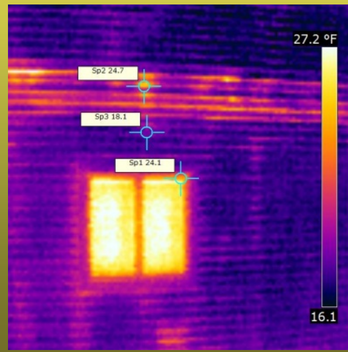

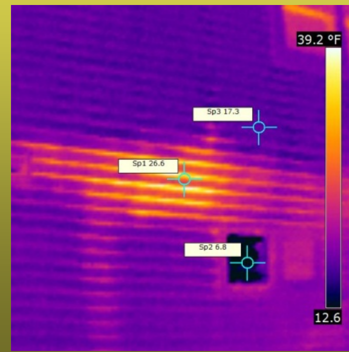

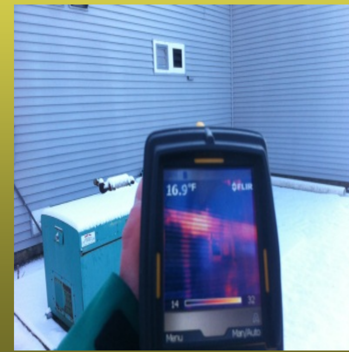

Facility Audit Report

Hollis Fire Department

FINAL

May 2012

Prepared for:
Town of Hollis
7 Monument Square
Hollis, NH 03049

Prepared by:
Acadia Engineers & Constructors
90 Main Street
Newmarket, NH 03857

Hollis Energy Committee

ACADIA ENGINEERS & CONSTRUCTORS

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A. EXECUTIVE SUMMARY

Program Introduction

The Town of Hollis requested investment grade audits for seven (7) municipal buildings and five (5) school buildings located within the Town. Funding was provided by the United States Department of Energy (DOE) through the New Hampshire Office of Energy and Planning (NHOEP) Energy Efficiency Conservation Block Grant (EECBG) program.

Figure 1: Hollis Fire Department

Phase one of the evaluation process involves site assessment planning including evaluating utility bills, benchmarking, reviewing available building and mechanical plans and coordinating site reviews with facility managers. Phase two involves a comprehensive and holistic facility evaluation to gather relevant information and data. Analyzing the collected data and developing recommendations for energy efficiency measures is completed in Phase three. This information is presented to the Town within this report.

The objective of the building evaluation completed at the Hollis Fire Department (Figure 1) is to identify measures that reduce the net energy consumption thereby reducing operating costs and the consumption of non-renewable fossil fuel energies. In addition to energy conservation, the evaluations and recommendations presented herein consider occupant comfort and holistic building performance consistent with its intended use and function. The information obtained as part of this evaluation has been used to develop recommended Energy Efficiency Measures (EEMs). These EEMs provide the basis for future building improvements and modifying the manner in which the building systems are operated.

Procedure

Facility audits or evaluations identify all appropriate EEMs and a financial analysis that considers implementation costs, operating costs, and attainable savings. The objective is to identify the predicted energy savings, the amount the measure will cost, and the estimated payback period for each EEM. The evaluation also identifies any changes to operations and maintenance procedures that will reduce energy consumption. A comprehensive field survey of the facility is completed to evaluate the following:

- *Building Characteristics*
- *Building Use and Function*
- *Envelope Systems*
- *Heating and Cooling Systems*
- *Ventilation Systems*
- *Electrical and Lighting Systems*
- *Domestic Hot Water Systems*
- *Plug Loads*

Following completion of the field evaluation, the data and information are reviewed to develop proposed recommendations for the facility. All information, data, and recommendations are then compiled into a comprehensive report. The final report is then distributed to the municipality or school to assist with implementation and budgeting of the proposed EEMs. The information provided in the reports will assist the owner with determining the best value EEMs for their facilities. The reports also identify potential financial resources available to help fund the EEMs.

On January 3rd, 2012, AEC personnel completed site surveys at the Hollis Fire Department to obtain the information necessary to complete an assessment of overall building performance. All building systems that impact energy consumption were evaluated including the building envelope, heating and cooling, ventilation, electrical, plumbing, and mechanical. Secondary observations are also reported herein and include building code compliance, life safety, structural systems, and roofing systems. This evaluation also considers whole building performance that measures how well the integrated building systems in the Fire Department function as a composite system.

AEC completed a desktop review of the data provided by the town including historical energy consumption data. The field review included an evaluation of all building systems and data collection including an infra-red thermal imaging survey, indoor air quality measurements, lighting density measurements, and metering of lighting fixtures and HVAC equipment. The Fire Department building was modeled using a building energy modeling computer program (eQUEST®) and calibrated to historical energy data. A series of energy efficiency measures (EEMs) were then simulated in the 3-D building model to measure their effect on energy consumption. Capital investment costs for each EEM were developed, and based upon the predicted cost savings associated with the energy efficiency measure, the payback term is calculated. A savings to investment ratio (SIR) for each EEM is then calculated based on the cost of implementation, the predicted energy cost savings, and the predicted service life of the measure/equipment. Other noted recommendations relate to indoor air quality, occupant comfort, code compliance, accessibility, and life safety.

Summary of Findings

The following significant findings are presented for the Hollis Fire Department (HFD) building:

1. The HPD facility uses less energy than expected.
2. There is a substantial amount of HVAC equipment in the HPD facility.
3. HVAC equipment is sized for residential applications.

Notable Observations

The following notable observations were made during the desktop data review and/or the building evaluation. Notable observations may be related to data that is outside the normal or expected range, irregularities in building use or function, or problematic systems.

- The liquefied propane boiler system is approaching the end of its predicted service life.
- Five (5) split air handler units (AHUs) provide conditioned air to the offices. Heat is provided to the building by a liquefied propane (LP) boiler and a hydronic system. Five (5) pad mounted condensing units provide cooling for the AHUs.
- The heating capacity (175 MBH) of the hot-water boiler unit appears to be insufficient for the design heating load.
- The apparatus garage is heated by a large LP fired heater and by solar thermal heating provided by the overhead doors.
- There appears to be an excessive amount of kitchen appliances in the building (two ovens, two dishwashers, two commercial refrigerators and one commercial freezer).
- Occupants appear to power off lighting fixtures in unoccupied rooms.

- The energy usage for the building is low compared to the national average for a Public Safety Facility.

Summary of Recommendations

Following is a summary table identifying the proposed recommendations, EEM investment costs, predicted annual energy cost savings, simple payback period and savings to investment ratio. Part G provides a more detailed explanation of these recommendations.

The energy cost savings and resulting payback are based upon each independent measure implemented for the building in its current condition and function. There are interdependencies among measures that will affect the net composite energy savings. Interdependent measures are parametrically related therefore the net energy savings from two dependent measures do not equal the resulting savings determined by the addition of the two measures considered independent of each other. Investment costs are provided for budgetary planning only. They are estimated based on current industry pricing. A detailed cost estimate should be developed prior to appropriating capital funds for the more costly measures. Budgetary cost estimates for the Tier III and more costly Tier II measures are presented in Appendix J.

EEM No.	EEM Description	Capital Cost	Annual Cost Savings	Payback (yrs.)	SIR
T1-1	Remove the vending machine in apparatus garage.	$0	$240	0	-
T1-2	Remove the compact refrigerator on second floor and utilize refrigerators on first floor.	$0	$106	0	-
T1-3	Consolidate the two commercial refrigerators into a single unit.	$0	$296	0	-
T1-4	Replace incandescent bulbs with compact fluorescent bulbs (12).	$36	$41	-	-
T1-5	Replace CRT computer monitors (5) with ENERGY STAR® rated LCD monitors.	$700	$420	1.7	4.8
T1-6	Complete air sealing on entry doors and windows.	$580	$392	1.5	4.7
T2-1	Install occupancy sensors to control lighting in high-bay garage.	$736	$350	2.1	5.7
T2-2	Replace existing domestic hot water heater with mini-tank LP-fired hot water heater, OR, a condensing tank unit.	$2,428	$280	8.7	2.3
T2-3	Replace exterior metal halide wallpack fixtures with LED units (4).	$2,963	$200	14.8	1.7
T2-4	Install de-stratification fan units (6) in high-bay to create an air curtain along overhead doors.	$4,522	$491	9.2	1.5
T3-1a	Replace existing LP-fire boiler with an automated wood pellet-fueled hot water boiler. Install NEMA premium rated circulation pumps with VFD controllers.	$37,433	$2,680	14.0	1.8
T3-1b	Replace existing LP-fire boiler with high-efficiency LP-fired modulating condensing unit. Install NEMA premium rated circulation pumps with VFD controllers.	$27,945	$1,781	15.7	1.6
T3-2	Replace five (5) A/C condensing units with high efficiency units (SEER 20 / EER 13).	$7,390	$560	13.2	1.4
T3-3	Augment LP-fired air furnace in high-bay with LP-fired IR heaters (6).	$11,663	$798	14.6	1.2
T3-4	Add additional six (6) inches blown in cellulous to apparatus garage ceiling (6,300 SF).	$19,702	$650	30.3	1.0

The following table summarizes the renewable energy technologies that were considered for the Hollis Fire Department. Scores are determined based upon the feasibility of the technology for the facility. A more focused feasibility study should be completed prior to considering any renewable energy system(s).

Renewable Energy Technology	Score
Biomass Heating	82%
Ground-Mounted Photovoltaic	79%
Geothermal Heating and Cooling	78%
Roof-Mounted Photovoltaic	76%
Solar Domestic Hot Water	76%
Solar Thermal Heating	72%
Wind Turbine Generator	71%
Combined Heat and Power	63%

Master Planning Considerations

The existing Hollis Fire Department (HFD) facility has continuously functioned in its current space as a fire station since 1978. The Always Ready Engine house located in the Hollis Village functioned as the original fire hall. In 1950, the HFD moved to an addition on the south side of the Town Hall. When the HFD required additional space, the current facility was constructed. The building was renovated in 2006 to improve building function and the facility remains well maintained. The renovation included expansion of the building and improving envelope insulation of walls and the roof and installing new windows and doors. Lighting systems were upgraded as part of the 2011 Town lighting upgrade project.

In general, the building envelope is in satisfactory condition. The roof is in fair condition however there is a persistent leak on the east side of the building resulting in damage to interior materials.

Heating, cooling and ventilation (HVAC) equipment are dated and relatively inefficient compared to modern equipment. Much of the HVAC equipment is approaching the end of its predicted service life. Replacing aging equipment at the end of its useful life and continued preventative maintenance is recommended.

The HFD facility has been well maintained and its current configuration and systems support its intended use. No major renovations are necessary and with continued maintenance the facility is expected to endure for the foreseeable future.

B. PROCEDURES & METHODOLOGY

Standards and Protocol

The American Society for Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) has developed the most widely accepted process for completing energy audits at commercial facilities. ASHRAE document RP-669, SP-56, *Procedures for Commercial Building Energy Audits* defines several levels of audits. The appropriate level of audit for a particular facility depends on the availability of existing data and information, owner objectives, and owner budget. Levels range from simple benchmarking to a comprehensive review of all building systems. The most comprehensive audit is a Level III audit which was completed at the Hollis Fire Department. Level III audits are commonly referred to as “Investment Grade Audits”.

Basic elements of a Level III Investment Grade Audit include the following:

- A review of existing facility data including energy usage.
- Benchmarking the facilities energy usage relative to similar use facilities.
- An on-site inspection and survey of all facility systems.
- On-site measurements and data collection.
- Informal interviews with owners, facility managers, and occupants.
- Energy use analysis and development of efficiency measures.
- Developing a simple payback cost estimate for each recommended measure.
- Development of a comprehensive report that clearly presents all findings and provides recommended energy conservation measures and the associated costs.

In addition to the ASHRAE standard for commercial audits, there are industry and code-based standards that must be considered when analyzing building systems and evaluating energy conservation measures. All recommendations must be consistent with the intent of these standards. For example, the US Environmental Protection Agency (EPA) has established a recommended carbon dioxide (CO_2) threshold concentration of 1,000 parts per million (ppm) to promote a healthy indoor air environment. ASHRAE defines recommended temperatures, relative humidity levels, minimum ventilation rates, and energy standards. The Illuminating Engineering Society of North America (IESNA) prescribes recommended lighting densities based on the designated space use. The International Code Council (ICC) is the adopted standard for all building and energy codes (2009) in the state of New Hampshire. New Hampshire has also adopted ASHRAE Standards 62.1 and 90.1.

Table 1: Relevant Industry Codes and Standards

Standard	Description
28 CFR Part 36	ADA Standards for Accessible Design
ANSI/ASHRAE Standard 55	Thermal Environmental Conditions for Occupancy
ANSI/ASHRAE Standard 62.1	Ventilation for Acceptable Indoor Air Quality
ANSI/ASHRAE/IESNA Standard 90.1	Energy Standards for Buildings Except Low-Rise Residential Buildings
ICC 2009	International Building Code (IBC)
ICC 2009	International Existing Building Code (IEBC)
ICC 2009	International Energy Conservation Code (IECC)
ICC 2009	International Mechanical Code (IMC)
ICC 2009	International Fuel Gas Code (IFGC)
IESNA Lighting Handbook	Reference and Application
NFPA 70	National Electrical Code (NEC)

While the primary objective of an energy audit is identify energy conservation measures, such measures cannot adversely affect occupant comfort and indoor air quality. For example, if a building ventilation system is inadequate then it would be recommended that additional ventilation capacity be added. The electrical power required to operate the added ventilation equipment would increase energy consumption. Typically, the net energy usage incorporating the sum of the recommended conservation measures would still be less than the current usage even with the added ventilation equipment.

It is noted that although there is a prescriptive approach to commercial building audits, that every building is unique in many ways. Buildings should be evaluated consistent with the characteristics that define its need and appropriate function. This includes the following:

- *Use*: Current building use and occupant needs.
- *Systems*: Building systems characteristics and integration.
- *Control*: The effectiveness in which the existing building systems controls are utilized.

Desktop Data Review

Ideally, the building owner provides all available information to the engineering firm prior to initiating the facility site review. Information such as utility bills, building plans, repair records, planned improvements, and occupant concerns will help the building engineer identify potential issues before initiating the site review. The Building Engineer can then focus the site review toward problematic and energy intensive building systems.

Facility Site Review

Following the desktop data review, the Engineer initiates the facility site review. This review includes all major building systems including the envelope, electrical, mechanical, heating, cooling, and ventilation. The Engineer not only determines the performance and operating characteristics of all building systems, they also evaluate how the users operate the systems and how they perceive building performance. Photographs of representative systems, major equipment, and any identified issues are obtained to help document existing conditions. Field notes are maintained by the Engineer to further document building and user characteristics.

Data Measurements

In addition to collecting equipment information, several data measurements are obtained as part of the facility site review. This data is necessary to identify potential building issues and to collect the information needed to develop an accurate energy analysis. Measurements include:

- Infra-red thermal imaging survey of the building envelope.
- Indoor air quality (IAQ) measurements (temperature, relative humidity, and CO_2).
- Lighting metering to determine energy use and operating schedules.
- Lighting output density.
- Metering of energy intensive electrical equipment (e.g., motors, compressors, heaters) to determine energy use and operating schedules.
- Metering of energy intensive plug-loads to determine energy use and operating schedules.

Data Gap Review

Once the facility site review and data measurements are substantially complete, the Engineer begins reviewing and processing all of the collected data. Any data gaps discovered during this process are addressed prior to completing the audit report.

