



BuildingEnergy NYC Wednesday Webinars

Optimizing Ventilation for Decarbonization

11.13.24

Agenda



- Review agenda & introductions
- Policy context and incentives
- Optimizing ventilation through duct sealing
- Case study
- Q & A

Today's Speakers



Maggie McCarey

- Vice President, Policy & Business Development
- 15 years of energy efficiency and building decarbonization policy
- Former MA DOER Energy Efficiency Director



Tom Holmes

- Northeast Commercial Business Manager
- 20+ Years Designing & Implementing Building Performance Projects
- Specialist in Existing Building Envelope & Ventilation



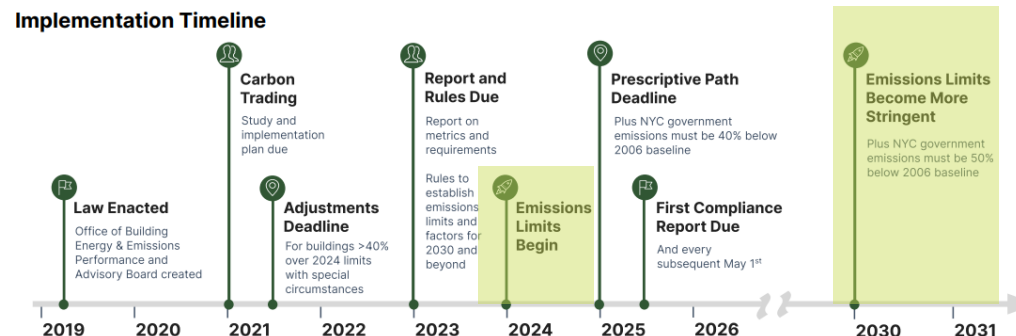
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| Policy Context

Local Law 97



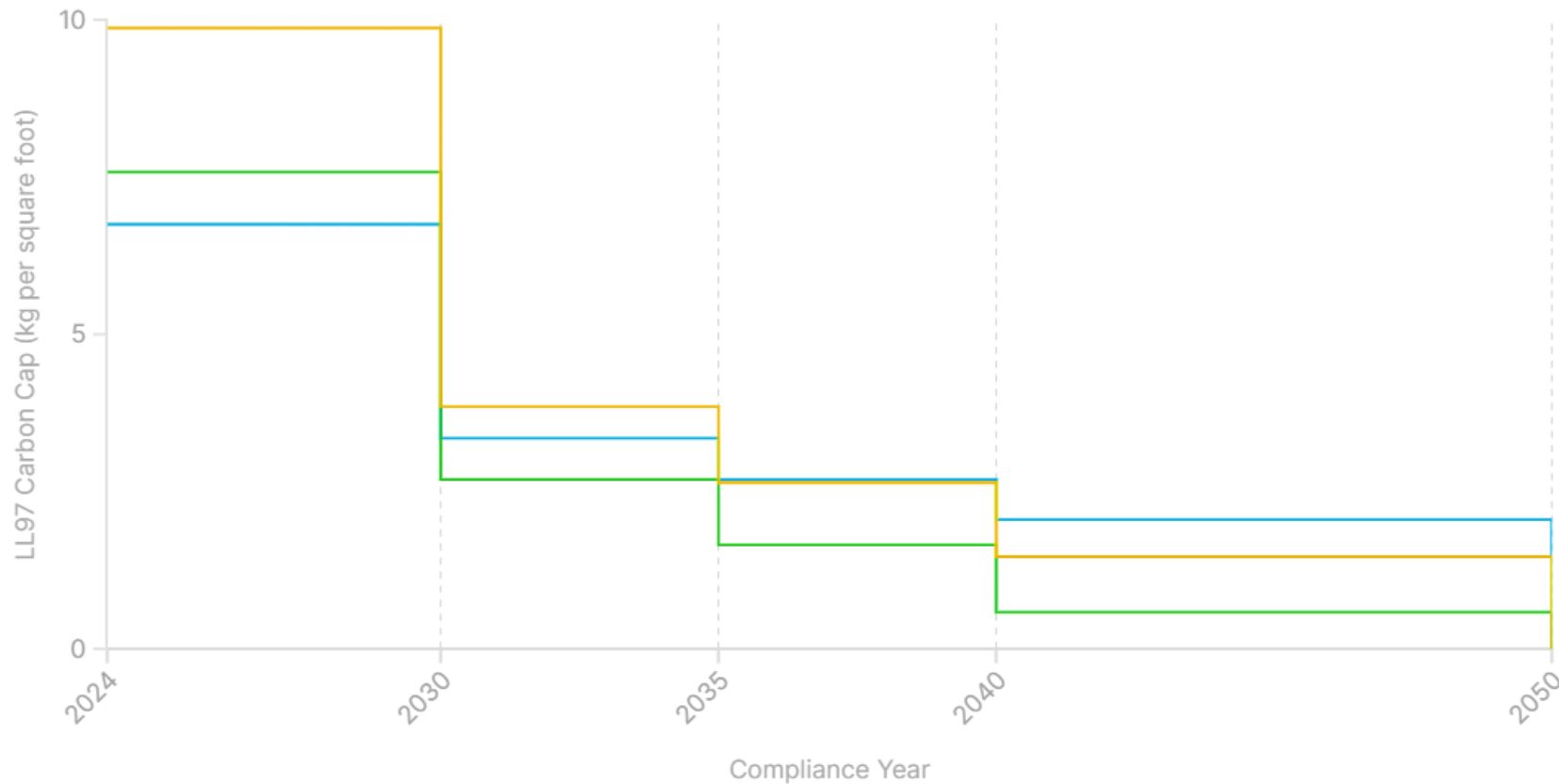
- Requires buildings over 25,000 square feet to meet new greenhouse gas limits that decline over time
- Starting in 2025, an emissions report must be submitted by May 1 every year for the previous year – 2024 is the first reporting year
- 2024-2029 limits impact the top 20% of emitters and 2030 impact the top 75%
- Penalties for being over the CO₂ emission limit start at \$268 per year per metric ton



CO₂ Limits Over Time



■ Multifamily Housing ■ Office ■ Hotel ■ Supermarket/Grocery Store ■ Data Center ■ Financial Office



Carbon caps become more stringent over a series of compliance periods: 2024-29, 2030-34, 2035-39, 2040-49, and 2050 onwards.

