EXECUTIVE SUMMARY

This Energy Reduction Plan details the specific steps to be taken by the ownership and management at XXXXXXXXXX Apartments – XXXXXXXXXX to achieve a prescribed performance target of 29% as part of the New York State Energy Research and Development Authority's (NYSERDA's) *Multifamily Performance Program.* Implementation of this Plan and achievement of the performance target enables this project to be recognized as a "New York Energy $mart Multifamily Building."

This project was evaluated using NYSERDA's Benchmarking Tool to evaluate its current energy consumption relative to similar buildings. The results of this evaluation are presented in Table 1.

Table 1. Benchmarking Results and Performance Target

	Actual
Project's Total Annual Energy Consumption (MMBtu/yr)	**6,859**
Project's Annual Electricity Consumption (MMBtu/yr)	2,081
Project's Annual GAS Consumption (MMBtu/yr)	4,778
Project's Annual OIL Consumption (MMBtu/yr)	0
Project's Annual STEAM Consumption (MMBtu/yr)	0
Entire Building Gross Floor Area	75,320
Actual Annual Heating Degree Days	4,523
Actual Annual Cooling Degree Days	1,055
Typical Annual Heating Degree Days	4,805
Typical Annual Cooling Degree Days	1,096
Project's Benchmarking Score	34
Source Energy Use Intensity (kBtu/sf2-year)	158.7
Project's Performance Target	20%
Source Energy Use Intensity Target (kBtu/sf2-yr)	127.0

This document is an energy audit report for XXXXXXXXXX Avenue, located in New York, NY. Based on the field visits performed by Steven Winter Associates, Inc. (SWA) staff and the results of a comprehensive energy analysis, this report describes in detail the building's current condition and recommendations for energy efficient improvements.

The condition of individual apartments and the appliances and devices are included the scope of this report if affecting overall building performance and safety. General recommendations have been made for residents to decrease their own energy costs and improve comfort and safety within their apartments wherever possible; however, it is understood that apartment owners are not bound by these recommendations.

A utility bill analysis for the whole building (apartments + common areas) indicates that gas use for space heating and domestic hot water represents approximately 37% of annual energy costs -- the greatest component of whole building energy use. Moreover, the normalized heating energy use of the building is greater than a typical NYC gas heated building. Improving heating system performance is therefore a critical aspect of the proposed scope of work and will be accomplished by a whole building strategy that (1) improves boiler system performance and control to minimize overheating and (2)

reduces the amount of heat required (heating load) by upgrading the building envelope and eliminating energy waste due to over-ventilation and uncontrolled airflow through the building.

It is important to note that NO energy savings from a reduction in heating load will actually be realized unless the boiler understands that less heat is required. For this reason, improved heating system controls will be critical to realizing energy savings. While gas use obviously represents a big part of the story at XXXXXXXXXX Apartments, it is important to keep in mind that a significant fraction of the building energy costs are a result of electricity use associated with lighting, appliances and miscellaneous equipment which are all addressed by proposed the scope of work. A comprehensive energy assessment that evaluated a suite of potential measures to achieve the project's performance target and improve the health, safety, comfort, and security of its residents and staff has been conducted on this project. The results of this assessment are detailed in Sections I and II. Based on this initial assessment, a set of improvements has been selected in consultation with building ownership and management that will effectively achieve the project's performance target. The implementation of this set of improvements is presented in Section III. Their overall metrics are presented in Table 2 with their details in Table 3.

Table 2. Energy Reduction Plan Summary Metrics

Total Investment:	$460,639	**Payback Period (years):**	6.4
Annual Savings:*	$71,783	**Savings to Investment Ratio:**	2.318422639
	2,968 million Btu	**Net Life Cycle Savings:**	$551,493
Summer Peak	151,500 kWh	**Discounted at 3.0% over (yrs):**	20
Demand Reduction:	11.2 kW	**Project Phased over:**	1 years
New Gas:	0 million Btu (New purchases for cogen, conversions)		

*million Btu figure includes all interactive effects, but excludes gas consumption of proposed cogen or conversions

Table 3. Detailed List of Recommended Measures for Entire Project

	Measure	Installed Cost (incl. design)	Energy Savings		Demand Savings	Water/ Sewer Savings	O&M Savings	Cost Savings	Payback	S.I.R.	Life Cycle Savings	Years for LCC
			MMBtu	kWh	kW	1000 gals	$	$	years		$	years
Measures to be undertakend by buildings - savings accrue to building												
1	Replace Boilers	$66,000	328	4,000	0.0	0.0	$0	$5,640	11.70	1.49	$32,211	25
2	Replace HW Maker	$20,000	110	0	0.0	0.0	$0	$1,650	12.12	1.44	$8,732	25
3	Install Roof Insulation	$15,064	67	0	0.0	0.0	$0	$1,005	14.99	1.16	$2,436	25
4	Install TRVs	$39,600	397	0	0.0	0.0	$0	$5,955	6.65	1.80	$31,491	15
5	Reduce Common Area Lighting	$39,900	0	70,000	8.0	0.0	$0	$12,600	3.17	3.77	$110,518	15
6	Upgrade Clothes Washers	$1,000	52	0	0.0	0.0	$0	$781	1.28	8.82	$7,818	14
7	Upgrade Ventilation	$86,726	1,092	44,000	0.0	0.0	$0	$24,298	3.57	4.88	$336,374	25
8	Install Low Flow Fixtures	$2,970	413	0	0.0	1,000.0	$0	$6,192	0.48	12.99	$35,610	7
9	Window Replacement	$73,919	283	0	0.0	0.0	$0	$4,245	17.41	1.00	$0	25
10	Whole Building Air Sealing	$53,360	226	0	0.0	0.0	$0	$3,388	15.75	0.68	-$17,333	13
Measures to be undertaken by buiding - savings accrue to tenants												
11	Upgrade Apartment Lighting	$39,600	0	17,500	1.6	0.0	$0	$3,150	12.57	0.79	-$8,245	12
12	Replace Refrigerators	$22,500	0	16,000	1.6	0.0	$0	$2,880	7.81	1.53	$11,881	15
13	Measure #13	$0	0	0	0.0	0.0	$0	$0	#DIV/0!	#DIV/0!	$0	0
14	Measure #14	$0	0	0	0.0	0.0	$0	$0	#DIV/0!	#DIV/0!	$0	0
15	Measure #15	$0	0	0	0.0	0.0	$0	$0	#DIV/0!	#DIV/0!	$0	0
Measures with no energy savings												
16	Measure #16	$0									$0	0
17	Measure #17	$0									$0	0
18	Measure #18	$0									$0	0
19	Measure #19	$0									$0	0
20	Measure #20	$0									$0	0
Total for Improvements		$460,639	2,968	151,500	11.2	1,000	$0	$71,783			$551,493	
CM Fees		$0	*Overall project management, all fees associated with specific measures should be noted above.*									
Partner Fees		$0										
TOTALS		**$460,639**	**2,968**	**151,500**	**11.2**			**$71,783**			**$551,493**	

We are able to estimate a 15% reduction in electric consumption and 47% reduction in gas consumption, based on the savings realized when this set of improvements are implemented.

The Financing Plan detailed in Section IV and summarized in Table 5 describes the costs associated with achieving the performance target and the sources of funding that will cover those costs.

Confirmation of Achievement of Target

Based on the Detailed List of Recommended Measures detailed in Table 3 selected from the evaluated measures indicated in Section III, the attached Benchmarking Tool confirms in Design Assistant section that this proposed scope of work will meet or exceed a performance target of 20%.

Table 4. Benchmarking Tool & Design Assistant

NYSERDA Multi-Family Building Performance Benchmarking Tool - Ver. 2.1

The NYSERDA Multi-Family Building Energy Use Benchmarking Tool quantifies the projected performance of a user-defined building relative to all HUD 5-plus unit multi-family residential buildings nationwide. A score of 75 denotes performance at the top 25th percentile of 5-plus unit multi-family buildings. A score of 50 denotes performance at the 50th percentile (the mid-point). To use this tool, you will need to calculate your building's annual energy consumption. Provide entries for your building in the "white cells" below. Click on underlined headings for help.

Building(s) Description

Building Name: "optional entry"

5-digit Zip Code: Not Sure?

Mapping Location: New York, NY

Entire Building Gross Floor Area (sqft)	Number of Family Units	Percent of Units with Laundry Hookups	Percent of Gross Floor Area Heated	Percent of Gross Floor Area Cooled
75,320	99		100.0	40.0

Weather Description

	Typical	Pre-Retrofit	Post-Retrofit
Annual HDD:	4805	4523	
Annual CDD:	1096	1055	

IMPORTANT: Annual entries should correspond to the same time period as the pre-/post-retrofit annual consumptions reported below. Pre- or post-retrofit values must be provided to score your building.

Annual Energy Consumptions and Costs ----- IMPORTANT: Entries should represent 12 continuous months of consumption

	Pre-Retrofit				Post-Retrofit			
	Electricity	Natl Gas	Fuel Oil	District Steam	Electricity	Natl Gas	Fuel Oil	District Steam
Units:	MMBtu	MMBtu	Gal #2	kLbs	kWh	MMBtu	Gal #2	kLbs
Energy	2,081	4,778						
Cost ($)	120,940	71,666						
No. of buildings	1	1						

IMPORTANT: Number of buildings represented by the reported energy use values above should always be equal for all reported fuels.

