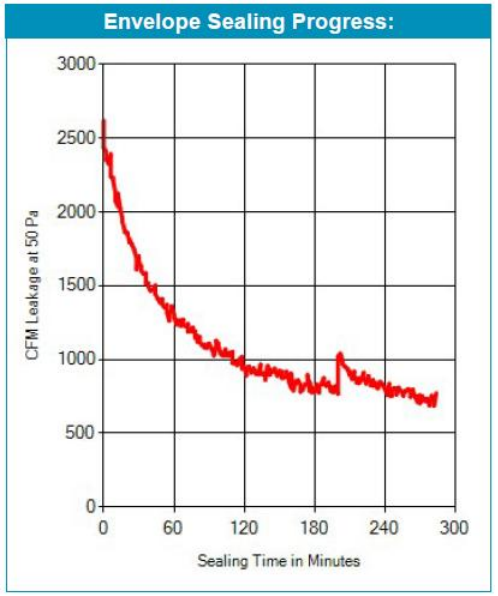
Envelope Sealing Reports By Phase



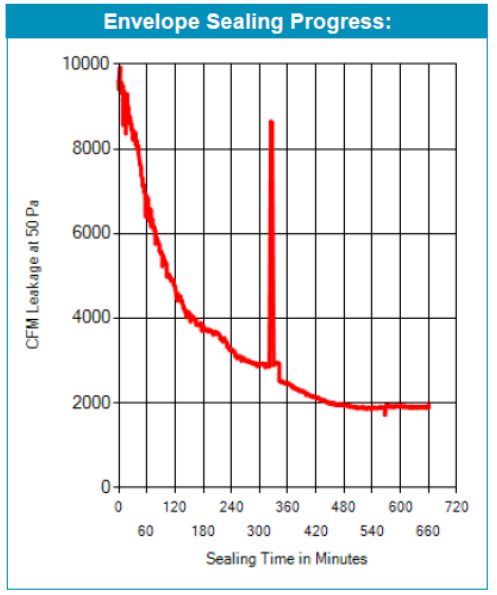
Phase 1 Seal



Phase 2 Seal



Phase 3 Seal



Phase 4 Seal

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Sealing Results By Phase

Sealing Phase	After ACH50	Before cfm	After cfm
Phase 1: 3rd Floor Living	0.30 ACH50	3,110 cfm	351 cfm
Phase 2: 1st & 2nd Floors Living, Stair D	0.62 ACH50	8,350 cfm	1,655 cfm
Phase 3: Basement Living, Stairs A & B	1.40 ACH50	2,620 cfm	772 cfm
Phase 4: 4th Floor Living, Stairway C	1.55 ACH50	9,403 cfm	1,964 cfm
Total CFM Reduction (unguarded)		**23,523 cfm**	**4,753 cfm**

Total Air Tightness Achieved = 0.86 ACH50

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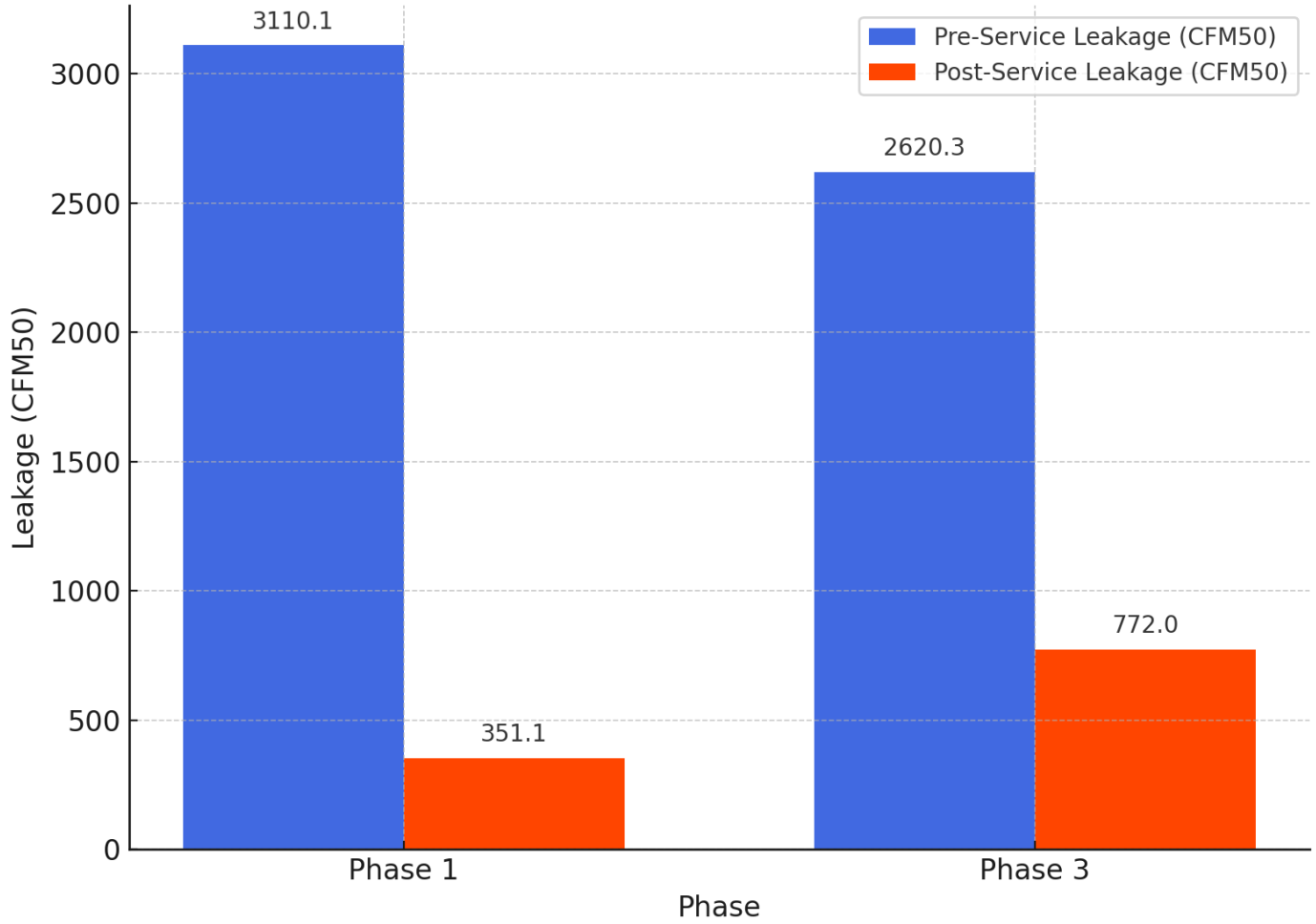
Sealing Results: Phases 1 & 3

