Sustainable Rehab: *Simple to Complex Fixes of Existing Buildings*

GreenHomeNYC October Forum

October 21, 2015

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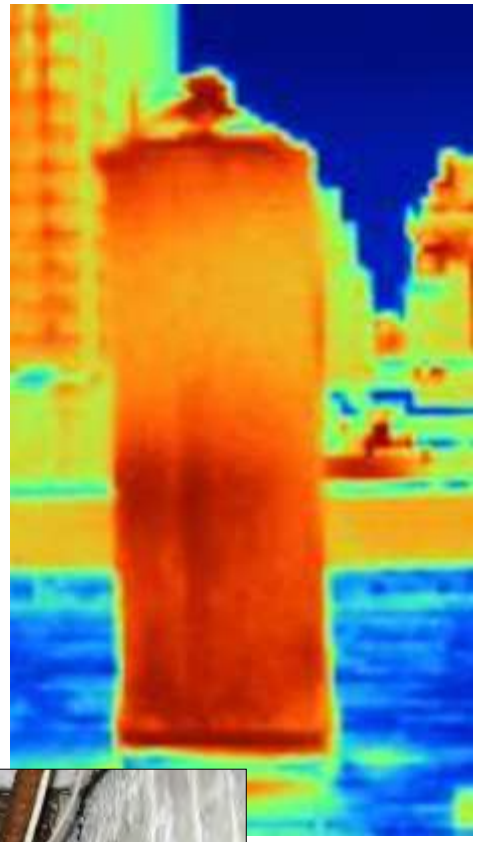
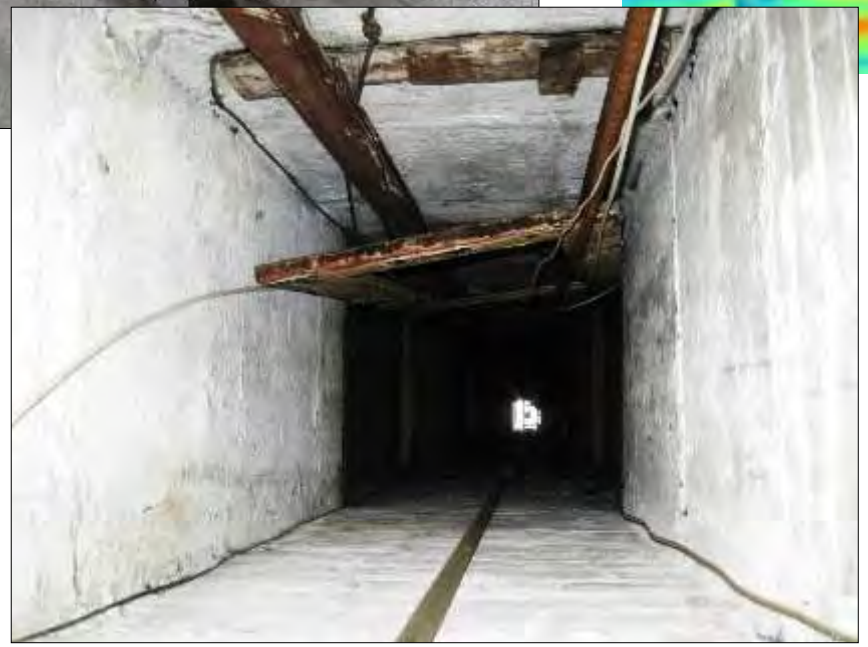
12 Buildings in 30 minutes:

Learning to Look

Multifamily Audits & Rehabs:
Small, medium, large;
oil, gas, electric;
master and individually metered;
NYC to Buffalo;
4800 to 7000 HDD!






Sycamore
431
Gardens


CAUTION
Energy Efficient
VANGUARD
ENERGYGUARD

Auburn Housing Authority
188 Units, 24 Buildings
All 1951furnaces, hot water makers replaced
Lighting and refrigerators replaced

50% gas savings.

Vacancy rate from 20% to 1%.

- 1873 Historic building
- Converted to senior housing
- Attic air sealing and insulation
- Heating and DHW replacement
- 20% savings
- No preservation alarms!

Rehab/Refi Huge Success

Old vs. New System

35 apts, 36,000 ft2

- Mod rehab + full weatherization package ($4000/apt)
- Boiler, airsealing, windows, insulation, better controls
- Oil usage declined (weather adjusted) 63.7%.
- Annual oil usage from $119,636 to $43,448
- Savings of $76,188 **($2177/apartment)** per year.