Calculated unit cost:	58.12 $/unit	15.00 $/unit	$/unit	$/unit	$/unit	$/unit	$/unit	$/unit

Results

	Pre-Retrofit		Post-Retrofit	
	Your Building	Average	Your Building	Average
Score Against Peers	34	50		50
Building Site Energy Use (MMBtu/year)	6,859	NA		NA
Building Source Energy Use (MMBtu/year)	11,955	9,970		8,695
Site Energy Use Intensity (kBtu/ft2-year)	91.1	NA		NA
Source Energy Use Intensity (kBtu/ft2-year)	158.7	132.4		115.4

Weather-normalized Percent Source Energy Use Reduction After Retrofit

Design Assistant

Projected Annual Energy Consumption

	Electricity	Natl Gas	Fuel Oil	District Steam
Units:	MMBtu	MMBtu	Gal #2	kLbs
Energy	1,763	2,524		

Projected Percent Source Energy Reduction	29%
Projected Score Against Peers	66
Projected Building Site Energy Use (MMBtu/year)	4,287
Projected Building Source Energy Use (MMBtu/year)	8,533
Projected Site Energy Use Intensity (kBtu/ft2-year)	56.9
Projected Source Energy Use Intensity (kBtu/ft2-year)	113.3

Table 5. Financing Plan

ELIGIBLE USES

Total Costs of Improvements	$460,639
Construction Management Fees	$0
Multifamily Performance Partner Fees	$0
TOTAL ELIGIBLE USES*	**$460,639**

*Total Eligible Uses must match the Total Investment amount in the Plan Summary table (Table 2). The project's cost-effectiveness must be based on the total of these Eligible Uses.

SOURCES

			Committed or Requested	Date Available
Anticipated NYSERDA Grant	$128,800	NYSERDA		
NYSERDA Adv. Measures Incentive	$0	NYSERDA		
NYSERDA Energy $mart Loan Fund	$0	Energy $mart Loan Fund		
Other NYSERDA program funds	$0			
Firm Gas Program Incentives	$0	<Enter Gas Company name>		
Building Reserves	$0	N/A		
Additional debt	$0	<Enter source>		
In-kind contributions	$0	N/A		
Federal funds - source #1	$190,000	WAP		
Federal funds - source #2	$126,900	Tax-Exempt Bonds, Low-Income Housing Tax Credits		
State funds - source #1	$0	<Enter source>		
State funds - source #2	$0	<Enter source>		
Local/utility funds - source #1	$0	<Enter source>		
Local/utility funds - source #2	$0	<Enter source>		
Additional funds #1	$126,900	Seller's Note		
Additional funds #2	$0	<Enter source>		
TOTAL SOURCES**	**$572,600**			

**Total Sources must equal Total Eligible Uses.

This Plan has been prepared by Marc Zuluaga and Keirnyn Ross at Steven Winter Associates. All questions should be addressed to Marc Zuluaga.

SECTION I. INITIAL BENCHMARK REPORT

This section includes the Initial Benchmark Report as generated by the Program's Benchmarking Tool and Incentive Workbook.

NYSERDA Multifamily Performance Program Initial Benchmark Report

Benchmark Score and Incentive Summary

Incentive Summary

Total Apartment Units	Affordable Housing
99	

Initial Benchmark Score	**34**
Energy Reduction Target %	**20%**
Energy Reduction Target Source Energy (MMBtu/year)	**2,391 MMBtu**
Performance Incentives	
Incentive #1: Energy Reduction Plan	$10,000
Addendum Incentive #1: Multiple Energy Audits *(enter data in rows 54 & 55)*	$0
Incentive #2: At 50% Construction Completion	$79,200
Incentive #3: At Construction Substantial Completion	$39,600
Incentive #4: Energy Performance (at 29% achieved reduction)	$72,765
Special Incentives for Advanced Measures:	
Advanced Metering Equipment	$0
Combined Heat and Power (CHP) System	$0
Building Operator Training & Certification	$0
Owner's Manual	$0
Photovoltaic (PV) Systems	$0
TOTAL INCENTIVE	**$201,565**

Performance Incentives

Energy Reduction Target

Energy Reduction Target

Score	Quartile	Source Energy (MMBtu/year)	Energy Reduction Target	Reduction Target Source Energy (MMBtu/year)
34	2nd	11,955 MMBtu	20%	2,391 MMBtu

quartile	score range	reduction target
1st	<= 25	20%
2nd	26 to 50	20%
3rd	51 to 75	20%
4th	>75	20%

[redacted] achieved a benchmarking score of 34. This places [redacted] in the 2nd quartile as compared with multi-family buildings nation wide. [redacted]s reduction target for participation in the NYSERDA Multi-Family Building Program is 20% of the building's source energy. The building's pre-retrofit source energy use is 11,955 MMBtu and its source energy reduction target is 2,391 MMBtu.

INCENTIVE #1: Energy Reduction Plan

INCENTIVE #1: Energy Reduction Plan

INCENTIVE #1 for	not including Special Incentives
$10,000	

	Affordable Housing	Market-Rate Housing
up to 30 units	$5,000	$2,500
Base Incentive 31 units and over	$10,000	$5,000
Additional Incentive per unit for projects over 100 units	$20	$10

ADDENDUM INCENTIVE #1: Additional Energy Assessments

ADDENDUM INCENTIVE #1: Additional Energy Assessments

Enter total number of **Additional Assessments** that represent ≥ 15 units.
Enter total Number of **Units** in *Additional Assessments* < 15 units.

ADDENDUM INCENTIVE #1 not including INCENTIVE #1
$0

	Affordable Housing	Market-Rate Housing
Additional Incentive per assessment representing ≥ 15 units	$3,750	$1,875
Additional Incentive per unit for assessments representing <15 units	$250	$125

INCENTIVE #2: At 50% Construction Completion

INCENTIVE #2: At 50% Construction Completion

INCENTIVE #2 for	
$79,200	

	Affordable Housing	Market-Rate Housing
Incentive per unit	$800	$300

INCENTIVE #3: At Construction Substantial Completion

INCENTIVE #3: At Construction Substantial Completion

INCENTIVE #3 for	
$39,600	

	Affordable Housing	Market-Rate Housing
Incentive per unit	$400	$300

INCENTIVE #4: Energy Performance

INCENTIVE #4: Energy Performance

Achieved % Reduction in Building Source Energy (default 20%)	29%

INCENTIVE #4 for	
$72,765	

			Affordable Housing	Market-Rate Housing
quartile	score range	reduction target	incentive per unit	
1st	<= 25	20%	$400	$200
2nd	26 to 50	20%	$375	$175
3rd	51 to 75	20%	$350	$150
4th	>75	20%	$325	$125
for every percentage point beyond the reduction target add:			$40	$20

Special Incentives for Advanced Measures

SPECIAL INCENTIVE: Advanced Metering Equipment

Advanced Metering Equipment

Cost of Resident Education and Regulatory Assistance (default $3,500)	
Resident Education and Regulatory Assistance Incentive	$0

Total cost of the Advanced Metering System (default: $500 per apartment)	
Number of Advanced Master Meters to be Installed (default: 1 per building)	
Combined Advanced Submeter and Master Meter Incentives	$0

Advanced Metering Equipment Incentive for
$0

	Affordable Housing	Market-Rate Housing
Ed. & Reg. Assistance Incentive (per project)[1]	$3,500	$2,000
Advanced Submeter Incentive (per apartment)[2]	$200	$150
Advanced Master Meter Incentive (per m. m.)[2]	$2,000	$1,500

[1] Incentive will not exceed 100% of cost for services.

[2] Combined incentive not to exceed 50% of total cost.

SPECIAL INCENTIVE: Combined Heat & Power (CHP) System

Combined Heat and Power (CHP) System

kW of CHP system	

Combined Heat and Power (CHP) System Incentive for
$0

	Affordable Housing	Market-Rate Housing
CHP System Incentive (per kW)	$1,000	$750

SPECIAL INCENTIVE: Building Operator Training & Certification

Building Operator Training & Certification

Number of Building Operator Training & Certification Attendees	
Cost per Attendee (default $2,000)	$1,500

Building Operator Training & Certification Incentive fc
$0

	Affordable Housing	Market-Rate Housing
Bldg Operator Training & Cert. Incentive (per attendee)	$1,500	$1,000
Maximum Incentive as Percent of Total Cost	75%	50%

SPECIAL INCENTIVE: Owner's Manual

Owner's Manual Incentive

Is an Owner's Manual available for the owner and staff?	Please Make Selection

Owner's Manual Incentive for
$0

	Affordable	Market-Rate
Owner's Manual Incentive with BOT&C	$1,000	$750
Owner's Manual Incentive without BOT&C	$500	$500

SPECIAL INCENTIVE: Photovoltaic (PV) Systems

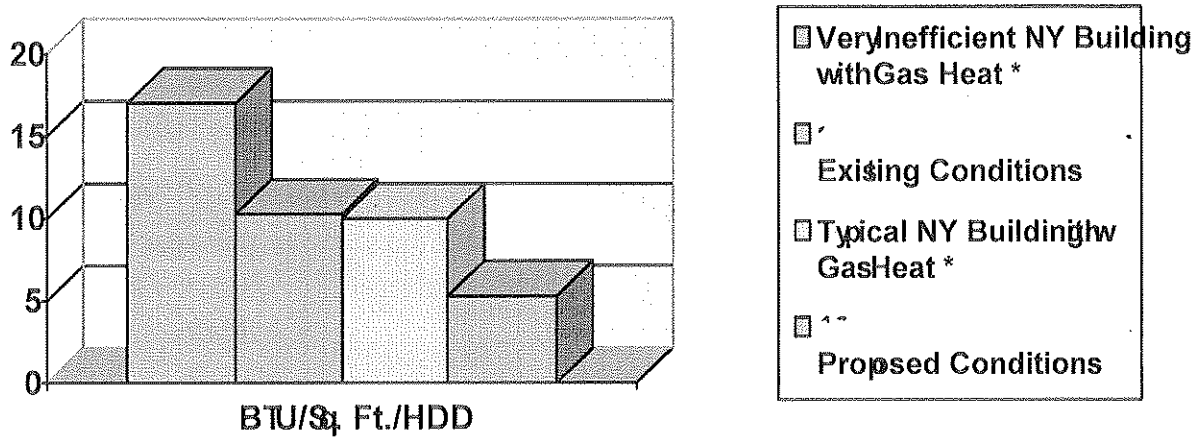
Photovoltaic (PV) Systems

The Photovoltaic System is	Please Make Selection
Total kW of the Photovoltaic System	

Photovoltaic (PV) Systems Incentive
$0

	Building Integrated	Not Building Integrated
First 25 kW (per watt)	$4.50	$4.00
Next 25 kW (per watt)	$3.50	$3.00
PV systems with over 50 kW are not Eligible under this program		

The heating energy efficiency of the building compared can be better understood by normalizing for weather and square footage. The "heating BTU per square foot per heating degree day" for the building is 10.2 BTU/sq. ft./ HDD – which is below average for NYC gas heated buildings. By implementing the improvements recommended in this report, the building can be expected to operate around 5 BTU/sq. ft./ HDD.