Energy Modeling and Conservation Measures

To identify the best value EEMs and ensure that the calculated energy and cost savings are relatively accurate, a DOE approved energy modeling software program is utilized. A three-dimensional model of the building is created using the simulation program. This includes all characteristic envelope systems, HVACR systems, domestic hot water systems, and mechanical systems. The geographic position and orientation of the building is input and regional climatic data is imported from the program database.

After the building is accurately modeled, the program simulates building performance and provides the estimated energy use for electric and heating fuel(s). The Engineer then compares the energy data to actual building data. The cause for any significant differences is determined and the building is re-simulated until the model closely matches the actual data. AEC utilizes eQUEST© for all building simulations and energy modeling.

With the base model complete, the Engineer then implements various energy reducing measures and simulates the performance of the building with the new measure. The resulting energy consumption is then compared to the baseline model and predicted energy savings are analyzed.

Cost Estimating and Payback

The cost for implementing each evaluated EEM is then estimated by the Engineer. This provides a net estimated energy savings per dollar invested. Simple payback calculations determine the number of years required for the capital investment cost to equal the present day cost savings realized from energy reductions. The savings to investment ratio (SIR) is the accumulated annual cost savings (as determined by the expected service life of the material or equipment associated with the EEM) divided by the cost of investment. A SIR equal to 1.0 indicates that the EEM has a “break-even” or net-zero cost. The higher the SIR, the more favorable the return on investment is.

C. FACILITY INFORMATION / EXISTING CONDITIONS

Setting

The Hollis Fire Department (HFD) is located in Hollis, NH within a light commercial setting (Figure 2). The building and facilities are located on a land parcel owned by the Town of Hollis and is within the Hollis Historic District. The HFD facility is located at 10 Glenice Drive immediately north of State Route 130.

Figure 2: Aerial Photo of HFD (2011)

A small group of commercial buildings defines the western boundary of the parcel and a large open field defines the parcel to the east. Residential developments and the Town Center are located to the south. Lightly wooded areas bound the site to the north. Parking for visitors is provided on the east side of the building and a paved parking area located on the south side of the building provides parking for department vehicles. The gross area of the HFD building is 13,090 square feet.

History

The Hollis Fire Department has a rich history. The HFD was first created in the early 1800's when the Town purchased their first pump. This pump was hand operated and pulled to the scene by volunteer fire fighters. The Always Ready Fire House (Figure 3) was constructed as the first fire hall in 1859 and housed the Town's first horse drawn fire pump ("Always Ready") that was capable of discharging water over 100 feet. The following year the Town purchased its second fire pump "Company One".

Figure 3: Always Ready Fire House (c. 1900)

In 1927 the Department purchased its first motorized engine and continued to grow slowly over the next few decades. In 1950, the HFD constructed an addition on the current Town Hall (currently renovated and an assembly area) and relocated their operations. By the mid-1970's the HFD required additional space and purchased a plot of land off Ash Street where they constructed the current facility in 1978. In 2006 the HFD renovated the building to increase space and improve function. Since the 1950's, the Town has maintained a full-time fire department with ambulatory services to Nashua.

Use, Function & Occupancy Schedule

The HFD and the land it occupies are owned by the Town of Hollis. The building is a two-story structure with a large apparatus garage on the south side of the building. Spatial configuration and functional use of the building is typical of a fire department. Spaces include a meeting room, offices, locker rooms, kitchen, mechanical rooms, apparatus garage, and several storage closets. The building is staffed 24 hours a day 365 days a year.

Anecdotal Information

Anecdotal information includes all relevant information collected during the desktop review, as part of occupant interviews, or general observations noted during the site evaluation. Generally, anecdotal information corresponds to issues or concerns that may not be apparent during the building evaluation. It includes complaints about seasonal occupant comfort, maintenance issues, systems or equipment performance issues, recent improvements or changes in use, and previous reports prepared by others. Anecdotal information obtained during the HFD evaluation includes the following:

- A persistent roof leak occurs at section between the apparatus garage and the 2006 second floor addition (Figure 4).
- Spots "bleed up" through the floor tiles in the kitchen.
- Drifting snow accumulates in the main entrance way.

Figure 4: Water Stain from Roof Leak

Utility Data

Utility data for the HFD was provided by the Town for 2010 and 2011. Table 2 summarizes the total energy consumption including electric and oil usage. Energy consumption and cost for electricity per pay period is shown in Table 3 and Figure 5. The regional electric utility supplier is Public Service Company of New Hampshire (PSNH) and liquefied propane (LP) is provided by a local supplier.

Table 2: Annual Energy Consumption (2010-2011)

Energy	Period	Consumption	Units	Cost
Electric	January 2010 – December 2010	61,766	Kilowatt hours	$8,946
Liquefied Propane	January 2010 – December 2010	5,727	Gallons	$10,957
			Total Annual Energy Cost (2010):	$19,903
Electric	January 2011 – December 2011	59,910	Kilowatt hours	$8,789
Liquefied Propane	January 2011 – December 2011	3,677	Gallons	$6,141
			Total Annual Energy Cost (2011):	$14,930

The monthly electrical usage (Figure 5) reveals that the use peaks during the summer months indicating a significant amount of energy is consumed by the cooling system. Over the twelve (12) month period (2010), August is the peak demand month, consuming 6,120 kWh of electricity. Over the 12 month period (2011), July is the peak demand month, consuming 5,920 kWh of electricity.

Table 3: Monthly Electric Consumption (2010-2011)

Month	Year	Electric Consumption (kWh)	Electric Cost
Jan	2010	5,600	$822
Feb	2010	5,440	$765
Mar	2010	5,280	$743
Apr	2010	4,920	$677
May	2010	5,120	$707
June	2010	4,560	$658
July	2010	5,880	$872
Aug	2010	6,120	$879
Sep	2010	4,960	$766
Oct	2010	4,840	$716
Nov	2010	4,360	$648
Dec	2010	4,686	$694
Total:	*2010*	*61,766*	*$8,946*
Jan	2011	5,440	$804
Feb	2011	5,400	$776
Mar	2011	4,760	$773
Apr	2011	5,200	$754
May	2011	4,240	$644
June	2011	4,560	$699
July	2011	5,920	$849
Aug	2011	5,680	$849
Sep	2011	5,320	$761
Oct	2011	4,280	$623
Nov	2011	4,630	$627
Dec	2011	4,480	$631
Total:	*2011*	*59,910*	*$8,790*
Totals:	*2010-2011*	*121,676*	*$17,736*

Annual electric usage for the Hollis Fire Department based on the most recent data provided by Town (January 2010 through December 2011) is 61,766 kWh at a cost of $8,946 for 2010 and 59,910 kWh at a cost of $8,790 for 2011. Based on the building size and function, this usage is lower than similar use Fire/Police facilities.

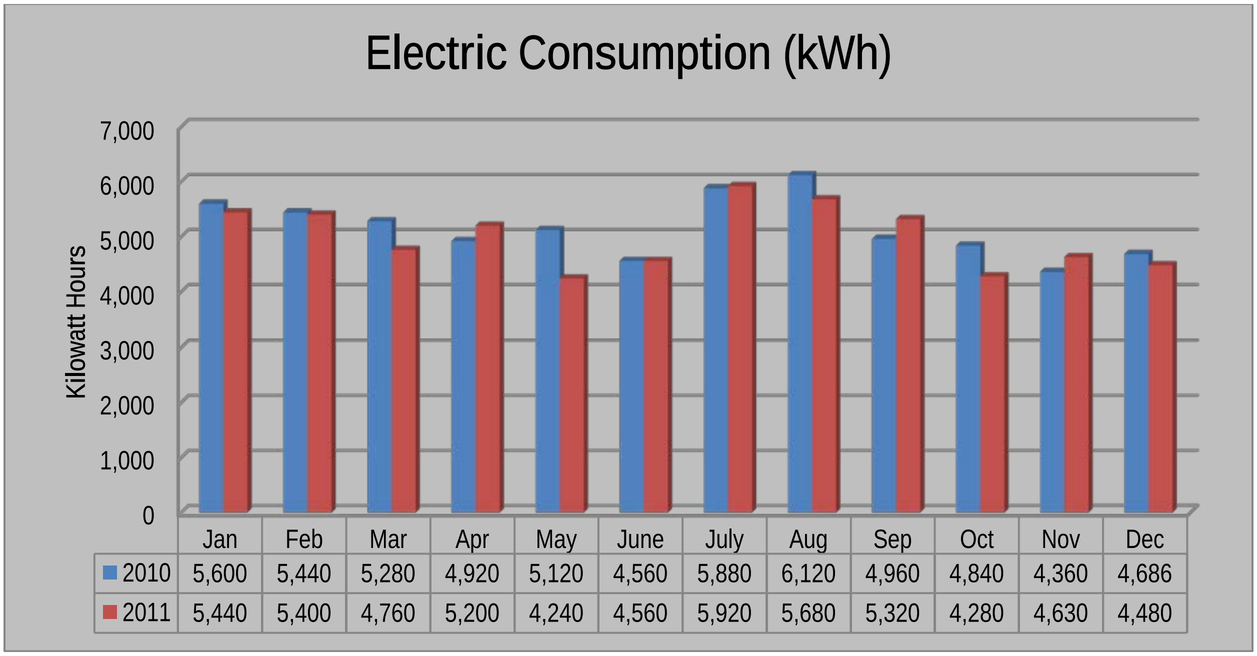


Figure 5: Electric Consumption (2011)

To provide the most accurate recommendations for energy conservation, the energy consumption based on end use was determined. Table 4 presents the predicted electrical usage for categories including lighting, plug loads, and mechanical equipment. Mechanical equipment includes all hard-wired, permanently installed equipment including ventilation, exhaust, heating, cooling, pumps, etc. These values were determined using observations from the field audit and typical energy consumption data for equipment and appliances in the building. A more detailed accounting of all electrical equipment by end-use is presented in Part C of this Report.

Table 4: Categorized Electrical Consumption (2011)

Equipment Type	Annual Consumption (kWh/yr)	% of Total Consumption	Annual Cost
Plug Loads	24,754	42%	$3,466
Mechanical Equipment	24,595	42%	$3,443
Lighting Fixtures	9,432	16%	$1,321
Totals:	58,781	100%	$8,230

Electrical consumption is largely consumed by plug loads and mechanical equipment which have nearly equal consumptions. Plug loads are predicted to consume 24,754 kWh/yr. Major plug load equipment includes the truck power in the high bay (32% plug load), the vending machine, and appliances. Mechanical loads are predicted to consume 24,595 kWh of the electricity –this is mostly attributable to for the five (5) air handling units in the attic (10,920 kWh or 44%). At 9,432 kWh/year, lighting fixtures account for 16% of the electrical demand in the building. The low consumption for the lighting category is partially attributable to energy efficiency practices by HFD personnel who power off lighting in unoccupied spaces. Figure 6 illustrates the estimated cost associated with each of the three categories.

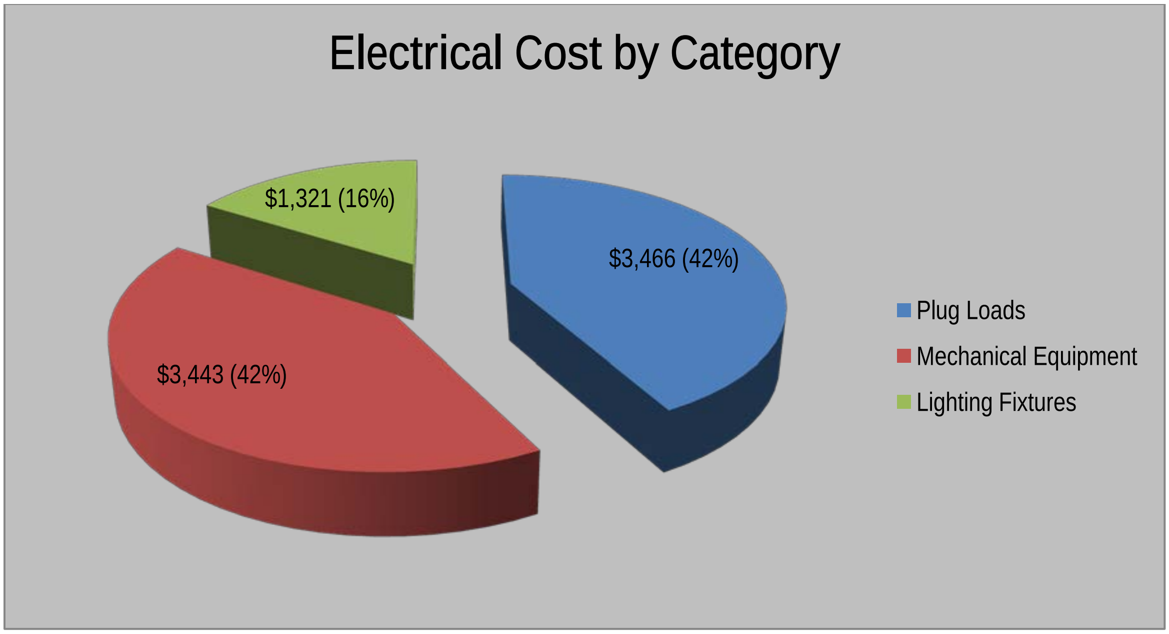


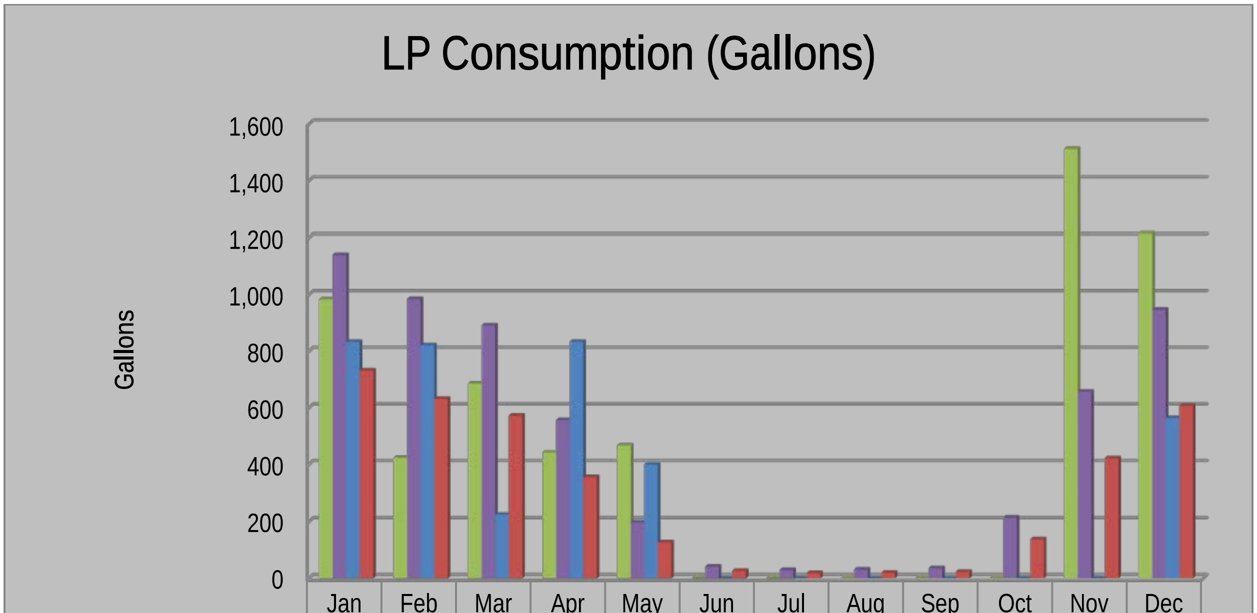
Figure 6: Hollis Fire Department Electrical Cost by Category (2011)

Plug loads account for the highest annual cost of $3,466 (2011). Consumption for mechanical systems is within the expected range of 40%-50% of total energy use. Lighting fixtures consume a comparatively small amount of electricity due to active measures and a recent lighting upgrade ($1,321 or 16%).