But, I don’t want to talk about those…

Date	Usage (Therms)	Usage (Cost)
12/30/2010	243	$314.23
11/29/2010	121	$176.64
10/27/2010	37	$66.23
9/28/2010	18	$38.51
8/30/2010	22	$48.13
7/29/2010	20	$45.52
6/29/2010	19	$40.55
6/2/2010	30	$63.40
4/29/2010	40	$85.67
3/31/2010	93	$163.70
3/2/2010	208	$306.36
2/1/2010	247	$374.48
12/31/2009	206	$311.26
12/1/2009	72	$132.56
10/30/2009	51	$77.76
10/2/2009	22	$41.34
9/2/2009	18	$36.29
8/4/2009	25	$48.40
7/2/2009	27	$46.59
6/2/2009	30	$51.51
5/1/2009	73	$122.26
4/1/2009	119	$200.94
3/3/2009	176	$290.95
2/2/2009	253	$416.49
1/2/2009	199	$342.93
12/2/2008	127	$215.90

1098 therms in most recent 12 months

79 therms used from 6/2 to 9/28 = 118 days = .67 therms/day in summer (non heating)

The above number is 2/3 the national average

.67 x 365 = annual non-heating usage = 244.4= 22.3% of total

1098 - 244.4 = heating usage = 853.6 therms

Building square footage = 2868 ft2

Winter Heating Degree days = 4872

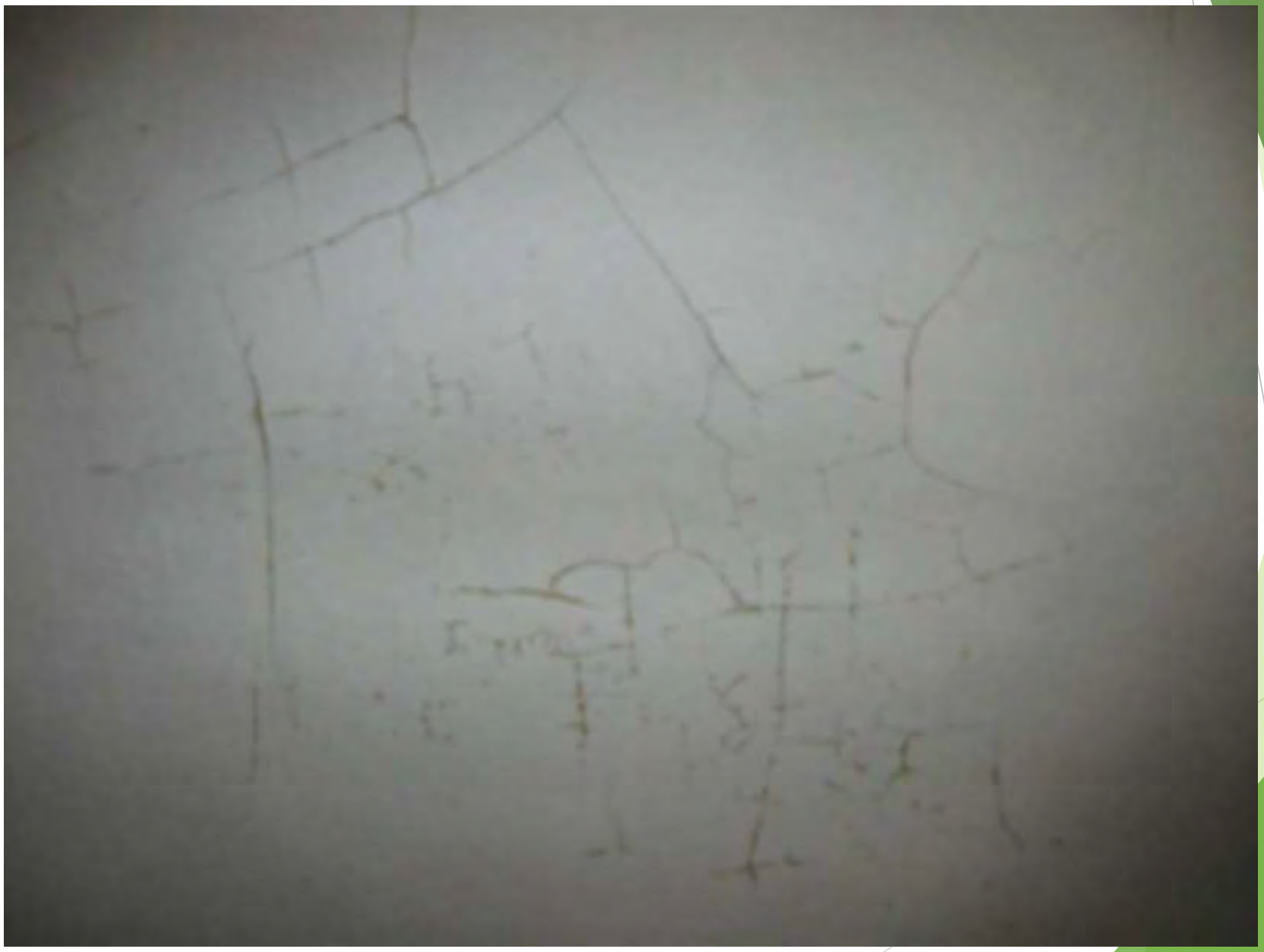
853.6 ÷ 2868 ÷ 4872 x 100,000 (Btu in one therm of gas) =