Hetzel Hall Phases 1 & 3: Ext. Envelope Air Leakage Reduction Over Time



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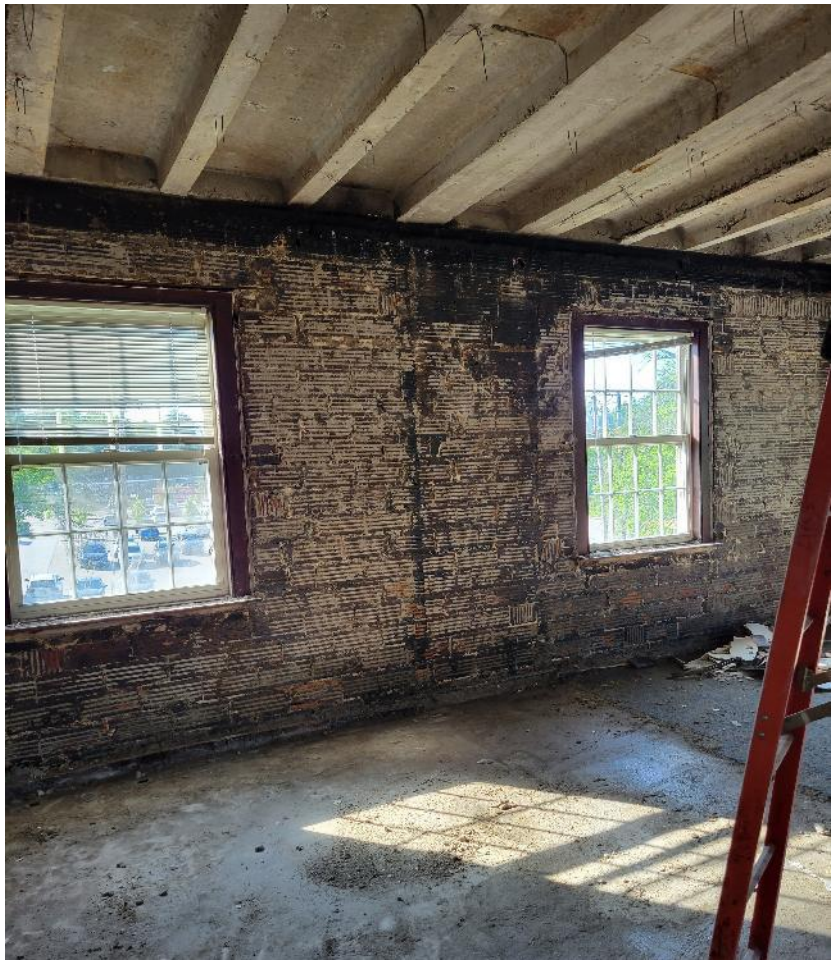
Exterior Wall: Work After Air Sealing