Table 5: Monthly Heating Fuel Consumption (2011)

Month	LP Purchased (Gallons)	Cost of Purchase	LP Consumption (Gallons)	Cost of Consumption
Jan	983	$2,117	1,140	$2,181
Feb	423	$963	984	$1,883
Mar	685	$1,479	891	$1,705
Apr	442	$949	557	$1,065
May	467	$1,038	198	$379
Jun	0	$0	41	$79
Jul	0	$0	29	$56
Aug	0	$0	31	$60
Sep	0	$0	36	$69
Oct	0	$0	215	$411
Nov	1,512	$2,439	657	$1,258
Dec	1,215	$1,972	947	$1,811
Total (2010):	*5,727*	*$10,957*	*5,727*	*$10,957*
Jan	833	$1,350	732	$1,222
Feb	821	$1,322	632	$1,056
Mar	225	$363	572	$956
Apr	833	$1,342	358	$597
May	400	$644	127	$212
June	0	$0	27	$44
July	0	$0	19	$31
Aug	0	$0	20	$34
Sep	0	$0	23	$39
Oct	0	$0	138	$231
Nov	0	$0	422	$705
Dec	564	$1,121	608	$1,015
Total (2011):	*3,678*	*$6,142*	*3,678*	*$6,142*
Totals (2010-2011):	*9,404*	*$17,099*	*9,404*	*$17,099*

Liquid propane heating fuel for space heating and domestic hot water heating at the HFD is provided by a local supplier (Table 5, Figure 7). In 2010 the building consumed 5,727 gallons of liquefied propane while in 2011 the building consumed 3,678 gallons of liquefied propane. The annual heating fuel cost for the HFD facility is $10,957 (2010) and $6,142 (2011).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LP Purchased (2010)	983	423	685	442	467	0	0	0	0	0	1,512	1,215
LP Consumed (2010)	1,140	984	891	557	198	41	29	31	36	215	657	947
LP Purchased (2011)	833	821	225	833	400	0	0	0	0	0	0	564
LP Consumed (2011)	732	632	572	358	127	27	19	20	23	138	422	608

Figure 7: Heating Fuel Consumption (2011)

Considering the building systems including the envelope integrity (insulation and air leakage), mechanical equipment, and use of the facility, the heating fuel usage is within the expected range. Heating of the building is supplied by an 80.3% efficient boiler and heating of the high bay area is supplied by a 75% efficient energy recovery ventilator (ERV). Operating efficiencies for these units decreases with age and they considered inefficient by today's standards. Modern conventional condensing gas-fired boilers can operate at efficiencies as high as 98%. With improved jacket insulation and boiler design, modern boilers have a much higher thermal efficiency than the existing units.

Other explanations for the high usage include heating setpoints that are higher than recommended in occupied spaces of the building. For example, ten (10) temperature readings were taken at representative locations on the second floor and nine (9) exceeded the 70°F maximum recommended setpoint with an average recorded temperature of 73.0°F. Recommended heating setpoints for a Public Safety Building range between 67°F and 70°F. Conversely, representative temperatures were recorded at eleven (11) locations, including the high bay, where temperatures were below the maximum recommended temperature with an average of 69°F. Several occupants were occupying second floor spaces while the first floor was generally unoccupied during the temperature measurements.

D. FACILITY SYSTEMS

Building Envelope

The following sections present the building envelope systems and insulation values for each assembly. Assembly values are compared to the *International Energy Conservation Code (IECC), 2009* for commercial buildings located in Climate Zone 5. The IECC code is used as a standard of comparison only and existing buildings are not required to comply with the code unless it undergoes a substantial renovation. New construction and major renovations are required to comply with current energy codes. A set of building design plans for the renovation project between 2005 and 2006 was reviewed.

Floor Systems

The concrete floor in the building is four (4) inches in thickness. There are two different floor systems on the first floor consisting of vinyl flooring and carpeting (Table 6). The floor system has an installed assembly insulation resistance (R) value of 1.2 and 2.0 respectively. Although the IECC does not specify an insulation requirement for unheated slab on grade floors in Climate Zone 5, a minimum value of R-10 is generally recommended. The perimeter of the foundation is insulated with two (2) inch polystyrene board insulated to depth of four (4) feet.

Table 6: Floor Insulation Values

Vinyl Covered Floor				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Concrete slab	4.0	0.3	1.0	0.3
Vinyl Tile	¼	0.2	1.0	0.2
Interior air film	NA	0.7	NA	0.7
			Installed Assembly	1.2
			2009 IECC Requirement:	NR
			Best Practice Recommendation	10.0
Carpet Covered Floor				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Concrete slab	4.0	0.3	1.0	0.3
Carpet	NA	1.0	1.0	1.0
Interior air film	NA	0.7	NA	0.7
			Installed Assembly	2.0
			2009 IECC Requirement:	NR
			Best Practice Recommendation	10.0

Wall Systems

The building is a two-story timber framed building build on grade. The exterior walls are framed in 2-inch by 6-inch timber members 16-inches on-center, and insulated with six (6) inches of un-faced fiberglass batt insulation. There is a six (6) millimeter polyethylene vapor barrier installed to reduce moisture and air infiltration. The interior walls are covered in 5/8-inch gypsum wallboard. The exterior of the building is clad in vinyl clapboard siding. The wall systems do not comply with current energy code standards (IECC 2009) as presented in Table 7.

Table 7: Wall Assembly Insulation Values

Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Vinyl Clapboard Siding	NA	0.2	1.0	0.2
Plywood Sheathing	5/8	0.7	1.0	0.7
Fiberglass Batt Insulation	6	21.0	0.7	14.7
Gypsum Wallboard	5/8	0.5	1.0	0.5
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	17.0 + 0ci
			2009 IECC Requirement:	13 + 3.8ci
			Code Compliant?	NO

Ceiling Systems

Ceilings on the first floor are covered in gypsum board and insulated with six (6) inches of fiberglass batts. This insulation was designed to provide sound attenuation and does not provide a thermal barrier. The second floor of the building is covered in gypsum board and insulated with ten (10) inches of blown-in fiberglass insulation. The high bay is insulated with six (6) inches of blown-in cellulous and covered in gypsum. Additional blown-in cellulous in the attic of the high bay will reduce thermal transfer and lower heating and cooling loads.

Figure 8: Attic Insulation

Roofing Systems

With the exception of the high-bay roof section, the original roofing system on the HFD building was upgraded during the 2005-2006 renovation. The new roof has several pitched sections and is covered with fiberglass asphalt shingles. No insulation exists in the roof rafters (cold roof). The floor of the attic space throughout is insulated with blown-in fiberglass insulation and partially covered with plywood for worker access (Figure 8). The roof of the high bay is also a cold roof with 6 inches of blown cellulous insulation in the attic floor.

Table 8: Attic Insulation Values

Attic Insulation (Offices)				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Blown-in Fiberglass	10.0	38.0	0.7	26.6
Gypsum	5/8	0.6	1.0	0.6
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	28.1
			2009 IECC Requirement:	38.0
			Code Compliant?	NO
Attic Insulation (High Bay)				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Blown-in Cellulose	6.0	18.0	0.7	12.6
Gypsum	5/8	0.6	0.9	0.5
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	14.0
			2009 IECC Requirement:	38.0
			Code Compliant?	NO

Fenestration Systems

Fenestration systems on the Fire Department building include operable windows, fixed window units, and partially-glazed entry doors. Window units in the building are 3½" vinyl trimmed windows with double-pane glass and include casement, double casement, and awning units. Consistent with IECC requirements, fenestration performance is measured by the U-factor, the solar heat gain coefficient (SHGC), and air leakage as determined by the unit manufacturer. No manufacturer information was available for the windows or doors therefore compliance with IECC standards for commercial buildings located in Climate Zone 5 cannot be established.

Thermal transfer and air leakage commonly occurs at the seals of operable windows and the interface between the window and the wall opening which was observed using infrared imaging. Recommendations include exterior and interior inspection and re-caulking of window jambs, headers, and sills as needed. If the operable window units have adjustable jambs, they should be inspected and adjusted as necessary to maintain a complete air seal.

Doors

The door units in HFD building include insulated steel doors and insulated fiberglass doors with partial top window glaze which were installed as part of the renovation project. The east entry door and frame to the high bay were replaced during the renovation with an insulated steel door. Based on visual observations and thermal imaging, the insulation values of the door units is satisfactory however the seals on door jambs, partings, and thresholds are incomplete allowing air leakage (Figure 9).

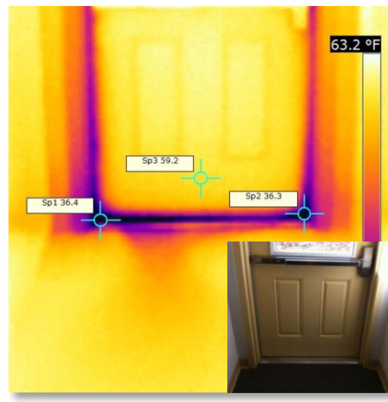


Figure 9: Air Leakage at Door Frame

Air Sealing

Based on the thermal imaging survey and visual observations, air leakage occurs through windows and entry doors. Although this is typical even for a modern building, simple measures can significantly reduce air leakage. Recommended measures for windows include: 1) adjusting jamb seals on operating windows; 2) adding weather-stripping; 3) caulking interior frames and moldings; and, 4) locking/clasping windows to maintain a complete seal.

Air sealing of all door units can be improved with commercial weather-stripping. All door and window units should be regularly inspected (every 2 to 3 years) to ensure proper operation, identify faulty seals, and to identify any deteriorated caulking requiring replacement.

Other air sealing recommendations include inspecting all exhaust and ventilation ducts to determine if they have a positive pressure actuated damper. Dampers are recommended on all exterior ducting to prevent passive air leakage.

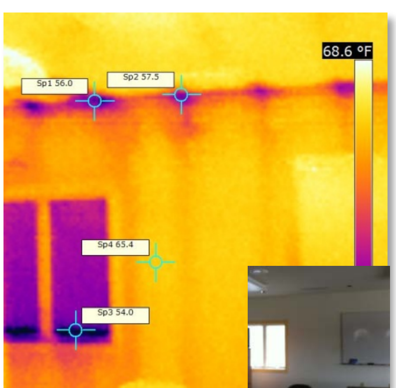


Figure 10: Thermal Bridging at Studs

Thermal Imaging Survey

The thermal imaging survey was completed indoors on January 3rd 2012 outdoors on the morning of January 20th 2012. Outdoor ambient temperature was approximately 28°F during the indoor survey and 17°F during the exterior survey. The survey was conducted using a FLIR© B-CAM infra-red (IR) camera. The building exterior and interior envelope and major mechanical and electrical equipment were surveyed with the IR camera. IR camera surveys not only identify heat transfer through building envelopes, they also identify trapped moisture, electrical system overloading, heat loss through ducting and piping, high energy lighting fixtures, and energy intensive plug load equipment. Appendix B presents the survey report.

The IR surveys revealed the following notable observations:

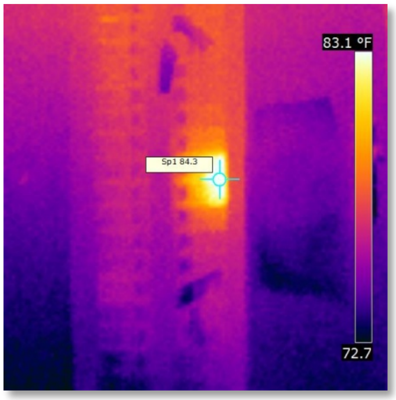


Figure 11: Potentially Overloaded Circuit

- The integrity of wall insulation is marginal with the highest thermal transfer occurring at gaps (missing insulation), the top wall plate, and at the corners of the room where the walls meet (typical).
- Poorly sealed windows and doors allow thermal transfer and air leakage.
- The garage doors revealed some transfer through the seams in the door units and at the frame.
- The energy recovery ventilator in the high bay revealed heat loss through the exhaust duct and the ceiling penetration due to improper insulation.
- Heat loss from the boiler unit and the domestic hot water heater is evident due to poor jacket insulation.
- The electrical circuit panel revealed the high bay light circuit may be overloaded (Figure 11).
- The exposed concrete on the exterior revealed a thermal loss to the exterior.
- The west side of the building revealed a large thermal gap between the first and second floors (band joist).

Electrical Systems

Supply & Distribution

Three-phase grid electricity is supplied to the main panel in the boiler room. A sub-distribution panel is installed for the generator and pumps. Based on the IR thermal imaging the circuit for the bay lighting system may be overloaded.

Lighting Systems

Most lights throughout the facility were upgraded as part of the 2011 lighting upgrade project throughout the town. As presented in Table 9, there are a variety of lighting fixtures and lamp types at the HFD facility. Lighting fixtures in the building consist mainly of recessed mounted high performance T8 fluorescent fixtures and some surface mounted compact fluorescent lighting (CFL) fixtures. Incandescent lamp fixtures account for the third highest in total watts (second floor meeting room). Exterior fixtures are metal halide (MH) units (Figure 12) and exist signs are LED units.


Figure 12: Exterior MH Fixtures

Table 9: Lighting Fixture Schedule

Fixture Lamp Type	Location(s)	Control	No. Lamps	Watts/fixture	Qty.	Total Watts
T8	Throughout	Switch, Motion	1	17-112	125	6,839
CFL	Throughout	Switch, Motion	1	17-60	38	1,081
Incandescent	Boiler room, 2nd fl. meeting room	Switch	1	60	12	720
Metal Halide	Exterior	Switch	1	50	4	200
LED	Exit Signs, 2nd fl. meeting room	Switch	1	5	16	104
				Totals:	195	8,944

Table 10 presents the energy consumption by lighting fixture type. The high performance T8 fluorescent fixtures are the main source of lighting and account for 75% of all lighting energy consumption annually. CFL fixtures located throughout the building account for the second highest in total wattage and the second highest in energy consumption with an estimated 10% of the lighting consumption annually. The exterior MH fixtures are predicted to account for 7% of lighting consumption. LED fixtures (exit signs) account for 578 kWh/yr, or 6% of lighting consumption. Incandescent fixtures in the second floor meeting room are estimated to consume the least amount of electricity at 173 kWh/yr, or 2% of lighting consumption based on their low use frequency.

Table 10: Lighting Fixture Energy Consumption

Fixture Lamp Type	Location(s)	Est. Usage (KWH/yr)	% of Total
T8	Throughout	7,119	75%
CFL	Throughout	989	10%
Metal Halide	Exterior	634	7%
LED	Exit Signs, 2nd floor meeting room	578	6%
Incandescent	Boiler Room, 2nd floor meeting room	173	2%
	Totals:	9,493	100%

Lighting density measurements in NFD building were obtained to establish if building illumination is consistent with the *Illuminating Engineer Society of North America* (IESNA) standards for the prescribed use. These measurements were obtained during normal operating conditions on January 3rd, 2012 between the hours of 1303 and 1344. Table 11 presents the lighting density measurements obtained in units of foot-candles (FCs).