6.1 Btu/ft2/HDD about 20% higher than national average

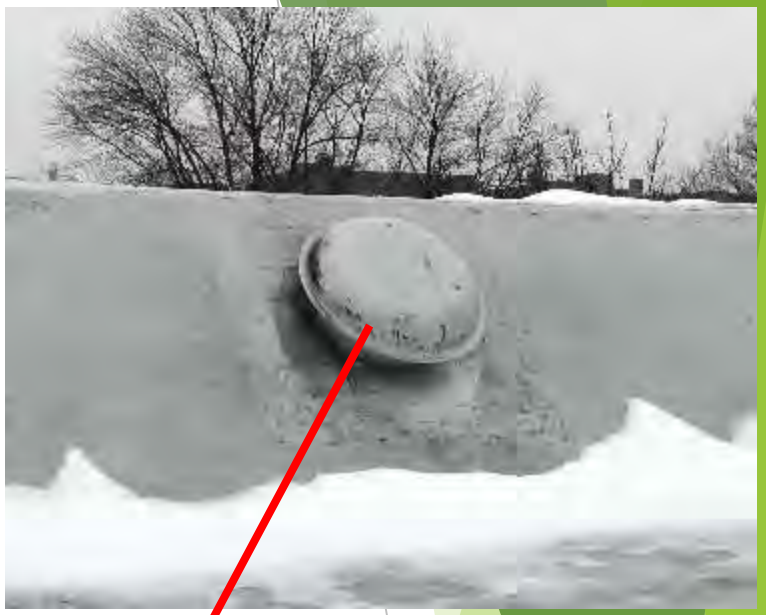
22.3%
Of gas
Usage
For
Hot
water

Guess the efficiency of this unit!

This is why I got the call…



"Don't go on the roof, it will be covered with snow and ice!"



Previous owner installed roofing humidification & heating system

This all electric building in Auburn NY added an insulated exterior skin and windows prior to our audit; we still found cost effective work by balancing the ventilation system, adding a HRV, and doing apartment electric measures.


ON
OFF

Auburn Heights, Auburn, NY


AUBURN HEIGHTS
APARTMENTS
MGR.
252-7171
TDD-711

What an Audit Should Look Like (What my audits look like)

CPC
One-Stop Financing Solutions for Multifamily Housing Developers
The Community Preservation Corporation

28 East 28th Street, 9th Floor
New York, New York 10016-7943
Tel: (212) 869-5500
Fax: (212) 683-0694
www.communityp.com

Auburn Heights Apartments Energy Analysis

100, 200, 300, 400, 500, 600 & 700 Austin Drive, Auburn, NY

Site Visits:
August 26, 2010
January 26, 2011
Audit Performed by:
F.L. Andrew Padian
Substantial assistance on this audit was provided by:
Michelle Toncic

Executive Summary

Auburn Heights Apartments is a seven building electrically heated complex in Auburn NY owned and managed by Two Plus Four Construction. The manager of the building and her husband live at the complex ; he is the chief maintenance person for the building, and both are a wealth of knowledge about the complex. Designed in the 1970's and built in the 1980's, these complexes were many during that time that were convinced to build with first cost cheap electric heat, because we were all told that electricity would soon be "too cheap to meter". That cost is now almost 17¢/kilowatt hour (kwh), equivalent to gas that would be almost $5/therm. Gas in Auburn currently runs $2.50 a therm, so these residents are paying twice for heat what comparable gas apartments would pay. This high cost conditions residents to keep thermostats at minimum levels and close off rooms when they are not in use; low income buildings such as this with electric heat typically see energy models where the thermostat settings are very low.