SECTION II. EXISTING CONDITIONS

This assessment consists of the following buildings: XXXXXXXXXX Ave. The building located at XXXXXXXXXX Ave. was assessed for purposes of developing an energy assessment and scope of work for this building type.

To determine the most appropriate and effective scope of work to achieve this project's performance target, a comprehensive energy assessment has been conducted. On June 27, 2007 and April 22nd, 2008, Keirnyn Ross from SWA visited the project site and conducted a detailed energy assessment of the property. The building was built in 1992. It consists of 99 units one of which houses the super. It is located in Manhattan, rectangular in shape and is oriented along a NE-SW axis. There is a courtyard with on the side of the building and a parking lot with 10 spaces. It is free standing with nearby buildings at similar heights.

Building Ownership, Management, and Staffing

XXXXXXXXXX Apartments is owned and managed by The XXXXXXXXXX Group. The head superintendent is [redacted] who manages a staff of 1.5 FTE. This energy audit will be coordinated with a refinancing / major capital improvement to be undertaken in 2008.

Building Occupancy

The building's 105 residents are all seniors.

Energy Suppliers, Metering, and Electrical Systems

Electricity and Gas is supplied to the building by Con Edison. Apartments are sub-metered for electricity, common area of the building are on one meter. As is illustrated in the table below, whole building energy costs were approximately $192,755 in 2006/7. Gas use for space heating, domestic hot water, and laundry represented $71,666 of annual energy costs -- the greatest component of whole building energy use. Of this total annual gas use, SWA estimates that approximately 73% is associated with space heating, 27% is associated with domestic hot water heating, laundry and cooking gas. Appendix A contains a utility bill analysis that further subdivides the energy consumption of the building by end use (i.e. electricity for lights and appliances vs. electricity for cooling vs. gas for space heating vs. gas for domestic hot water, etc.)

	Fuel Use		Cost
	kWh	Therms	Dollars
Common Area Electricity @ $0.18/kWh	348,320	-	$62,698
Apartment Electricity @ $0.22/kWh	261,379	-	$58,242
Gas @ $1.50/Therm	-	47,777	$71,666
Totals	609,699	47,777	$192,605

Envelope

The building construction is 8" CMU & 4" face brick, with 3-1/2" foil-faced fiberglass batt insulation. The roof membrane and water flashings were in fair to poor condition, resurfacing is to

be coordinated with adding new insulation. The windows were in fair condition, however many tenants complained of air leakage. There were signs of thermal bridging in several of the apartments. The doors were in good condition however many needed new weather stripping. The basement is finished with some spaces used as community rooms.

Mechanical Systems

Apartments and interior hallways are centrally heated with a hot water system. Corridors are cooled via a rooftop air conditioning unit with a cooling coil; it is rated for 4900 CFM. Cooling is the responsibility of the tenants. All tenants have A/C sleeves and use window A/C units.

The building has 7 atmospheric gas boilers (tied together), operating at about 79% efficiency. This system is capable of providing more than what is necessary to provide adequate heat for the building. Domestic hot water is provided through means of a heat exchanger which is fed heated water form the boilers.

Boiler Room Efficiency Test	
CO ppm	140
O2 %	3.5
Airfree CO	173 ppm
amb	78.6 F
stack	530 F
efficiency	78.60%
CO2	9.90%
Excess Air	17.90%
CO	170 ppm
Draft	.01" W.C.

Water was measured at the tap at 118 degrees Fahrenheit, which is acceptable. Toilets are all 3.5 GPF.

Apartment	Bath Faucet GPM	Shower GPM	Kitchen Faucet GPM
7F	1.5	1.75	1.5
9L	1.5	3.5	1.5
7L	1.5	1.5	2.5
5L	1.5	1.5	1.5
3L	1.5	2.5	1.75
1L	1.5	1.75	2.0
1A	1.75	1.75	1.5
9B	1.5	1.75	1.5
4B	1.75	1.75	2.0

Lighting

Lighting in apartments is provided by hard-wired fixtures in baths, kitchens and living rooms. The kitchen is lit by a ceiling mounted 1'x4' T12 Fixture containing two 34 W T12 lamps. The bathrooms are lit by three wall mounted screw-in fixtures with the bulbs averaging at 60 watts, and the majority of which are incandescent. The majority of entryway fixtures are wall mounted screw-ins with incandescent bulbs averaging at 60W. Approximate 10 apartment living rooms have been

retrofitted to 2 pin CFL fixtures with two 13W lamps. The majority of common area lighting is fluorescent. All is controlled by manual switching.

Appliances

All apartments have a refrigerator. No apartments have dishwashers. Most apartments have one or two sleeve air conditioners. The table below presents SWA's survey of appliances in nine apartments.

XXXXXXXXXX Apartments Apartment Appliances

Apartment Unit #	Refrigerator Make	Refrigerator Model	kWh per year
7F	General Electric	GTH15BBRERWW	401
9L	General Electric	GTS15BBMFRWW	484
7L	General Electric	GTS16BBSERWW	455
5L	Magic Chef	RB15KN-1AL	1062
3L	General Electric	GTH16BBSXRWW	455
1L	Magic Chef	RB15KN-AL	1062
1A	General Electric	TBX14SABNRWW	692
9B	General Electric	GTH16BBSXRWW	455
4B	General Electric	GTH16BBSXRWW	455

Refrigerator replacement has been tracked since 2005. Approximately 30 have replaced. 20 of the new refrigerators use 455 kWh/yr. General Electric model # GTS16BBSERWW. 10 of the new refrigerators use 386 kWh/yr. General Electric model # GTH16BBSERWW. These began to be purchased in June 2006 and qualify under the old Energy Star standard, but not the new one. The previous Res-Tech audit found other models that used 525 kWh/yr. Frigidaire model # FRT18G4AWB. The most recent MPP audit found models that use 1062 kWh/yr. Magic Chef model number RB15KN-AL.

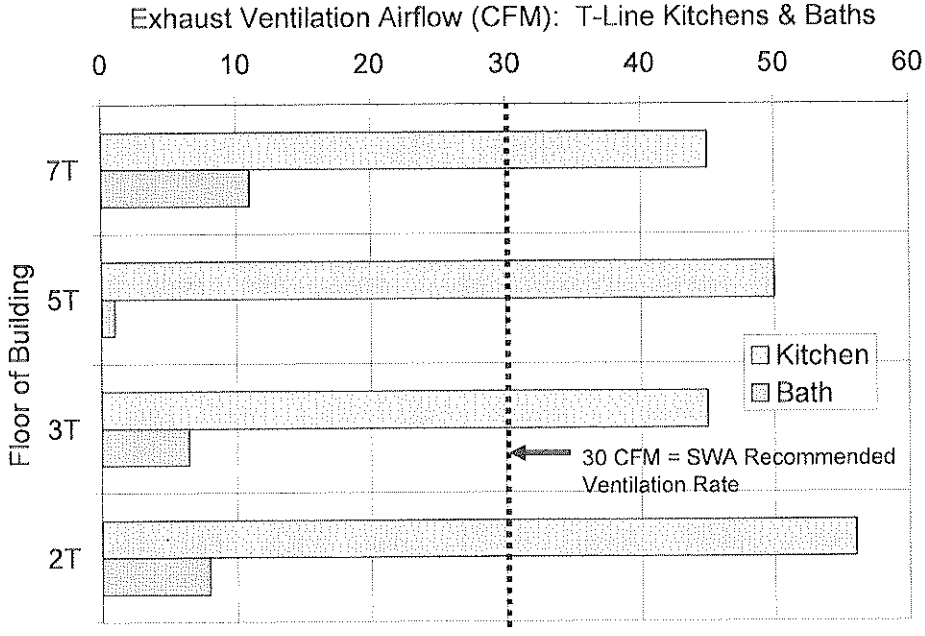
Laundry Equipment

The building currently contains four washing machines, two of which run on 30 gallons/cycle- Speed Queens, and two on 40 gallons/cycle- Wascomat W620. Both machine types can be replaced with 15 gallon/cycle machines. The laundry equipment leasing company (Hi-Rise) is willing to work with the building management to revise or renew (depending on the remaining agreement) the leasing agreement with EnergyStar equipment.

Ventilation & Infiltration

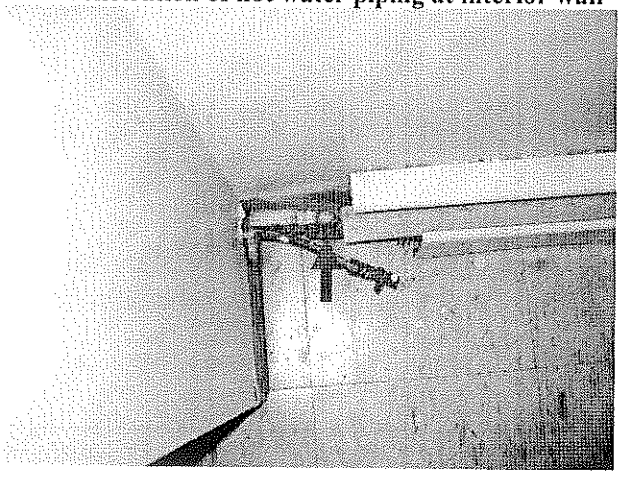
Kitchens and bathrooms have continuous mechanical ventilation which appeared to be working, although some residents on the top floor complain of noisy fans. Common areas also have mechanical ventilation but several the fans did not appear to be operating. It is recommended that all fans be turned off for no more than eight hours a day during times of low activity to reduce energy use while maintaining adequate ventilation. SWA is willing to work with the building to discuss these options.

