# GREENER HOMES PILOT PROGRAM
## ENERGY REDUCTION PLAN

## Eastern Ave Apartments

**30 Eastern Ave**
**Concord New Hampshire 03301**

**Owner:** CATCH Neighborhood Housing
**Phone:** 603-225-8835
**Property Manager:** Gerald Walsh
**Audit Date:** May 26th, 2010
**Report Contracted by:** New Hampshire Housing Finance Authority
**Report Prepared by:** TRC Energy Services

**Report Date:** June 24th, 2010

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# TABLE OF CONTENTS



## TABLE OF FIGURES



## APPENDICIES

## EXECUTIVE SUMMARY

A comprehensive energy assessment that evaluated a suite of potential measures to achieve the facility's energy performance target and improve the health, safety, comfort, and security of its residents and staff was conducted at Eastern Avenue Apartments. The findings and recommendations of this assessment are detailed in Sections I and II. Based on this initial assessment, a scope of work has been proposed in consultation with the building ownership and management that will effectively achieve energy savings in Section II. The energy reduction summary metrics and the detailed list of recommended measures are presented in Tables 1 and 2.

This report contains an Energy Reduction Plan (ERP) which details specific steps to be taken by the ownership and management at Eastern Avenue Apartments to achieve estimated energy savings.

This facility was benchmarked against other Housing and Urban Development (HUD) buildings to evaluate and compare its current energy consumption relative to similar buildings in the U.S. in the Benchmarking database. The benchmarking results are presented in Table 3. Eastern Avenue Apartments achieved a benchmarking score of 68. This places Eastern Avenue Apartments in the 3rd quartile as compared with multi-family buildings nationwide. Eastern Avenue's reduction target is 28% of the building's current source energy.

**Table 1: Energy Reduction Plan Summary Metrics**

| | | | |
|---|---|---|---|
| **Total Investment:** | $49,537 | **Payback Period (years):** | 10.7 |
| **Annual Savings:** | $4,616 | **Savings to Investment Ratio:** | 1.26 |
| | 288 million Btu | **Net Life Cycle Savings:** | $13,092 |
| **Summer Peak** | 7,029 kWh | **Discounted at 3.0% over (yrs):** | 17.7 |
| **Demand Reduction:** | 6.2 kW | **Project Phased over:** | 1 years |
| **New Gas:** | 0 million Btu (New purchases for cogen, conversions) | | |
| **Electric Reduction:** | 11% | **Fuel Use Reduction:** | 37% |

## Table 2: Detailed List of Recommended Measures for Entire Project

| | Measure | Installed Cost (incl. design) | Annual Energy Savings | | Demand Savings | Annual Water/ Sewer Savings | Annual O&M Savings | Annual Cost Savings | Payback | S.I.R. | Life Cycle Savings | Years for LCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MMBtu | kWh | kW | 1000 gals | $ | $ | years | | $ | years |
| **Energy Savings Measures** | | | | | | | | | | | | |
| 1 | Infiltration Reduction & Window Replacement Single pane | $17,400 | 119 | 370 | 0.0 | 0.0 | $0 | $1,448 | 12.02 | 1.24 | $4,138 | 20 |
| 2 | Install Modulating Boiler and controls | $26,000 | 50 | 0 | 0.0 | 0.0 | $0 | $577 | 45.03 | 0.33 | -$17,411 | 20 |
| 3 | Replace Table lamp bulbs | $96 | -3 | 1,106 | 0.1 | 0.0 | $0 | $172 | 0.56 | 8.19 | $690 | 5 |
| 4 | Replace old Ceiling FIxtures | $480 | -1 | 412 | 0.0 | 0.0 | $0 | $63 | 7.59 | 1.96 | $461 | 20 |
| 5 | LED Exit Signs | $360 | -1 | 511 | 0.1 | 0.0 | $0 | $79 | 4.54 | 3.28 | $821 | 20 |
| 6 | Refrigerator Replacement | $3,000 | -10 | 4,635 | 6.0 | 0.0 | $0 | $725 | 4.14 | 3.46 | $7,380 | 19 |
| 7 | Energy Star Washers | $1 | 6 | 0 | 0.0 | 6.0 | $0 | $68 | 0.01 | 767.34 | $766 | 14 |
| 8 | Water Heater Replacement | $1,800 | 92 | -5 | 0.0 | 0.0 | $0 | $1,064 | 1.69 | 8.80 | $14,032 | 20 |
| 9 | Low Flow Device Installation | $400 | 36 | 0 | 0.0 | 96.0 | $0 | $420 | 0.95 | 6.54 | $2,216 | 7 |
| | | | | | | | | | | | | |
| **Heath & Safety Measures** | | | | | | | | | | | | |
| 10 | 0 | $0 | | | | | | | | | | |
| | | | | | | | | | | | | |
| | Total for Improvements | $49,537 | 288 | 7,029 | 6.2 | 102 | $0 | $4,616 | | | $13,092 | |
| | | | | | | | | | | | | |
| **TOTALS** | | **$49,537** | **288** | **7,029** | **6.2** | **102** | **$0** | **$4,616** | **10.73** | **1.26** | **$13,092** | |

**Notes:**

The SIR calculation uses a discount rate of 3% per annum. The individual measures in the package are meant to work together to deliver sustained, comprehensive energy savings, therefore certain measures may have a negative life cycle savings. Modeled price of Oil was $2.66 per gallon. Modeled price of Electricity was $0.139 per kWh, no energy cost escalation is factored into this formula.

The cost of replacement of the Energy Star washers is negligible because this equipment is owned by the Laundry Equipment Corporation of Manhester, NH.

**Table 3: Eastern Avenue Apartments Benchmarking Results**

**Building(s) Description**

Project Name: Eastern "optional entry"

5-digit Zip Code: 03301 *Not Sure?*

Mapping Location: *Concord, NH*

| 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 |
|---|---|---|---|---|
| 17,101 | 14 | | 100.0 | |

**Weather Description**

| | *Typical* | *Pre-Retrofit* | *Post-Retrofit* |
|---|---|---|---|
| Annual HDD: | 7554 | 7554 | |
| Annual CDD: | 328 | 328 | |

*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/Propane | Fuel Oil | District Steam | Electricity | Natl Gas/Propane | Fuel Oil | District Steam |
| *Units:* | MMBtu | Natl gas MMBtu | MMBtu | MMBtu | kWh | Natl gas therms | MMBtu | MMBtu |
| Energy | 212 | 628 | | | | | | |
| Cost ($) | 9,623 | 5,977 | | | | | | |
| 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: | 45.39 $/unit | 9.52 $/unit | $/unit | $/unit | $/unit | $/unit | $/unit | $/unit |

**Results**

| | *Pre-Retrofit* | | *Post-Retrofit* | |
|---|---|---|---|---|
| | Your Building | Average | Your Building | Average |
| Score Against Peers | 68 | 50 | | 50 |
| Building Site Energy Use (MMBtu/year) | 840 | NA | | NA |
| Building Source Energy Use (MMBtu/year) | 1,366 | 1,621 | | 1,366 |
| Site Energy Use Intensity (kBtu/ft2-year) | 49.1 | NA | | NA |
| Source Energy Use Intensity (kBtu/ft2-year) | 79.9 | 94.8 | | 79.9 |

Weather-normalized Percent Source Energy Use Reduction After Retrofit

**Design Assistant**

*Projected Annual Energy Consumption*

| | Electricity | Natl Gas/Propane | Fuel Oil | District Steam |
|---|---|---|---|---|
| *Units:* | MMBtu | Natl gas MMBtu | MMBtu | MMBtu |
| Energy | 188 | 340 | | |

| | |
|---|---|
| Projected Percent Source Energy Reduction | 28% |
| Projected Score Against Peers | 85 |
| Projected Building Site Energy Use (MMBtu/year) | 528 |
| Projected Building Source Energy Use (MMBtu/year) | 985 |
| Projected Site Energy Use Intensity (kBtu/ft2-year) | 30.9 |
| Projected Source Energy Use Intensity (kBtu/ft2-year) | 57.6 |

## SECTION I. EXISTING CONDITIONS

Eastern Avenue Apartments, located in Concord, New Hampshire, consists of 14 apartment units in one large building. The building is a two story above grade building with the rear basement fully exposed. Each unit does not have an exterior door with the exception of a few providing exterior access. Each apartment unit comprises a kitchen/dining area joined to the living room, bathroom and a single bedroom.