There are two types of residential buildings here, the most common is an eight-unit complex, there are five of these comprising 40 units; additionally there are two duplex-style apartments, one is 4 units and one is six units. The latter type is slightly different in that they have gas hot water only.

Both buildings need apartment lighting retrofits, refrigerators, outdoor front door lights converted to CFL, airsealed and insulated roofs, and windows (although the cost of parts of the latter two must be subsidized by the owner in the duplex units because of low SIR).

Both types of buildings have lousy original doors in the front and the back, with the duplex units having really leaky sliding glass doors. It is cost effective to weatherstrip the doors, but if the owner wishes to contribute, the cost effective sealing budget could be incorporated into replacement of all of the doors.

The duplexes have a crawlspace under the storage space in the rear of each building, and it appears that none of those spaces have ever been covered with plastic over the original soil. As such, each space needs to be covered with plastic and the plastic needs to be weighted down. If these spaces are vented, the venting can then be closed.

SCOPE OF WORK AUBURN HEIGHTS, AUBURN, NY

Scope of Work for Electric Buildings at 100, 200, 300, 400, & 700 Austin Drive

Description	Location	Initial Cost ($)	First YearSavings ($)	S.I.R
Tighten all apartments to reduce leakage by 10% minimum *	Apartments	$37,500	*$3150.00	1.26
Upgrade external public lighting	Lighting	4,095.00	985.21	2.90
Weatherstrip Doors	Entrance (Doors)	2,000.00	371.05	2.00
REPLACE w/LowE argon-filled Thermal Pane	Large sliders (Windows)	20,000.00	2,013.75	1.80
Install 12" loose CELLULOSE	Primary (Roof)	20,362.50	2,304.78	1.70
Replace apartment lighting	Lighting	15,750.00	1,878.94	1.40
REPLACE w/LowE argon-filled Thermal Pane	Medium sliders (Windows)	20,000.00	1,283.99	1.10
Weatherstrip Doors	Rear (Doors)	2,000.00	191.00	1.00
REPLACE w/LowE argon-filled Thermal Pane	Primary (Windows)	37,500.00	1,798.23	0.80
Install 386 kwh/yr REFRIGERATOR	Appliance	22,000.00	1,277.22	0.80

*21 MWH saved by tightening@ electric buildings x .15/kwh assumes 15 year lifetime

Scope of Work for Duplex Buildings at 500&600 Austin Drive

Description	Location	Initial Cost ($)	First YearSavings ($)	S.I.R
Cover ground in rear crawl	Health & Safety	15,000	n/a	n/a
LO-FLO showers & restrictors	Appliance	250.00	796.15	47.80
Weatherstrip Doors	Garage (Doors)	500.00	274.55	5.80
REPLACE w/LowE argon-filled Thermal Pane	Medium sliders (Windows)	3,000.00	655.69	3.80
Weatherstrip Doors	Entrance (Doors)	500.00	146.95	3.10
Upgrade external public lighting	Lighting	1,365.00	328.40	2.90
Replace apartment lighting	Lighting	3,937.50	617.96	1.90
REPLACE w/LowE argon-filled Thermal Pane	Primary (Windows)	12,000.00	802.88	1.20
Install 386 kwh/yr REFRIGERATOR	Appliance	5,500.00	400.21	1.00
Install 12" loose CELLULOSE	Primary (Roof)	7,846.25	148.26	0.30
REPLACE w/LowE argon-filled Thermal Pane	Glass doors (Windows)	12,000.00	160.59	0.20
Total Investment, 7 Buildings		$243, 106	16,436	1.01

Please note that for all information in this audit, BPI protocols for measurement and sampling have been followed according to the Multifamily Building Analyst standards.

COMPLETE DESCRIPTION OF BUILDING AND SCOPE OF WORK

Both buildings need lighting retrofits in the apartments and at the front door, and the front door model needs to be designed for cold outdoor temperatures.

All of the windows are the original aluminum frame that are not thermally broken, and as such, act like single pane windows. The energy model calls for them to be replaced with models that have a minimum R value of 4. Some of the larger windows are less cost effective, so the owner will have to contribute depending upon the final bid price.

Further, the front, rear, and sliding glass doors are in poor condition, and it is cost effective to weatherstrip them. The owner wishes to replace them, and can if they pay for the majority of the cost and CPC's weatherization program invest the maximum allowed for the cost effectiveness of the weatherstripping, which would only last a few years anyway. Replacement is the better choice, but the owner must be willing to invest.