Ext. Wall After AeroBarrier

Mineral Wool Added

Wood Studs Installed

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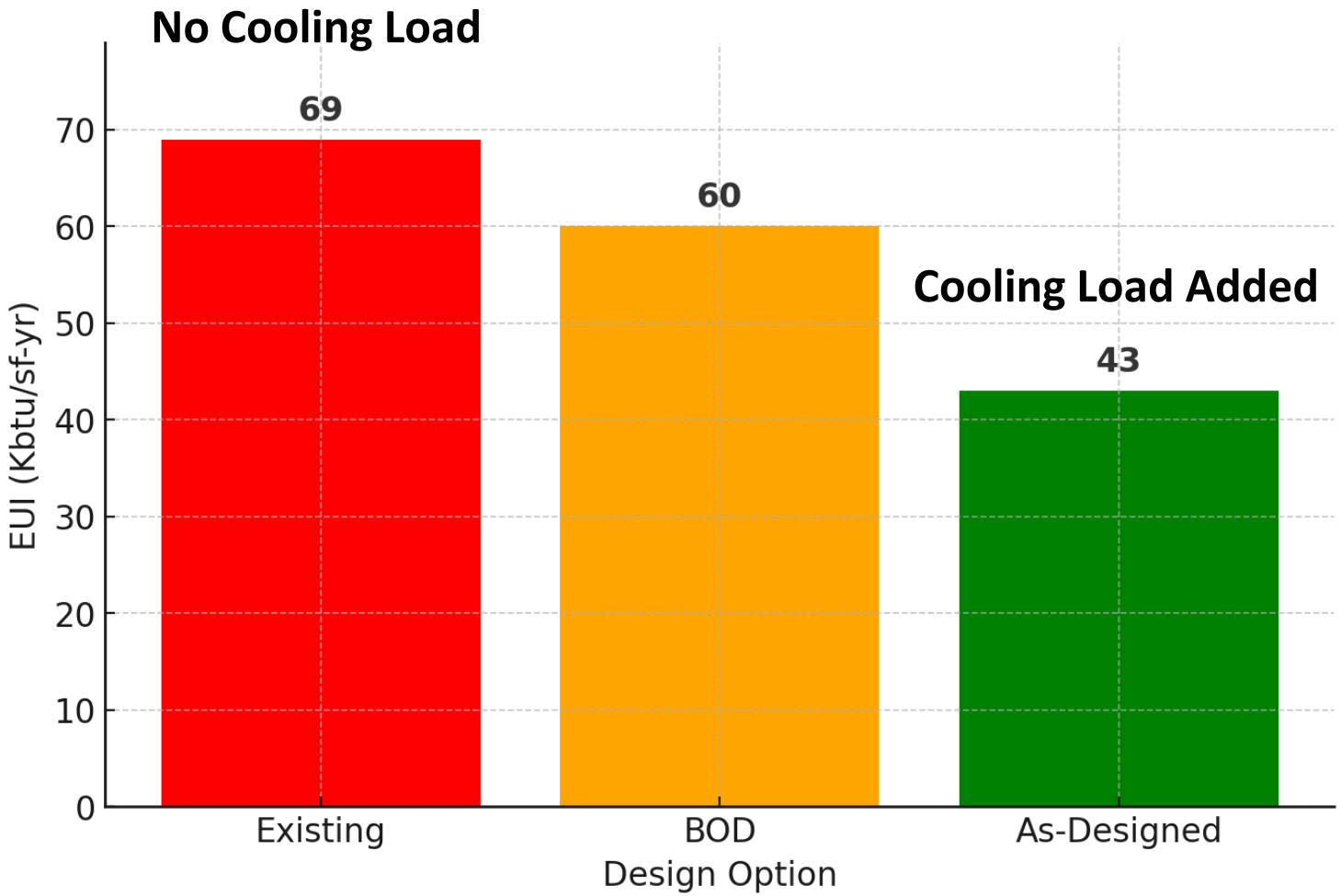
Building Energy Savings



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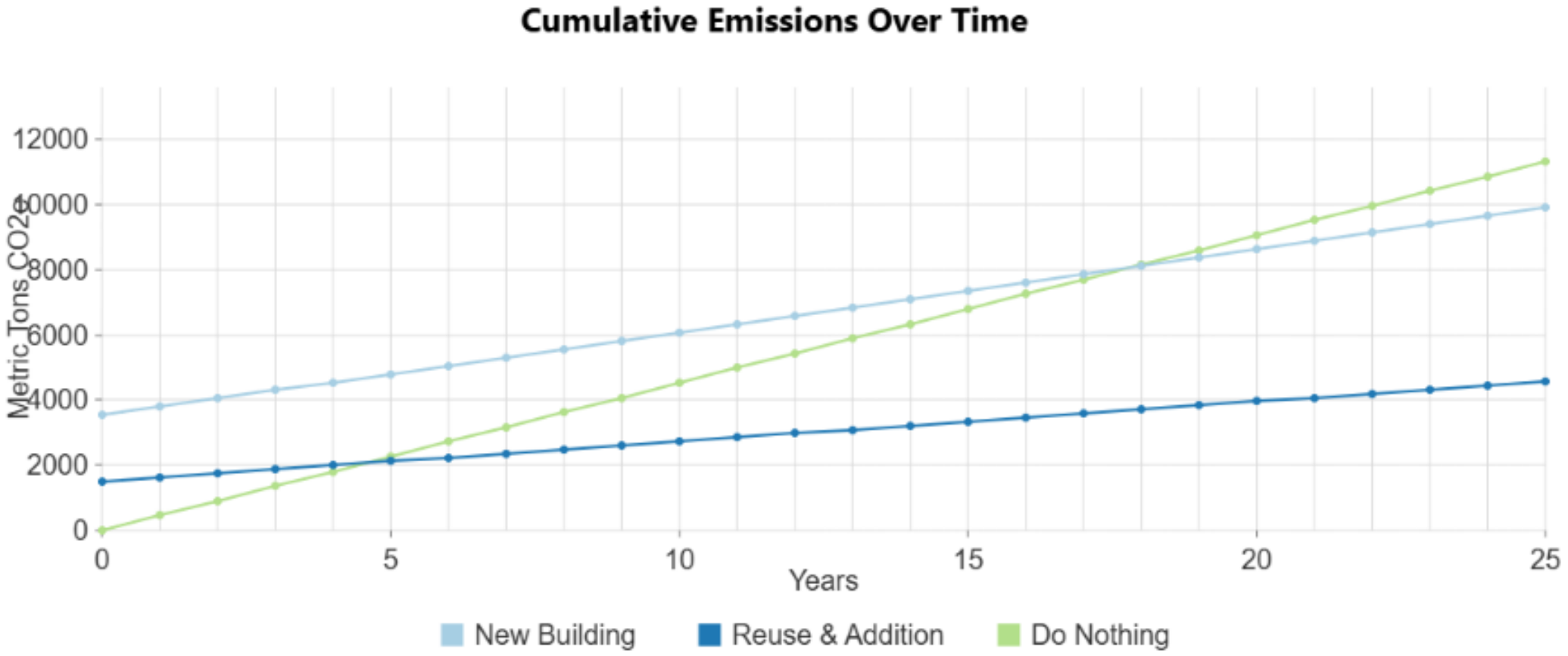
Carbon Footprint Comparison