This complex, built in 1945, sits just off Rte 132, with the front of the building facing southwest. Eastern Avenue Apartments are located in a multi-family residential area not far from downtown, with a few other multi- story buildings surrounding it. There is nearly no shading provided except by the neighboring trees on the grounds. There are tall buildings nearby that provide additional wind shielding.

On May 26th, 2010, Multifamily Building Specialist Dan Ramage and Michael McQueeney of TRC visited the project site and preformed a detailed energy assessment of the property. On the day of the assessment, the temperature outside was in the high-80's with a clear sky. As part of the energy assessment, all of the apartment units were assessed and accounted for.

### BUILDING OWNERSHIP, MANAGEMENT, AND STAFFING

The building is owned by CATCH Neighborhood Housing, of Concord, NH. The facility maintenance is performed by Gerald Walsh of MB Management and his staff. Major repairs and capital improvement projects are sub-contracted.

### MANAGEMENT AND EDUCATION OPTIONS

The building staff appears to have a working knowledge of energy efficiency issues but no formal training was conducted. Though no written preventive maintenance schedules were evident, routine maintenance tasks are performed. Total utility expenses are recorded annually and consumption is gauged by cost. Currently, no incentive program is in place to encourage energy

efficient behavior by the staff and residents. Some residents appear to have only a rudimentary understanding of energy efficiency and its benefits.

## BUILDING OCCUPANCY

At the time of the site assessment, the facility was occupied mostly by seniors. With one resident per unit on average, Eastern Avenue Apartments totals about 20 tenants. All of the tenants are over the age of 55 and must qualify as low income for the local area to live at the complex.

## ENERGY SUPPLIERS, METERING, AND ELECTRICAL SYSTEMS

The facility has a common area electric meter and an individual electric meter for each apartment unit. Electricity is supplied by Unitil and the electrical systems appear to be in good condition.

Natural gas is master-metered**.** Natural gas is supplied by National Grid, which is used for space heating and domestic hot water (DHW) production.

During the twelve-month analysis period (April 2009 - March 2010), the facility's energy consumption was as follows:

| Utility | Consumption | Units | Cost | Blended Rate |
|---|---|---|---|---|
| Natural Gas | 6,281 | Therms | $7,267.40 | $1.16/therm |
| Electricity | 62,081 | kWh | $9,622.00 | $0.155/kWh |

Please note that the electricity consumption for all the apartment units was estimated using 250kWh/month as the average consumption. This average is weather normalized. TRC anticipates working with the Management Company and tenants to verify this assumption.

Domestic water and sewer services are provided by the City of Concord. Water saving measures will reflect savings on the water bills, as well as quantifiable savings will result from reduced hot water demand.

Please refer to Appendix A for detailed utility data usage and costs.

## ENVELOPE

The building walls have approximately three and a half inches of blown in cellulose insulation from an upgrade possibly installed by the local community action energy program. The ground floor is built on slab at grade level with 1" foam board, 2x4 wood framing, sheathing and a white clapboard exterior cladding. There is an existing walk-out basement at the rear of the building.

The average occupied apartment temperatures measured 72.5 degrees.

There are approximately 77 window openings present in the complex, majority being white vinyl replacement windows in good shape. They are double pane with no low/e coating. The lower level windows in the rear of the building are single pane with 6 over 6 individually glazed panes of glass and a few single pane glass small awning type windows. All single pane windows appeared to have loose fitting metal storms. The vinyl windows are in good condition with no evident seal failures. The mechanicals are intact and operate well.

There are a total of 12 steel insulated exterior doors to the complex and generally in good condition. Weather-stripping is present and intact on all doors.

All buildings have pitch roofs with medium to dark asphalt shingles. The roofing appeared to be in excellent condition.

A CDX wooden roof deck supports the roofing and is securely fastened to the roof trusses. Soffit and ridge vents supply roof ventilation along with two non-functioning thermostatically controlled gable end fans.

Interior attic access is via two full size steel insulated doors on the top floor. The attic space, revealed approximately 3" inches of rock-wool fiber under about 11 inches of blown cellulose insulation. After examining the attic flat it was apparent that many gaps around plumbing and electrical penetrations were not sealed prior to insulating. Wall to ceiling connections and open knee-wall spaces also need to be sealed.

## INFILTRATION

Infiltration to the apartments occurred through:

- minor cracks around windows
- units with missing drywall ceilings (above 2 x 4 drop down ceiling tiles)
- framing connections; base of walls and tops of interior walls
- electrical outlets installed on walls with interstitial space between them (infiltration occurs through the top plates of the wall)
- plumbing penetrations which are connected to the attic space

- around the kitchen exhaust fan ductwork
- knee-wall wall spaces on the attic side allowing air into the walls

When infiltration occurs, unfiltered air moves from unhygienic/unwanted areas into conditioned living spaces. This can negatively influence indoor air quality and health and safety.

| Measured Complex Blower Door Metrics | |
|---|---|
| Average Apartment Square Footage | 476 |
| Measured Blower Door Ranges (cfm/50) | 998 to1026 |
| Average ACH – natural | .79 to.87 |
| ASHRAE Standard (ACH) | .35 |
| Best Practices Recommendations | Tight as possible, while maintaining controlled mechanical ventilation |

Infiltration (in air changes per hour) at this facility is quite high and at least twice the ASHRAE standards. A great portion of the air leakage occurs due to the missing drywall ceilings that have been covered over with tiled drop down ceiling. Since air leakage in buildings can represent anywhere from 5% to 40% of the space-conditioning costs, it's important to control the infiltration while maintaining good ventilation. This will improve tenant comfort, reduce large temperature swings and will prevent ice dams.

## MECHANICAL SYSTEMS

### Space Heating

All mechanical equipment is in its own self contained area in the basement. Well McClain model # CGB-6 650,000 BTU water filled atmospheric boiler is used for space heating and runs a continuous loop to feed the apartments units. This boiler is greatly oversized at the building's current heating requirement. It lacks proper indoor /outdoor controls to operate the boiler. This boiler should be upgraded to an ENERGY STAR boiler, sized for the building's heating load and along with the appropriate boiler control system. This boiler does not provide

domestic hot water.

The apartments use hydronic baseboard with thermostatic valves controlled by wall-mounted, 3 wire, 24 volt mercury based dial thermostats. The average temperature in the apartments units and common spaces was 72.5 degrees on a day with outside temperature of 88 degrees. Combustion air is supplied through a large open louvered exterior vent through ductwork.

The following boiler combustion efficiency data was obtained on site:

| | **Boiler** | **DHW** | **DHW** |
|---|---|---|---|
| **Make** | Well McClain | AoSmith | AoSmith |
| **Model** | CGB-6 | N/A | N/A |
| **Year** | 1970 | 1970 | 1970 |
| **Size** | 650K BTU | 180K BTU | 180K BTU |
| **Fuel** | Natural Gas | Natural Gas | Natural Gas |
| **Building** | 1 | 1 | 1 |
| **Efficiency** | 83% | 70% | 70% |
| **CO (ppm)** | 11 | N/A | N/A |
| **Draft (pa)** | N/A | N/A | N/A |
| **Stack Temp (F)** | 670° | N/A | N/A |

Insulation was found on most but not all of the distribution pipes in the mechanical room.

## DOMESTIC HOT WATER

In the same mechanical room, two old 80- gallon natural gas independently fired atmospheric hot water storage tank provide DHW and these vent into the chimney. These tanks run a continuous loop with circulator pumps. Each tank rated at 180,000 Btus is oversized for the building's current DHW needs and are very inefficient compared to an indirect fired domestic hot water setup. The water temperature in the apartment units ranges between 125 to 130 degrees. All showerheads were 2.5 gallons per minute (GPM), all kitchen faucets were 2.2 GPM and bathroom faucet aerators were 2.0 GPM. Approximately half of the apartment toilets have been upgraded from 3.5gpf to 1.6gpf.

## VENTILATION

The ventilation system for the complex consists of both kitchen range hoods and bathroom exhaust fan light combinations. Each apartment is equipped with both of these fans. Bathroom exhaust fans were rated at an average of 80 cfm. The kitchen exhaust fans are rated at 170cfm and are functional.

However, upon inspecting each apartment unit; a few observations were made. Majority of bathroom exhaust fans have been replaced by low sone (noise) 80-110 cfm fans with a time delay switch. The time delay switch can also be a light switch. Upon turning the switch on, the lights and fan should both come on and when switched off the fan will continue to run for the allotted time period it was initially set up for, usually 10 minutes. This allows removal of excess moisture and odor.