The rear storage closets are not connected to the building, but they are connected to the crawlspace which is small and difficult to access, except through a floor panel in each storage area. The wood floors of these closets routinely rot out, caused primarily by soil floors in the space that have never been covered with plastic. The venting is either sealed or unsealed throughout, but still allows cold air to enter the space, increasing the stack effect. If the crawl spaces are effectively leveled and covered with plastic uniformly, and the plastic is weighted down, this should eliminate much of the bulk moisture in the building from going upstairs. Then the selected contractor can seal the crawlspace vents, effectively bringing the space into the building, instead of having it completely outside. This should make the duplex apartments warmer and more durable.

The refrigerators need to be replaced throughout.

Although we would like to provide pre and post-tested blower door airsealing in each unit, it appears to only be cost effective according to the model in the all-electric buildings. These buildings are one complex, and as a complex, there is enough cost effectiveness of airsealing in the all electric buildings to subsidize the airsealing in the duplexes as well. Both buildings need their attics airsealed and further insulated, but it appears to be less cost effective in the duplexes. Similarly, it appears to be cost effective to replace the showerheads and aerators in the duplexes but not in the all electric buildings, we suggest that the owner pick up the difference.

Attached to this description are the modeled energy usage for the all electric buildings, then an additional model with the air leakage in the building reduced by 10%. The savings from that reduction is noted on the scope of work page, and estimated savings is calculated using the incremental cost of reduced electricity at 15¢/kilowatt hour (kwh).