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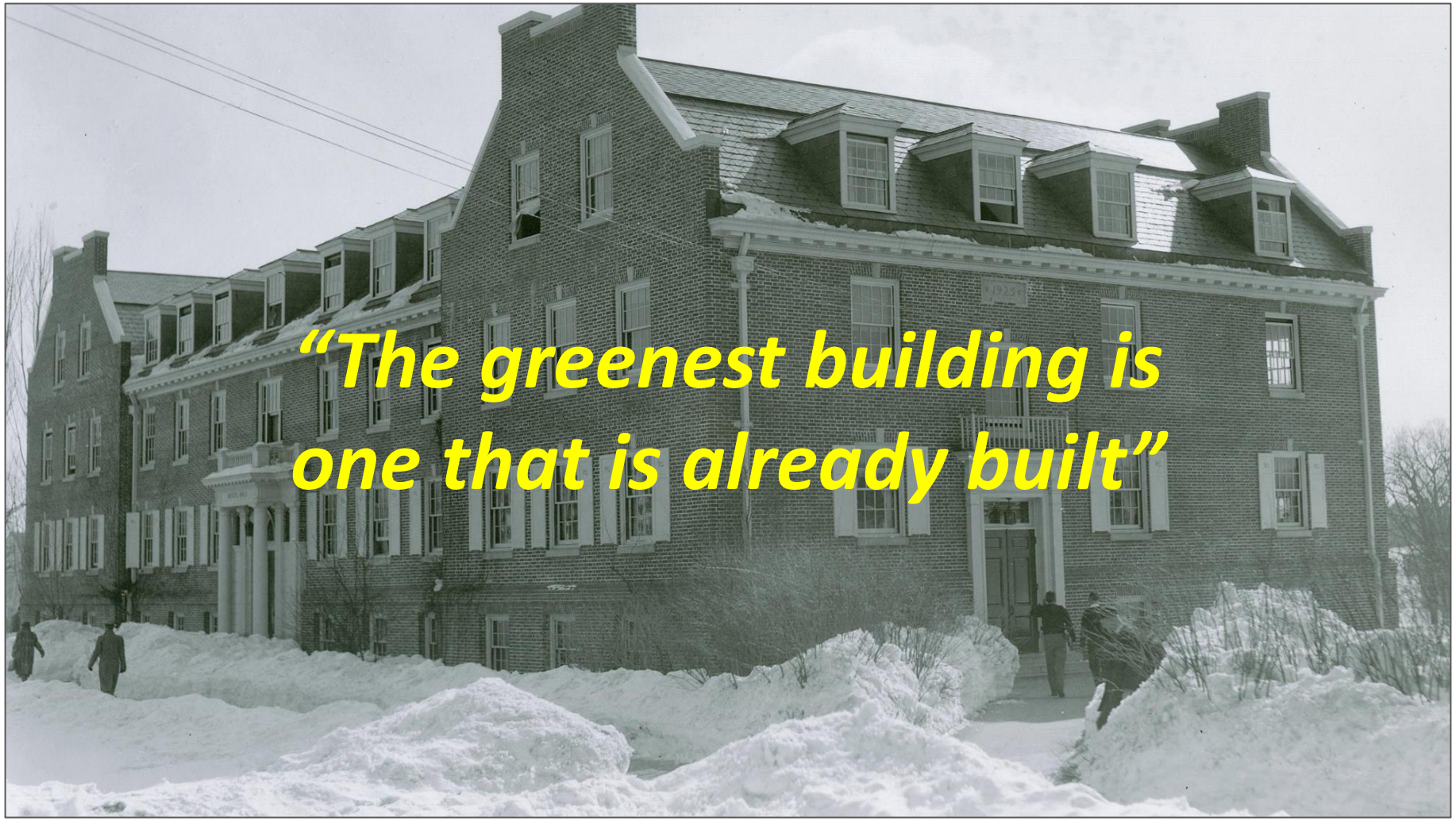
Hetzel Hall Deep Retrofit Worked!