It is important to do a routine exhaust fan grill cleaning to ensure efficient operation. Unit #5 had an older fan/light fixture with a missing lens cover while units #11 and #12 could use a exhaust fan grill cleaning.

Kitchen hoods operate on switches and according to some tenants, are used sparingly. All kitchen and bathroom exhaust fans appear to be vented to the outside; however, during any attic insulation upgrade this should be verified.

## LIGHTING

Each apartment has, on average, two ceiling fixtures and a bath/fan light combination. All apartment lighting operates on wall switches.

The apartment light fixtures were mainly fluorescent with twin biax bulbs, though some older incandescent fixtures are present in certain units as noted below. All units had around one to four table or floor lamps using incandescent light bulbs that should be upgraded to fluorescent.

Lighting in the residential common areas consists of flush mounted 4 foot T-8 fixtures, each containing two 32W T-8 with an advantium ballast using 62 watts each.

All laundry area lighting operates on wall switches. Exit signs contain 32W incandescent bulbs but of the four exit signs only one was operational (probably due to burnt out bulbs). We recommend an upgrade to LED exit signs for longevity and savings.

| Area or Unit # | Wattage | Needs Replace | # of Fixtures |
|---|---|---|---|
| Unit #1 | 120 | Yes | 1 |
| Unit #7 | 120 | Yes | 1 |
| Unit #9 | 120 | Yes | 1 |
| Unit #11 | 120 | Yes | 1 |

## LAUNDRY EQUIPMENT & APPLIANCES

The facility provides each tenant with a refrigerator and electric range. Other small appliances are found on most kitchen countertops. There are no dishwashers present. Most apartments have 14 or 15 cubic foot refrigerators that are approximately 1-5 years old. Manufacturers varied including Sears, Hotpoint, GE and Frigidaire. Six old refrigerators (1999) must be replaced. Please see spreadsheet in Appendix C.

Two sets of laundry equipment, used by the tenants, are located in the basement and owned by a private company. The equipment is coin-operated and not Energy Star rated, so its water usage is high and inefficient. No sign of corrosion or wear is present. The clothes dryers are properly vented outside. Although no coin-collection data was available,

based on maintenance staff interviews, a total of 20 loads per week were estimated for this equipment.

## ELEVATORS

There are no elevators in the building.

## HEALTH & SAFETY

There is a smoke detector present in each apartment unit. As none of the apartments contain fossil fuel-burning appliances, there is no need for carbon monoxide detectors. However, we recommend carbon monoxide detectors in the common areas.

No obvious safety hazards or concerns were observed at this facility.

## INDOOR AIR QUALITY

Currently the existing fans seem to be working sufficiently with a few minor exceptions as noted on the bath fan/refrigerator sheet. It looks as though the building may have participated in a weatherization program in the past that addressed bath fans and proper venting along with time delay controls which are all intact.

## OPERATION AND MAINTENANCE

We recommend developing a written O&M plan, so that a successor can gain historical insight into the building, its improvements and operation. Adopting O&M strategies helps efficient operation of expensive building equipment and systems and reduces risk of early equipment failure, unscheduled down time, utility costs and tenant losses.

This facility may already be following certain O&M practices. However, without written documentation, efficiently accounting for the returns is difficult. The following O&M practices can be performed on a regular basis:

- Cleaning A/C coils
- Clean and tune boilers
- Check window & door weather-strips and replace as required
- Clean bathroom exhaust fan units
- Clean refrigerator coils
- Drain sediment
- Clean DHW tanks
- Check DHW temperature settings
- Check for equipment corrosion

- Database of warranties and equipment documentation
- Schedule of cleanings/repair
- Record of completed tasks and location (apartment number)

There are a number of other resources that may help develop a property-specific O&M plan. Most of these plans suggest that around 5% to 20% can be saved on energy bills by adopting O&M programs that target energy efficiency. A few resources are included below:

- *Fifteen O&M Best Practices* made by The U.S. Environmental Protection Agency (EPA) in cooperation with the U.S. Department of Energy (DOE).
- http://www.scribd.com/doc/22358812/operation-and-maintenance-best-practices
- http://www.cmhc-schl.gc.ca/odpub/pdf/65893.pdf?lang=en - Energy and Water Tune-ups
- http://www.wbdg.org/om/om.php - Facilities Operations & Maintenance
- http://www.heritage.nsw.gov.au/docs/maintenance1-1_preparingplan.pdf - Preparing a Maintenance Plan

## MANAGEMENT & EDUCATION

### Resident Education Program & Materials

Recent studies show that changes in occupant behavior can account for a substantial percentage of energy savings with relatively little cost to the owners. Surveys indicate that as much as 69% of the participants in *Residential Education* classes have implemented at least some of the recommended practices, which had a direct impact on operating cost savings. Resident education programs can play a key role in helping deliver this type of information to tenants. At Eastern Avenue Apartments, owners pay energy bills, so tenant actions can have a significant influence on energy expenses. Consider a resident education / outreach program which may include awareness-meetings, display posters or even reward programs that encourage environmentally responsible behavior. Also, the introduction of green cleaning products will help promote good indoor air quality.

### Building Operator Training & Certification

Consider enrolling the maintenance staff in *Building Operator Training & Certification* classes. Such classes are available through several local, state and government organizations. Tying energy reduction goals to incentive compensation for the maintenance staff can have dramatic impacts on energy savings.

http://www.bpi.org/schedules training.aspx
http://www.eere.energy.gov/industry/bestpractices/training.html

## SECTION II. EVALUATED MEASURES

This section provides an overview of measures assessed for Eastern Avenue Apartments.

A TREAT model for Eastern Avenue Apartments was developed. TREAT compares modeled energy usage to actual energy usage with >90% reconciliation by end use for heat, hot water, base-load, and A/C. Existing conditions were assessed for all of the apartment units. All common areas, laundry areas and hallways were also assessed. Attic spaces and walls were explored to determine insulation condition and air sealing opportunities. Appliances, lighting, water, and shell features were examined and tested in the apartments. This includes measurement of water temperature and flow rates, appliance name plate data, examination of shell components, lighting levels and quantities, ambient temperatures and identification of health and safety concerns. The TREAT software model represents the entire building.

A comprehensive suite of potential energy reduction, health and safety, and education & management opportunities have been analyzed for this project. Appendix D includes a full list of commonly addressed measures and whether or not they apply to this project.

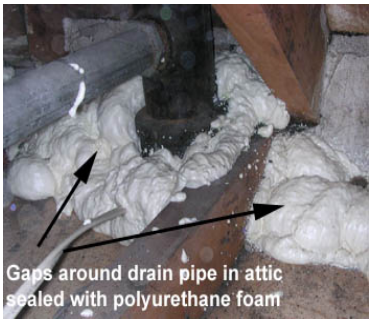
The analysis in this report was conducted using the TREAT building modeling software version 3.0.27. Based on this analysis, recommended energy efficiency measures are included in Table 2. They are also described in detail below.

### Measure #1: Infiltration Reduction & Window Replacement Single Pane

**Existing Conditions: Envelope & Window Replacement Single Pane**

**Envelope:**

Some general building construction details have not been air sealed, a few units are missing drywall above their 2’ x 4’ ceiling tiled ceiling. Overall, there is excessive air leakage into the building.




**Windows:**

Approximately 28 existing window openings are single-pane original wood-framed windows.

**Measure Description:**

- Reduce air infiltration into the building by use of expanding foam and transparent caulking to seal building penetrations such as: tops of interior walls in the attic, wall ceiling junctions in the attic, exposed plumbing pipe holes and chase ways both in attic and basement.
- Seal pipe holes under kitchen and bath sinks

- Seal missing drywall ceilings above acoustical tiled ceilings by taking down necessary 2x4 acoustical tiles and install 3/8" fan fold foam board above tiles so as to cause a solid air barrier to attic, sealing all edges and seams with expanding foam in units where applicable.

**Window Replacement:**

Replace existing quantity of (28) single pane wood windows in the heated basement area, with white vinyl Energy Star windows with low/e and argon or krypton gas and a U-value of .30 or less.

- Use 50 year caulking for the exterior and a minimum of a 30 year paintable caulking for the interior.
- Seal around all interior window trim upon installation of new windows. Seal around new window frame with minimal expansion foam before installing trim.
- Remove existing storm windows

**Important Assumptions:**

Estimated savings: $1,448/yr.
Estimated installed cost: $17,400
Simple payback: 12.02 years

**Measure #2: Install Modulating Boiler and Controls**

**Existing Conditions:** One oversized and tired boiler exists that is currently short cycling and has no controls to reduce excess fuel consumption and runtime.