The T8 lamp fixtures are relatively efficient units. While replacement of the fixtures would not provide a reasonable payback on investment, adding controls to reduce the frequency of operation is recommended, especially in common spaces such as corridors. Motion controllers are installed in locker rooms, dining room and in the first floor corridor leading to the high bay.

There are two (2) large yard lights that are rented from PSNH. It may be beneficial to replace these units with LED fixtures and connect them to the building meter.

IESNA Standards

Lighting densities were recorded at twenty-three (23) representative locations. Fifteen (15) of the measurements exceed IESNA recommended standards. Common areas such as hallways, bathrooms and meeting rooms exceed recommended standards in most places. Some offices are below the recommended standard while others are slightly above. The density in the second floor meeting room significantly exceeds standards (70.7 FC at full capacity and 35.7 FC and half capacity). Illumination densities in the first floor offices (1 and 2) were low due to the absence of overhead lighting fixtures. Lights were designed to illuminate at these densities with the intent of the bulbs losing their densities over time. Another major upgrade is not cost practical at this time however improvements can still be made.

Methods to reduce lighting densities include reducing the quantity of fixtures, replacing them with lower-wattage fixtures, and installing lower wattage bulbs in the existing fixtures. Other methods to reduce lighting density include replacing overhead lighting with task lighting, adding multiple control zones, adding daylight controls and adding dimming controls. Newer technology fixtures provide higher lighting density per watt than the existing older fixtures and provide improved lighting quality. The lighting density data is included in Appendix C.

While these lighting densities were generally higher than recommended, proper lighting practices were observed. Lights in unoccupied rooms were not illuminated. The recreation room was occupied but overhead lights were off with some task lighting and natural lighting. Motion controllers are located in the locker rooms, dining room and corridor leading to the high bay which eliminates the need to manually control lights.

Table 11: Illumination Densities

Location	Lighting Density (FC)	Recommended Density (FC) (1)
2nd floor Meeting Room	71	30
Exercise Room	35	30
Bedroom	6	10
Bedroom Corridor	23	5
Dining Room	19	30
Kitchen	34	30
1st fl Corridor	22	5
Office 1	15	50
Office 2	15	50
Locker room	65	5
High bay	22	30
2nd fl rear corridor	36	5
2nd fl Men's Lavatory	34	5
Rear stairwell	10	5
2nd Floor corridor	33	5
Storage room	19	30
Office 1	36	50
Office 3	31	50
Lavatory	12	5
Chief's Office	52	50
Conference room	57	30
Office 5	67	50
Receptionist	57	50

(1) Based upon IESNA standards and AEC recommendations.

Figure 13: Commercial Refrigerators and Freezer

Plug Loads

Plug loads for the HFD facility were determined based on equipment nameplate information. The operating time for each item is based on observations, occupant loading, schedule, and typical operating time for the equipment. Plug loads are categorized as appliances, electronics and office equipment. Appendix F presents an inventory of all plug load equipment.

Based on this analysis, the total annual plug load is 24,754 kWh/yr. This accounts for 42% of annual consumption for the facility. The commercial refrigerators (2), commercial freezer, vending machine and compact refrigerator account for the majority of this load at 10,000 kWh/yr. The "other" category includes miscellaneous electronics including the truck power in the high bay which is estimated to consume 7,800 kWh/yr or 37% of total plug load.

Table 12: Plug Load Energy Consumption

Category	Location(s)	Est. Usage (kWh/year)	% of Total
Appliances	Throughout	11,711	47%
Other	Throughout	9,048	37%
Office Equipment, Computers	Throughout	3,995	16%
	Subtotals	24,754	100%

Motors

Electrical motors are used for the elevator, air handling unit (AHU) fan motors, and garage door motors. Replacement of failed motors with premium efficiency NEMA rated motors is recommended. Variable Frequency Drives (VFDs) are also recommended for replacement AHU motors.

Emergency Power Systems

Two (2) LP powered generator supplies the building with electricity during grid outages. The newer unit may provide enough capacity to supply critical systems in the event of an outage. Eliminating the older unit would reduce maintenance costs and it could be utilized at another Town facility.

Plumbing Systems

Domestic Water Supply

Domestic water supply for the Fire Department is provided by a shallow on-site well. The well is located at the northeast corner of the high bay. Water demand includes lavatory, locker rooms (showers, toilets, sinks), kitchen and washing machine uses. Demand is expected to be moderate. A pond is located on-site to supply water for the pumper trucks.

Figure 14: Domestic Water Treatment System

Domestic Water Pump Systems

The water supply well is equipped with a ¾ horsepower pump, connected to a Franklin Electric variable frequency drive (VFD) and a 4.5 gallon Flexcon Flow-Thru™ pressurized storage tank (Figure 14). This system maintains a continuous flow of water even when it is not in demand to eliminate stagnation.

Domestic Water Treatment Systems

An Enting© water softening system is located adjacent to the well in the high bay to reduce hardness (mineral content).

Domestic Hot Water Systems

Figure 15: DHW Heater

Domestic hot water is provided by one (1) propane fired hot water heater located in the mechanical room (Figure 15). The unit was installed in 2008 and has an AFUE rating of 80%. Compared to current technologies this unit is relatively inefficient. It is recommended that this unit be replaced with a LP-fired mini-tank unit or a condensing tank unit. Other options include installing a combination tank as part of a new heating boiler system.

Hydronic Systems

Space conditioning is provided by hot water coils and fin-tube baseboard connected to a hydronic loop. Water is circulated by two (2) 2-horsepower circulation pumps located in the mechanical room. Pumps and distribution piping were observed to be in fair condition however some piping insulation can be improved.

Mechanical Systems

Figure 16: Hot Water Boiler

Heating Systems

Heat is provided to the office space of the building by one (1) LP-fire Peerless Boiler® (Figure 16). The rated efficiency of this unit when new is 80% and the de-rated efficiency is estimated at less than 75%. Low boiler combustion efficient results in a substantial amount of heat loss, reduced system inefficiency, and CO_2 emissions. The boiler supplies the hydronic system including zoned fin-tube baseboards and heating coils in five (5) AHUs located in the attic.

With a rated output of 172 MBH the residential boiler appears to be grossly undersized for the building. Prior to replacing the boiler, the building heating loads should be calculated to ensure that the replacement unit is appropriately sized.

The apparatus garage is heated with a modern LP-fired air unit with energy recovery. The output capacity of this unit is significant (400 MBH) relative to the space that it serves. An air source heating system is not the most efficient means to supply heat in a high-bay garage. Air exchanges occur each time the overhead doors are open resulting in the loss of heated air. More efficient heating systems include in-floor radiant heating and infra-red (IR) heaters. By heating mass, more heat is retained in the garage space when doors are opened.

Table 13: Heating Supply Systems

Heating Unit	Unit Description	Area(s) Served	Output (MBH)	Age (yrs.)	AFUE (new)	Control Type
Boiler No. 1	Peerless	Office Spaces	175	10	80%	Thermostat
ERV No. 1	Greenheck	Apparatus Gauge	400	7	80%	Thermostat

Cooling Systems

Figure 17: AC Units

Cooling is provided to the building with exception of the apparatus garage. Five three-ton condensers located on the west and rear of the building provide cooling (Figure 17). The Seasonal Energy Efficiency Ratio (SEER) of these units is rated at 12 when new and the de-rated SEER is estimated at 10. Condensers are charged with R-22 refrigerant. It is noted that the use of refrigerant R-22 is no longer permitted (per USEPA) based on its high ozone depletion potential.

The Energy Efficiency Ratio (EER) for the larger condensing units is 12 or less. Operating efficiency tends to decrease with system age. As cooling condensing units fail, they should be replaced with the highest rated equipment available. All exterior condenser piping insulation should be rated for outdoor exposure. Other recommendations include replacing the multiple residential size units with two larger commercial rated units.

As prescribed by the 2009 IECC, the current minimum SEER for smaller cooling systems is 13 and larger units are rated at a minimum EER of 11.2. Modern cooling systems can achieve SEERs up to 24. As example, replacing a unit with a SEER rating of 8 with a new unit rated at 16 would reduce energy consumption by 50% and provide an equivalent cooling capacity.

Pumps

Two (2) water circulation pumps are located in the mechanical room to circulated heater water through the hydronic loop and a pump is located within the well. It is recommended that when the motors on these pumps need to be replaced that premium rated NEMA motors with VFD controllers be installed.

Figure 18: Heating/Cooling Controls

Controls Systems

Heating systems in the office spaces are controlled by several programmable thermostats (Figure 18). It was observed that the set points of unoccupied areas were reduced. Areas that were occupied, however, were higher than recommended (>74°F). The high bay is controlled by a clock faced thermostat that was set to 60°F. It is recommended that the set point in this located be reduced to 55°F.

Direct digital control (DDC) is a computer based system allowing the operator to schedule temperature setpoints while still allowing occupants some manual control of their temperature. Due to the current good practices of occupants, a DDC system is not cost practical for the HFD.

Refrigeration

Two (2) commercial refrigeration units and one commercial freezer unit are located in the kitchen. These units consume a significant amount of energy annually. The refrigerators are not at full capacity and it appears that one unit could accommodate food storage.

Mechanical Equipment Energy Consumption

The electrical energy consumption for mechanical equipment was determined according to nameplate information and building function and occupancy schedules. Table 14 presents a summary of the mechanical equipment and annual energy usage. Appendix E presents the detailed inventory and the associated energy consumption for each piece of mechanical equipment. Total mechanical consumption per year is estimated to be 24,595 kWh per year compared to 24,754 kWh for plug loads and 9,432 kWh for lighting.

Table 14: Mechanical Equipment Energy Consumption

Equipment Type	Qty.	Item Manufacturer(s)	Consumption (kWh/yr)	% of Total
AHU	5	First Co®	10,920	44%
Air Conditioner	5	York®	7,105	29%
Circulation Pumps	2	Taco®	2,700	11%
Well pump	1	NA	1,500	6%
Boiler Blowers	1	NA	1,170	5%
ERV	1	Greenheck®	1,200	5%
		Totals:	24,595	100%

Figure 19: Attic Air Handling Unit

The five (5) air handling units in the attic are estimated to consume the most amount of energy of all the mechanical loads (Figure 19). These are used throughout the year to condition and provide fresh air to the building. Each unit is fitted with a hydronic heating coil and an air conditioning evaporator coil.

The five (5) air conditioners are estimated to consume a moderate amount of energy at 7,105 kWh/yr or 29% of mechanical consumption. These are low efficiency units as indicated by their low EER rating and they are estimated to operate frequently during summer and transitional seasons.

Ventilation Systems

Exhaust Ventilation Systems

Exhaust fan units provide several functions including humidity control, odor control, venting of VOC containing materials (e.g., cleaning solvents), chemical gas venting in laboratories, and venting of cooking fumes. Operation frequency and schedules for the fans units should be consistent with the use type and intensity of the vented space. For example, lavatories may be demand ventilated (interlocked with light switch) or they may operate continuously at a low rate during occupied periods. Spaces equipped with exhaust fans are commonly over-ventilated resulting in increased energy consumption. All exhaust controls and rates should be consistent with ASHRAE Standard 62.1. Fan ducting should have pressure actuated dampers to restrict air flow and heat loss when the units are not operating.

Exhaust ventilation systems in the HFD building are limited to lavatory exhaust fans. These are interconnected with the lights to only operate when the bathrooms are occupied (occupancy sensors). A large exhaust fan removes vehicle exhaust fumes from the high bay garage. This unit is controlled with a manual switch.

Exchange Air Ventilation Systems

Exchange air ventilation systems exhaust interior air with high CO_2 concentrations and humidity and replace it with fresh outdoor air. Ventilation rates and system capacity should be designed consistent with the minimum prescribed code standards (ASHRAE 62.1). Systems should be demand (CO_2) controlled with energy recovery capacity (ASHRAE 90.1).

Exchange air ventilation in the HFD building is provided by the five (5) AHUs located in the attic and the ERV unit in the high-bay garage. Based on the measured CO_2 concentrations in the HFD building, the AHUs may be exchanging more air than necessary (over-ventilation). Because the residential units do not have economizers, they provide 100% outdoor air and adding demand controls will not improve efficiency. Replacement AHUs should be commercial rated units with economizers, energy recovery units, and demand controllers to optimize system efficiency.

Energy Recovery Ventilation Systems

The Greenheck® unit in the high bay is an energy recovery ventilation system. The unit is very large with an input of 400,000 Btu/hr and services the high bay area. No service information was observed by the unit. It is recommended that all gas fired unit be serviced annually to ensure the unit is running at peak efficiency. Replacement AHUs for the office spaces should be equipped with energy recovery units.

Indoor Air Quality

Indoor air quality (IAQ) is established based upon temperature (°F), relative humidity (%), and carbon dioxide (CO_2); measured in parts per million (ppm). This data provides the best representation of building ventilation performance and occupant comfort. They are also indicative of conditions that are detrimental to building systems including moisture intrusion and the potential for fungi growth (mold and mildew) and related damage of building materials.

Recommended temperatures vary based on the season, occupant activity, and relative humidity levels. Generally, recommended setpoint heating temperatures in northern New England range between 67°F and 70°F and recommended cooling setpoint temperatures range between 73°F and 76°F. Relative humidity (RH) levels fluctuate consistent with seasonal atmospheric conditions. A range between 30% and 65% is recommended (ASHRAE). While there are no known adverse health effects related to elevated CO_2 concentrations, it can cause acute illness including headaches, drowsiness, lethargy, and nausea. For this reason, the U.S. Environmental Protection Agency (EPA) has established a recommended threshold concentration of 1,000 ppm.

The IAQ in the Fire Department was measured on January 3rd, 2012 between the hours of 1303 and 1344. The building was normally occupied when the measurements were obtained. Thirteen (13) IAQ measurements were obtained at representative locations throughout the building. Appendix C presents all of the measurements. Results of the IAQ measurements are summarized as follows:

- Temperatures in the building ranged from 65.6°F in the second floor meeting room, to 74.6°F in the Receptionist's office. The average recorded temperature was 70.7°F.
- Relative humidity levels were relatively consistent. A measurement of 12.5% was recorded in the rear stairwell and 23.1% in the second floor meeting room. The average relative humidity was 15.0%.
- CO_2 concentrations ranged from 444 ppm in one of the bedrooms to 635 ppm in the Receptionist's Office with an average of 570 ppm. No levels exceeded the EPA recommended threshold of 1,000 ppm.

Table 15: Summary of IAQ Data

IAQ Metric	Low	High	Avg.	Range of Variance	Recommended
Temperature (°F)	65.6	74.6	70.7	9.0	67 – 70
Relative Humidity (%)	12.5	23.1	15.0	10.6	30 - 65
Carbon Dioxide (ppm)	444	635	570	191	<1,000

Temperatures had an overall wide range of variance of 9°F but were relatively consistent with temperatures recorded on the same floor. Recorded temperatures in second floor spaces averaged a few degrees warmer than the first floor. Relative humidity also varied some throughout the building with a 10.6% range of variance between the lowest and highest recordings. CO_2 concentrations were consistently low with a moderate range of variance of 191 ppm. Figure 20 presents the data trending for the three IAQ parameters.