Fan	Space Served	Total Fan Design CFM	# of baths or kitchens served by fan
TEF 1	bathroom	720	18
TEF4	bathroom	720	18
TEF 5	bathroom	720	18
TEF 6	bathroom	720	18
TEF 2	bathroom	1,120	28
TEF 3	bathroom	360	9
KEF 1	kitchen	1,080	9
KEF 5	kitchen	1,080	9
KEF 10	kitchen	1,080	9
KEF 2	kitchen	2,160	18
KEF 8	kitchen	2,160	18
KEF 3	kitchen	120	1
KEF 7	kitchen	120	1
KEF 4	kitchen	960	8
KEF 6	kitchen	960	8
KEF 9	kitchen	2,280	19
Total		16,360	209

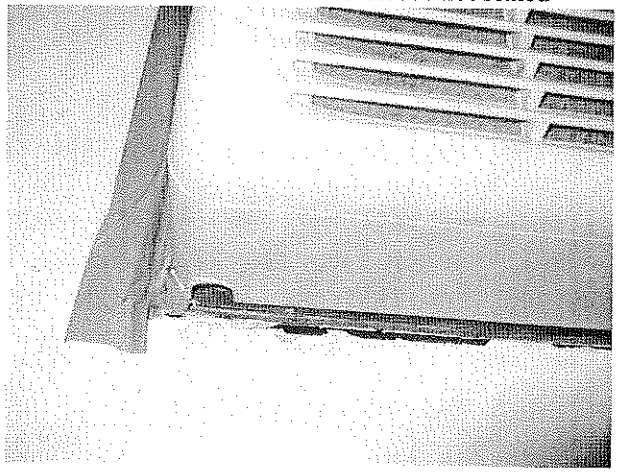


During our site visits, SWA noticed many opportunities for "air-sealing" some of which are illustrated in the pictures below.

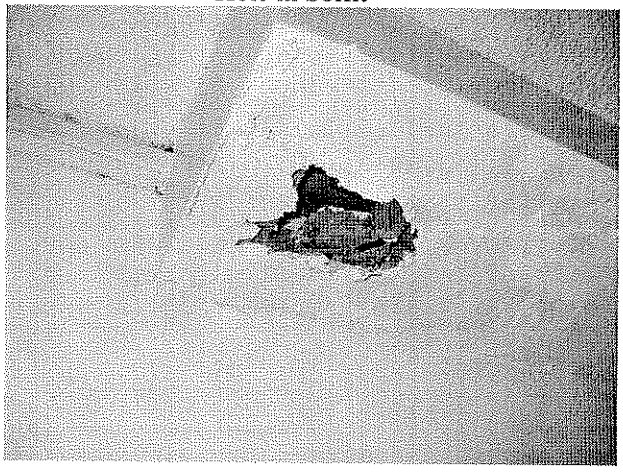
Penetration of hot water piping at interior wall



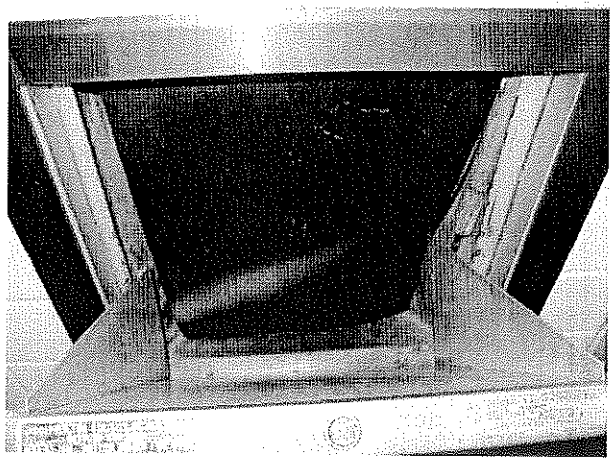
Air conditioner Sleeve not sealed



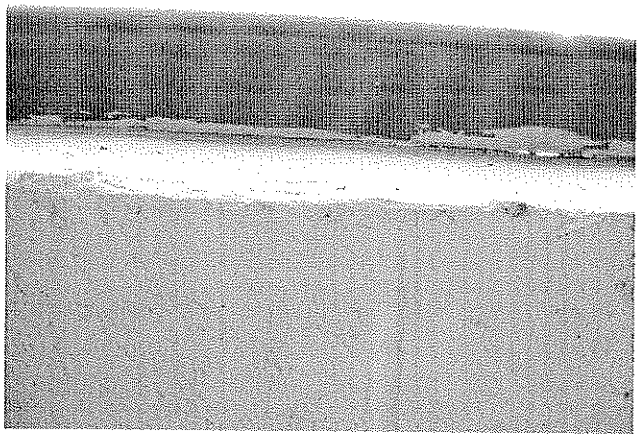
Hole in Soffit



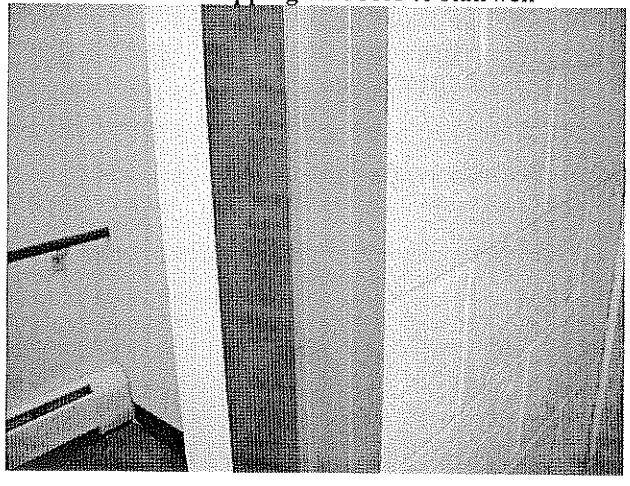
No weather-stripping on trash chute door



Gap between window frame and opening



No weather-stripping on doors to stairwell



Elevators
There are two elevators in the building in fair condition. The make of the elevators is Armor. The motor model is D.C. Hoist Motor with 15 HP. The make of the controls is Armor / Kone, model number TMS 600.

Health & Safety
All apartments are wired with smoke and CO detectors.

Overview of Building's Energy Use Variables
The following is a summary of the characteristics of this project that may impact its overall energy consumption. This data is being collected for use by NYSERDA and its agents to better identify the variables that control and predict a building's energy consumption.

Table 6. Energy Use Variables

Gross Floor Area:	75,320		
Heated % or Heated Floor Area of Building (approximation is sufficient):			100%
Cooled % or Cooled Floor Area of Building (approximation is sufficient):			40%
Number of Floors:	9		
Number of Units:	99		
Studio Apts:	24	3-BR Apts:	0
1-BR Apts:	74	4-BR Apts:	0
2-BR Apts:	1	>4-BR Apts:	0
Total Number of Bedrooms:	100		
Central Laundry?	Y		
Number of Parking Spaces:	10		
Elevator in Building?	Y		
Row or Townhouse Building with Separate Entrances for each Unit?			N
i.e. 1-, 2-, or 3-level units butted together with separate outdoor entrances for each unit.			
Number of Units Served by Central Electric Meter (mastermeter):			0
Does reported use for a central electric meter (mastermeter) include the electric use of all common area spaces?			Y or N
Number of Units Served by Central Gas Meter:			99
Does reported use for a central gas meter include the gas use of all common spaces?			Y
Number of Units Served by a Central, Fuel Oil-Fired Furnace:			0

SECTION III. EVALUATED MEASURES

In accordance with NYSERDA's Energy Reduction Plan Guidelines "Section 2.23 Measures Requiring Consideration," a comprehensive suite of potential energy reduction opportunities has been analyzed for this project.

The result of this analysis is presented in this Section. This analysis was conducted using the Targeted Residential Energy Analysis Tool (TREAT) building modeling software, version by Marc Zuluaga and Keirnyn Ross who developed and reviewed the model.

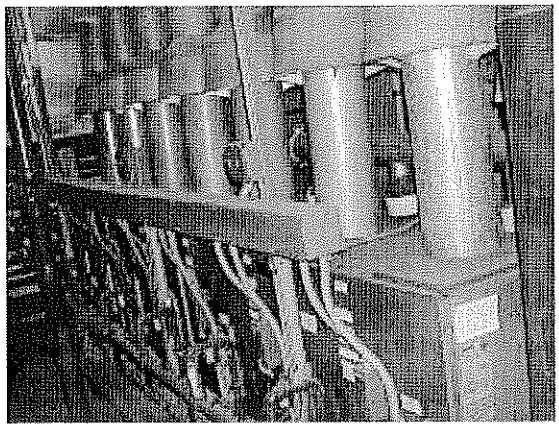
Energy Efficiency Options

The following list of measures represents the entire list of energy efficiency opportunities evaluated for this project.