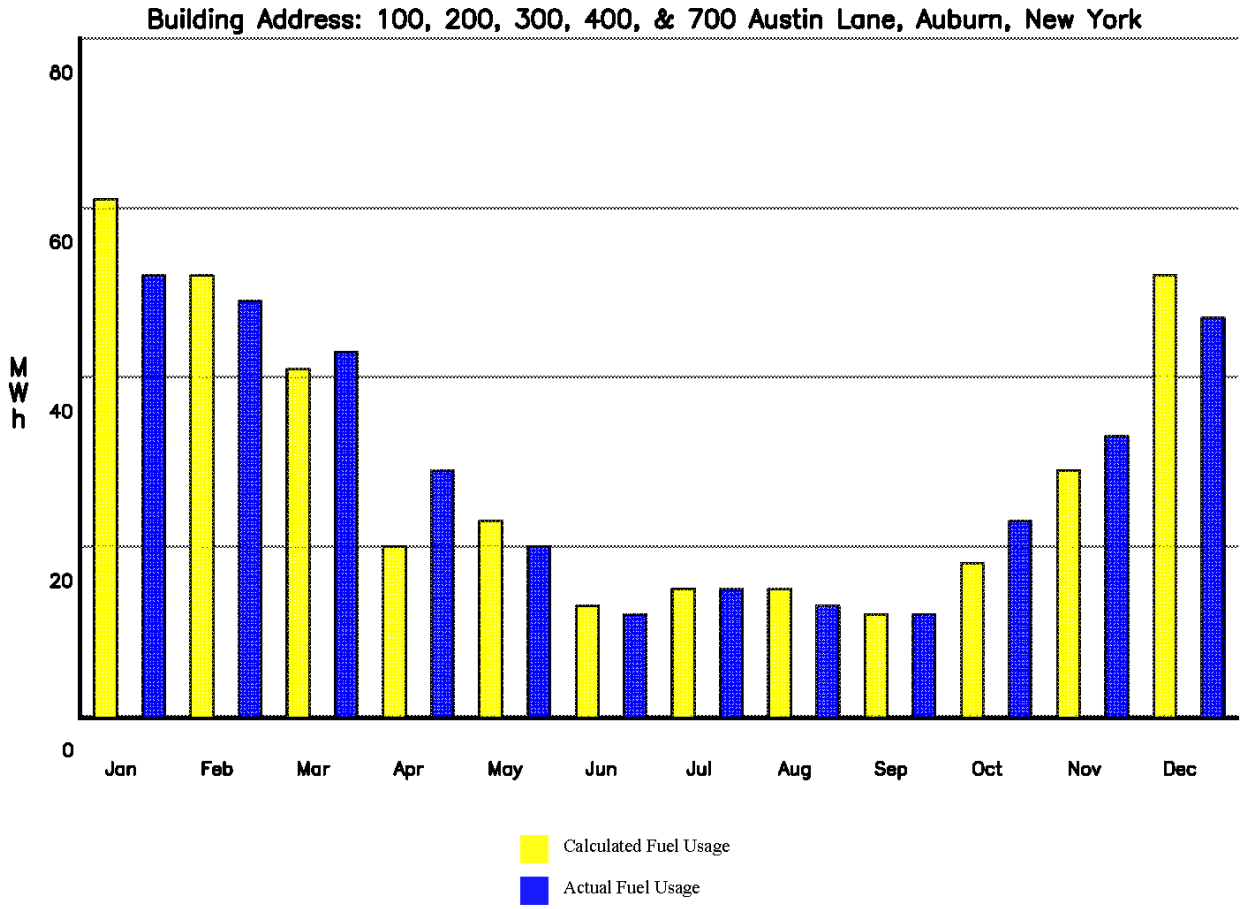
Building Modeling

Building Address: 100, 200, 300, 400, & 700 Austin Lane, Auburn, New York

Auditor: Andrew Padian **Audit Date:** 01/26/2011

Month	Calculated Fuel Use	Actual Fuel Use	DayTime Heat On-Time	NightTime Heat On-Time	Total Heating Load	Solar Gain	Infiltration	NH Electric **
	MWh	MWh	%	%	MMBtu			
January	61.00	53.00	35.60	10.60	164.00			
February	53.00	49.00	34.60	12.00	150.00			
March	42.00	43.00	24.60	3.20	99.00			
April	20.00	30.00	8.40	0.00	29.00			
May	23.00	20.00	0.00	0.00	-1.00			
June	14.00	13.00	0.00	0.00	-3.00			
July	16.00	15.00	0.00	0.00	-5.00			
August	15.00	14.00	0.00	0.00	-3.00			
September	12.00	12.00	0.00	0.00	-1.00			
October	19.00	24.00	5.70	0.00	20.00			
November	30.00	34.00	18.20	0.00	63.00			
December	52.00	47.00	31.30	6.40	134.00			
Sum	**357.00**	**354.00**			**646.00**			
Average	**29.75**	**29.50**	**13.20**	**2.68**	**53.00**			

(**) NH Electric (Non-Heating Electric Use): includes EAEM (EA-Quip Applicable Electric Measures), cooling