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Lessons Learned

- Air sealing goals were accomplished with AeroBarrier
- Air sealing would have been much more challenging with other methods and materials due to project constraints including timeline
- Initial and final blower door test should be added to scope
- Communication and education with GC and relevant trades regarding air sealing is important
- Make sure to optimize sequencing and scheduling

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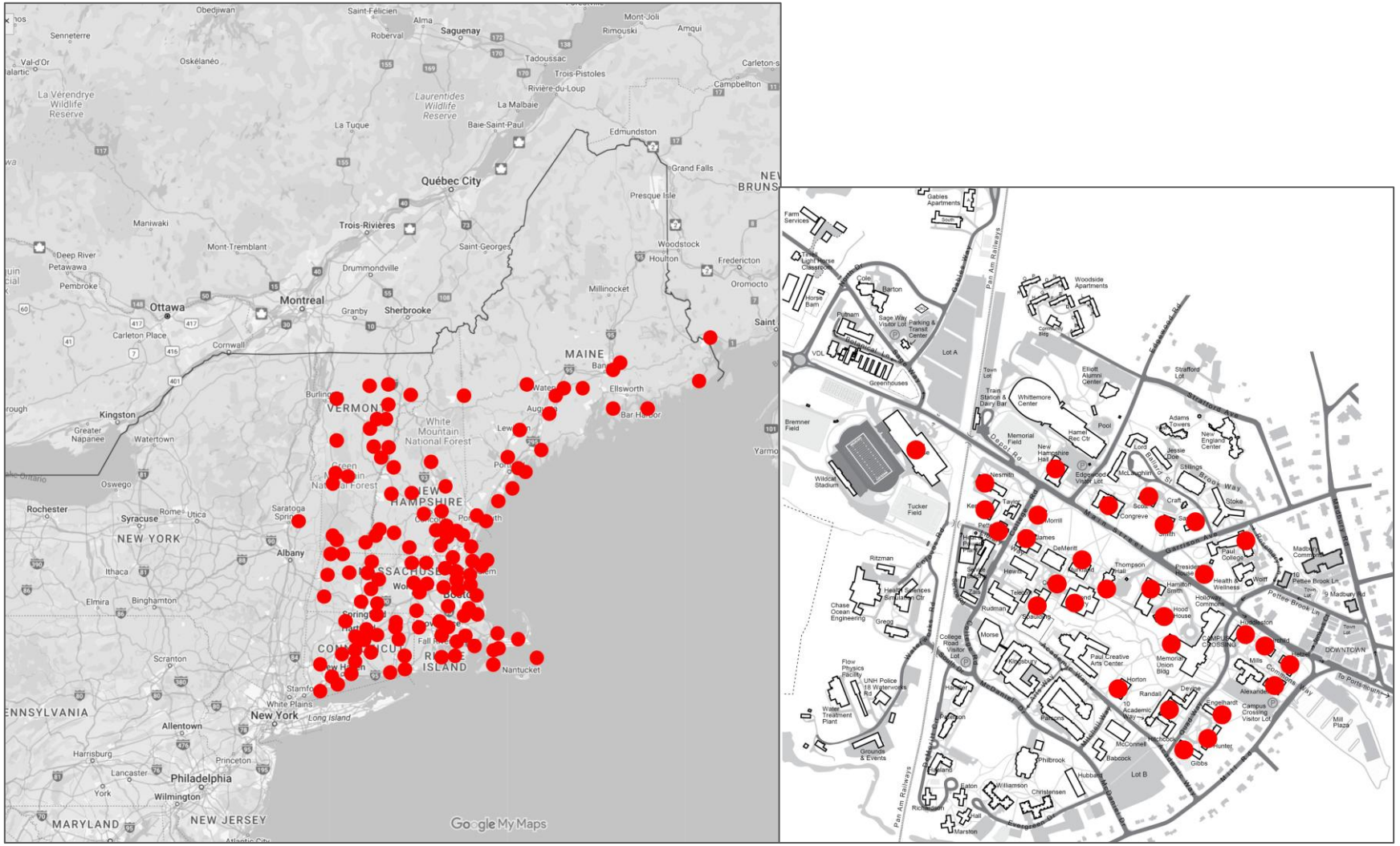
Opportunity Abounds



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Jaycee Place: Ventilation Overhaul Case Study

Jaycee Place: Project Overview

- 100,600 SF, 8 Story Apartment Building constructed in 1976
- 138 low income, affordable apartments
- Part of major modernization project
  - ✓ *Apartment & Common Area Renovations*
  - ✓ *New Space Heating Boilers & Controls*
  - ✓ *New DHW Boilers*
  - ✓ *Elevator Modernization*
  - ✓ *Site Improvements*
  - ✓ ***Central Ventilation System Upgrade & Fan Replacement***