Measure	Evaluated (yes/no)	Comments
Lighting and Appliances		
Bi-Level Lighting	Yes	Recommendations included
Energy Star CFL's	Yes	Recommendations included
Energy Star Clothes Washers	Yes	Recommendations included
Energy Star Dishwashers	No	No dishwashers in apartments
Energy Star Refrigerators	Yes	Recommendations included
LED exit Signs	Yes	Recommendations included
Occupancy sensors for common areas	Yes	Recommendations included
Super T8 Bulbs and Ballasts	Yes	Recommendations for T8s or better in many common areas
HVAC Measures		
Combined Heat and Power (CHP) System	No	Number of units in building, is not large enough to justify CHP.
Decentralization of central boiler plants	No	Not cost effective compared to high efficiency boiler upgrade.
Energy Management System	Yes	Upgrade of boiler controls recommended
Energy Star boilers	Yes	Boiler replacement recommended
Heat recovery from exhaust air	Yes	No supply air system in the building that could be matched with exhaust system for RHV.
Outdoor air reset for hydronic systems	Yes	Upgrade of boiler controls recommended
Replace #2 Oil with dual fuel system	No	Current fuel is natural gas
Separate DHW direct-fired boiler, condensing if gas	Yes	Not recommended. Sealed combustion boiler for heat and DHW (with storage tank) is optimal for this building and has been recommended.
Thermostatic Radiator Valve	Yes	Recommended for apartments.
Timers on roof fans per code requirement	No	Not recommended. Unacceptable for indoor air quality.
Envelope		
Air sealing	Yes	Recommendations included
Insulate all hot surfaces	No	Already Exist
Insulate roof deck or attic	Yes	Recommendation included as part of planned roof replacement
Other		
Elevator motors and controls	No	Equipment is in good condition
Low-flow showerheads and sink aerators	Yes	Recommendations included
Thermostatic/smoke driven louvers and fans in elevator machine rooms and stairwells	Yes	Recommendations included

Recommendations for Energy Conservation

Upgrade Boilers and Heating Pumps (Measure #1)



The building currently has 7 Hydrotherm atmospheric gas boilers, which are inefficient by design with significant standby losses. Removing 7 of these boilers (which are currently piped together) and replacing them with two 87% efficient sealed combustion boilers, each sized to 70% of the building heating and domestic hot water load, will result in energy savings by both improving combustion efficiency and reducing standby losses, saving an estimated $7,500. These two new boilers can be integrated with the existing domestic hot water storage tank. The LAARS Rheos boiler is one example of a high performance sealed combustion boiler approved by the NYC DOB. The two boiler system will cover both heating and domestic hot water (DHW) loads, while providing sufficient temporary back up in case of failure with one boiler. During summer months, one boiler can be shut down, while the other boiler covers the entire DHW load.

When new boilers are installed, a new heating system control with an outdoor temperature control reset and night setback should be part of the new system. The current heating system configuration is inflexible in that it does not allow for night setback. A new control with an outdoor temperature control reset will have the ability to run different water temperatures to the apartments.

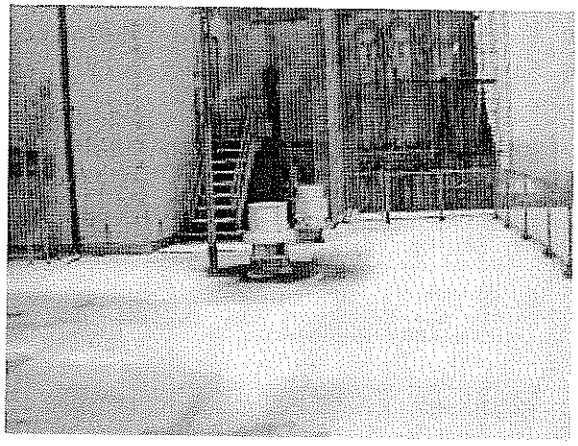
Employing a night setback control will allow for the possibility of further reduce heating energy usage by 12%. Typically, SWA recommends maintaining a 75 – 78 degree maximum temperature in winter with an eight hour 10 degree night setback. For example, with an updated control, the building could reduce the temperature between 65 and 75°F from 10pm to 6am and still be within code. At the same time, SWA recognizes that the senior tenants at XXXXXXXXXX may be particularly sensitive to space temperature control. For this reason, SWA recommends lowering thermostat setpoints gradually over time. Also, note that installing thermostatic radiator valves (TRVs) in all apartments (ECM 4) will improve the ability of tenants to control the temperature in their apartments and minimize issues associated with a central boiler setback control.

Variable Frequency Drives should also be installed on the heating pumps as part of the boiler upgrade.

Replace hot water maker (Measure #2)

The existing Duramax hot water maker is near the end of its useful life. As stated above, installing two boilers will provide the building with all domestic hot water needs while providing back up for heating.

Increase roof insulation (Measure #3)



The existing roof surface is near the end of its useful life. SWA recommends insulating the roof when it is resurfaced. This can be achieved with rigid foam poly-isocyanurate insulation boards installed on top of the roof deck, thickness should achieve R-37. SWA recommends an Energy Star rated "cool" roof membrane to minimize temperature cycling of the roof surface and enhance durability. Note that arrangements must be made to temporarily remove the communications equipment installed on the roof prior to the roof work. The Cool Roofs Rating Council provides a database of manufacturers of cool roof products www.coolroofs.org/.

Install Thermostatic Radiator Valves (TRVs) in all apartment units (Measure #4)

TRVs will enable residents to control room temperature ($200/TRV installation). Installing the controls in an easily accessible location would encourage residents to utilize the controls and maintain comfortable temperatures in apartment units without opening and closing windows, which is difficult for many of the elderly residents and increases the stack effect in the building. SWA recommends a TRV with a remote thermostat such as the Honeywell T104C1036. The building manager was wary of the tenants comfort level with any high tech digital control interfaces. For this reason, and to reduce the installed cost of the measure SWA recommends a TRV with a simple dial T-stat instead of an electronic Thermostat with zone valve that requires an electrical connection. More information on Honeywell TRV products is available at: http://customer.honeywell.com/honeywell/ProductInfo.aspx/T104C1036

Reduce common area lighting (Measure #5)

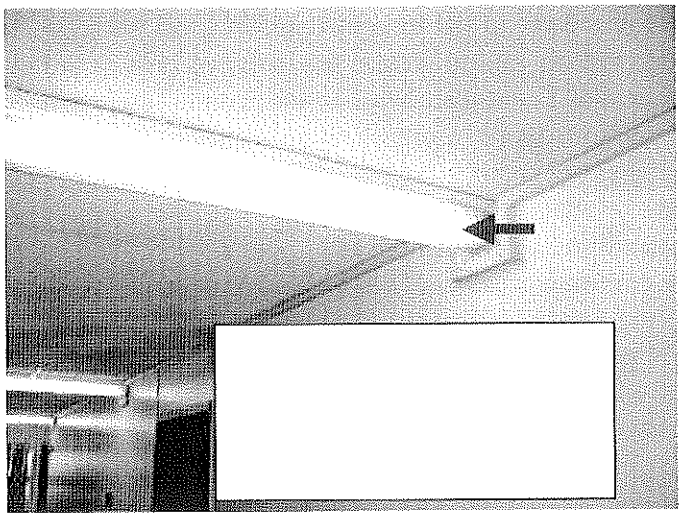
Nearly all of the common areas wall sconces have been converted to CFLs, which is an excellent first step in creating a more efficient lighting plan. For further improvement, SWA recommends installing bi-level occupancy sensor lighting in stairwells and 2nd through 9th floor overhead corridor lighting. SWA also recommends installing occupancy sensors to completely turn off lighting in laundry, boiler, mechanical equipment and community rooms.

Installing bi-level occupancy sensors in the stairwells will significantly reduce energy consumption (especially in a senior building such as XXXXXXXXXX). When any of the sensors detects movement in the stairwell, the lights will come on to full output, and remain on full power for the pre-set time interval. For example, the LAMAR Voyager Occu-Smart Fixture incorporates a dimmable ballast and occupancy sensor, resulting in a 20 second delay after motion is no longer detected at which point the lights will revert to 8 percent of the full light output. More information on a successful stairwell bi-level lighting case study can be found at: www.archenergy.com/lrp/products/brochures/deliverable_6.2.5_CaseStudy_5.1.pdf

At XXXXXXXXXX, stairwell lighting is provided at each floor and at intermediate landings. Additional capital and operating cost savings may be achieved by eliminating the intermediate landing stairwell lighting altogether (and replacing the other T12 stairwell lighting fixtures with

T8 LAMAR Voyager or equivalent bi-level fixtures). In addition to providing *more* lighting at full output than the existing stairwell fixtures, the LAMAR Voyager fixtures are also designed to provide a better distribution of lighting – "throwing" light further down the open stairwells, allowing for lighting needs to be met with only one fixture per floor. On June 20, 2007 SWA visited the building with a representative from LAMAR lighting and determined that this configuration was potentially feasible. As a next step before the implementation of this recommendation, SWA recommends conducting a simple study, unscrewing the existing landing bulbs to get a better sense of light distribution in the stairwells. Either SWA or a representative from LAMAR lighting could provide this evaluation service. For egress spaces (such as stairwells and corridors) NYC code for new construction or major gut rehabs requires light levels of 10 foot candles (a measure of luminance) during periods of occupancy and 2 foot candles at all other times. Implementation costs and operating cost savings for this ECM are based on eliminating stairwell landing fixtures.

In corridors, SWA recommends replacing the existing T12 linear fluorescent with LAMAR Cordelia fixtures (T8 lamps with integral dimmable ballast and occupancy sensor). Wiring for these fixtures is provided through a side end cap and is therefore very compatible with the existing wiring configuration, allowing for a true "drop-in" replacement. Since the proposed new T8 Cordelia fixtures will provide *more* lighting at full output than the existing lamps, as with the stairwell lighting, there is also the possibility of eliminating some of the ceiling fixtures. This possibility should be evaluated prior to implementation (by either SWA or the lighting rep.). Implementation costs and operating cost savings for this ECM are *not* based on eliminating any corridor fixtures.