Incentives to Support Implementation and Compliance



The Consolidated Edison Multifamily Energy Efficiency Program Manual
September 23, 2024



Custom Measure: Ventilation Overhaul	<ul style="list-style-type: none"> • Co- or Pre-requisite measures: Rooftop exhaust fans to be replaced No existing Constant airflow regulators (CARs) installed within the registers • Existing motor efficiency for exhaust fans must be based off motor nameplate • For motors with no nameplate efficiency, 	<ul style="list-style-type: none"> • Facility operation hours, facility type, and description of existing load profile must be provided. • Proposed quantity to be replaced • Description of what each fan serves • Applicable fan timer schedules for baseline and proposed conditions. • CFM measures and aerosol reports for the 	<ul style="list-style-type: none"> • Proposed motor must be higher than applicable minimum motor efficiency as stated in the latest ECCCNY • Kitchens and bathrooms shall be continuously ventilated to a minimum of 25 CFM as stated in the latest version of the NYC Mechanical code <p>Note: Savings associated with shafts being cleaned and sealed should not be included</p>
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Fuel Type	Incentives*
Electricity Savings	\$0.35/kWh
Natural Gas Savings	\$3.00/therm
District Steam Savings	\$120/Mlbs
Oil savings	\$80/Mlbs

*Con Edison eligibility and project review and approval required for all projects; other requirements and max % incentives of total project cost apply
<https://www.coned.com/-/media/files/coned/documents/save-energy-money/rebates-incentives-tax-credits/rebates-incentives-for-multifamily-customers/multifamily-program-manual.pdf>
 Low – 0% interest financing may also be available: <https://www.coned.com/en/save-money/rebates-incentives-tax-credits/financing-as-low-as-zero-percent>