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Jaycee Place: Project Overview

SUMMARY OF ENERGY CONSERVATION MEASURES

Energy Conservation Measure	Priority	Estimated Savings	Est. Cost[1]
Heating, Air Conditioning, Ventilation, & Hot Water			
Ventilation Upgrade Investigation	High	To Be Determined	$ 400,000
Building Heat Monitoring	High	12% Heating Fuel Use	$ 20,000
Temperature Limiting Thermostats	Medium	10% Heating Fuel Use	$ 50,000
Pipe Insulation	High	2% Domestic Heat Fuel Use	$ 1,500
Retro-Commission Domestic Water System	High	To Be Determined	$ 6,000
Duct Cleaning	High	N/A	$ 120,000
Venting Review by Engineer of Record	High	N/A	$ -
Boiler Service	High	N/A	$ 1,500
Measures Evaluated but Not Recommended			
Replace Heating Boilers			
Refrigerator Replacement			
Upgrade Lighting and Controls			
Solar Photovoltaic			
Solar Domestic Hot Water			
Combined Heat and Power (CHP or Cogen)			
Window Replacement			

1. This is a rough estimated cost and is intended for initial analysis purposes only. Contractor bids will be required to understand actual project costs.

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Jaycee Place Apartments, Lowell, MA
Scope of Work
April 5, 2022
Page 8 of 9

Energy Conservation Measure	Priority	Estimated Savings	Est. Cost[1]
Heating, Air Conditioning, Ventilation, & Hot Water			
Ventilation Upgrade Investigation	High	To Be Determined	$ 400,000
Building Heat Monitoring	High	12% Heating Fuel Use	$ 20,000
Temperature Limiting Thermostats	Medium	10% Heating Fuel Use	$ 50,000
Pipe Insulation	High	2% Domestic Heat Fuel Use	$ 1,500
Retro-Commission Domestic Water System	High	To Be Determined	$ 6,000

d provide new motors/control

ergy Star certified, minimum
air reset.
ncy Electronically Commutated

control the heat in the boilers

lling units. Thermostats in
n accessible location.

- Clean existing dryer exhaust ductwork.
- Provide new roof top bathroom exhaust fans. Clean video inspect/document and install mastic liner to fill gaps in exhaust ductwork and install new exhaust grille, fire damper, and constant airflow regulator (CAR) at each bathroom.
- Replace existing air conditioning system at elevator machine room.

Division 26 – Electrical

- All controls (load center panels, switches, thermostats, telephone jacks, etc.) throughout seven (7) handicap dwelling units shall be located no higher than 48-inches AFF. All non-counter type

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How We Make them Work

Optimize Vent Air Flows:

- Standardized, Consistent Flows
- Self-Balancing to All Vents and to All Floors
- Reduces Heating & Cooling Loads

Reduce Exhaust Riser Leakage via Automated Duct Sealing

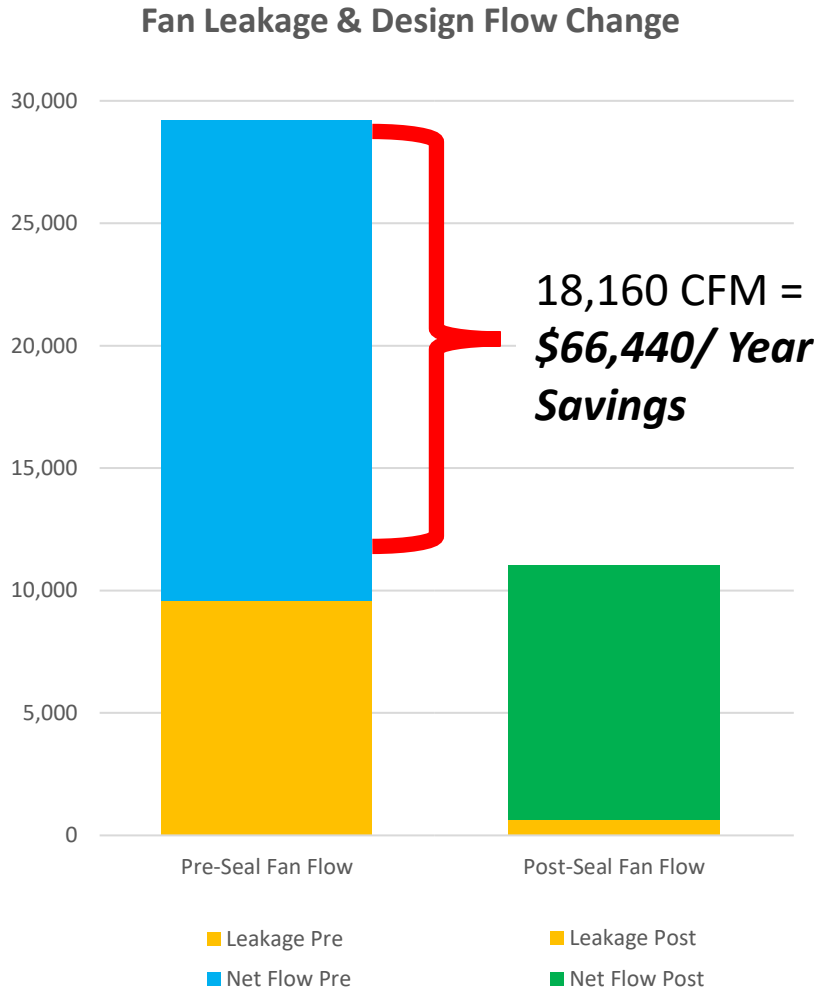
- Focuses 95% of Exhaust Flow to the Vents
- Allows Reduced Fan Flows Without Compromising Vent Performance