**Measure Description:**

- Replace existing boiler with a modulating, 95% thermal efficiency or greater condensing boiler system according to plans and specifications provided by a design professional using standard methods such as ACCA manual J, or ASHRAE. The maximum input capacity of each new condensing boiler shall be sized to provide at least 60% of the estimated peak design heating load for the buildings that it serves
- The cost to develop a professional design-build and specify the improvement and its components and contractual work-scope should be included in overall cost. A professional mechanical engineer should review design
- Install new boiler controls to maximize boiler efficiency including an outdoor reset control
- Determine that the mechanical spaces are free of asbestos
- Replace the circulation pumps with "smart" variable speed pumps that can provide constant and /or proportional differential pressure to regulate the flow as the valves open and close, similar to the Wilo Stratos or Grundfos Magna

- Install boiler water treatment system and hydraulic separator to balance multiple circuits and reduce scale and dirt build-up in piping. Dirt and scale build-up in piping insulates the piping and results in more boiler combustion heat going up the chimney and reducing efficiency
- Install CO sensor in boiler room
- Seal off open combustion air duct with the new sealed combustion boiler system. The existing motorized air louvered vent into the boiler should remain inoperable until future summer heat in the mechanical room would warrant a need to provide outside air to the space
- Installer shall provide training to the owner or management staff to demonstrate proper use of the system and its applicable controls. Deliver the user's manual, including measurement reports, warranties, and approved submittals
- Installation must meet New Hampshire State Energy Conservation Construction Code

**Important Assumptions based on a stand-alone installed measure:**
Estimated savings: $577/yr
Estimated installed cost: $26,000
Simple payback: 45.03 years

**Measure #3: Replace Table Lamp Bulbs**

**Existing Conditions:**
There are inefficient incandescent bulbs installed

**Measure Description:**
Replace all existing incandescent floor and/or table lamp bulbs with new 20 watt fluorescent mini-spiral bulbs. The lumen ratio of current to new bulbs should ideally be 3:1. Example: (current 60 watt to be changed with a 20 watt)

Disposal of light bulbs off-site should be in compliance with state and local solid waste regulations, unless otherwise instructed by the owner.

**Important Assumptions:**
Estimated savings: $172/yr.
Estimated installed cost: $96
Simple payback: 0.56 years

## Measure #4: Replace Old Ceiling Fixtures in Units

**Existing Conditions:**
Inefficient light fixtures are installed in the units.

**Measure Description:**

- Replace all existing incandescent ceiling mounted fixtures within the units with a 2 to 1 ratio of wattage using pin based fluorescent fixtures. Glass domes should be either lightly frosted or spiral type for maximum light output.
- Measure and record existing light level with a hand held light meter held at the mid-point between lighting fixtures. If only one fixture is in the room, measure at the mid-point between the fixture and farthest wall. The meter should be held 30 inches above the floor.
- Submit product information and obtain owner approval prior to ordering.
- Dispose the light bulbs off-site in compliance with state and local solid waste regulations, unless otherwise instructed by the owner.

**Important Assumptions:**
Estimated savings: $63/yr
Estimated installed cost: $480
Simple payback: 7.59 years

## Measure #5: LED Exit Signs

**Existing Conditions:**
Inefficient incandescent exit signs in place that also require frequent bulb replacement due to short life expectancy.

**Measure Description:**
Replace all existing incandescent exit signs in the common hallways with new 3 watt LED exit signs

**Important Assumptions:**
Estimated savings: $79/yr
Estimated installed cost: $360
Simple payback: 4.54 years

## Measure #6: Refrigerator Replacement

**Existing Conditions:**
Six inefficient refrigerators are currently used. The operating conditions are poor resulting in high energy consumption.

**Measure Description:**
- Replace the six older model refrigerators with new, similarly-sized models rated at atleast 360kWh/year Energy Star refrigerators
- Ensure proper disposal of old refrigerators in accordance with the regulations
- Deliver all owner's manuals, and warranties to the owner.

**Important Assumptions:**
Estimated savings: $725/yr.
Estimated installed cost: $3,000
Simple payback: 4.14 years

## Measure #7: Energy Star Washers

**Existing Conditions**:
Two older inefficient washing machines are installed that consume excess water and require long dryer time for clothes drying

**Measure Description:**
- Accurate data on current usage should first be obtained from laundry revenue in order to accurately estimate the number of loads
- Replace the two existing clothes washing machines with new Energy Star models.

**Important Assumptions:**
Estimated savings: $68/yr
Estimated installed cost: negligible
Simple payback: N/A

## Measure #8: Water Heater Replacement

**Existing Conditions:**
Two old atmospheric type hot water heaters that are currently greatly oversized for the building's current hot water requirement

**Measure Description:**

- Disconnect and remove both existing hot water heaters and install a new indirect stainless steel tank in line with the boiler. New boiler to feed a new insulated stainless steel storage tank (indirect fired).
- Provide aquastat recirculation control between boiler and storage tanks. The Aquastat set point should be set at a temperature not higher than 130°
- Replace existing manual mixing valves with electronically controlled automatic mixing valves to ensure controlled and accurate delivery at the faucets within the temperature range of 120-125°. Ensure a storage tank temperature of 130° or per New Hampshire Mechanical Code
- Insulate the uninsulated DHW hot water pipes in the basement with 1" fiberglass insulation and according to New Hampshire State Energy Conservation Construction Code
- All work should be performed as per New Hampshire Building Code

**Important Assumptions:**
Estimated savings: $1,064/yr
Estimated installed cost: $1,800
Simple payback: 1.69 years

**Measure #9: Low Flow Devices**

**Existing Conditions:**
All showerheads averaged 2.5gpm, kitchen sink aerators were under 2.2gpm and bath aerators were 2.0gpm.

**Measure Description:**
Install 1.75 gallon per minute showerheads along with 1.0 gallon per minute bathroom aerators, 1.5gpm kitchen aerators that will increase the water pressure and lower water consumption. The kitchen aerator shall have the capability of jet stream or normal stream flow and also features an easy quick flip on/off feature that can be used for hand washing dishes. This will lower hot water usage and decrease fuel, water and sewer bills

In units where a handheld showerhead exists, replace with handheld shower unit using 1.75 gallons or less with built-in massage feature.

**Important Assumptions:**
Estimated savings: $420/yr
Estimated installed cost: $400
Simple payback: 0.95 year

## HEALTH & SAFETY ISSUES

**Bath fans:**
Concerns and notes on the existing bath fans, listed in Appendix C, should be investigated and addressed where necessary.

**Estimated Cost:** unknown

**Other Recommendations:**

In addition to the measures listed above, there are other improvements you can consider for your building.

**Solar Thermal:** Since this complex has centralized domestic hot water systems, the installation of solar thermal panels on the south facing roof could produce 30 to 60% of your hot water needs annually. This should be considered once the other equipment upgrades are in place.

**Green Cleaning Products:** The use of earth-friendly cleaning products provides better indoor air quality and environmental benefits. We highly recommend integrating green cleaning products into standard maintenance practices.

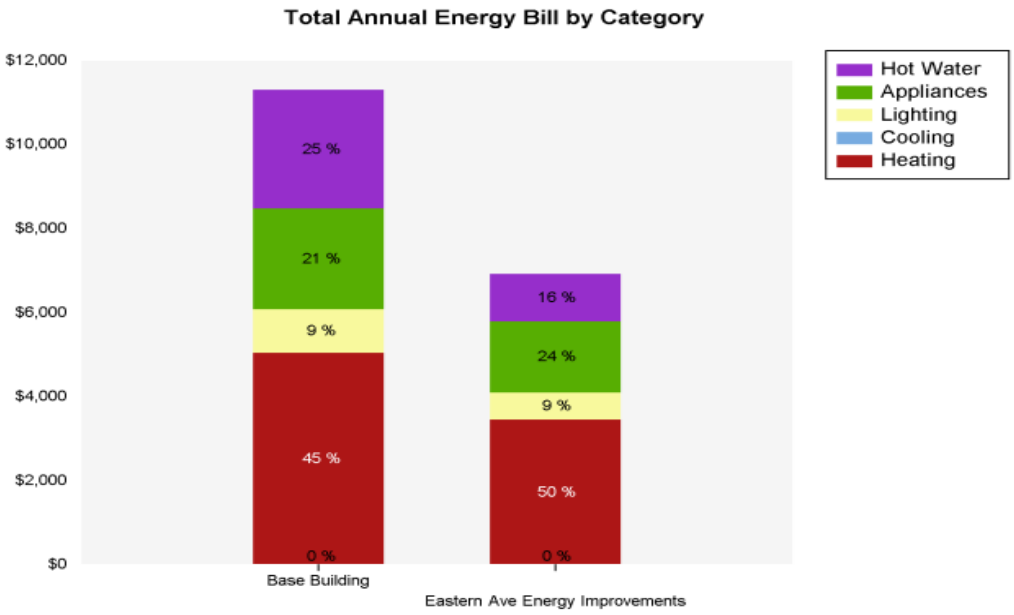
**Education and Awareness Programs:** Recent studies have shown that changes in occupant behavior can account for a substantial percentage of energy savings. Consider a resident education / outreach program which may include awareness-meetings, display posters or even reward programs that encourage environmentally responsible behavior.