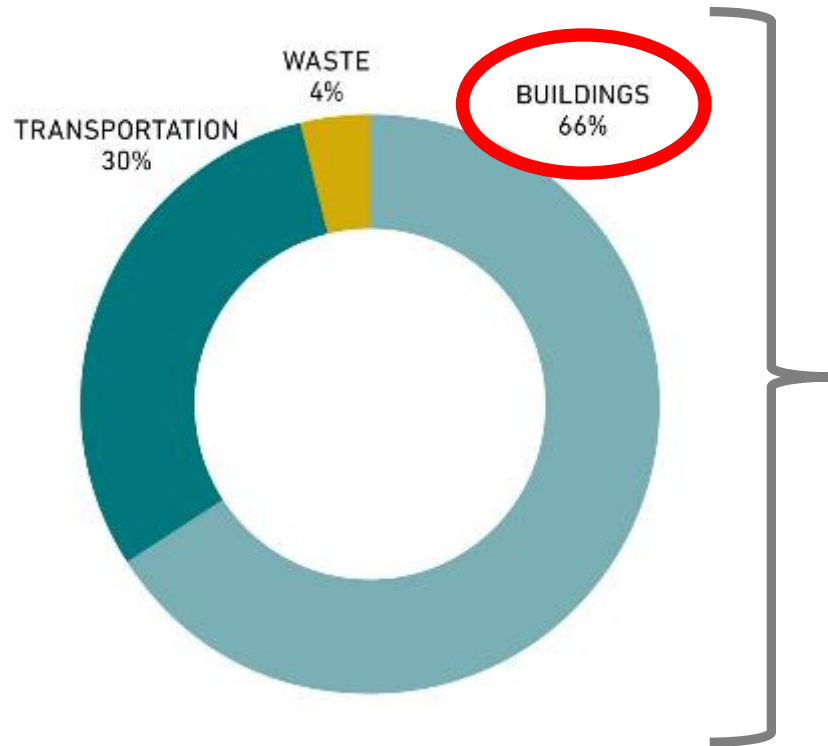


| Optimizing Ventilation

Energy Consumption in NYC

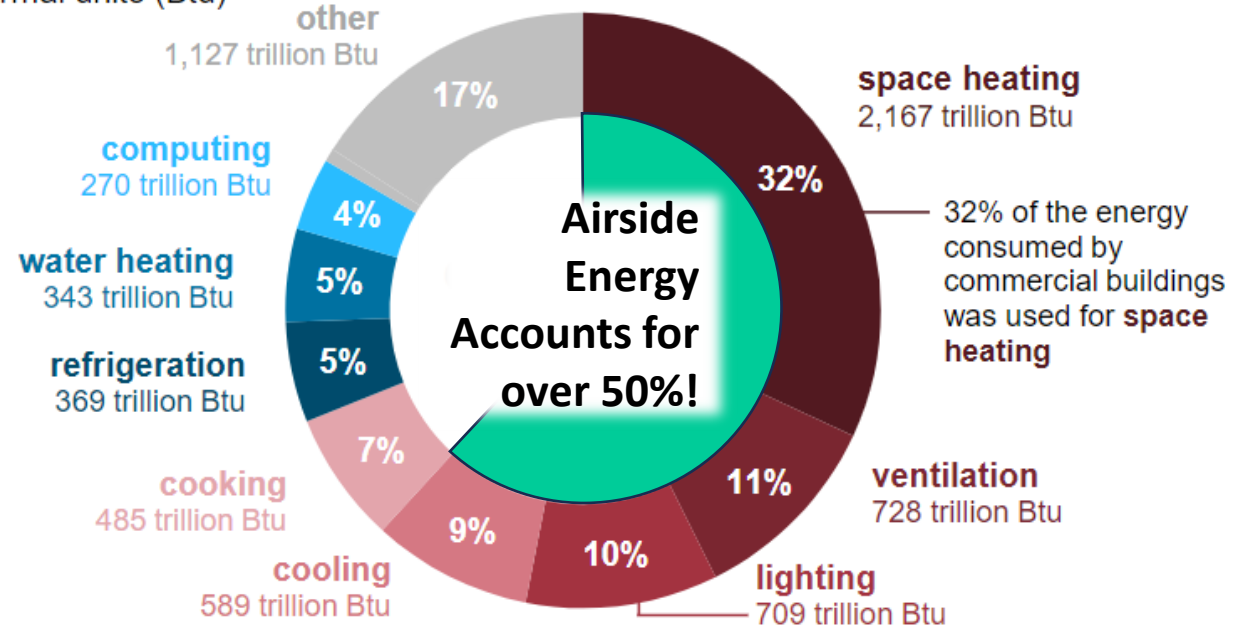


Buildings account for 2/3 greenhouse gas emissions



End uses of energy consumption by U.S. commercial buildings (2018)

British thermal units (Btu)



Airside Energy Accounts for over 50%!

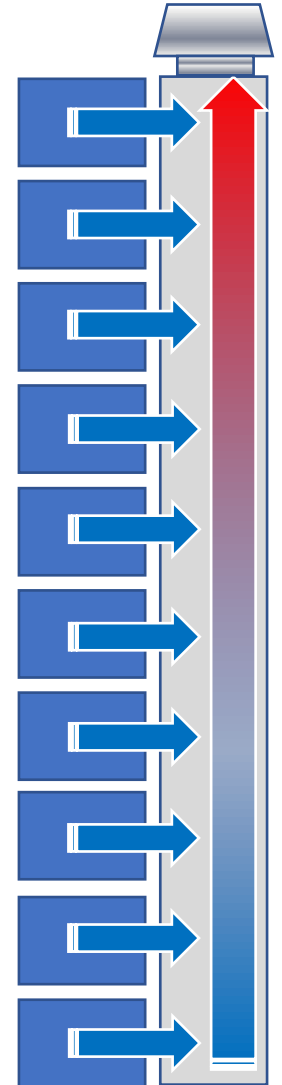
32% of the energy consumed by commercial buildings was used for **space heating**

Data source: U.S. Energy Information Administration, *Commercial Buildings Energy Consumption Survey*

How a Ventilation System Should Perform

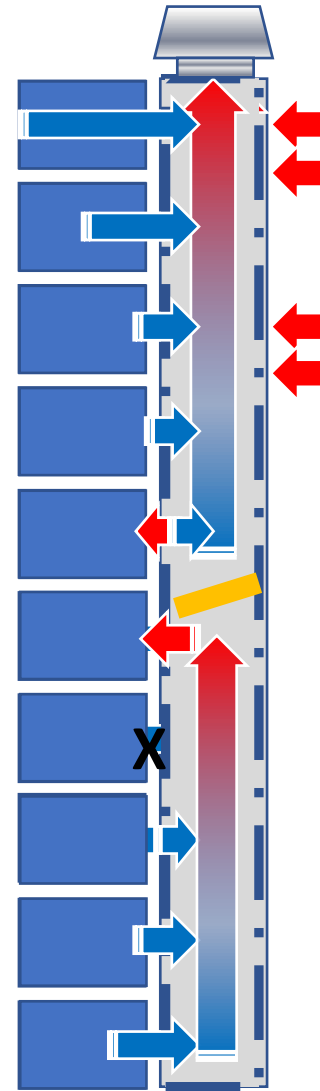


- Roof fan draws air from the riser
- Exhausting air flows up the risers to the fan
- Vents in the apartments pull air to the risers
- Fresh air replaces stale air



How Your Ventilation System *Does* Perform

- ✘ Fans over-exhaust because leaky ducts limit optimizing them
- ✘ The risers have gaps and holes that compete with the vents
- ✘ Air flows at the vents vary wildly, sometimes flowing *into* the apartments or changing direction with the wind
- ✘ Shaft blockages or accumulated leaks prevent lower floors from removing any air at all or send it into apartments above
- ✘ Occupants block up their vents or neglect them to the point where no flow can get through.
- ✘ Common area heating & cooling systems can't keep pace with over-ventilation