Optimize the Fans:

- Reduce Gross Flows 30% - 60%
- Reduce Fan Power 20% - 50%
- Reduce Kw Demand
- Improved Fan Life

Exhaust Leakage Reduction & Optimization

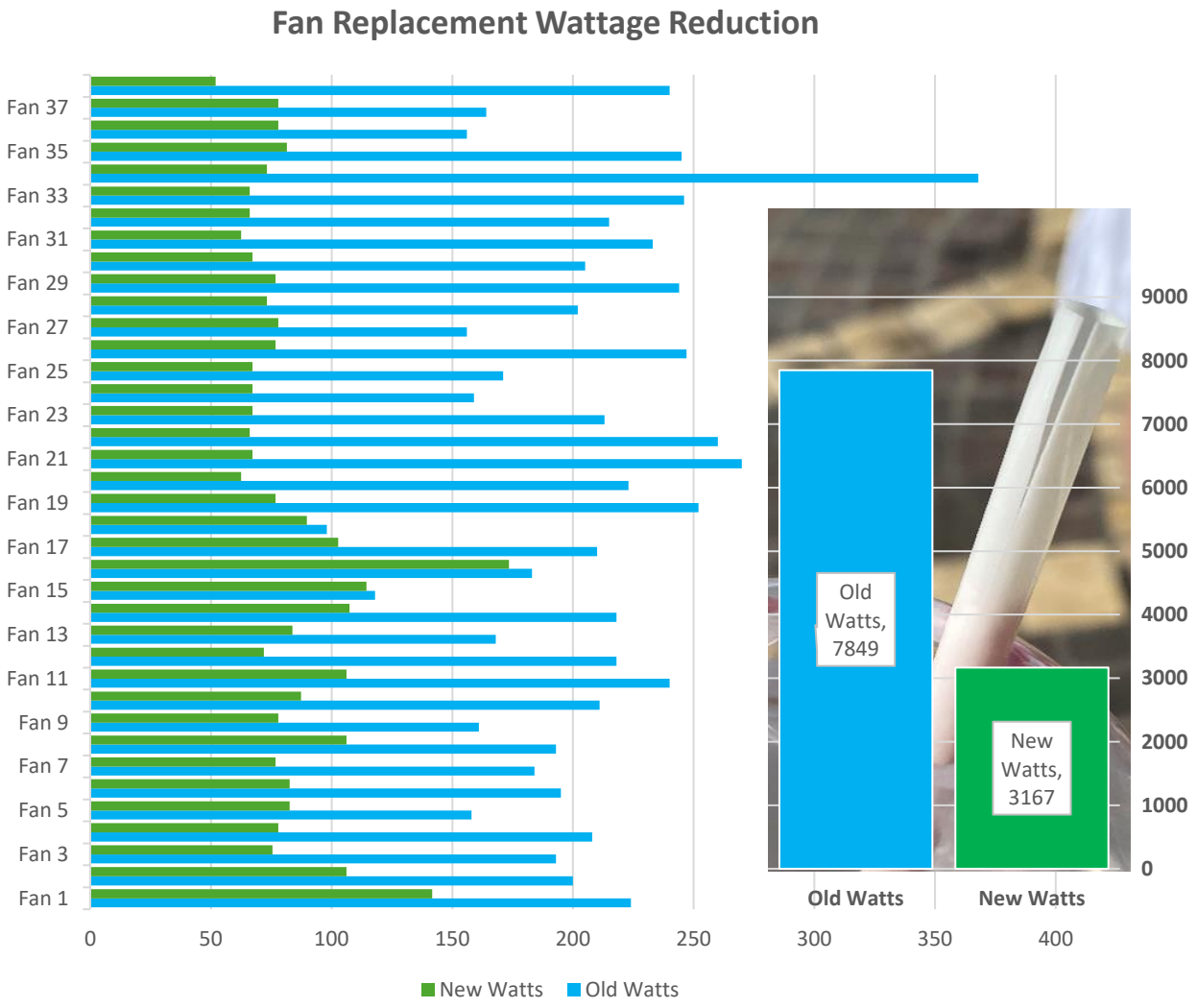
- Each CFM of Exhaust Costs:
  - $3.00 (2.1 Terms) of Natural Gas per Year
  - $0.16 (1 kWh) of Electricity per Year
- Eliminate 6,000 CFM of Duct Leakage with Aeroseal duct sealing
- Manually Seal the Rooftop Curbs
- Manually Seal Gaps at the Vents
- Install Self-Balancing Constant Flow Regulators with Revised Design Flows