**Solar (Photovoltaic) Panels:** Photovoltaic panels produce electricity. Since this facility has a single electric meter, consider installing solar panels to reduce electricity expense. Federal and State programs are available to help off-set the cost of installation.

**Operation and Maintenance Documentation:** A well documented O&M plan will ensure that efficient operation of expensive building systems and reduce the risk of early equipment failure.

**APPENDIX A**

Analysis of fuel and electricity bills




| | Base Building | Eastern Ave Energy Improvements | **Savings** |
|---|---|---|---|
| Heating | $5,043 | $3,445 | $1,598 |
| Cooling | $0 | $0 | $0 |
| Lighting | $1,032 | $654 | $379 |
| Appliances | $2,397 | $1,692 | $704 |
| Hot Water | $2,817 | $1,118 | $1,700 |
| Total | $11,290 | $6,908 | **$4,381** |

**Modeled Billing history**

| Start Month | End Month | Fuel Natural Gas Therms | Cost | | Electricity kWh | Costs |
|---|---|---|---|---|---|---|
| 3/25/2010 | 4/27/2010 | 649 | $833.45 | | 4278 | $663.09 |
| 2/24/2010 | 3/25/2010 | 803 | $982.92 | | 5116 | $792.98 |
| 1/27/2010 | 2/24/2010 | 974 | $1,132.71 | | 5293 | $820.42 |
| 12/29/2009 | 1/27/2010 | 1,159 | $1,355.41 | | 5507 | $853.59 |
| 11/25/2009 | 12/29/2009 | 684 | $839.88 | | 5117 | $793.14 |
| 10/28/2009 | 11/25/2009 | 430 | $434.11 | | 4844 | $750.82 |
| 9/28/2009 | 10/28/2009 | 284 | $257.37 | | 4781 | $741.06 |
| 8/27/2009 | 9/28/2009 | 151 | $158.07 | | 5611 | $869.71 |
| 7/29/2009 | 8/27/2009 | 177 | $188.48 | | 5946 | $921.63 |
| 6/26/2009 | 7/29/2009 | 200 | $208.11 | | 5844 | $905.82 |
| 5/27/2009 | 6/26/2009 | 297 | $310.55 | | 4724 | $732.22 |
| 4/28/2009 | 5/27/2009 | 473 | $566.40 | | 5020 | $778.10 |
| | Totals | 6,281 | $7,267.46 | | 62,081 | $9,622.56 |
| | MMBtu | 628 | | | 212 | |
| | Average Cost Per Unit | $1.16 | | | $0.155 | |
| | Total Combined MMBtu | | | 840 | | |

## Actual Bill History Electric

| Read Date | Read Type | Days | Average Daily kWh | Total Billed kWh | Metered Demand kW | Demand kVA | Demand kW | Load Factor | Price | Delivery Energy Amount | Supplier Charge Amount |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/25/2010 | Actual | 32 | 44 | 1,419 | 13.7 | | 13.7 | 13% | 0.10379 | $147.28 | $120.46 |
| 5/24/2010 | Actual | 27 | 46 | 1,239 | 13.9 | | 13.9 | 14% | 0.11728 | $145.31 | $106.18 |
| 4/17/2010 | Actual | 33 | 48 | 1,576 | 13.5 | | 13.5 | 15% | 0.05443 | $148.82 | $142.42 |
| 3/25/2010 | Actual | 29 | 51 | 1,478 | 12.9 | | 12.9 | 16% | 0.09626 | $142.08 | $133.39 |
| 2/24/2010 | Actual | 28 | 58 | 1,616 | 13.7 | | 13.7 | 18% | 0.09355 | $151.18 | $146.04 |
| 11/27/2010 | Actual | 29 | 62 | 1,793 | 14.1 | | 14.1 | 18% | 0.08803 | $157.04 | $162.03 |
| 12/29/2009 | Actual | 34 | 59 | 2.007 | 13.7 | | 13.7 | 16% | 0.07917 | $158.90 | $181.37 |
| 11/25/2009 | Actual | 28 | 58 | 1,617 | 13.4 | | 13.4 | 18% | 0.09204 | $148.82 | $145.15 |
| 10/28/2009 | Actual | 30 | 56 | 1,694 | 14.2 | | 14.2 | 17% | 0.09249 | $156.67 | $145.99 |
| 9/28/2009 | Actual | 32 | 51 | 1,631 | 13.2 | | 13.2 | 16% | 0.09045 | $147.53 | $140.56 |
| 8/27/2009 | Actual | 29 | 49 | 1.411 | 13.4 | | 13.4 | 15% | 0.1035 | $146.04 | $121.60 |
| 7/29/2009 | Actual | 33 | 53 | 1,746 | 13.8 | | 13.8 | 16% | 0.09618 | $167.93 | $150.47 |
| 6/26/2009 | Actual | 30 | 55 | 1,644 | 13.8 | | 13.8 | 17% | 0.10078 | $165.68 | $141.88 |
| 5/27/2009 | Actual | 29 | 54 | 1,574 | 13.6 | | 13.6 | 17% | 0.1032 | $162.44 | $139.91 |
| 4/28/2009 | Actual | 32 | 59 | 1,870 | 14.3 | | 14.3 | 17% | 0.09345 | $175.03 | $210.51 |
| 3/27/2009 | Actual | 30 | 82 | 2.461 | 15.9 | | 15.9 | 21% | 0.08197 | $201.74 | $276.59 |
| 2/25/2009 | Actual | 28 | 87 | 2,427 | 16.4 | | 16.4 | 22% | 0.00458 | $205.27 | $272.77 |
| 1/28/2009 | Actual | 30 | 104 | 3,107 | 16.2 | | 16.2 | 27% | 0.07035 | $218.57 | $349.20 |
| 12/29/2008 | Actual | 33 | 74 | 2,433 | 14.6 | | 14.6 | 21% | 0.07808 | $189.97 | $273.44 |
| 11/26/2008 | Actual | 26 | 68 | 1,890 | 14.6 | | 14.6 | 19% | 0.09417 | $177.98 | $210.50 |
| 10/29/2008 | Actual | 33 | 56 | 1,041 | 14.3 | | 14.3 | 16% | 0.09463 | $174.22 | $189.48 |
| 9/26/2008 | Actual | 30 | 52 | 1,565 | 13.7 | | 13.7 | 16% | 0.10326 | $161.60 | $161.05 |
| 8/27/2008 | Actual | 29 | 57 | 1,658 | 13.6 | | 13.6 | 16% | 0.09465 | $157.26 | $170.62 |
| 7/29/2008 | Actual | 33 | 56 | 1,854 | 13.9 | | 13.9 | 17% | 0.0881 | $163.34 | $190.80 |
| 6/26/2008 | Actual | 29 | 62 | 1,787 | 14.5 | | 14.5 | 18% | 0.09362 | $167.20 | $183.90 |