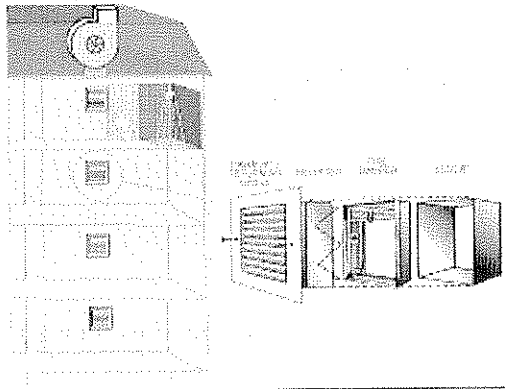
SWA recommends installing add-on occupancy sensor controls on the lighting for community, laundry, boiler and equipment rooms. The WattStopper Intelliswitch is one example of an occupancy sensor that can be easily integrated in place of a light switch. www.energyfederation.org/consumer/default.php/cPath/39_898_771. This simple change could result in the following lighting electricity savings:

- Offices → 13% - 50% lighting electricity savings
- Restrooms → 30% - 90% lighting electricity savings
- Storage areas → 45% - 80% lighting electricity savings

SWA also recommends changing the remaining incandescent exit signs in the basement to LED.

Replace Common Area Clothes Washers with High Performance Models (Measure #8)
The four common area clothes washers should be replaced with front loading Energy Star models with a Modified Energy Factor (MEF) greater than 2.1. Energy savings will be realized both by a reduction in electricity and in hot water required. Such a change typically does not require a capital investment but can be implemented by changing the lease on the equipment. Energy savings associated with this measure can be most accurately calculated if the leasing company provides SWA with information regarding the total amount of money collected from the machines on an annual basis (to be correlated with number of washes per year).

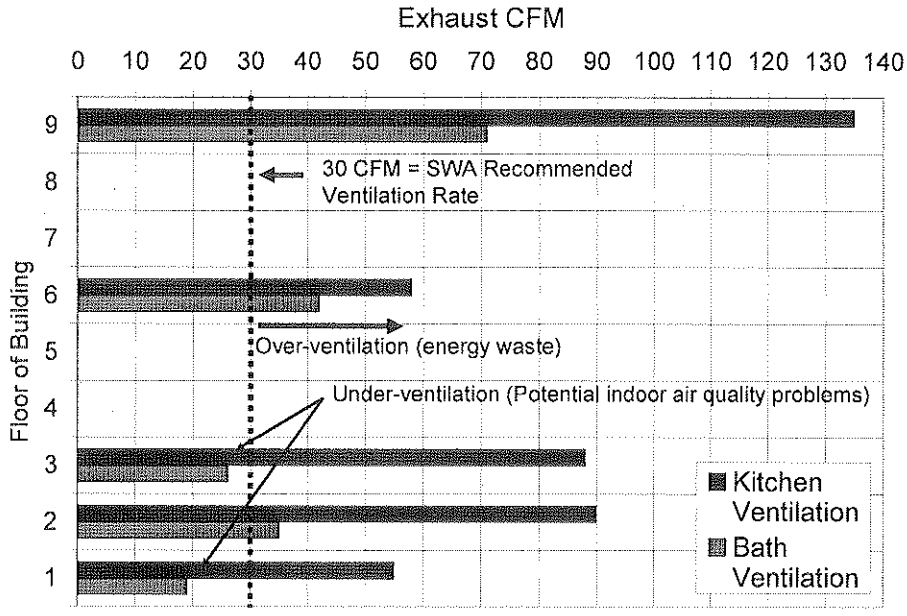
Improve Ventilation System Energy and Indoor Air Quality Performance (Measure #7)
SWA evaluated the kitchen and bathroom exhaust ventilation system performance in the "F" line of apartments at the building. Results indicate that exhaust ventilation rates at each floor are significantly out of balance with extreme over-ventilation at many floors combined with under-ventilation on other floors. The resulting performance results in a worst case scenario for energy efficiency and indoor air quality. In SWA's experience, this performance is very typical with central exhaust systems in multifamily buildings since codes do not require the actual field performance



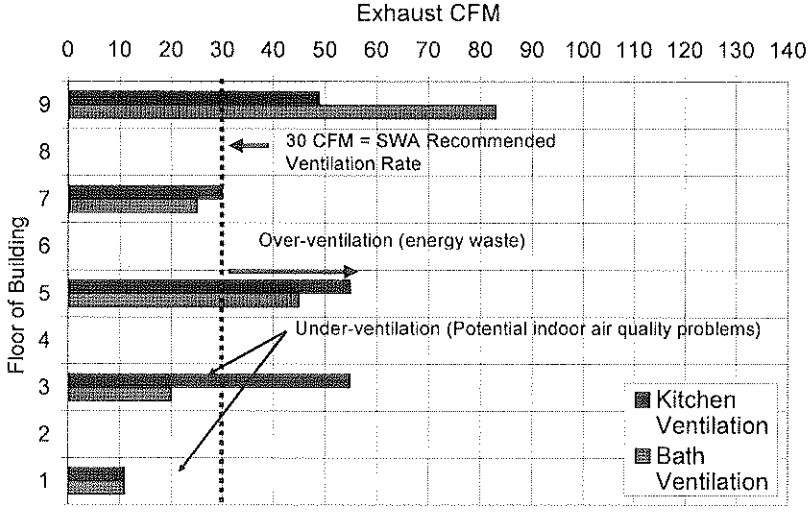
Central Exhaust Ventilation System

According to building plans, XXXXXXXXXX was designed for 40 Cubic Feet Per Minute (CFM) continuous exhaust ventilation in bathrooms and 120 CFM continuous exhaust ventilation in kitchen. Measured kitchen and bathroom exhaust ventilation rates are presented in the chart below for 5 apartments in the "A" line. New NYC minimum continuous ventilation requirements are 20 CFM in bathrooms and 25 CFM in kitchens. As a best practice for optimal energy and air quality performance, SWA recommends a continuous exhaust ventilation rate of 30 CFM for kitchens and 30 CFM for bathrooms. The measurements below indicate that there is a potential to significantly reduce energy waste by lowering ventilation rates in many cases, especially in upper floor kitchens. In addition, there are certain cases (especially lower floor bathrooms) that were found to be under-ventilated. Indoor air quality would be improved by increasing ventilation rates in these units to 30 CFM.

Measured Ventilation Rates in the "A" Line at XXXXXXXXXX



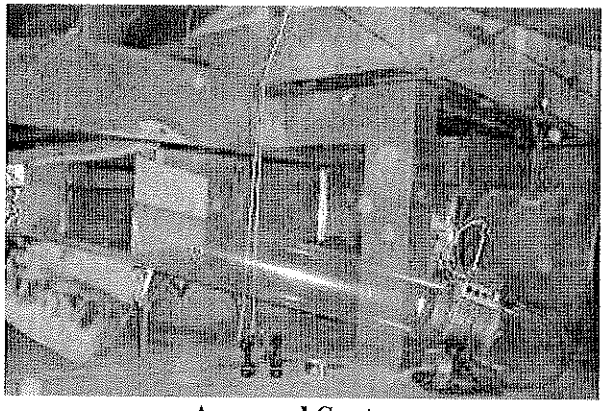
New Measured Ventilation Rates in the "L" Line at XXXXXXXXXX



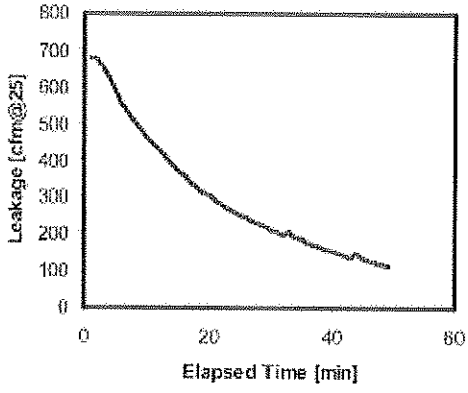
SWA recommends improving the apartment ventilation systems at XXXXXXXXXX so that 30 CFM is continuously exhausted from each kitchen and bathroom. New higher efficiency roof fans should also be installed. Achieving such precise control over the exhaust ventilation rates with a central ventilation system requires:

- **A tightly sealed exhaust shaft**. A tight shaft is critical to ensuring that the suction pressure at each floor is the same. With leaky shafts, there is excessive pressure drop between the top and bottom of the shaft, resulting in less airflow at lower floors and more airflow at upper floors.
- **A means of regulating airflow at each floor in response to changing environmental conditions.** Apartment pressures are constantly fluctuating due to wind and the "stack" effect. Truly balancing a central ventilation system from floor to floor and from season to season requires an active mechanism for maintaining a constant ventilation rate over a wide range of conditions.

SWA recommends sealing the exhaust ventilation risers at XXXXXXXXXX using Carrier's Aeroseal technology. To date, Aeroseal has been successfully used to seal supply and return duct leakage in over 20,000 homes and over 400 non-residential buildings. Aeroseal works by sealing holes from the inside with a polymer based sealing agent that is forced into duct systems at high pressure. The sealing agent does not coat the ducts, remains rubbery over time and lasts for 15 years. By effectively sealing all holes up to 3/8" extensive field testing of the system has demonstrated that it can be used to seal 80% - 90% of existing duct leakage. The Aeroseal system is the only commercially available technology that can be used to seal in existing buildings. At XXXXXXXXXX, the sealant would be blown into the top of the ventilation riser shaft at the roof. Apartment exhaust grilles at each floor would then be temporarily taped and the sealant agent would then be used to plug all unintentional leakage locations. The fan used to introduce the sealant into the duct system is also used to measure the duct leakage reduction in real time during the Aerosealing process with an output to a laptop for automatic documentation. The graph below presents the leakage reductions achieved during Aerosealing in a commercial office building. Typically, 800 to 1300 CFM of duct leaks can be sealed in one hour.