Achieve Energy & GHG Reductions



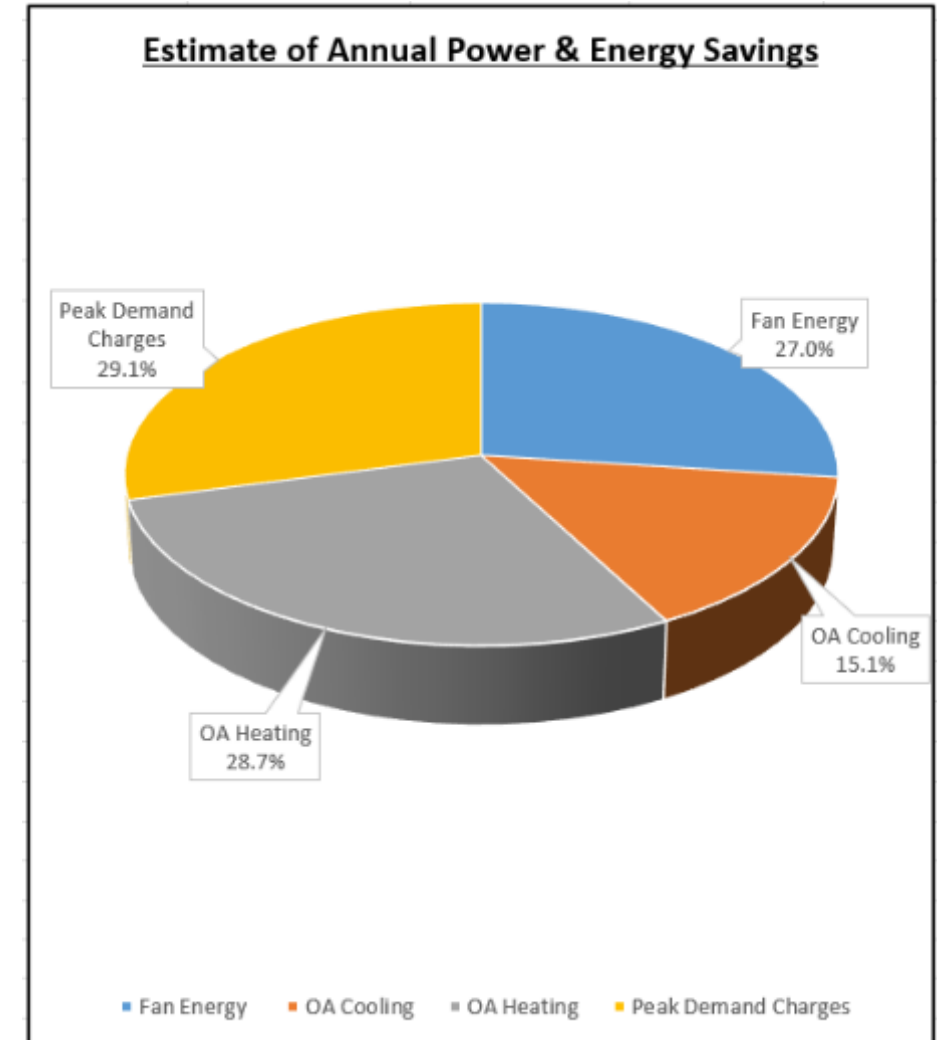
- Reduce building energy use by tens of thousands of \$\$ per year
- Significantly cut building GHG emissions
- Proven solution that qualifies for Con Ed, local & NYS energy & GHG reduction incentives
- Avoid today's LL97 fines & start preparing for 2030 reduction targets



Four-Way + Energy Savings



- Fan Energy – Reduce fan speeds without reducing delivered fan *performance*
- Peak Demand – Can equal *or exceed* run-time kWh reductions
- OA Heating – Less wasted supply air means less OA to heat up in the first place
- OA Cooling – Reduce the load on chillers
- These are *direct savings* from sealing – *interactive savings at chiller motors, improved building pressurization, etc. are a bonus!*



Cost of a CFM: Cut in half with Aeroseal



CFM Calculations		
JayCee Place		
Energy Calculations	Heating	Cooling
Heating/ Cooling System Type	Hydronic Gas	Electric Chiller
Fuel	Nat Gas	Electricity
Rate	\$1.65	\$0.22
Unit	Therm	kWh
Units/MMBTU	10	292.997363
Input Cost per MMBTU	\$16.50	\$64.46
Efficiency	82%	80%
Output Cost per MMBTU	\$20.12	\$80.57
Tons tCO ² e/ MMBTU	0.0648	0.1813
Reference Apartment Temp	70	77
NYC Annualized HDD/CDD 2021-2022	5608	232
MMBTU/ CFM/ Year	0.1454	0.0060
Cost per CFM per Year	\$2.92	\$0.48
Total MM BTU/ CFM/ Year	0.1514	
Total tCO ₂ e/ CFM/ Year	0.0105	
Total Cost/ CFM/ Year	\$3.41	

- “Old Code” apartments exhaust 150 CFM or more
 - 100 CFM from kitchens
 - 50 CFM from bathrooms)
- 150 CFM X 200 apartments = 30,000 CFM
 - \$102,000/ year
 - 4,500 MMBTU/ year
 - 315 tCO²e/ year

Optimizing the Air Side



Building Details (Adjust these values in the "References" Tab)				Existing	Proposed	Difference	
Building Total Square Footage	496,240						
Day Indoor Temp (Heating)	70	deg F	(H&C Settings)	13.00	13.00	0.00	
Night Indoor Temp	67	deg F	(H&C Settings)	22.75	17.38	5.38	
Day Indoor Temp (Cooling)	76	deg F	(H&C Settings)				
Night Indoor Temp	78	deg F	(H&C Settings)				
Operating Hours per Day	16	(RAM, TDPM)	(H&C Settings)				
				AHU System Fan HP			
				Exhaust System Fan HP			
				Total AHU Zone Flow	11,700	12,600	-900
				Total Exhaust CFM	83,400	41,190	42,210
				Electric Use (kWh)			

Annual GHG Used by Ventilation (kg)

Electricity (kWh)

District Steam (MMBTU) Heating

Total GHG Used by Ventilation

Existing Proposed Difference

Existing	Proposed	Difference
199,674	138,492	61,182
357,123	223,896	133,227
556,797	362,388	194,409