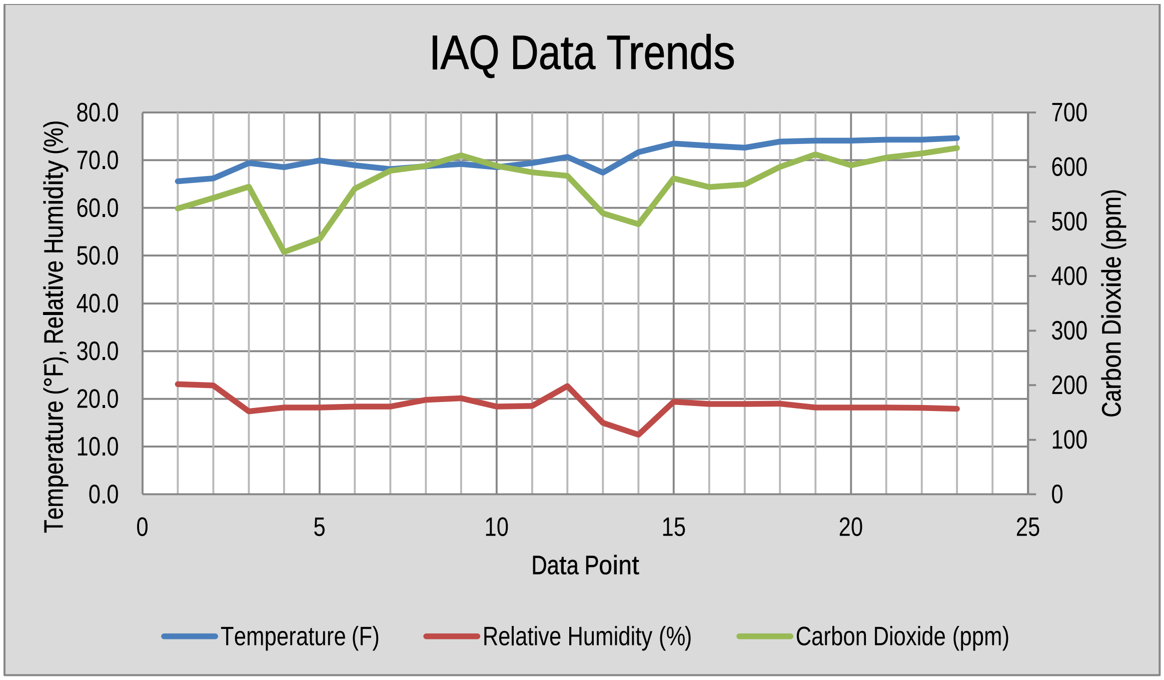


Figure 20: Indoor Air Quality Data Trends

Secondary Observations

Observations noted herein are not directly related to the objective of the energy audit. Investigation of these items is beyond the defined scope of services and these observations are not intended to be inclusive of all building issues and code infractions. They are provided as anecdotal information for the Town's consideration and may warrant further investigation.

Structural Systems

There were no structural system issues noted within the HFD facility.

Roofing Systems

There is a persistent leak through the roof at the east side of the building. Depending on the location, leaks can lead to ceiling, wall, structural, mechanical, electrical damage. Moisture also promotes the development of mold and mildew. It is recommended this leak be addressed before any further damage is done.

Building Code

No building code issues were identified.

Life Safety Code

No life safety codes were observed during the field audit. The building contains a wet sprinkler system supplied by water reservoirs.

ADA Accessibility

The HFD facility appears to comply with current ADA standards. The first floor of the building accessible and the second floor can be accessed by a wheelchair lift at the main entrance.

Hazardous Building Materials

No hazardous building materials were identified during the site review.

E. BUILDING ENERGY MODELING

Source Data

Required source data input for the eQUEST© model includes geographical location, building use type(s), occupancy schedules, building dimensions, envelope systems, fenestration systems, lighting systems, and all mechanical systems (heating, cooling, ventilation domestic hot water). The building characteristics and systems data was obtained during the building site review. Energy usage was provided by the Town for grid electricity and heating oil.

Model Calibration

The quality of the output data is a function of the accuracy of the input data. While eQUEST© is a sophisticated computer simulation program, like any program there are limitations resulting from unusual building characteristics and operating variables that cannot be discretely defined in the program. To ensure that the model simulates the building operation with high accuracy, an iterative model calibration process is completed where actual building energy usage data is checked against the model output values. This process is repeated until the deviation between the energy usage derived from the baseline building simulation and the actual energy consumption is within an acceptable range.

Summary of Model Results

The HFD facility was modeled using eQUEST© computer simulation program. Developing an accurate baseline model of the building presented certain challenges including accounting for the high electrical usage and the high heating fuel usage. Once the baseline calibration was completed, several major Energy Efficiency Measures (EEMs) were simulated within the model including:

- Replacing the Peerless Boiler® with a modulating gas condensing unit.
- Replacing the DHW heater with a tankless demand gas-fired unit.

The resulting energy savings and costs for these measures are presented in Section G (Recommendations) and the model output is provided in Appendix I. Tables 16 and 17 present a summary of the model predicted annual energy usage by category for electrical and heating fuel. The actual electrical consumption of 59,910 kWh/yr is slightly higher than the model prediction of 58,750 kWh/yr.

Table 16: Model Predicted Baseline Electrical Usage

Electric Category	Annual Usage (kWh x 1,000)
Space Cooling	7.05
Vent. Fans	11.06
Pumps & Aux.	6.21
Exterior Lighting	0.64
Misc. Equipment	24.95
Area Lights	8.85
Total Predicted:	**58.75**
Total Actual:	**59.10**

Actual heating fuel consumption (337.0 MBtu) is slightly lower than the model predicted value (339.2 MBtu) based on available data through December 2011. This variation is within the expected range of deviation.

Table 17: Model Predicted Heating Fuel Usage

Electric Category	Annual Usage (MBtu)
Space Heating	328.3
Hot Water	7.9
Pumps & Aux.	3.0
Total Predicted:	339.2
Total Actual:	337.0

The energy modeling results are depicted graphically by a monthly bar graph (Figure 21) which summarizes the energy consumption for electricity and gas consumption separately by category. For example, "Area Lighting" is relatively consistent throughout the year while "Space Cooling" has a seasonal variation.

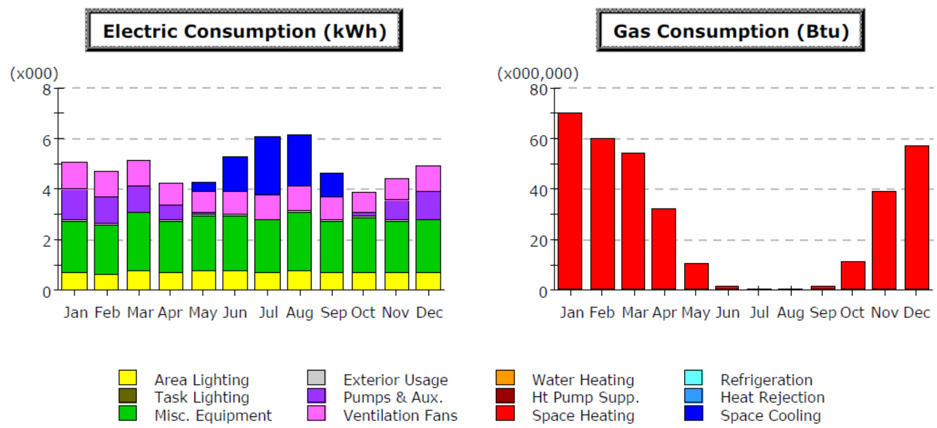


Figure 21: Monthly Energy Use Graph by Category (Baseline)

Annual energy consumption by category is also graphed using eQUEST® (Figure 22). This information is depicted in a pie graph and helps determine the largest overall use categories. For the HFD the "Misc. Equipment" category is determined to use the most electrical energy (42%) while "Space Heating" consumes the most amount of gas (97%). "Misc. Equipment" includes all plug loads such as office equipment and appliances. A final comparison between the baseline and modeled energy efficiency measures is also provided in the appendices in bar graph format to illustrate changes in energy use with each measure.

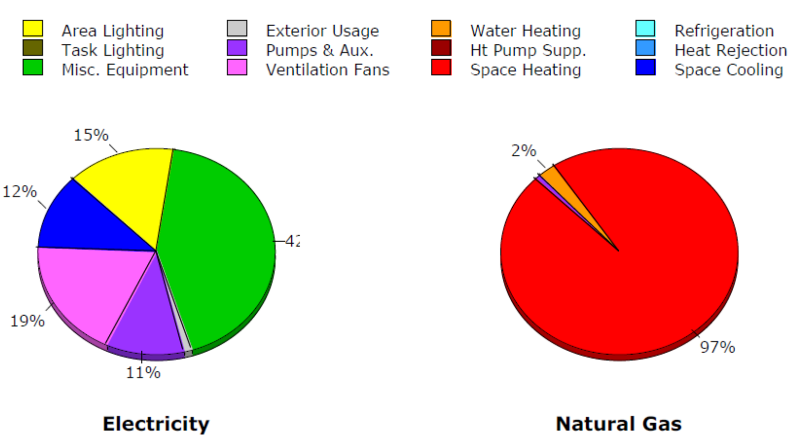


Figure 22: Annual Energy Use Graph by Category (Baseline)

F. FACILITY BENCHMARKING

ENERGY STAR for Commercial Buildings

The Fire Department was benchmarked using the EPA's ENERGY STAR® Portfolio Manager for Commercial Buildings. This benchmarking program accounts for building characteristics, regional climatic data, and user function. It then ranks a building within its defined category amongst all other buildings entered in the program to date. The defining metric is the building Energy Use Intensity (EUI). If a building scores at or above the 75th percentile within its category then it becomes eligible for ENERGY STAR® certification pending an on-site validation review by a licensed Professional Engineer. Currently the program does not have categories for every commercial building type but they can still be entered into the program and checked against similar buildings to determine where the building ranks compared to the current national average. The average energy intensity for every building type category is constantly changing and theoretically is it reducing as more efficient buildings are constructed and existing buildings implement energy efficiency measures. Therefore, buildings that currently meet the eligibility requirements may not be eligible next year when they apply for annual re-certification.

The Hollis Fire Department is defined as a "Fire Station/Police Station" use building and cannot be certified in the Commercial Building ENERGY STAR® program do to its use category. Utility data for electric and heating fuel for the preceding twelve (12) months was input into the benchmarking program. Table 18 presents the annual energy use (through December 2011) and Table 19 presents a summary of the Statement of Energy Performance (SEP) benchmarking results. The SEP is presented in Appendix G.

Table 18: Annual Energy Consumption

Energy	Site Usage (kBtu)
Electric – Grid	204,413
Propane	337,034
Total Energy:	541,447

Table 19: SEP Benchmarking Summary

Location	Site EUI (kBtu/ft^2/yr)	Source EUI (kBtu/ft^2/yr)
Hollis Fire Department	41	78
National Median (Office)	82	146
% Difference:		-46%
Portfolio Manager Score:		NA

Compared to the office buildings that have entered data into Portfolio Manager to date, the HFD facility energy use is considerably lower than the national average. The source EUI for the HFD building is 78 kBtu/ft^2/yr while the national average is 146 kBtu/ft^2/yr, meaning it uses 46% less energy than the average public safety building.

G. RECOMMENDATIONS

Energy Conservation Measures

Based on the observations and measurements of the Fire Department, several energy conservation measures (EEMs) are proposed for consideration (Tables 20 to 22). These recommendations are grouped into three tiers based on the cost and effort required to implement the EEM. EEMs are ranked within each tier based on the capital cost for implementation versus the net estimated energy cost savings.

Tier I EEMs are measures that can be quickly implemented with little effort for no or little cost. They include routine maintenance items that can often be completed by facility maintenance personnel and changes in occupant behavior or building operation. Tier II items generally require contracted tradesmen to complete but can generally be implemented at low cost and within operating building maintenance budgets. EEMs that require large capital expenditure and budgetary planning (one year or greater) are categorized as Tier III measures.

Simple payback is calculated for the proposed EEMs. The cost to implement the measure is estimated based on current industry labor and equipment costs and the annual cost savings represents the reduced costs for energy savings. The net energy and cost savings for smaller EEMs is based on the estimated reduction of the associated energy consumption as defined in the model and equipment inventory. Using these costs, the payback period is then calculated as the number of years at which the capital cost of implementation equals the accumulated energy cost savings. Other qualitative considerations that do not influence the Simple Payback Method calculation but should be considered by the owner during the decision-making process include:

- Occupant comfort.
- Relative operation and maintenance requirements.
- Remaining useful life of equipment and systems to be replaced.

Energy cost savings are based current cost of electricity at $0.14 per kWh (PSNH) and the current price of propane of $3.55 per gallon. (NHOEP March 12, 2012)

Tier I Energy Efficiency Measures

Tier I EEMs are measures that can be quickly implemented with little effort for zero or little cost (Table 20). They include routine maintenance items that can often be completed by facility maintenance personnel, and changes to occupant behavior or building operation. Six (6) Tier I EEMs are recommended.

Table 20: Tier I Energy Efficiency Measures

EEM No.	EEM Description	Capital Cost	Annual Cost Savings	Payback (yrs.)	SIR
T1-1	Remove the vending machine in apparatus garage.	$0	$240	0	-
T1-2	Remove the compact refrigerator on second floor and utilize refrigerators on first floor.	$0	$106	0	-
T1-3	Consolidate the two commercial refrigerators into a single unit. Disconnect the second unit.	$0	$296	0	-
T1-4	Replace incandescent bulbs with compact fluorescent bulbs (12).	$36	$41	-	-
T1-5	Replace CRT computer monitors (5) with ENERGY STAR® rated LCD monitors.	$700	$420	1.7	4.8
T1-6	Complete air sealing on entry doors and windows (Figure 23).	$580	$392	1.5	4.7

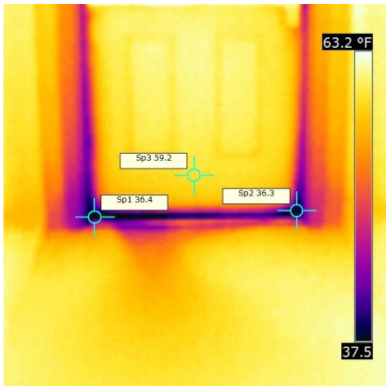


Figure 23: Poor Seal Around Door

Recommended Tier I EEMs include reducing the plug load by removing the vending machine and compact refrigerator; replacing old inefficient CRT computer monitors with LED units, and replacing incandescent bulbs with compact fluorescents. Air sealing measures of doors and windows will provide substantial energy savings (heating and cooling) and will reduce nuisance drafts.

If the department prefers to keep a vending machine at the facility, it is recommended the current unit be replaced with an Energy Star qualified machine. Since machines are typically rented from a supplier, the department would have to specifically request an Energy Star rated machine. Energy Star qualified machines typically use half the energy a standard unit uses and are typically provided by the supplier at no additional cost depending on the contract between the supplier and the department.

Tier II Energy Efficiency Measures

Tier II items generally require contracted tradesmen to complete but can be implemented at low cost and within operating building maintenance budgets. Four (4) recommended Tier II EEMs are presented in Table 21.

Table 21: Tier II Energy Efficiency Measures

EEM No.	EEM Description	Capital Cost	Annual Cost Savings	Payback (yrs.)	SIR
T2-1	Install occupancy sensors to control lighting in high-bay garage.	$736	$350	2.1	5.7
T2-2	Replace existing domestic hot water heater with mini-tank LP-fired hot water heater, OR, a condensing tank unit.	$2,428	$280	8.7	2.3
T2-3	Replace exterior metal halide wallpack fixtures with LED units (4).	$2,963	$200	14.8	1.7
T2-4	Install de-stratification fan units (6) in high-bay to create an air curtain along overhead doors.	$4,522	$491	9.2	1.5

The existing domestic hot water (DHW) tank is inefficient. Considering the moderate demand for hot water in the HFD, replacing the tank unit with a mini-tank LP-fired unit or a condensing tank unit would yield significant energy savings. If the hot water boiler is replaced then a combination domestic storage tank system should be considered.