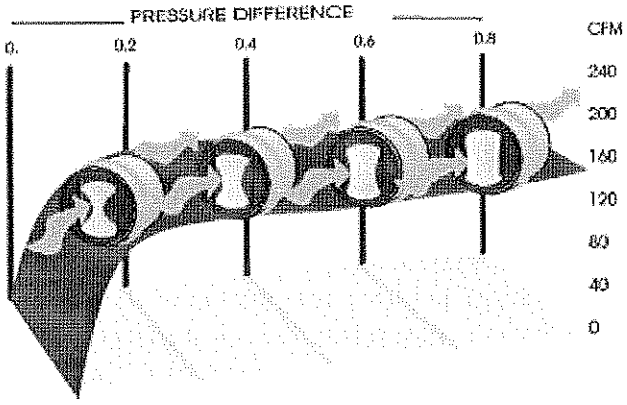


Aeroseal System

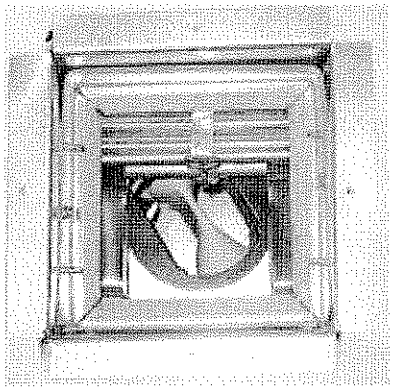


Leakage Reduction During Aerosealing

SWA Recommends retrofitting ALDES Constant Air Regulator (CAR) dampers behind each bathroom and kitchen exhaust grille at XXXXXXXXXX. This simple product incorporates a silicon bladder mechanism that expands as the pressure drop across the damper increases. This design results in a constant airflow rate over a wide range of pressure differences across the damper. These performance characteristics allow for dynamic control of exhaust airflow even as apartment pressures fluctuate significantly due to wind or stack effect. Since CAR dampers are factory calibrated for a particular airflow rate (i.e. 30 CFM) they require no manual balancing during installation and are maintenance free. At XXXXXXXXXX, these dampers could be used to precisely "dial into" the desired ventilation rate for each space.



Aldes CAR Damper: Airflow vs. Pressure Difference



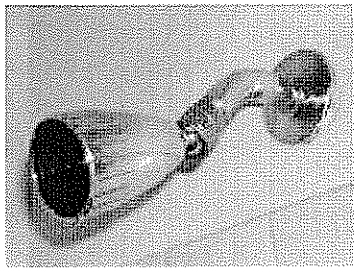
CAR Damper Installed (Exhaust Grille Removed)

The design ventilation rates for the 6 bathroom exhaust fans and 10 kitchen exhaust fans at XXXXXXXXXX are presented below along with SWA recommendations for ventilation rates and corresponding CFM reductions.

XXXXXXXXXX Roof Ventilation Rates: Design CFM and Recommended CFM

Fan	Space Served	Total Fan Design CFM	# of baths or kitchens served by fan	SWA Recommended Total Fan CFM @ 30 CFM per kitchen or bath	Fan Ventilation CFM Reduction
TEF 1	bathroom	720	18	540	180
TEF4	bathroom	720	18	540	180
TEF 5	bathroom	720	18	540	180
TEF 6	bathroom	720	18	540	180
TEF 2	bathroom	1,120	28	840	280
TEF 3	bathroom	360	9	270	90
KEF 1	kitchen	1,080	9	270	810
KEF 5	kitchen	1,080	9	270	810
KEF 10	kitchen	1,080	9	270	810
KEF 2	kitchen	2,160	18	540	1,620
KEF 8	kitchen	2,160	18	540	1,620
KEF 3	kitchen	120	1	30	90
KEF 7	kitchen	120	1	30	90
KEF 4	kitchen	960	8	240	720
KEF 6	kitchen	960	8	240	720
KEF 9	kitchen	2,280	19	570	1,710
Total		16,360	209	6,270	10,090

Install low flow shower heads, faucet aerators and toilets – where not already installed (Measure #8)



More efficient water consuming devices will save energy through reduced gas consumption for water heating and will save money by reducing the water and sewer bills. Most importantly, faucets and showerheads should be converted to low flow devices, but residents may choose to upgrade other apartment appliances as well. Fixtures that use water and may be improved include:

- Faucets (max 1.5 GPM in bathrooms, max 2.5 GPM in kitchen)
- Showers (max 2.5 Gallons per minute)
- Dishwashers (EnergyStar®)
- Toilets (max 1.6 Gallons per flush)

NOTE: EnergyStar® labeled equipment is rated as using less hot water and electricity. Most manufacturers offer EnergyStar products. More information can be found at www.energystar.gov.

SWAs testing of showerheads in apartment units showed that several units are already using 1.5 gallons per minute (gpm) showerheads. It is recommended that all future showerhead replacements continue to adhere to this high standard. Sink aerators should be replaced with 0.5gpm aerators in all bathroom sinks. SWA is willing to work with the building to select appropriate equipment and test it in a few apartments. The Niagra EARTH 1.5 GPM showehead is one example of a product that has been favorably reviewed by end users. Additionally, there are a few low flow handheld (wand-type) showerheads, which may be of interest to the residents. Two options (neither of which we can personally endorse) include:

Ultra Oxygenics Hand-Held Showerhead
http://www.gaiam.com/retail/product/01-0452?HCR=OTC-booyahfeeds&site_id=boofd_nexttag_01-0452&Atlas=True&gcid=C18376x020&keyword=01-0452

GS North America Comfort Hand Shower On Bar - 2360
http://www.qualitybath.com/product~name~GS+North+America+2360~ID~13135.htm

Also, Niagara sells a 2.0 wand showerhead that is not shown on their web site but can be ordered from the company.

Window Replacement (Measure #9)
Replace windows with accessible windows that tenants can open and close independently. Window specifications should be for double-paned windows with low-e glazing.

Whole Building Air Sealing (Measure #10)
Uncontrolled airflow through buildings (infiltration) is a major source of heat loss during the winter. SWA recommends sealing unintentional holes throughout the building to reduce infiltration. Infiltration is driven both by wind and the "chimney" effect (warm air naturally rises through the building, existing at the top and drawing cold air in at the bottom). In typical multifamily buildings, heat loss due to infiltration is roughly comparable to the combined impacts of heat loss through wall, window and roof surfaces! Reducing cold drafts will compliment energy savings possible with Measure #1 (improved heating system controls) since tenant comfort is dependent on both apartment temperature and draft control. For instance in a drafty apartment, a tenant may require a space temperature of 78 °F to feel comfortable, while in a non-drafty apartment that same tenant may feel comfortable at 75 °F. In addition, reducing the uncontrolled movement of air through a building minimizes the transfer smells, pollutants, noise, pests and smoke between units. These non-energy benefits will result in both improved quality of life and life safety (reducing pathways for smoke movement will improve fire performance). From an energy standpoint, reducing holes between units (even if they are not directly to the outside) is critical to effectively "compartmentalizing"

apartments and minimizing the vertical movement of air through the building resulting from the chimney effect.

The majority of air sealing can be accomplished using backer rod and one-component low expansion poly urethane foam, silicone, or siliconized acrylic caulk. Siliconized Caulk should be used when the area will be left exposed and painting will occur. For weather-stripping doors SWA recommends using a product with a rigid carrier, or fastener, for durability as opposed to a rolled peel and stick product which tends to fail soon after installation. The carriers come in wood, plastic and steel for different aesthetics and levels of durability. These can be found at Energy Federation Incorporated:

http://www.energyfederation.org/consumer/default.php/cPath/21_391

Fully cataloguing all the opportunities for air sealing at the building is a separate audit in and of itself. For this reason, SWA recommends soliciting an air sealing scope of work and bid a qualified air-sealing contractor. Air sealing may need to be coordinated with (repairing existing windows #9) and (Measure #3 (roof resurfacing and insulation).

SWA can review an air-sealing scope along with projected energy savings and update the energy model accordingly. For now, SWA has conservatively estimated that best practice air-sealing can reduce building infiltration by 20%. A best practice air sealing scope of work for any Multifamily building should include:

- Sealing the Top of the Building (seal roof/wall intersection, weather-strip roof doors)
- Sealing the Bottom of the Building (weather-strip ground floor doors, seal pipe, cable and other service penetrations)
- Sealing Vertical Shafts (weather-strip stairwell fire doors at each floor, seal garbage chute perimeter and access hatches, install motorized dampers connected to smoke detectors in stairwell vents so that these vents are closed unless there is a fire).
- Sealing Outside Walls and Openings (seal behind baseboard heaters and A/C sleeves).
- Compartmentalizing Service Areas and Apartments (seal plumbing, electrical, cable and other wall, floor and ceiling penetrations)

Upgrade Apartment lighting (Measure #11)

Compact Fluorescent Lights are now available in various shapes, sizes, and wattages. Permanent lighting fixtures for CFLs have been tested in some apartment entryways and one bathroom vanity. Installing permanent fixtures ensures that CFLs will continue to be used and not replaced with incandescent bulbs.

Alternatively, if installing the permanent fixtures is not feasible at this time, residents should install EnergyStar® labeled compact fluorescent lighting (CFL) wherever possible. This practice can cut electricity usage by up to two thirds. CFLs can be purchased in a screw-in model that can be installed directly into any fixture that takes incandescent lights. See Appendix B for more information about electricity reduction and CFL bulbs.

In the case that XXXXXXXXXX Avenue does not elect to install permanent CFL fixtures, residents could be encouraged to use CFLs if the superintendent maintained a stock of bulbs for residents to purchase at reduced cost. This would result in reduced maintenance time for the superintendant since the bulbs would be required to be changed much less frequently.