**Gas Actual Bill History**

| Bill To Date | Days | Meter READ | Read Type | Usage CCF | Usage Therms | Usage (Cost) |
|---|---|---|---|---|---|---|
| 6/10/2010 | 30 | 6515 | ACTUAL | 167 | 172 | $199.83 |
| 5/11/2010 | 29 | 6348 | ACTUAL | 459 | 474 | $559.47 |
| 4/12/2010 | 31 | 5889 | ACTUAL | 624 | 649 | $833.45 |
| 3/12/2010 | 29 | 5265 | ACTUAL | 769 | 803 | $982.92 |
| 2/1/2010 | 29 | 4496 | ACTUAL | 932 | 974 | $1,132,71 |
| 1/13/2010 | 33 | 3564 | ACTUAL | 1117 | 1,159 | $1,355.41 |
| 12/11/2009 | 30 | 2447 | ACTUAL | 658 | 684 | $839.88 |
| 11/11/2009 | 26 | 1789 | ACTUAL | 415 | 430 | $434.11 |
| 10/16/2009 | 31 | 1374 | ACTUAL | 217 | 284 | $257.37 |
| 9/15/2009 | 28 | 1103 | ACTUAL | 146 | 151 | $158,07 |
| 8/18/2009 | 33 | 957 | ACTUAL | 170 | 177 | $188.48 |
| 7/16/2009 | 30 | 787 | ACTUAL | 193 | 200 | $208.11 |
| 6/16/2009 | 34 | 594 | ACTUAL | 285 | 297 | $310.55 |
| 5/13/2009 | 30 | 309 | ACTUAL | 456 | 473 | $566.40 |
| 4/13/2009 | 31 | 9853 | ACTUAL | 758 | 780 | $1,042.35 |
| 3/13/2009 | 29 | 9095 | ACTUAL | 902 | 927 | $1,289.47 |
| 2/12/2009 | 29 | 8193 | ACTUAL | 1,058 | 1,092 | $1,550.05 |
| 1/14/2009 | 33 | 7135 | ACTUAL | 1,047 | 1,092 | $1,574.92 |
| 12/12/2008 | 30 | 6088 | ACTUAL | 770 | 803 | $1,194.34 |
| 11/12/2008 | 28 | 5319 | ACTUAL | 438 | 458 | $691.22 |
| 10/15/2008 | 30 | 4880 | ACTUAL | 268 | 284 | $435.43 |
| 9/15/2008 | 32 | 4612 | ACTUAL | 186 | 194 | $335.15 |
| 8/14/2008 | 29 | 4426 | ACTUAL | 150 | 156 | $286.06 |
| 7/16/2008 | 33 | 4276 | ACTUAL | 171 | 178 | $319. 70 |
| 6/13/2008 | 30 | 4105 | ACTUAL | 259 | 270 | $427.02 |
| 5/14/2008 | 30 | 3846 | ACTUAL | 402 | 423 | $648,56 |
| 4/14/2008 | 31 | 3444 | ACTUAL | 705 | 734 | $1,091.38 |
| 3/14/2006 | 29 | 2739 | ACTUAL | 821 | 847 | $1,204.93 |
| 2/14/2008 | 30 | 1918 | ACTUAL | 878 | 900 | $1,262.34 |
| 1/15/2008 | 33 | 1040 | ACTUAL | 974 | 1014 | $1,433.9S |
| 12/13/2007 | 30 | 66 | ACTUAL | 810 | 836 | $1,205.40 |
| 11/13/2007 | 32 | 9256 | ACTUAL | 514 | 528 | $712.81 |
| 10/12/2007 | 29 | 6742 | ACTUAL | 215 | 277 | $201.50 |
| 9/13/2007 | 30 | 8527 | ACTUAL | 179 | 186 | $236.44 |
| 8/14/2007 | 29 | 8348 | ACTUAL | 174 | 181 | $246.21 |
| 7/16/2007 | 32 | 8174 | ACTUAL | 230 | 239 | $341.12 |

**Water Savings for Eastern Apartments**

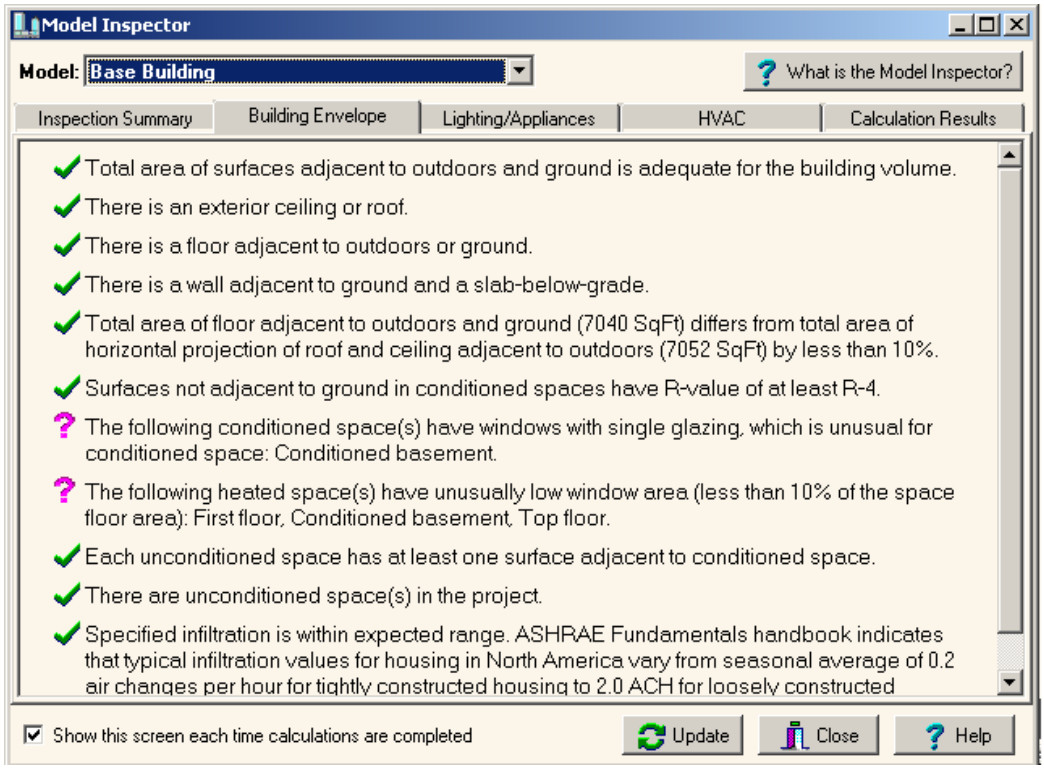
| Low-Flow Showerhead Replacement | | | |
|---|---|---|---|
| | Existing | Proposed | Saved |
| Number in Measure | 8 | 8 | |
| GPM | 2.5 | 1.5 | |
| Minutes per day | 15 | 15 | |
| Gallons per day | 300 | 180 | |
| Gallons per year | 109,500 | 65,700 | 43,800 |
| Cubic Feet per year | 14,639 | 8,783 | 5,856 |

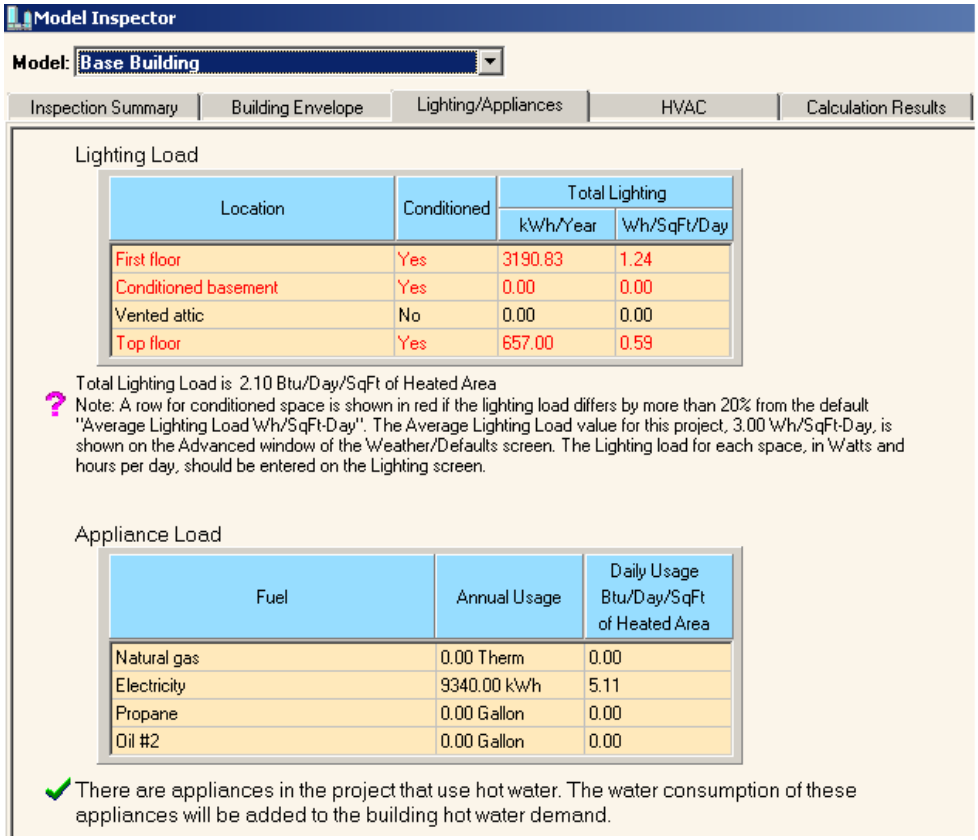
| Low-Flow Aerator Replacement | | | |
|---|---|---|---|
| | Existing | Proposed | Saved |
| Number in Measure | 12 | 12 | |
| GPM | 2 | 1.2 | |
| Minutes per day | 15 | 15 | |
| Gallons per day | 360 | 216 | |
| Gallons per year | 131,400 | 78,840 | 52,560 |
| Cubic Feet per year | 17,567 | 10,540 | 7,027 |