Overhead lighting in the apparatus garage is controlled with a manual switch and operates frequently. Installing occupancy sensor controls will reduce lighting energy. Replacing the exterior metal halide wallpack fixtures would yield a cost savings while improving lighting quality. Hot air in the high-bay area migrates to the ceiling space resulting in a temperature difference at the occupied level (typically 4°F to 6°F).

When the overhead doors are opened the denser cold air enters the space at the lower level and displaces the less dense heated air at the upper level. Installing de-stratification fan units above each overhead door will force the heated air to the floor level providing air mixing and temperature equilibrium. The units will also create an air curtain (pressure differential) thereby reducing the rate of cold air entering the open doors.

Tier III Energy Efficiency Measures

EEMs that require large capital expenditure and budgetary planning (one year or greater) are categorized as Tier III measures. Four (4) Tier III EEMs are provided in Table 22 for the HFD facility.

Table 22: Tier III Energy Efficiency Measures

EEM No.	EEM Description	Capital Cost	Annual Cost Savings	Payback (yrs.)	SIR
T3-1a	Replace existing LP-fire boiler with an automated wood pellet-fueled hot water boiler. Install NEMA premium rated circulation pumps with VFD controllers.	$37,433	$2,680	14.0	1.8
T3-1b	Replace existing LP-fire boiler with high-efficiency LP-fired modulating condensing unit. Install NEMA premium rated circulation pumps with VFD controllers.	$27,945	$1,781	15.7	1.6
T3-2	Replace five (5) A/C condensing units with high efficiency units (SEER 20 / EER 13).	$7,390	$560	13.2	1.4
T3-3	Augment LP-fired air furnace in high-bay with LP-fired IR heaters (6).	$11,663	$798	14.6	1.2
T3-4	Add additional six (6) inches blown in cellulous to apparatus garage ceiling (6,300 SF).	$19,702	$650	30.3	1.0

(1) Tier III EEM investment costs include fees for design & engineering, construction management, and a 15% cost contingency.

Figure 24: Peerless Boiler IR

The Peerless Boiler® is nearing the end of its useful life (Figure 24) and replacing this with a high efficiency LP-fired modulating condensing unit or an automated wood-pellet would significantly reduce energy consumption (Figure 25). The unit also appears to be significantly under-sized for the expected heat loading of the building. A wood based pellet unit is a practical alternative to a fossil-fuel fired boiler. Costs for these units is typically higher than conventional units however the fuel cost (per Btu) is significantly less than fossil-fuels and they have lower CO_2e emissions. As part of the system replacement NEMA rated circulation pumps with VFD controllers are recommended. The dated five (5) split A/C units have low efficiency ratings. Recommendations include replacing the five (5) units with 3 larger commercial units with minimum rated efficiencies of SEER=20 and/or EER=13.

As mentioned herein, the air heating unit in the high-bay is an inefficient means to heat the space. The unit is expected to operate frequently with the overhead doors and it accounts for most of the heating fuel in the HFD facility. IR units heat mass as opposed to air. Installing several ceiling suspended units over equipment and floor areas will provide an efficient source of heating and will reduce the operating frequency of the air heating unit. Increasing the thermal integrity of the high-bay attic floor will provide a substantial reduction in heating and will reduce heat loading to the space in warmer seasons.


Figure 25: Automated Wood Pellet Boiler (Maine Energy Systems®)

The energy cost savings and resulting payback are based upon each independent measure implemented for the building in its current condition and function. There are interdependencies among measures that will affect the net realized energy savings. For example, replacing lighting fixtures with lower energy units reduces heat load to the building thereby requiring more heating fuel to compensate for the loss in heat from the inefficient light fixtures. Also, many of the larger capital Tier III EEM projects may include some of the smaller dependent Tier I and II EEMs.

Capital costs are provided for budgetary planning only. They are estimated based on current industry pricing for materials and labor. A detailed cost estimate should be developed prior to appropriating capital funds for the more costly measures.

EEMs Considered but not Recommended

The following measures were identified as part of the building evaluation but are not recommended as best-value EEMs. Considerations include the cost feasibility and payback term and occupant comfort concerns.

1. A lighting retrofit project was recently completed (2011) and replacing the modern fixtures with higher efficiency units is not cost practical at this time.
2. Several insulation gaps were noted during the IR survey of walls. Spot injection insulation would improve the thermal integrity of the walls however the cost payback is rather long.
3. Replacing high-bay heating system with a more efficient system such as in-floor radiant heating would reduce heating fuel consumption however there are more cost practical solutions recommended herein including de-stratification fans units and augmenting the system with IR heaters.
4. Insulating the exposed foundation wall would be a costly measure providing a long payback.

O&M Considerations

O&M and considerations are provided for existing systems and for proposed EEMs. They are intended to provide best-value practices for the building manager and to identify any O&M requirements for the proposed EEMs.

1. A new warranted heating boiler will reduce maintenance and repair costs and replacement parts are readily available.
2. A new warranted domestic hot water heating unit will reduce maintenance and repair costs and replacement parts are more readily available.

Indoor Air Quality Measures

Based upon the measured indoor air quality in the Hollis Fire Department, no area exceeds the EPA CO_2 recommended threshold of 1,000 ppm. CO_2 concentrations ranged between 444 and 635, with a building average of 570 ppm. With consistently low measurements the building appears to be over-ventilated. Measures to reduce ventilation frequency are provided herein.

Renewable Energy Considerations

While renewable energy systems generally require a higher capital investment, they provide a significant reduction in the consumption of non-renewable fossil fuel energies. Other obvious benefits include a reduction in ozone depleting gas emissions (as measured by CO_2 equivalency), otherwise referred to as the "carbon footprint". Renewable energy systems also reduce the reliance upon fossil fuels derived from foreign nations and mitigate pricing fluctuations in a volatile and unpredictable market.

Evaluating the practicality of a renewable energy system for a specific facility should consider several facility specific variables including:

- Geographical location.
- Building orientation.
- Adjacent and abutting land features.
- Site footprint and open space.
- Building systems configuration and condition.
- Local zoning or permitting restrictions.
- Currently available financial resources (grants, utility provider rebates, tax incentives).

Table 23 provides a summary description of the more common and proven renewable energy technologies. The Table also provides a preliminary feasibility assessment for implementing each technology at the HFD facility. Additionally, each renewable energy technology is scored and graded based on technology and facility specific characteristics. Appendix H presents the criteria used to develop the score and grade for each renewable energy technology. A more rigorous engineering evaluation should be completed if the Town is considering implementing any renewable energy system.

Table 23: Renewable Energy Considerations

Renewable Energy System	System Description & Site Feasibility
Biomass Heating Systems	System Description: Biomass heating systems include wood chip fueled furnaces and wood pellet fueled furnaces. For several reasons, wood chip systems are generally practical only in large scale applications. Wood pellet systems can be practical in any size. Wood chip systems are maintenance intensive based on the market availability and procurement of woodchip feedstock and variability of woodchip characteristics (specie, size, moisture content, bark content, Btu value) which affect the operating efficiency of the furnace and heating output. They require a constant feed via a hopper and conveyor system and feed rates must vary according to feedstock Btu value and heating demand. For these reasons they typically require full-time maintenance and are practical only in large scale applications. Wood pellet systems are much less maintenance intensive and feedstock availability and consistency is less of an issue. Both systems reduce the dependency on fossil-fuels and feedstock can be harvested locally.
Score: 82%	*Site Feasibility:* *A conventional pellet boiler unit is a practical heating system for the building however this requires additional effort for procurement of pellets, storing pellets, periodic filling the pellet hopper during the heating season, and emptying the ash. However, there are new systems with automated feed and ash removal systems that would be a practical application at the Fire Department.*
Ground-Mounted Solar Photovoltaic Systems	System Description: A ground-mounted PV system is composed of the same solar collector panels used for a roof-mount system. The collectors are mounted on a frame support system on the ground verses a roof structure. This is advantageous when roof framing cannot accommodate the increased load of the collector panel and the ease of installation and access for maintenance and repair.
Score: 79%	*Site Feasibility:* *The open space to the south of the Fire Department provides an ample amount of south facing land for a medium-sized (10kW-30kW) system to be placed on. This would require a design and permitting process with the local utility for a grid-tie connection. Current utility incentives and renewable energy grants would help offset the capital cost for the system.*
Geothermal Heating & Cooling	System Description: Geothermal heating systems utilize solar energy residing in the upper crust of the earth. Cooling is provided by transferring heat from the building to the ground. There are a variety of heating/cooling transfer systems but the most common consists of a deep well and piping loop network. All systems include a compressor and pumps which require electrical energy. Geothermal systems are a proven and accepted technology in the New England region. Site constraints and building HVAC characteristics determine the practicality.
Score: 78%	*Site Feasibility:* *Considering the existing hydronic heating equipment is compatible with a ground-source water heat pump system, it is a practical technology for the building. There appears to be ample land available for the system to be installed.*
Roof-Mounted Solar Photovoltaic Systems	System Description: Photovoltaic (PV) systems are composed of solar energy collector panels that are electrically connected to DC/AC inverter(s). The inverter(s) then distributes the AC current to the building electrical distribution system. Surplus energy is sent into the utility grid via net metering and reimbursed by the utility at a discounted rate. The capital investment cost for PV systems is high but the technology is becoming increasingly more efficient thereby lowering initial costs.

Score: 76%	***Site Feasibility:*** *The roof of the high bay has a large surface area which faces the south which would be conducive to a medium-sized (10kW-30kW) system. This would require a design and permitting process with the local utility for a grid-tie connection. Current utility incentives and renewable energy grants would help offset the capital cost for the system. A structural evaluation of the roof framing system would be required to ensure that it could accommodate the increased loading. The existing electrical systems may require upgrade especially if the PV system is interconnected to the grid.*
Solar Domestic Hot Water	System Description: Solar domestic hot water (DHW) systems include a solar energy collector system which transfers the thermal energy to domestic water thereby heating the water. These are typically used in conjunction with an existing conventional DHW system as a supplemental water heating source. Because of the high capital cost, solar DHW systems are only feasible for facilities that have a relatively high demand for DHW.
Score: 76%	***Site Feasibility:*** *Based on the low demand for domestic hot water, a solar hot-water system may be a practical consideration for the building. The capital cost could be offset with substantial utility rebates and incentives. The system could provide primary DHW during summer months when demand is low. In colder months, it would provide secondary heating.*
Solar Thermal Systems	System Description: Similar to a roof-mounted solar PV system, solar thermal systems are most commonly installed on rooftops. These systems utilize solar energy for heating of outdoor air. The most common application is for pre-heating of outdoor air used for air exchanges systems in buildings. This reduces the heating fuel required to maintain setpoint temperatures in interior spaces.
Score: 72%	***Site Feasibility:*** *The building currently has an ample amount of space for a PV system to be installed and the solar-thermal could utilize the five (5) existing air handling units. A potential application includes augmenting the air furnace in the high-bay area with solar thermal system installed on the south facing roof. A more focused evaluation is required to determine if this is a cost practical solution.*
Wind Turbine Generator	System Description: Wind turbine generators (WTGs) simply convert wind energy into electrical energy via a turbine unit. WTGs may be pole mounted or rooftop mounted however system efficiency improves with increased elevation. Due to cost and site related constraints, WTG technology in New England is only practical for select sites. Constraints include local geographical and manmade features that alter wind direction, turbulence, or velocity. Other technology constraints include local variability of wind patterns and velocity. Additionally, WTGs require permitting (local, state, FAA) and local zoning that may restrict systems due to height limitations, and/or, visual detraction of the local landscape. Presently, WTG technology is not widely used in New England based on the relatively high capital cost compared to the energy savings.
Score: 71%	***Site Feasibility:*** *There is adequate site space to install a small (<5kW) pole-mounted wind turbine. However, considering the relatively low mean wind speeds in the region, a WTG unit may not be a cost practical consideration.*
Combined Heat & Power (CHP)	System Description: Combined heat and power (CHP) systems are reliant on non-renewable energies. Systems are composed of a fossil-fuel powered combustion engine and electrical generator. Electrical current is distributed to the building distribution system to reduce reliance on grid supplied electricity. Byproduct thermal energy derived from the combustion engine is recovered and used to heat the building (this is generally considered to be renewable energy). Another benefit of CHP systems is that they provide electrical energy during power outages in buildings that do not have emergency power backup. Larger CHP units require a substantially large fuel supply and if natural gas is not available then a LPG tank must be sited.
Score: 63%	***Site Feasibility:*** *Considering the relatively small electric and heating demand for the Fire Department, a CHP may not be cost practical. There is no natural gas within the Town and costs associated with the infrastructure development for a large propane tank would be high. CHP systems also require intensive maintenance and have a low expected service life.*

H. ENERGY EFFICIENCY INCENTIVE AND FUNDING OPPORTUNITIES

The State of New Hampshire along with the utility companies offer multiple programs designed to improve the energy efficiency of municipal and school buildings through financial incentives and technical support. Some of the currently available programs are presented herein however building managers are encouraged to explore all funding and incentive opportunities as some programs end and new programs are developed. For the most current listing of advertised programs and initiatives, visit www.dsireusa.org.

New Hampshire Public Utilities Commission

New Hampshire Pay for Performance

This program addresses the energy efficiency improvement needs of the commercial and industrial sector. The Program is implemented through a network of qualified Program Partners. Incentives will be paid out on the following three payment schedule: Incentive # 1: Is based on the area of conditioned space in square feet. Incentive #2: Per kWh saved and Per MMBTU saved based on projected savings and paid at construction completion. Incentive #3: Per kWh saved and Per MMBTU saved based on actual energy savings performance one year post construction. Total performance incentives (#2 and #3) will be capped at $300,000 or 50% of project cost on a per project basis. For more information visit http://nhp4p.com.

New Hampshire Public Utilities Commission's Renewable Energy Rebates

The Sustainable Energy Division provides an incentive program for solar electric (photovoltaic or PV) arrays and solar thermal systems for domestic hot water, space and process heat, with a capacity of 100 kW or equivalent thermal output or less. The rebate for PV systems as follows: $1.00 per Watt, capped at 25% of the costs of the system or $50,000, whichever is less. For solar hot water (SHW) systems, the base rebate is $0.07 per rated or modeled kBtu/year, capped at 25% of the cost of the facility or $50,000, whichever is less, as a one-time incentive payment. http://www.puc.state.nh.us/Sustainable%20Energy/RenewableEnergyRebates-CI.html.

New Hampshire Community Development Finance Authority

New Hampshire Community Development Finance Authority Revolving Loan Fund

The Enterprise Energy Fund is a low-interest loan and grant program available to businesses and nonprofit organizations to help finance energy improvements and renewable energy projects in their buildings. The loans will range from $10,000 to $500,000. Larger amounts will be considered on a case by case basis. The program is available to finance improvements to the overall energy efficiency performance of buildings owned by businesses and nonprofits, thereby lowering their overall energy costs and the associated carbon emissions. More information about the program can be found on their website www.nhcdfa.org. These activities may include:

- Improvements to the building's envelope, including air sealing and insulation in the walls, attics and foundations;
- Improvements to HVAC equipment and air exchange;
- Installation of renewable energy systems;
- Improvements to lighting, equipment, and other electrical systems; and
- Conduction of comprehensive, fuel-blind energy audits.