The foyer and bathroom incandescent fixtures should be replaced with high efficiency CFL lighting. A fixture that houses two 2 Pin 18W CFL should produce adequate light for each space. Some times there is concern that tenants would not want the upgrade because the bulbs are more expensive upfront. Below is a table that demonstrates the expected tenant savings from the lighting upgrade, based on the average electricity rate of $0.22.

Potential Tenant Annual Savings from Lighting Upgrade

Current Annual Lighting kWh	Current Annual Lighting Bill	Proposed Annual Lighting kWh	Proposed Annual Lighting Bill	**Annual Savings**
675	$148	307	$67	**$81**

Replace Apartment Refrigerators with Energy Star Models (Measure #12)

Most of the refrigerators surveyed by SWA (in a limited sample of apartments) are good candidates to be upgraded with new Energy Star models. Electricity savings for this measure will accrue to residents. SWA has conservatively estimated the potential for energy savings associated with replacing all 98 refrigerators in the apartments with new Energy Star models. These energy saving calculations can be updated if the building management can provide SWA with records of recent refrigerator replacement (including model #).

Table 7. Detailed List of Recommended Measures for XXXXXXXXXX Ave. for ERP.

	Measure	Installed Cost (incl. design)	Energy Savings		Demand Savings	Water/ Sewer Savings	O&M Savings	Cost Savings	Payback	S.I.R.	Life Cycle Savings	Years for LCC
			MMBtu	kWh	kW	1000 gals	$	$	years		$	years
Measures to be undertakend by buildings - savings accrue to building												
1	Replace Boilers	$66,000	328	4,000	0.0	0.0	$0	$5,640	11.70	1.49	$32,211	25
2	Replace HW Maker	$20,000	110	0	0.0	0.0	$0	$1,650	12.12	1.44	$8,732	25
3	Install Roof Insulation	$15,064	67	0	0.0	0.0	$0	$1,005	14.99	1.16	$2,436	25
4	Install TRVs	$39,600	397	0	0.0	0.0	$0	$5,955	6.65	1.80	$31,491	15
5	Reduce Common Area Lighting	$39,900	0	70,000	8.0	0.0	$0	$12,600	3.17	3.77	$110,518	15
6	Upgrade Clothes Washers	$1,000	52	0	0.0	0.0	$0	$781	1.28	8.82	$7,818	14
7	Upgrade Ventilation	$86,726	1,092	44,000	0.0	0.0	$0	$24,298	3.57	4.88	$336,374	25
8	Install Low Flow Fixtures	$2,970	413	0	0.0	1,000.0	$0	$6,192	0.48	12.99	$35,610	7
9	Window Replacement	$73,919	283	0	0.0	0.0	$0	$4,245	17.41	1.00	$0	25
10	Whole Building Air Sealing	$53,360	226	0	0.0	0.0	$0	$3,388	15.75	0.68	-$17,333	13
Measures to be undertaken by buiding - savings accrue to tenants												
11	Upgrade Apartment Lighting	$39,600	0	17,500	1.6	0.0	$0	$3,150	12.57	0.79	-$8,245	12
12	Replace Refrigerators	$22,500	0	16,000	1.6	0.0	$0	$2,880	7.81	1.53	$11,881	15
13	Measure #13	$0	0	0	0.0	0.0	$0	$0	#DIV/0!	#DIV/0!	$0	0
14	Measure #14	$0	0	0	0.0	0.0	$0	$0	#DIV/0!	#DIV/0!	$0	0
15	Measure #15	$0	0	0	0.0	0.0	$0	$0	#DIV/0!	#DIV/0!	$0	0
Measures with no energy savings												
16	Measure #16	$0									$0	0
17	Measure #17	$0									$0	0
18	Measure #18	$0									$0	0
19	Measure #19	$0									$0	0
20	Measure #20	$0									$0	0
Total for Improvements		$460,639	2,968	151,500	11.2	1,000	$0	$71,783			$551,493	
CM Fees		$0	*Overall project management. all fees associated with specific measures should be noted above.*									
Partner Fees		$0										
TOTALS		**$460,639**	**2,968**	**151,500**	**11.2**			**$71,783**			**$551,493**	

Health and Safety Options

The following list of measures represents the entire list of health, safety, comfort, repair, code compliance, and other non-energy opportunities evaluated for this project.

Measure	Evaluated (yes/no)	Comments
Health and Safety		
Asbestos mitigation as part of boiler and distribution system repair	No.	None was observed.
Carbon monoxide detectors (unless all-electric)	Yes	Already Exist
Emergency battery-powered lighting in common stairways and hallways	Yes	Recommendation Included in lighting upgrade
Installation and/or repair of mechanical ventilation	Yes	Recommendation Included as part of ventilation
Lead paint mitigation during window replacement	Yes	Not Applicable. Building built after 1980.
Seasonal dehumidification	No	Already Exists
Repair of roof and water flashings	Yes	Will be coordinated with roof and air sealing scope.
Replacement and/or repair of combustion vents	No	Not necessary
Smoke detectors	Yes	Already Exists
Ventilation cleaning and repair to ensure air quality	Yes	Recommendation Included as part of ventilation upgrade

Management and Education Options

Management and Education		
Question	Answer	Recommendation
(1) Is the building staff trained on energy efficiency issues?	No	SWA recommends participating in a Building Operator Training Seminar.
(2) Does the building have a formal, written preventive maintenance schedule?	Yes	No Comment
(3) Does the building management and/or staff maintain consumption records	Yes	No Comment

of the building?		
(4) Is there an incentive program in place for residents and/or building staff to encourage energy efficient behavior or identification of savings opportunities?	No	SWA recommends starting an incentive program in place for residents and/or building staff to encourage energy efficient behavior or identification of savings opportunities.
(5) Are the residents generally aware of the benefits of energy efficiency and what can be done to reduce their consumption?	No	SWA recommends teaching residents the benefits of energy efficiency and what can be done to reduce their consumption.

The building staff has not been specifically trained on energy efficiency issues, however, the buildings comply with formal, written preventive maintenance schedules. The management staff does not closely monitor fuel consumption records for the buildings.

SWA recommends developing on-going training opportunities for employees and tenants. Develop laminated tenant pages with apartment unit operation instructions and information on topics such as proper use of fan coil units, prevention of mold issues, green cleaning products, general energy saving tips, etc. The pages should be stored in kitchen cabinets for tenants to refer to; this approach will help residents become and remain aware of the benefits of energy efficiency and what can be done to reduce their consumption. Due in part to the fact that this is a direct-metered building, tenants would benefit from increased educational opportunities to increase their personal energy efficiency.

Operator Training & Certification

Operator Training and Certification is available to the building staff, management, owners, board members, or other appropriate persons of projects participating in the NYSERDA Program. Training is provided by NYSERDA-approved training organizations as indicated on www.getenergysmart.org. Certification is offered by the Building Performance Institute through its ***Multifamily Building Operator*** certification. Projects are eligible for the incentives indicated below for all participants related to the Project that successfully attend the training and certification. NYSERDA's Building Operator Training & Certification incentive is payable upon receipt of training completion certificate for each attendee for up to $1,500 / attendee.

SWA suggests that management and maintenance staff participate in the above mentioned EEBO training. SWA can tailor the class to focus on the improvements specific to XXXXXXXXXX Apartments. Typically, it is also a good idea for accounting staff to take the class, as many good ideas for management and maintenance strategies can be revealed.

SECTION IV. PLAN IMPLEMENTATION AND SCHEDULES

Table 8. Phase Metrics

	Pre-Construction	Phase I		Phase II	
		Savings	Post-Construction	Savings	Post-Construction
Total Energy (MMBtu/yr)	**6,859**	**3,484**	**3,374**	**0**	**6,859**
Electricity (MMBtu/yr)	2,081	517	1,564		2,081
Fuel (MMBtu/yr)	4,778	2,968	1,810		4,778
Source Energy Use Intensity	158.72		95.9		0.0
Target Source EUI	127.0		Phase I Proportion of Target		Phase I & II Proportion
Difference	31.7				
Performance Target	***20%***		100%		100%
					Phase II Proportion
					0%

Table 9. Preliminary Construction Schedule

# (from Table 3)	Measure	Delivery Method	Design Required?	Regulatory Review Date	Agency	Estimated Construction Start	Estimated Completion Date
1	Replace Boilers	Contracted Bid	Y	NA	NA	Spring 2009	Summer 2009
2	Replace HW Maker	Contracted bid	Y	NA	NA	Spring 2009	Summer 2009
3	Install Roof Insulation	Contracted bid	Y	NA	NA	Summer 2009	Summer 2009
4	Install TRVs	Contracted bid	Y	NA	NA	Spring 2009	Summer 2009
5	Reduce Common Area Lighting	Contracted bid	N	NA	NA	Spring 2009	Fall 2009
6	Upgrade Clothes Washers	Contracted bid	N	NA	NA	Summer 2009	Summer 2009
7	Upgrade Ventilation	Contracted bid	Y	NA	NA	Spring 2009	Summer 2009
8	Install Low Flow Fixtures	In-house Labor	N	NA	NA	Spring 2009	Fall 2009
9	Window Replacement	Contracted bid	N	NA	NA	Spring 2009	Summer 2009
10	Whole Building Air Sealing	In-house Labor	N	NA	NA	Summer 2009	Fall 2009
11	Upgrade Apartment Lighting	Contracted bid	N	NA	NA	Spring 2009	Fall 2009
12	Replace Refrigerators	In-house Labor	N	NA	NA	Spring 2009	Fall 2009
13	Measure #13	Contracted bid	Y or N				
14	Measure #14	Contracted bid	Y or N				
15	Measure #15	Contracted bid	Y or N				
16	Measure #16	Contracted bid	Y or N				
17	Measure #17	Contracted bid	Y or N				
18	Measure #18	Contracted bid	Y or N				
19	Measure #19	Contracted bid	Y or N				
20	Measure #20	Contracted bid	Y or N				