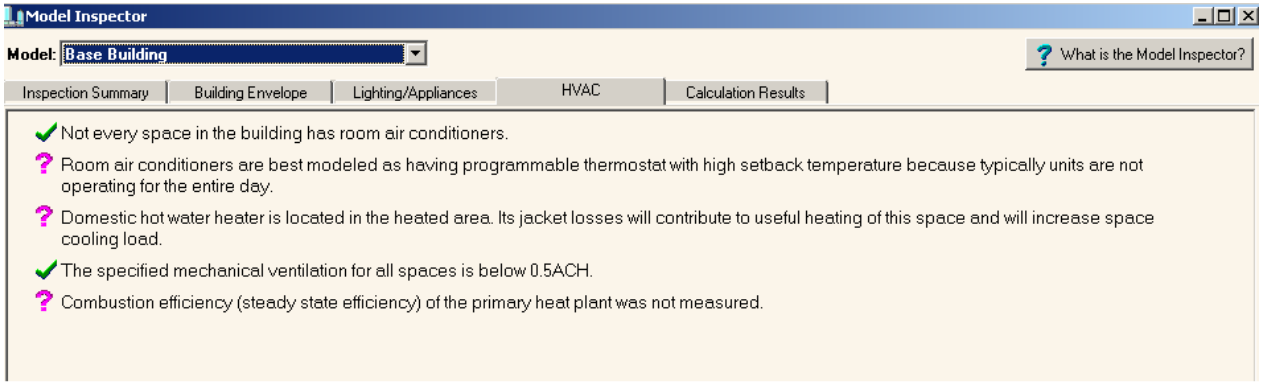
This data is purely for water and sewer savings. Cost per year is based on city rates for the building.

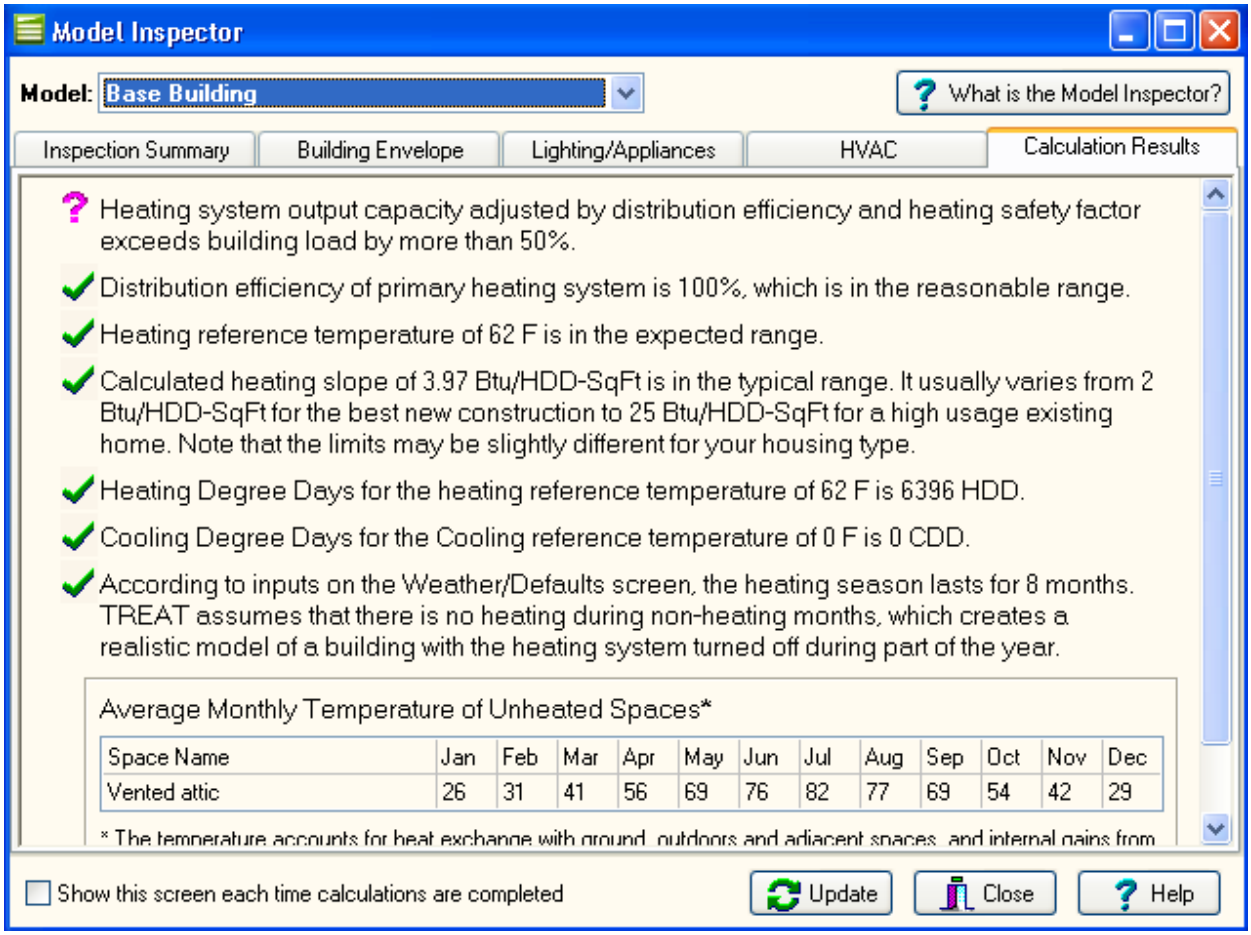
## APPENDIX B: MODELING REPORTS

TREAT file submitted electronically




Model Inspector
Model: Base Building
Inspection Summary
Building Envelope
Lighting/Appliances
HVAC
Calculation Results
Lighting Load
Location
Conditioned
Total Lighting
kWh/Year
Wh/SqFt/Day
First floor
Yes
3190.83
1.24
Conditioned basement
Yes
0.00
0.00
Vented attic
No
0.00
0.00
Top floor
Yes
657.00
0.59
Total Lighting Load is 2.10 Btu/Day/SqFt of Heated Area
Note: A row for conditioned space is shown in red if the lighting load differs by more than 20% from the default "Average Lighting Load Wh/SqFt-Day". The Average Lighting Load value for this project, 3.00 Wh/SqFt-Day, is shown on the Advanced window of the Weather/Defaults screen. The Lighting load for each space, in Watts and hours per day, should be entered on the Lighting screen.
Appliance Load
Fuel
Annual Usage
Daily Usage Btu/Day/SqFt of Heated Area
Natural gas
0.00 Therm
0.00
Electricity
9340.00 kWh
5.11
Propane
0.00 Gallon
0.00
Oil #2
0.00 Gallon
0.00
There are appliances in the project that use hot water. The water consumption of these appliances will be added to the building hot water demand.


Model Inspector
Model: Base Building
What is the Model Inspector?
Inspection Summary
Building Envelope
Lighting/Appliances
HVAC
Calculation Results
Not every space in the building has room air conditioners.
Room air conditioners are best modeled as having programmable thermostat with high setback temperature because typically units are not operating for the entire day.
Domestic hot water heater is located in the heated area. Its jacket losses will contribute to useful heating of this space and will increase space cooling load.
The specified mechanical ventilation for all spaces is below 0.5ACH.
Combustion efficiency (steady state efficiency) of the primary heat plant was not measured.