Public Service of New Hampshire (PSNH)

Commercial (Electric) Energy Efficiency Incentive Programs

This program targets any commercial/industrial member building a new facility, undergoing a major renovation, or replacing failed (end-of-life) equipment. The program offers prescriptive and custom rebates for lighting and lighting controls, motors, VFDs, HVAC systems, chillers and custom projects. http://www.psnh.com/SaveEnergyMoney/For-Business/Energy-Saving-Programsand-Incentives.aspx

SmartSTART

The SmartSTART (Savings Through Affordable Retrofit Technologies) advantage is simple – pay nothing out of pocket to have energy efficiency products and services installed in your building. The Smart Start program is limited to PSNH's municipal customers only and includes schools. The program is available on a first-come, first served basis to projects which have been pre-qualified by PSNH. The cost of the improvements is fronted by PSNH which is then repaid over time by the municipality or school using the savings generated by the products themselves. This program is for lighting and lighting controls, air sealing, insulation and other verifiable energy savings measures which have sufficient kilowatt-hour savings. For more information on this program visit: http://www.psnh.com/SaveEnergyMoney/For-BusinesslMunicipal-Smart-Start-Program.aspx

Clean Air - Cool Planet

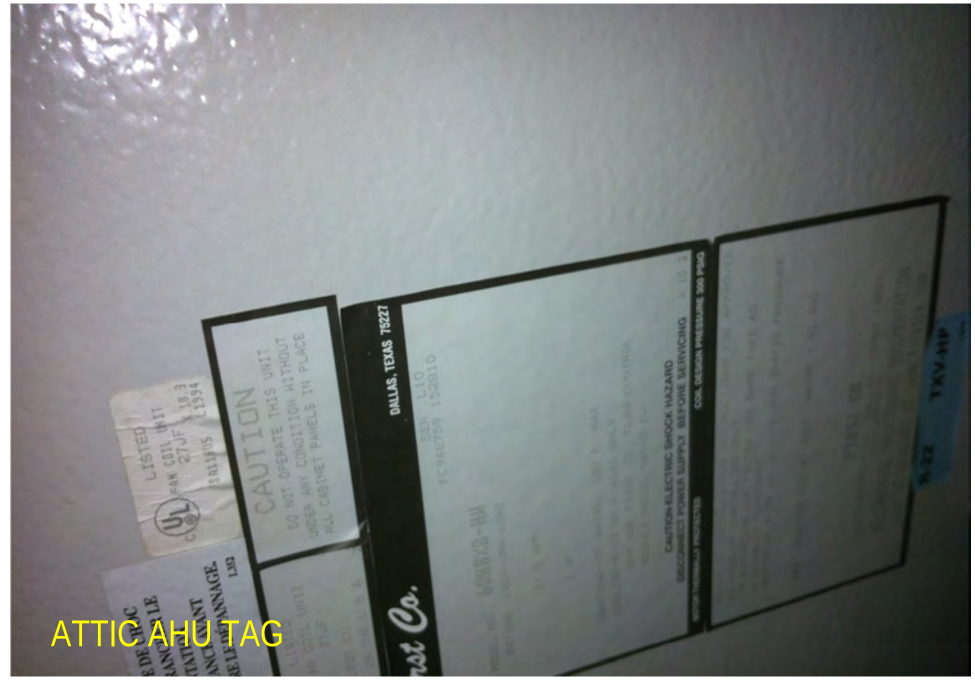
Community Energy Efficiency

CA-CP works with communities throughout the Northeast to find solutions to climate change and build constituencies for effective climate policies and actions. Much of their work focuses on successful models for energy efficiency and renewable energy planning. They advise and partner with citizens, educators, faith groups, small businesses, municipal governments, and other local leaders. They explore cost-effective opportunities that exist for communities to reduce their emissions as well as their vulnerability to climate impacts. One such example is CA-CP's partnership with the University of NH, NH Sustainable Energy Association and UNH Cooperative Extension to create www.myenergypian.net . A groundbreaking suite of web and outreach tools for individual action used by households, schools and community groups around the northeast. http://www.cleanair-coolplanet.orglfor_communities/index.php .

APPENDIX A

Photographs

ATTIC AIR HANDLE UNIT (AHU)