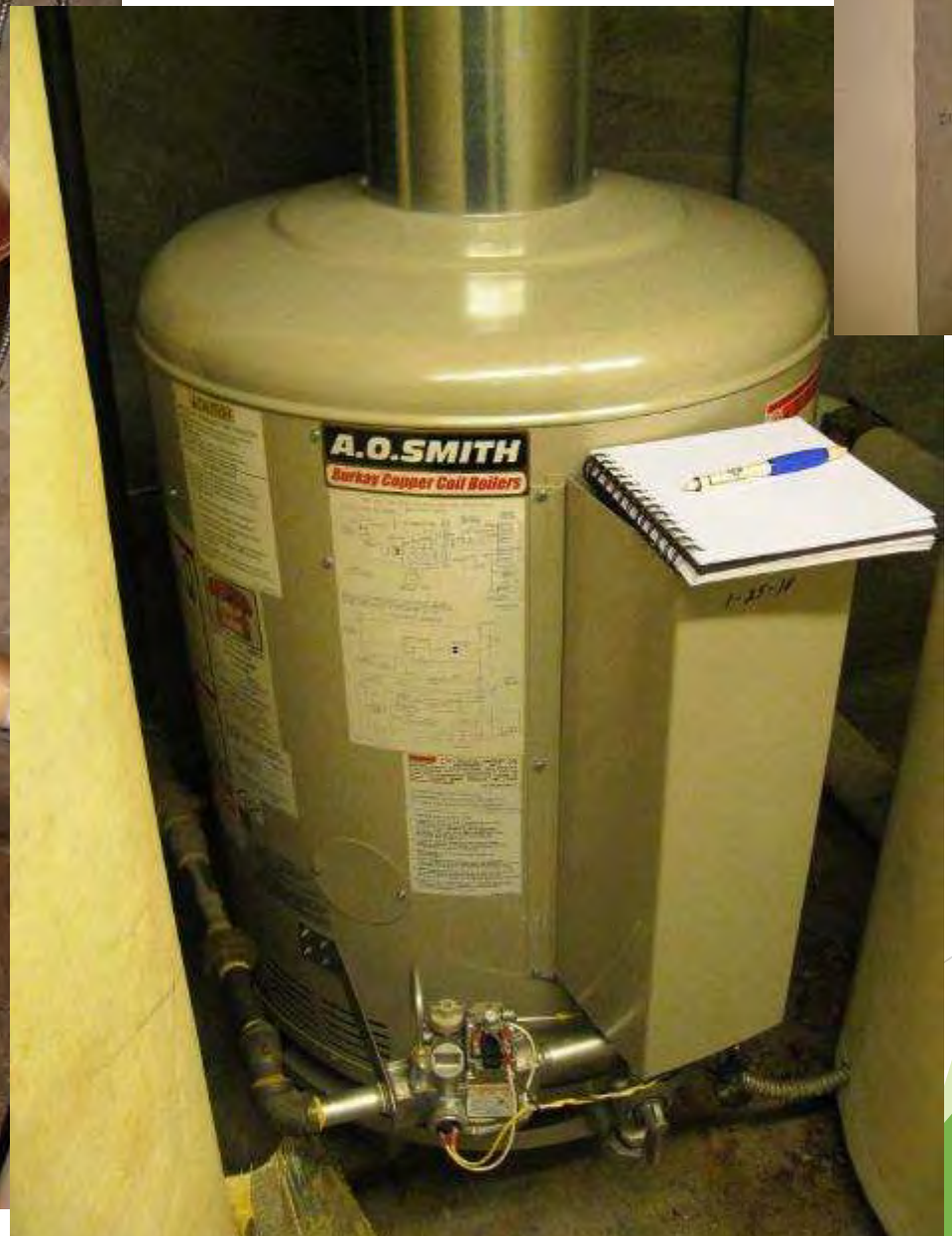


Building Name	Number of Units	Item #1 Apt. Air Sealing		
	8	Pre BD #	Post BD #	
101		671	606	9.69%
102		762	710	6.82%
103		640	532	16.88%
104		832	714	14.18%
105		708	633	10.59%
106		594	538	9.43%
107		786	600	23.66%
108		661	586	11.35%
				12.83%

ESB Building Number	Building Name	Number of Units	Item #1 Apt. Air Sealing		
74		8	Pre BD #	Post BD #	
	201		749	711	5.07%
	202		662	635	4.08%
	203		974	819	15.91%
	204		1032	982	4.84%
	205		600	562	6.33%
	206		721	685	4.99%
	207		660	579	12.27%
	208		952	685	28.05%
					10.19%

Pre	Post	% Difference
Overall	Reduction	10.41%

Canandaigua,
New York
30 miles SE of
Rochester, NY


A.O.SMITH
Burkay Copper Coil Boilers

1. Improvement Package 1

Improvement Name	Cost ($)	Annual Savings MMBtu	Annual Savings ($)	Payback (years)	Cashflow ($/year)	Improve-ment Life (Years)	SIR in Package
Heat Recovery Ventilation	35,000	54.41	2,392	14.6	-690	20	1.02
Air Sealing	60,000	95.53	4,200	14.3	-1,083	20	1.05
Common Area Lighting Upgrade	77,000	267.36	11,754	6.6	4,974	15	1.83
Water Heater Replacement	14,000	150.58	2,523	5.5	1,290	15	2.16
Refrigerator Replacement	20,000	93.13	4,094	4.9	2,333	15	2.46
Apt Lighting Upgrade	5,240	47.40	2,084	2.5	1,622	10	3.41
Low Flow Aerators and Showerheads	6,550	153.39	2,608	2.5	2,031	20	5.97
Total for Package	217,790	861.8	29,654	7.34	10,477	N/A	1.77

Non-Energy Benefits:

1. Heat Recovery Ventilation: Improve indoor air quality, increase value of building.
2. Air Sealing: Reduce drafts.

A Brief Look At Airsealing Numbers

Room	Date	Pre BD	Date	Post BD	Measures Installed/Comments		W/AC	W/O AC
105	18-Nov	659	12/13/2010	592	W/O AC			0.90
106	18-Nov	865	12/13/2010	602		W/AC	0.70	
107	18-Nov	728	12/13/2010	528	W/O AC			0.73
108	18-Nov	792	12/13/2010	591		W/AC	0.75	
109	18-Nov	1032	12/13/2010	638		W/AC	0.62	
110	18-Nov	834	12/13/2010	721	W/O AC			0.86
112	18-Nov	1085	12/13/2010	809		W/AC	0.75	
119	18-Nov	404	12/13/2010	392	W/O AC			0.97
121	18-Nov	844	12/13/2010	698	W/O AC			0.83
123	18-Nov	998	12/13/2010	724	W/O AC			0.73
124	18-Nov	985	12/13/2010	732		W/AC	0.74	
201	15-Nov	774	12/10/2010	597		W/AC	0.77	
202	15-Nov	791	12/10/2010	652		W/AC	0.82	
203	15-Nov	715	12/10/2010	583		W/AC	0.82	
204	15-Nov	710	12/10/2010	592		W/AC	0.83	
205	15-Nov	852	12/10/2010	612		W/AC	0.72	
206	15-Nov	772	12/10/2010	680		W/AC	0.88	
207	15-Nov	798	12/10/2010	610		W/AC	0.76	
208	15-Nov	817	12/10/2010	722	W/O AC			0.88
209	15-Nov	660	12/10/2010	543	W/O/AC			0.82
210	15-Nov	701	12/10/2010	622		W/AC	0.89	
211	15-Nov	975	12/10/2010	629		W/AC	0.65	
212	15-Nov	1195	12/10/2010	822		W/AC	0.69	

Some Production Notes:

- 131 apartments
- Pre-testing, retrofitting and post-testing
- Pre: 11/8, 9, 10, 11, 15, 16, 18
- Post: 12/9, 10, 13
- Start to finish: 36 days (including Thanksgiving holiday period)

…And some results……

GOAL = 20% Reduction

Air Sealing Includes: Entry Door Sweep, Door Gasket, Shower Sheetrock Penetration, Kitchen Sink, ceiling, Bathroom Sink,Gasket Plug Exterior Wall Incomplete Seals on AC Units Corrected with Sealed Covers

CFM 50pa Reductions without AC Covers = 17%

CFM 50pa Reductions with new AC Covers = 24%

CFM 50pa Reductions for all units = 24% or 26,261 CFM50pa

*(This does not include stairwell and corridor Air Sealing Measures)

131 apartments, electric heated, individually metered

New Hot Water Makers, showerheads, aerators

Tightened apartments average 24%

Apartment electric savings 25%!

Gas use for hot water down 46%

Water use down 21%

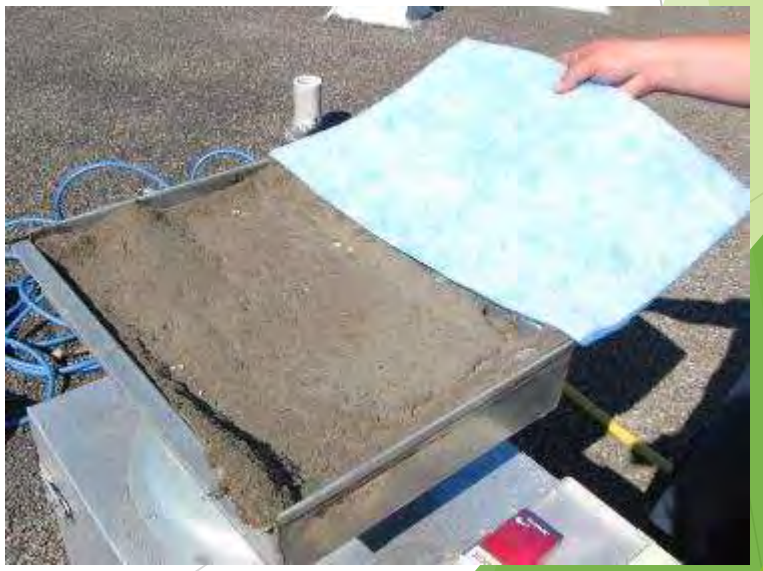
North Street Apartments Canandaguia, NY

Westchester Park Apartments
201 Units 170,000 ft^2
Buffalo, NY

Figure 3 Typical condition at the south wall of the basement – CMU wall; top four feet covered by fiberglass roll insulation; damp footing and lower course; the earthen floor partially covered by black plastic membrane (est. 70% coverage); trench dug near the footing in an effort to direct seepage to sump crocks; concrete interior posts support the concrete floor above.

Figure 6 in the NW corner solution deposits have accumulated where rainwater runs down walls from above.

Figure 27 At the East facing entryway the detail is the same and a great deal of water enters here as well.



Before we fixed the basement, these roof fans operated as a building-wide moisture mitigation system

Some Lessons/Takeaways:

- Tightening buildings comes up big
- Do model, then model air leakage
- Do model, then model mechanical airflows
- Build tight, ventilate right
- Fix/Upgrade ventilation
- Don’t reinvent the wheel
- Consult the sages