GHG Use: Kilograms per Building SqFt

2025 Percent of LL97 GHG Carbon Cap

1.1220 0.7303 0.3918

16.6% 10.8% 5.8%

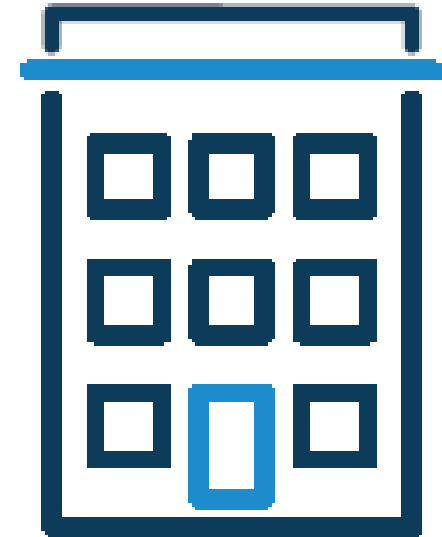
Estimated Con Edison Utility Incentive (Market Rate Multifamily)				Total Annual Savings: \$123,906			
Electric Incentive per kWh:	\$0.35			Annual GHG Used by Ventilation (kg)	Existing	Proposed	Difference
Incentive Value (Electric) - Fan Savings		\$9,914.21		Electricity (kWh)	199,674	138,492	61,182
Incentive Value (Electric) - Heating Savings		\$0.00		District Steam (MMBTU) Heating	357,123	223,896	133,227
Incentive Value (Electric) - Cooling Savings		\$23,452.00		Total GHG Used by Ventilation	556,797	362,388	194,409
Total Incentive Value (Electric)		\$33,366.21		GHG Use: Kilograms per Building SqFt	1.1220	0.7303	0.3918
Gas incentive per Therm:	\$3.00	Not Eligible	\$0.00	2025 Percent of LL97 GHG Carbon Cap	16.6%	10.8%	5.8%
District Steam Incentive per 1000LBS:	\$70.00	Eligible	\$208,528.60	Total Project Price:	\$921,520.00		
Incentive Cap: \$1,000,000 or	70%		\$645,064.00	Less Utility Incentives:		\$241,894.81	
Total Est. Utility Incentive (Electric & Gas):	26%	Incentive:	\$241,894.81	Net Project Price:			\$679,625.19
				Less First Year Energy Savings:		\$123,905.64	
				Net Cost after Incentives & 1st Year Savings:			\$555,719.56
				Simple Pay Back Period in Years (before incentives):			7.44
				Simple Pay Back Period in Years (with proposed incentives):			5.49

Note: Incentives are estimated and are subject to acceptance and approval by Consolidated Edison

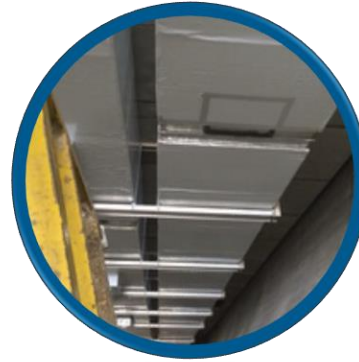
Improve Building Performance



- Reduce lobby & elevator depressurization problems
- Improve poor apartment ventilation
- Better control odor transfer
- Resolve IAQ complaints (and fines)
- Strong First Step integrates well with longer-term electrification objectives



How We Make Them Work



Optimize Apartment Air Flows:

- Standardized, Consistent Flows
- Reduced Heating & Cooling Loads
- Self-Balancing to All Vents and to All Floors
- Promotes Healthy IAQ

Reduce Exhaust Riser Leakage

- Focuses 97% of Exhaust Flow to the Vents
- Allows Reduced Fan Flows Without Compromising Vent Performance

Replace/ Revise the Fans:

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

Start with the Fans



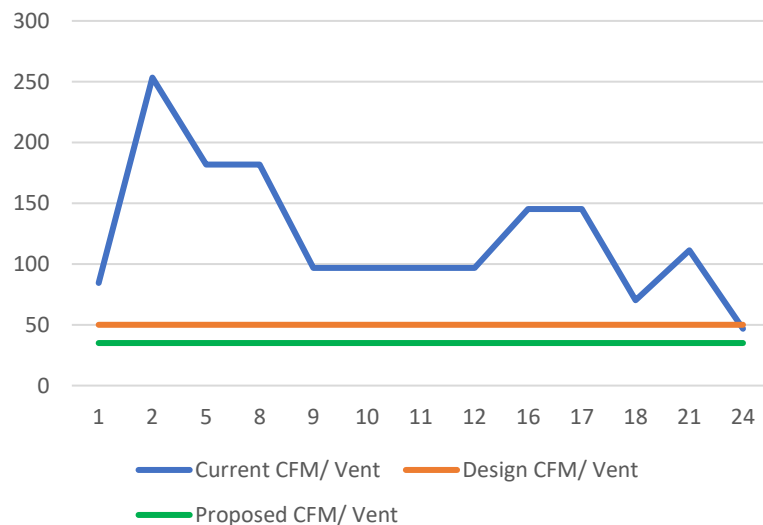
Fan Energy Savings: Speed Controls (2024)



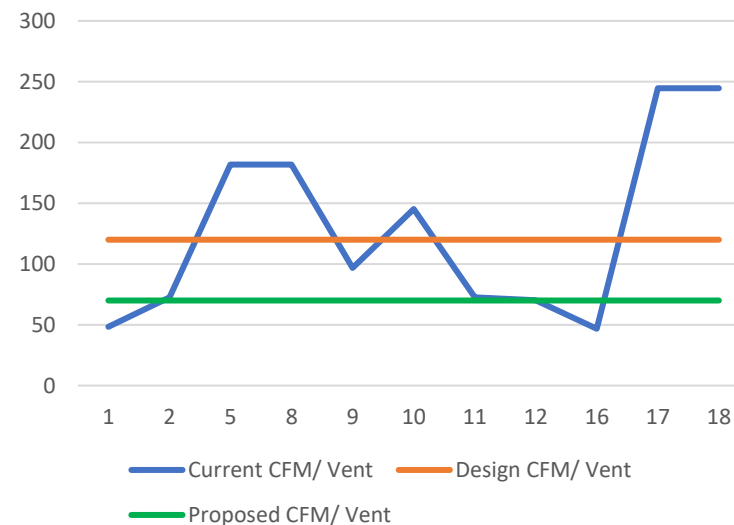
Changing the Fans, Alone, is Not Enough:

- 42 Fans Upgraded to VFDs
- Huge Variability from Vent to Vent, Apt to Apt
- Half the Fans Still Run at Full Speed (reduced savings)

Bathroom Vent Avg Flow (CFM)



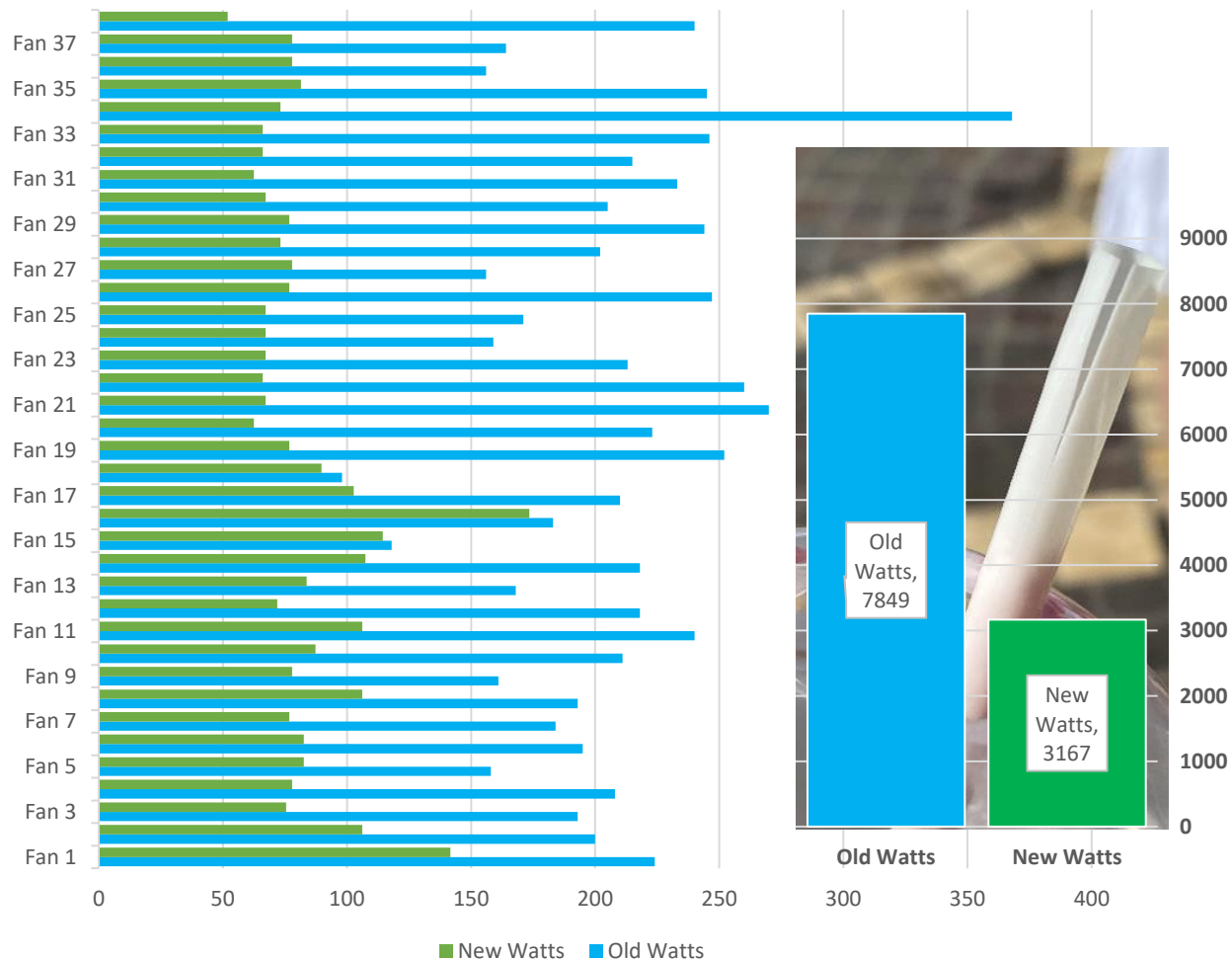
Kitchen Vent Avg Flow (CFM)



Fan Energy Savings



Fan Replacement Wattage Reduction



Optimizing 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

Optimize the Vents



Self-Balancing Flow Dampers (CARs)



- Use the pressure difference between duct and apartment
- Automatically maintain a constant, pre-set vent airflow in every vent, automatically adjusting to changing conditions