Aeroseal Duct Sealing System

- Seals gaps up to 5/8”
- Goes everywhere the *Air Goes*
- Reliably eliminates 90%+ of all leakage
- 100% Performance Verification
- Sealant remains flexible; 40+ year life (3yr warranty)
- No lingering odors or off-gassing
- Over 300,000 homes and 10,000 commercial buildings

Replacing the Fans



- 38 New Fans Replace Aging, Poorly Performing Fans
- 60% Reduction in Fan Power
- 40,000 Annual kWh Savings
- $9,000 Annual Electric Savings
- 4 kW Shed from Demand Load
- Each Fan Individually Tuned to Match Performance Needed

Project Results (Inspect What You Expect)

	Pre-Production Model Estimates (from original energy model)			Post-Production Data Validation (Live Data This Workbook)			Variance (Results vs Estimate)		
	Existing	Proposed	Difference	Existing	Proposed	Difference	Variance	Units	Var %
Total Exhaust CFM *(Fan System Detail)*	28,185	10,691	17,494	29,222	11,062	18,160	666	***CFM***	3.81%
Electric Use (kWh)	*(from Fan System Detail)*			*(from Fan System Detail)*					
Fan Energy (kWh)	99,536	27,497	72,039	81,224	38,395	42,829	-29,210	***kWh***	-40.55%
Heating Energy Use (kWh)	0	0	0	0	0	0	0	***kWh***	0.00%
Cooling Energy Use (kWh)	27,273	10,345	16,927	28,276	10,704	17,572	645	***kWh***	3.81%
Total Electric Use (kWh) Fan & Cooling	126,809	37,842	**88,966**	109,500	49,099	**60,401**	**-28,565**	***kWh***	**-32.11%**
Heating Fuel Use (Therm)	*(from Fan System Detail)*			*(from Fan System Detail)*					
Heating Energy Use (Nat Gas)	60,169	22,651	**37,518**	62,383	23,236	**39,147**	**1,629**	***Therm***	**4.34%**
	Quantity	Unit/ Rate		Quantity	Unit/ Rate				
Annual Cost Savings *(Dollars)*									
Electricity (kWh)	88,966	$0.167	$14,831	60,401	$0.167	$10,069	($4,762)	***Dollars***	-32.11%
Nat Gas (Therm)	37,518	$1.440	$54,026	39,147	$1.440	$56,371	$2,345	***Dollars***	4.34%
	Total Annual Savings:		**$68,857**	**Total Annual Savings:**		**$66,440**	**($2,417)**	*Dollars*	**-3.51%**
Annual GHG Reductions *(tCO2e)*									
Electricity (kWh)	88,966	0.0007090	63.1	60,401	0.0007090	42.8	-20	***tCO2e***	-32.11%
Nat Gas (Therm)	37,518	0.0053000	198.8	39,147	0.0053000	207.5	9	***tCO2e***	4.34%
	Total GHG Reductions:		**261.9**	**Total GHG Reductions:**		**250.3**	**-12**	***tCO2e***	**-4.44%**

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Incentives Used

MA LEAN Program paid for the fans

- Complete Project: $360,000
- Fan Incentive: ($100,000)
- Net Project Cost: $260,000

- Savings per Year: $66,000
- Simple ROI: Less than 4 Years
- Measure Life: 20 Years

FEDERAL, STATE, AND UTILITY COMPANY INCENTIVE PROGRAMS

Program Name	Incentive Details	Incentive Amount
Mass Save – Energy Efficiency Programs	Rebates or incentives including: • Programmable Thermostats • Air Sealing & Weatherization • Pipe Insulation • Heating System Controls • Motor or Drive Controls • Faucet Aerators	Varies on scope. Some measures are direct installation by the program and are paid up to 70% by the Sponsors of Mass Save.
Mass Save – Technical Assistance and Engineering Services	Assistance in selection, engineering, and installation of: • Building Envelope / Weatherization Improvements • Energy Management Systems • HVAC Systems • Variable Frequency Drives Also provided are targeted Commissioning and Retro-Commissioning services.	Pre-qualified independent engineers and consultants help businesses become more energy efficient. Financial assistance of up to 50% of the cost provided by the Sponsors of Mass Save.

LEAN Low-Income Multi-Family Program	Possible measures:
	• Air sealing
	• Programmable Thermostats
	• DHW measures:
	  ○ Pipe Insulation
	  ○ Low-Flow Showerheads
	  ○ Faucet Aerators
	  ○ System Replacement
	• Refrigerators
	• Duct Sealing
		A program administrator will detail energy efficiency measures and will assess benefit cost ratios. Cost-effective measures are at no cost to the owner.

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Lessons Learned

- Securing Incentives Add Time & Complexity
  - Late adoption of incentives resulted in dropping AC sleeve air sealing measures, which would have been a good complimentary improvement.
  - Long timeline meant ventilation work scope wasn't integrated into the rest of the project.
- Commissioning Is King!
  - Project concluded in June, but we returned in October for final commissioning under "winter conditions"
  - "Real World" fan performance had us revise our energy model

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Q&A/Discussion

Q&A/Discussion

Thank you!

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