Model Inspector
Model: Base Building
What is the Model Inspector?
Inspection Summary
Building Envelope
Lighting/Appliances
HVAC
Calculation Results
Heating system output capacity adjusted by distribution efficiency and heating safety factor exceeds building load by more than 50%.
Distribution efficiency of primary heating system is 100%, which is in the reasonable range.
Heating reference temperature of 62 F is in the expected range.
Calculated heating slope of 3.97 Btu/HDD-SqFt is in the typical range. It usually varies from 2 Btu/HDD-SqFt for the best new construction to 25 Btu/HDD-SqFt for a high usage existing home. Note that the limits may be slightly different for your housing type.
Heating Degree Days for the heating reference temperature of 62 F is 6396 HDD.
Cooling Degree Days for the Cooling reference temperature of 0 F is 0 CDD.
According to inputs on the Weather/Defaults screen, the heating season lasts for 8 months. TREAT assumes that there is no heating during non-heating months, which creates a realistic model of a building with the heating system turned off during part of the year.
Average Monthly Temperature of Unheated Spaces*
Space Name Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Vented attic 26 31 41 56 69 76 82 77 69 54 42 29
* The temperature accounts for heat exchange with ground, outdoors and adjacent spaces, and internal gains from
Show this screen each time calculations are completed
Update
Close
Help

**APPENDIX C:**

Refrigerator Inventory & Ventilation Equipment notes by unit

| Unit# | Model# | Year Made | Brand | Bathroom/ Fan Notes/Other |
|---|---|---|---|---|
| 1 | 2538612680 | 1989 | SEARS | |
| 2 | MTX14CYXKRWH | 1995 | RCA | timer switch set to '0' or not working |
| 3 | A33FRTGRHD1 | 2000 | FRIGEDAIRE | |
| 4 | ETH141PKWRO | 1980 | WHIRLPOOL | old indicators of dirt or mold on bathroom ceiling |
| 5 | NO LABEL | 1995 | KENMORE | older fan/light missing lens cover |
| 6 | FRT18H6CQ1GD18 | 2003 | FRIGEDAIRE | missing drywall ceiling |
| 7 | FRT18L4W5AD18 | 2009 | FRIGEDAIRE | |
| 8 | FRT15HB3A02AD15 | NEW | FRIGEDAIRE | |
| 9 | GTS12BBMALWW | 2001 | GE | |
| 10 | NO LABEL 15ATR80 | 1980'S | HOTPOINT | |
| 11 | TBX18LKE | 1988 | GE | needs fan cleaning |
| 12 | FRT18H6CW1 | 2003 | FRIGEDAIRE | needs fan cleaning |
| 13 | AS15FRT15B3AW5 | 2004 | FRIGEDAIRE | |
| 14 | AS15FRT15B3AW5 | 2004 | FRIGEDAIRE | |

Refrigerators made prior to 2000 should be replaced.

**APPENDIX D:**

| Measure Description | Evaluation Status | Additional |
|---|---|---|
| ***Lighting & Appliances*** | | |
| ***Apartment Level*** | | |
| Hardwired CFL Fixtures | Recommended | See measure description |
| Screw-in CFL Bulbs | Recommended | see measure description |
| Super T8 Bulbs and Ballasts | Not Evaluated | Not Applicable |
| ENERGY STAR Refrigerators | Recommended | see measure description |
| ENERGY STAR Dishwashers | Not Evaluated | Not Applicable |
| ENERGY STAR Clothes Washers | Evaluated | See Evaluated & Not Recommended Section |
| ***Common Areas*** | | |
| Hardwired CFL Fixtures | Not Recommended | Not Applicable |
| Screw-in CFL Bulbs | Recommended | see measure description |
| Bi-level lighting | Not Evaluated | Not Applicable |
| LED Exit Signs | Not Evaluated | Exist |
| Continuous Burn-time lighting upgrades | Nor Evaluated | Exist |
| Occupancy Sensors (i.e.. laundry room) | Not Evaluated | Not Applicable |
| Super **T8** Bulbs and Ballasts | Not Evaluated | Not Applicable |
| Outdoor lighting | Not Evaluated | Not Applicable |
| ***Envelope*** | | |
| Air Sealing *(including weather stripping)* | Recommended | see measure description |
| Insulate Roof Deck or Attic | Recommended | see measure description |
| Insulate Walls | Not Evaluated | Not Applicable |
| High Efficiency Windows/Storm Windows | Recommended | See measure description |
| ***HVAC Measures*** | | |
| ***Boilers*** | | |
| High Efficiency Boilers* | Not Recommended | See Evaluated & Not Recommended Section |
| Outdoor air reset controls | Recommended | See measure description under Boiler |
| Replace steam with hydronic boilers | Not Evaluated | Not Applicable |
| Energy Management System (boiler temp controls) | Not Evaluated | Not Applicable |
| Condensate Reclamation for Steam Systems | Not Evaluated | Not Applicable |
| Decentralization of Central Boiler Plants | Not Evaluated | Not Applicable |

| | | |
|---|---|---|
| Outdoor Air Reset for Hydronic Systems | Recommended | Part of Boiler replacement |
| Insulate Hot Surfaces; *condensate tank, piping...* | Not Recommended | Exist |
| Thermostatic Radiator Valves | Not Evaluated | Not Applicable |
| ***Furnaces*** | | |
| High Efficiency Furnace* | Not Evaluated | Not Applicable |
| Remove Electric DHW tanks and plumb indirect | Recommended | See measure description |
| Separate DHW direct-fired condensing boiler | Not Recommended | Exist |
| HVAC distribution - repairs, duct sealing, etc. | Not Evaluated | Not Applicable |
| ***Other*** | | |
| High Efficiency Cooling Systems* | Not Evaluated | Not Applicable |
| Heat Recovery from Exhaust Air | Not Evaluated | Not Applicable |
| Conversion from Electric to Gas Heat | Not Evaluated | Not Applicable |
| Conversion from electric to gas DI-IW | Not Evaluated | Not Applicable |
| Conversion from electric to gas Dryers | Not Evaluated | Not Applicable |
| Combined Heat and Power on 80+ unit bldgs | Not Evaluated | Not Applicable |
| Replace #6 Oil with Dual Fuel System | Not Evaluated | Not Applicable |
| Replace #2 Oil with natural gas | Not Recommended | Measure is cost-prohibitive |
| Timers on Roof Fans (per code requirement) | Not Evaluated | Not Applicable |
| ***Health and Safety*** | | |
| CO testing of all apartment gas appliances | Not Evaluated | Not Applicable |
| Carbon Monoxide Detectors (unless all-electric) | Not Evaluated | Not Applicable |
| Smoke Detectors | Not Recommended | Measure is present and functional |
| Repair Roof | Not Recommended | Not Applicable |
| Repair Water Drainage issues | Not Evaluated | Not Applicable |
| Combustion Vent Replacement / Repair | Not Evaluated | Not Applicable |
| Ventilation - Duct Repair/sealing/venting | Not Evaluated | Not Applicable |
| Mechanical Ventilation; Installation or Repair | Not recommended | Adequate |
| Forced-Air Filter Replacement | Not Evaluated | Not Applicable |
| Asbestos Mitigation | Not Evaluated | Not Applicable |
| Battery-powered Emergency Lighting | Not Evaluated | Not Applicable |
| Lead paint Mitigation | Not Evaluated | Not Applicable |
| Seasonal Dehumidification | Not Evaluated | Current condition is satisfactory |
| ***Water and Other*** | | |

| | | |
|---|---|---|
| Low-flow Showerheads and Sink Aerators | Recommended | see measure description |
| Low-flow Toilets | Recommended | see measure description |
| Elevator Motors and Controls | Not Evaluated | Not Applicable |
| Thermostatic/Smoke driven Louvers & Fans | Not Evaluated | Not Applicable |
| High Efficiency Motors (> 1 **HP,** 4 hp) | Not Evaluated | Not Applicable |
| Variable Speed Drives (> 1 **HP,** 4 hp) | Not Evaluated | Not Applicable |

## DISCLAIMER

The energy conservation opportunities included in this report have been reviewed for technical accuracy. However, as energy savings ultimately depend on behavioral factors, the weather, and many other factors outside its control, TRC Energy Services does not guarantee the energy or cost savings estimated in this report. All energy savings were based on the energy use for a 12-month period of actual energy utility bills. TRC Energy Services shall in no event be liable should the actual energy savings vary from the savings estimated herein.

Estimated installation costs are based on a variety of sources, including our own experience at similar facilities and contractor estimates. The cost estimates represent the best judgment of the auditors for the proposed action. The building owner is encouraged to confirm these cost estimates independently.

Since actual installed costs can vary widely for a particular installation, and for conditions which cannot be known prior to in-depth investigation and design, TRC Energy Services does not guarantee installed cost estimates and shall in no event be liable should actual installed costs vary from the estimated costs herein.

TRC Energy Services will not benefit in any way from any decision by the owner to select a particular contractor, vendor or manufacturer to supply or install any materials described or recommended in this report.