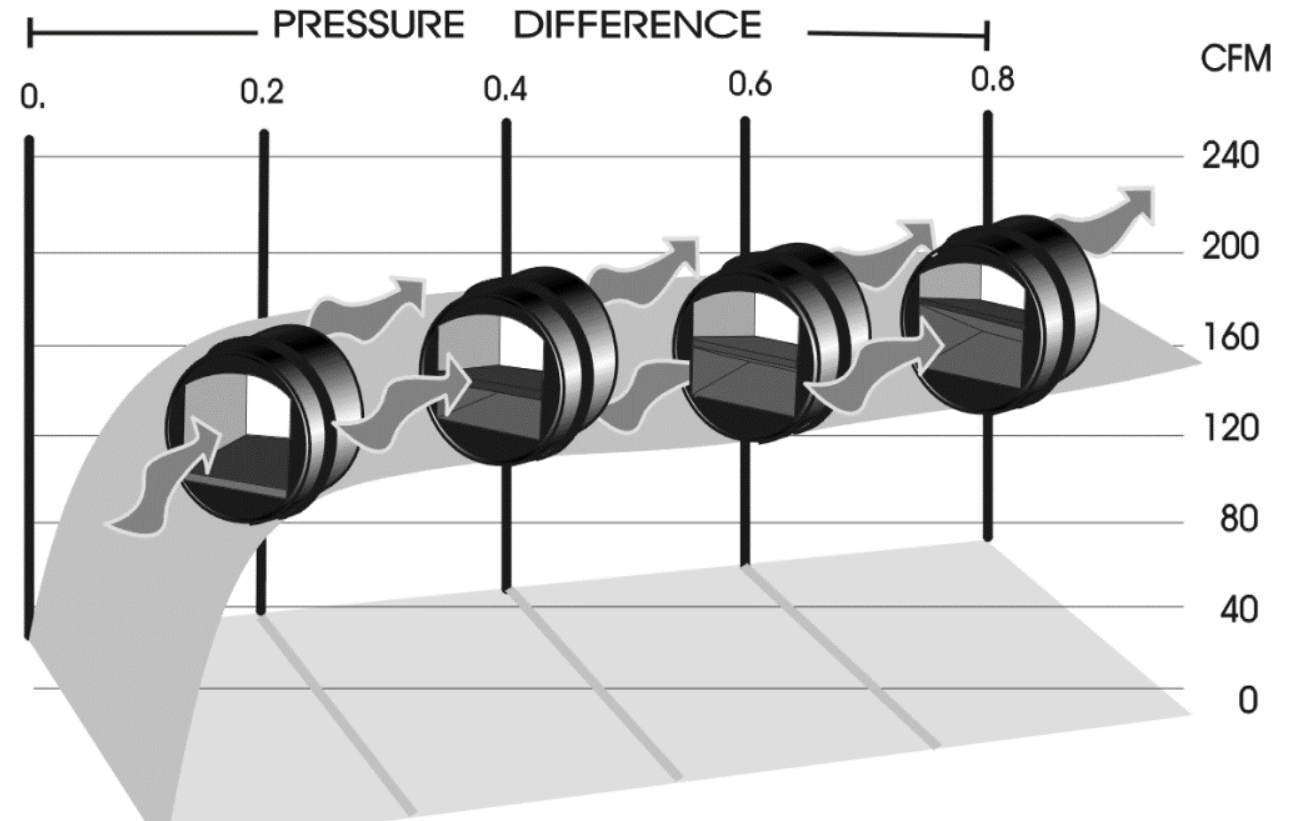


But...

- Smaller opening “competes” more with system leakage – ***requires tighter ducts (3% or less for reliable performance)***



Self-Balancing Flow Dampers



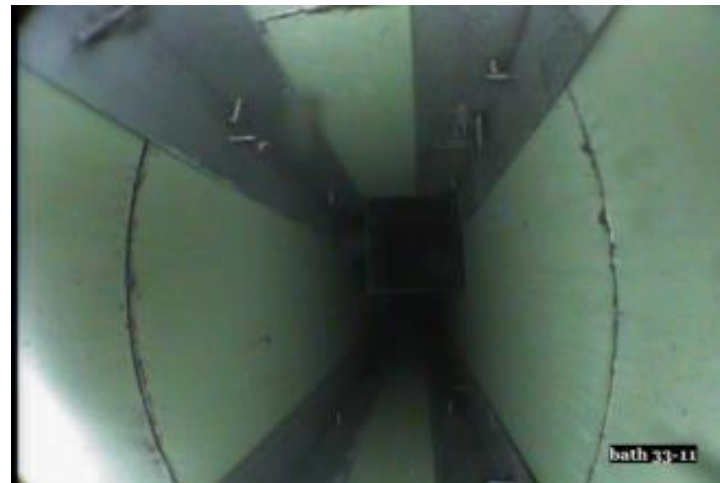
Seal the Risers



The Risers



- Risers generally come in three varieties
 - Masonry (tile) risers (1950s – to 1980s)
 - Drywall risers (1970s – Now)
 - Sheet metal risers (“Wedding Cake Bldgs”)
- Many systems are “hybrid”, using masonry or drywall for risers and sheet metal at offsets



Remote Mastic Application



- Seals Gaps of Up To 1"
- Good application for gross sealing of simple systems
- Can reliably reduce leakage to 15% - 20% of total design flow (not always tight enough for CAR dampers)
- You can only SEAL what you can SEE: snorkels, turns & other obstructions can't be reached remotely



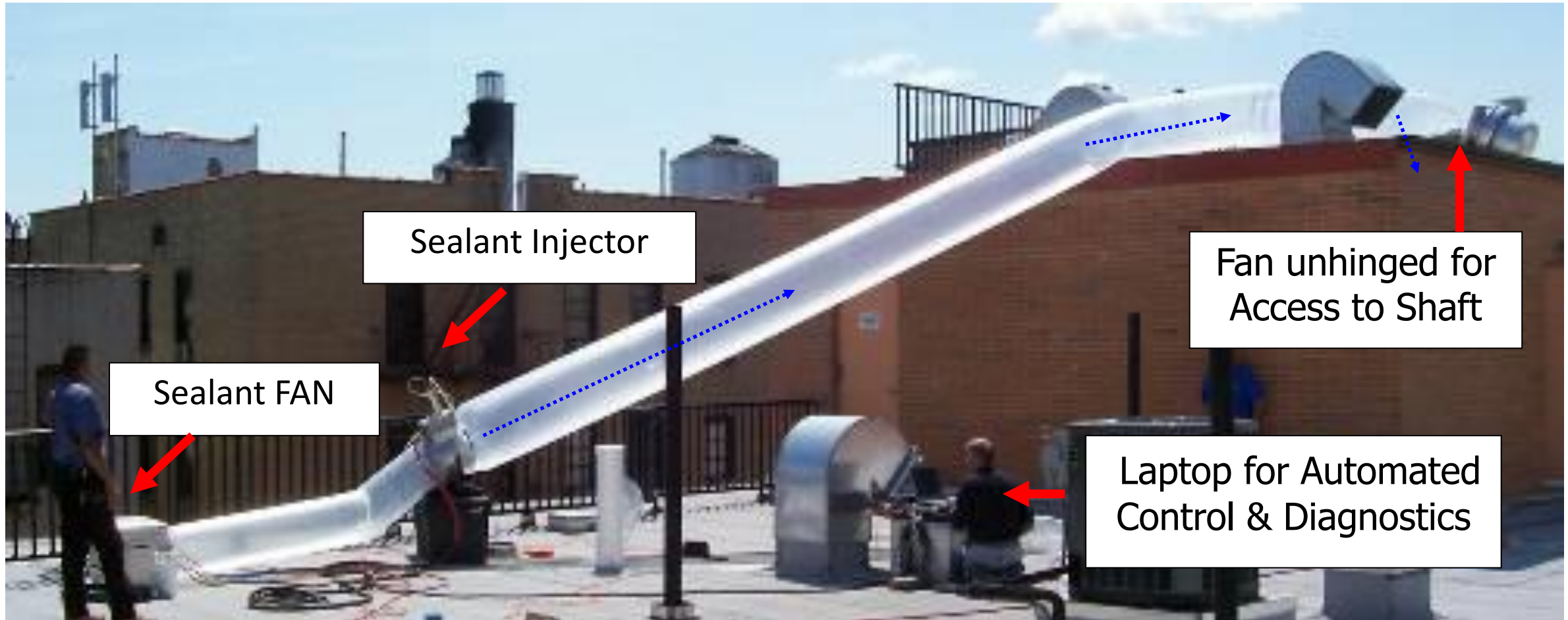
Proven & widely adopted Sealant



- Seals holes up to 5/8"
- Sealant remains rubbery
- Vinyl polymer is safe
- No lingering odors or off-gassing
- Lasts 20+ years (3yr warranty)
- Over 300,000 homes and 10,000 commercial buildings



Non-invasive Innovative Aeroseal Process



Sealant Injector

Fan unhooked for
Access to Shaft

Sealant FAN

Laptop for Automated
Control & Diagnostics

Verification, Instant Commissioning



COMMERCIAL LEAKAGE REPORT

Duct sealing performed at:
 Clemson
 5637 peachtree cir east
 Ridgefield, Ct 06877

Building Type: Library
 Seal Date: MM/DD/YYYY
 Barometric Pressure (Inches in HG): XXX

Aeroseal Gen 2.1 Case ID: XXXX
 Manometer Model: 900361
 Manometer Serial Number: 2121-SS-0025

Seal Specifics
 System Description: ERV-1
 Operating Pressure (WG): 0.40 inches
 Fan Capacity: 900 CFM
 Seal Description: 2nd Floor Exhaust
 Seal Type: Exhaust
 Seal CFM: 5,400 CFM

Duct Class (WG): 0.5 inches
 Test Pressure (WG): 2 inches
 Seal Class: C

	Rectangle	Round
Test Duct Surface Area (ft ²)	483	365
SMACNA Leakage Class	16	8
Leakage Allowed at 2" WG	25	12.5

Allowable Leakage
165 CFM

Leakage Before Test
253 CFM

Leakage After Test
11 CFM

Leakage Test
PASS

Leakage at .40" WG

Leakage at .60" WG

Duct sealing performed by:

Technician
 Dealer Name
 54 Danbury Road Suite 171
 Ridgefield, Ct 06877
 Phone: 203-921-8994

Dealer Logo

Note: Duct leakage results reported by Aeroseal conform to the calculations laid out in method D of ASTM E 1154: Standard Test Methods for determining air leakage of air distribution systems by fan pressurization.

Aeroseal | aeroseal.com | 877-FIX-DUCT | info@aeroseal.com

COMMERCIAL LEAKAGE REPORT

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Duct surface area calculator

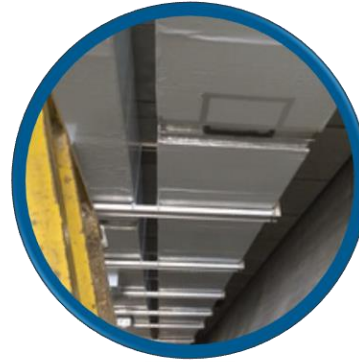
Rectangular					
Sect. No.	W (in.)	X (in.)	H (in.)	Len. (ft)	Surface Area (ft ²)
1	16	8	2.6	2.6	83.2
2	6	6	5.9	5.9	94.4
3	10	8	0.8	0.8	19.2
4	8	8	2.3	2.3	49.1
5	8	6	8.6	8.6	161
6	10	8	3.2	3.2	76.8
Total					483

Round			
Sect. No.	Diam. (in.)	Len. (ft)	Surface Area (ft ²)
1	4	18.8	157
2	5	11.4	119
3	6	7	88
4			
5			
6			
Total			365

Note: Duct leakage results reported by Aeroseal conform to the calculations laid out in method D of ASTM E 1154: Standard Test Methods for determining air leakage of air distribution systems by fan pressurization.

Aeroseal | aeroseal.com | 877-FIX-DUCT | info@aeroseal.com

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Commission the Integrated Solution



Commission the Fans:

- Tune Each Fan for Target Airflows
- Measure Fan Power *and* Static Pressure



Verify Every Riser

- Seal the Risers
- Seal the Fan Curbs
- 3% Solution



Commission the Vents:

- Measure Top, Middle & Bottom Floors



| Case Study: Jaycee Place

Multifamily Ventilation Overhaul Case Study:

- 138 Income Qualified Apartments
- Project Cost: \$370,000
- Annual Energy Reductions:
 - Electric: 83,000 kWh
 - Natural Gas: 24,500 therms
- Utility Incentive \$102,000 - 27%
- Annual Cost Savings: \$58,600
- Simple ROI: 4.6 years VS 20-year measure
- Full M&V with Results within 2% of predicted targets!



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| Q&A/Next Steps

Q & A/Discussion



Thank You!

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