ATTIC AHU TAG

ATTIC AHU, ROOF SUPPORT
AND EXPOSED WIRING

ATTIC AHU


UNIT#3
ATTIC AHU


ATTIC SPACE


UNIT#3
ATTIC AHU


Unit 1
ATTIC SPACE

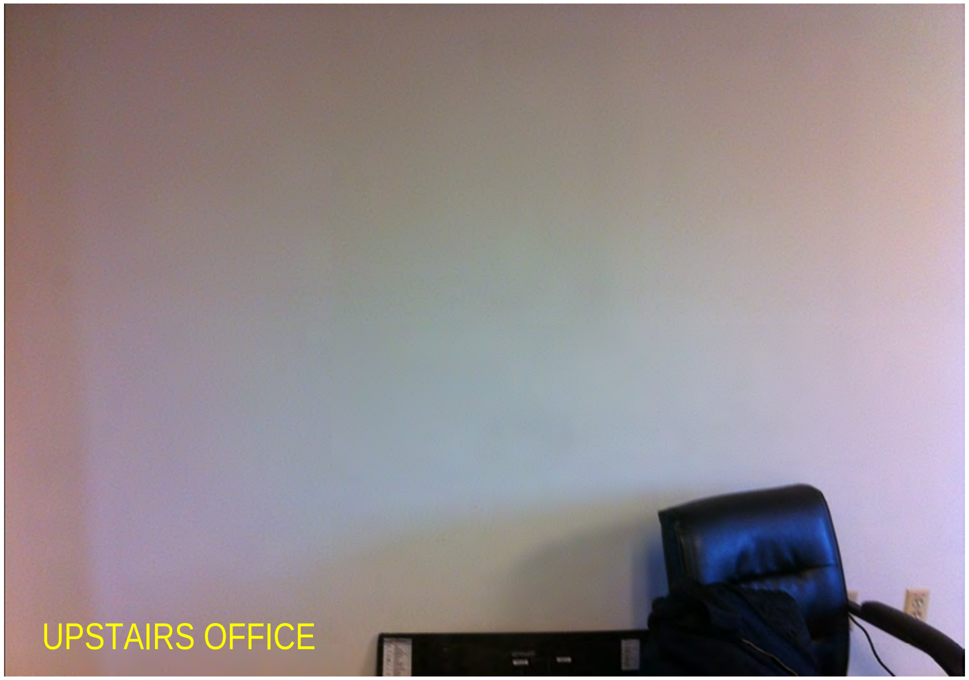

UNIT #5
ATTIC SPACE


UPSTAIRS MEETING ROOM

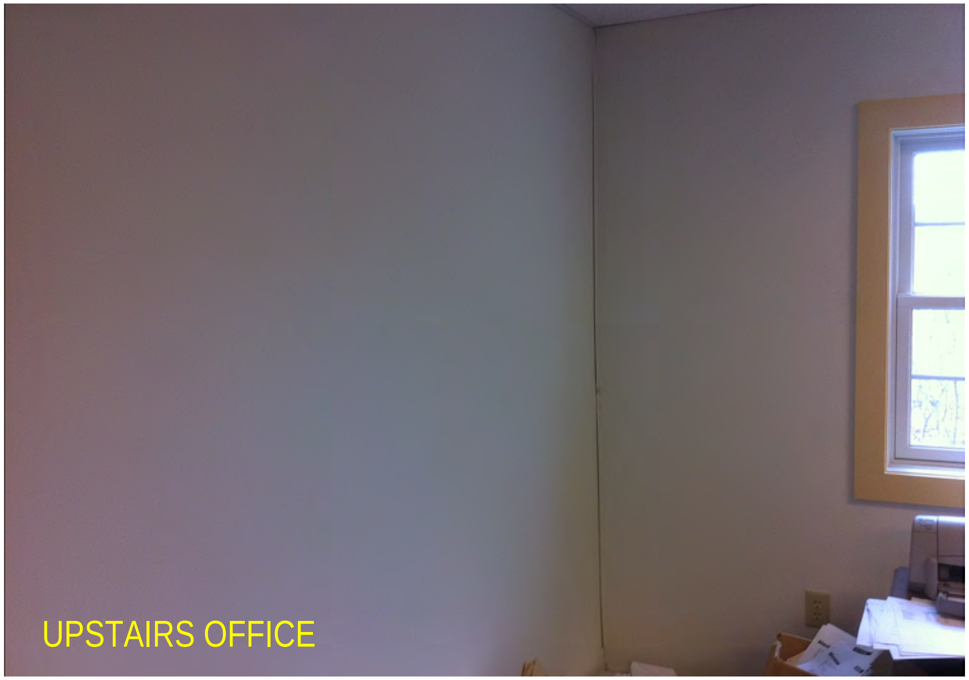

UNIT #2
ATTIC AHU

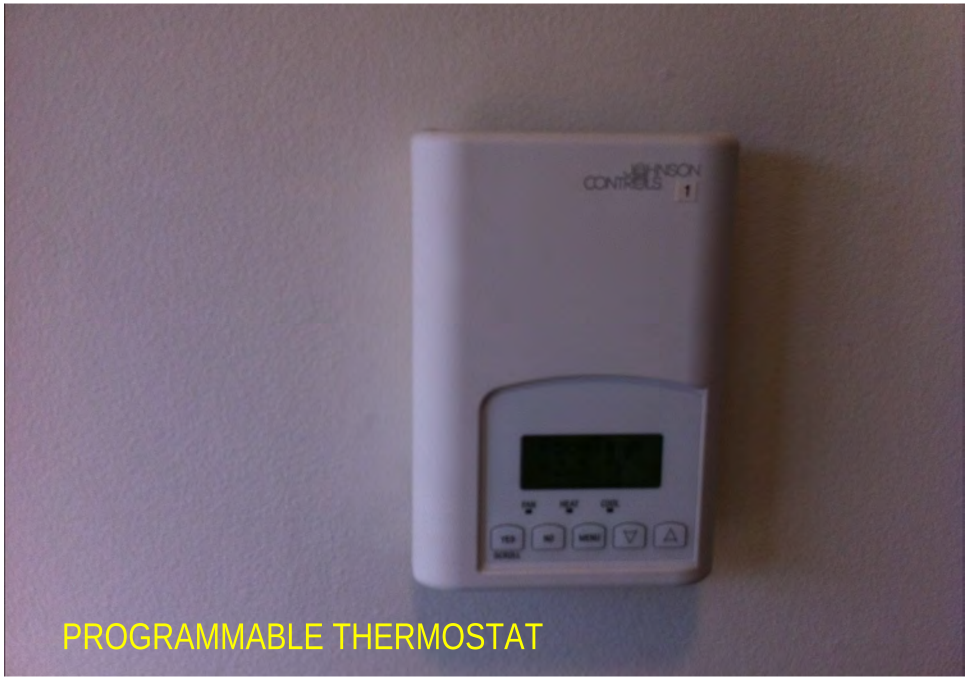

ATTIC SPACE


UPSTAIRS OFFICE


UPSTAIRS OFFICE

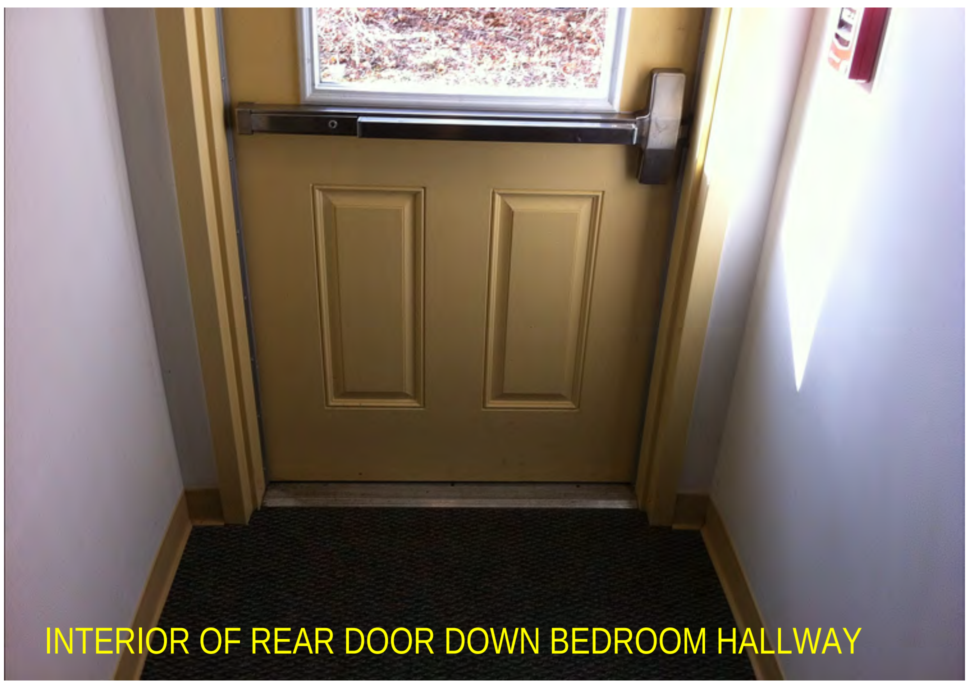

UPSTAIRS MEETING ROOM


UPSTAIRS OFFICE



PROGRAMMABLE THERMOSTAT

ATTIC SPACE



INTERIOR OF REAR DOOR DOWN BEDROOM HALLWAY

KITCHEN WITH 2 LARGE REFRIGERATORS
AND 1 LARGE FREEZER

EXHAUST IN HIGH BAY

LARGE HEATER IN HIGH BAY

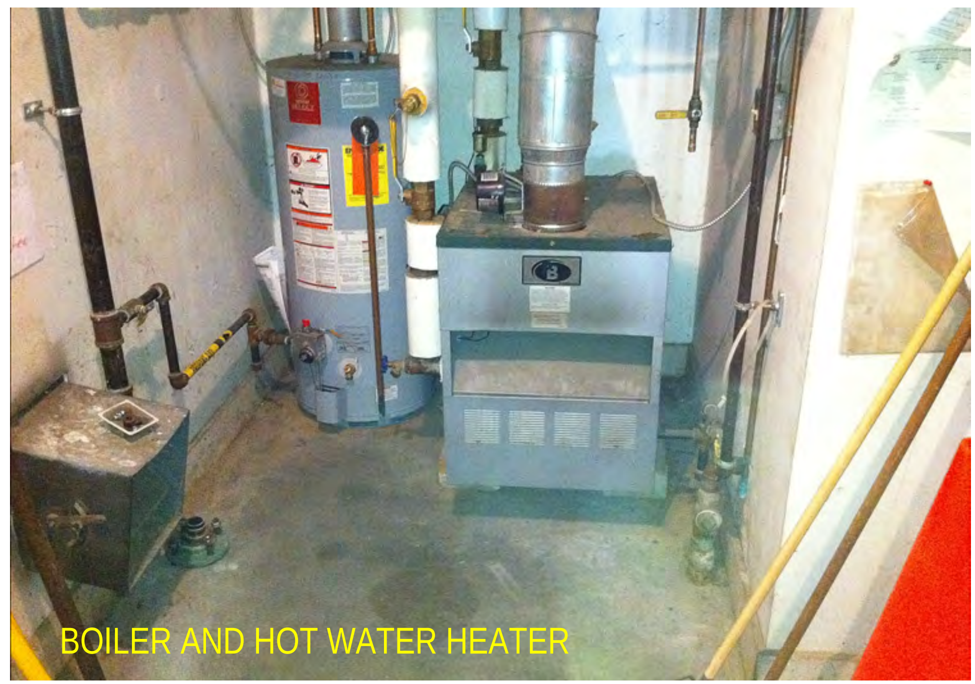
ATTIC SPACE

WATER SOFTENER SYSTEM

VENDING MACHINE IN HIGH BAY


BOILER ROOM

HIGH BAY HEATER

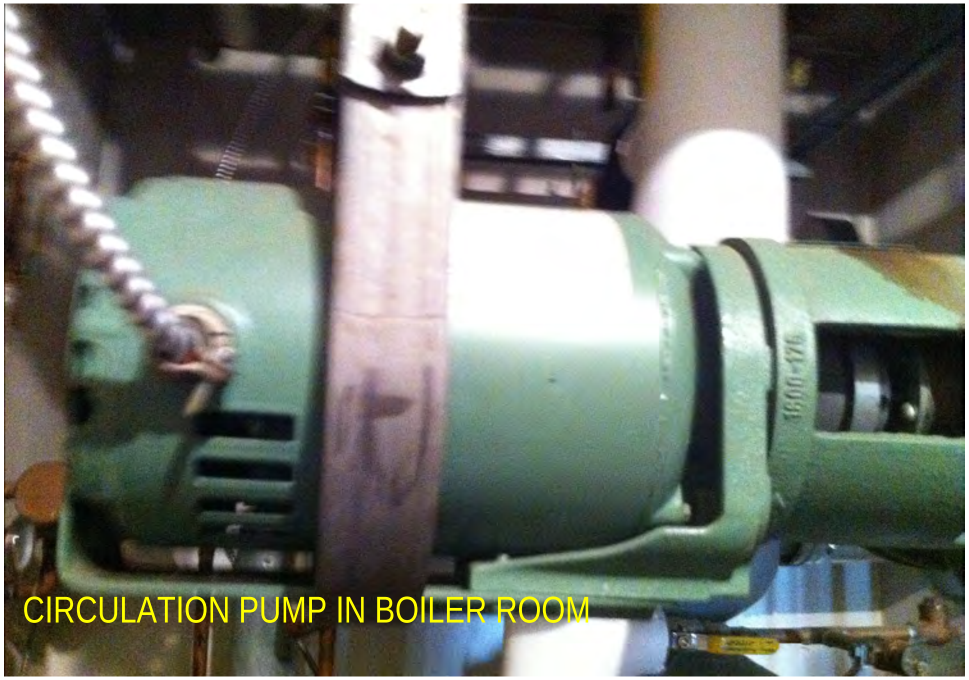

BOILER AND HOT WATER HEATER

HOT WATER HEATER

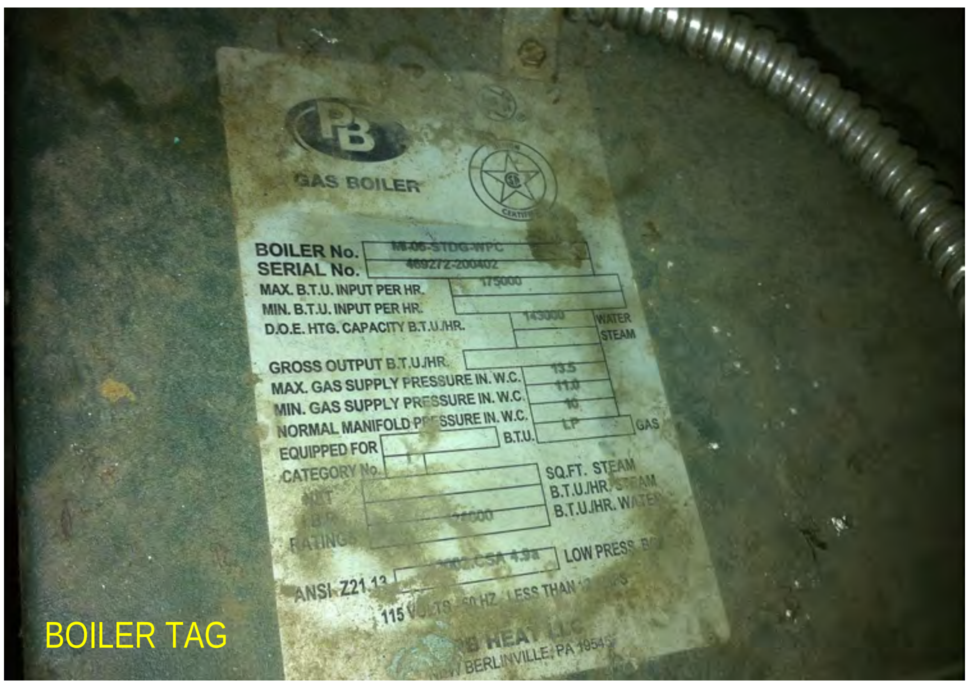
BOILER NAMEPLATE

App bay lights may be overloaded


BOILER


CIRCULATION PUMP IN BOILER ROOM


INSIDE OF EXTERIOR DOOR



BOILER TAG


CIRCULATION PUMP IN BOILER ROOM


EXTERIOR OF BUILDING


EXTERIOR OF BUILDING


HEATER BY DOORWAY IN HALLWAY


EXTERIOR OF BUILDING

EXTERIOR OF BUILDING

PROPANE STORAGE TANK FOR HEATING

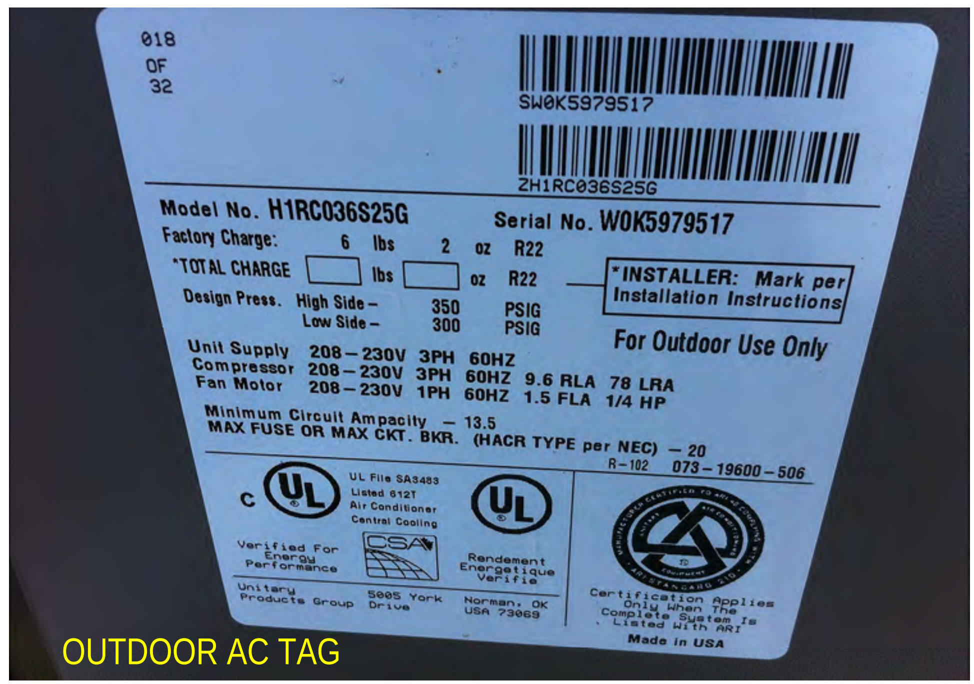
EXTERIOR OF BUILDING

BACKUP GENERATOR ON SITE

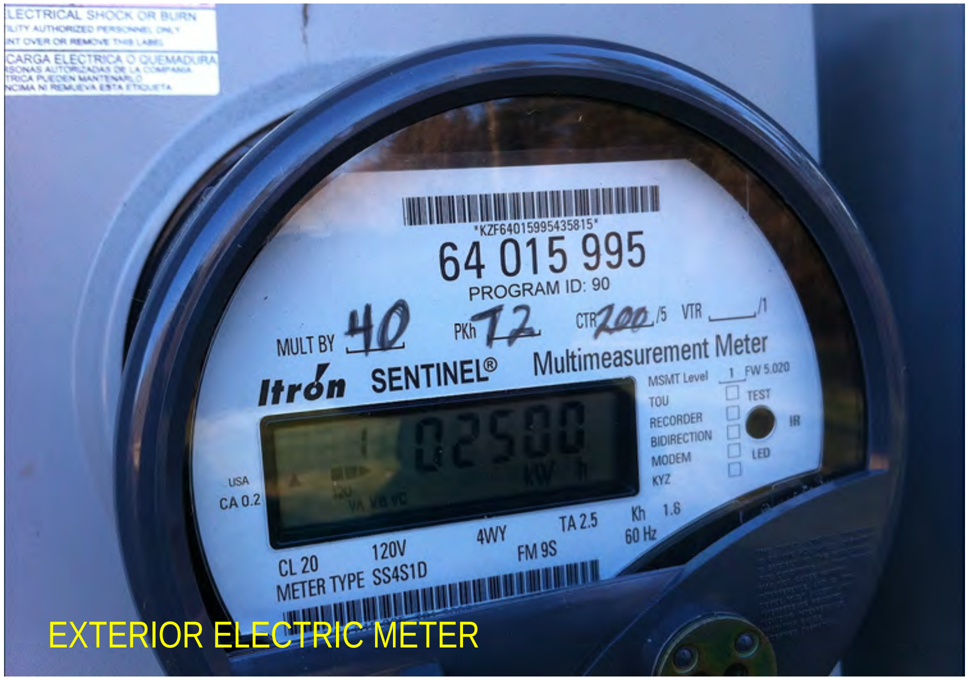

OUDOOR AC UNITS


EXTERIOR OF BUILDING


EXTERIOR OF BUILDING



OUTDOOR AC TAG



EXTERIOR ELECTRIC METER


EXTERIOR LIGHT FIXTURE

EXTERIOR ELECTRIC METER


EXTERIOR OF BUILDING


EXTERIOR OF BUILDING


OUTDOOR AC UNIT


EXTERIOR OF BUILDING


EXTERIOR OF BUILDING


BACKUP GENERATOR


EXTERIOR OF BUILDING

AC UNIT TAG


EXTERIOR OF BUILDING

EXTERIOR WATER SPIGOT

EXTERIOR OF BUILDING

EXTERIOR OF BUILDING

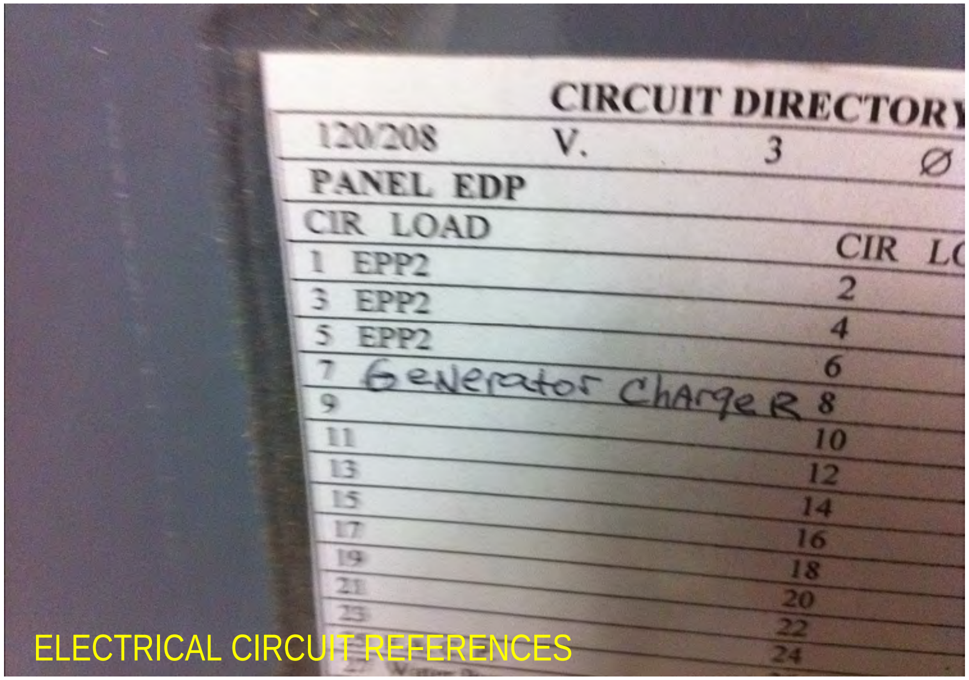
EXTERIOR OF BUILDING

EXTERIOR OF BUILDING

NEAR-EMPTY COMPACT REFRIGERATOR

EXTERIOR OF BUILDING

COPIER AND COMPACT REFRIGERATOR



ELECTRICAL CIRCUIT REFERENCES

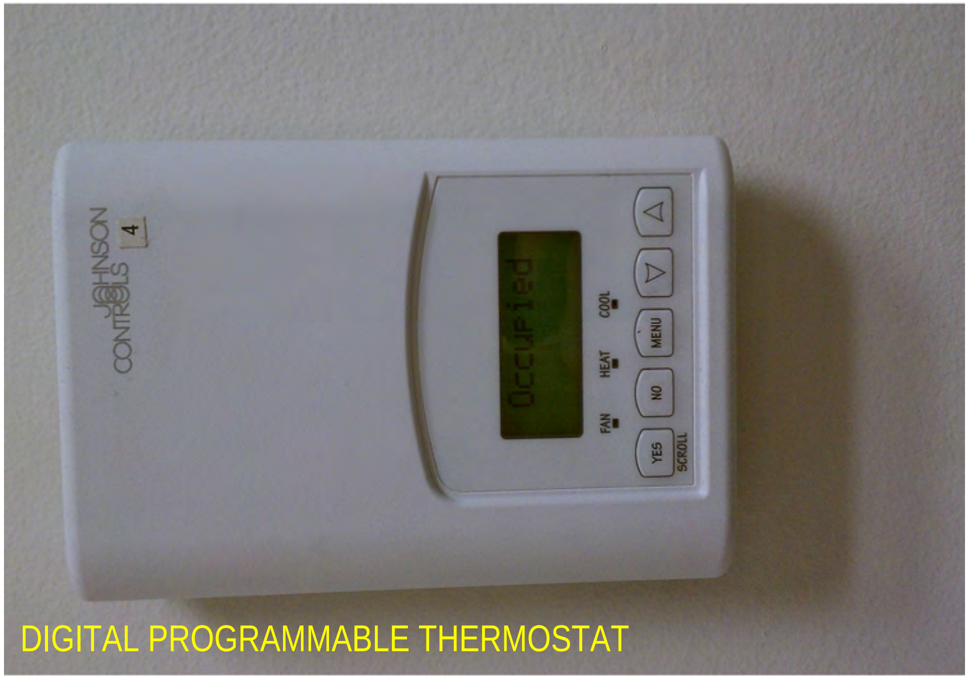
MANUAL THERMOSTAT

ELECTRICAL CIRCUIT BOX


CEILING TILE STAIN INDICATES LEAK AND MOLD


LIGHT FIXTURE IN CHEIF'S MEETING ROOM


SECURITY CARD SWIPE THROUGHOUT BUILDING



DIGITAL PROGRAMMABLE THERMOSTAT

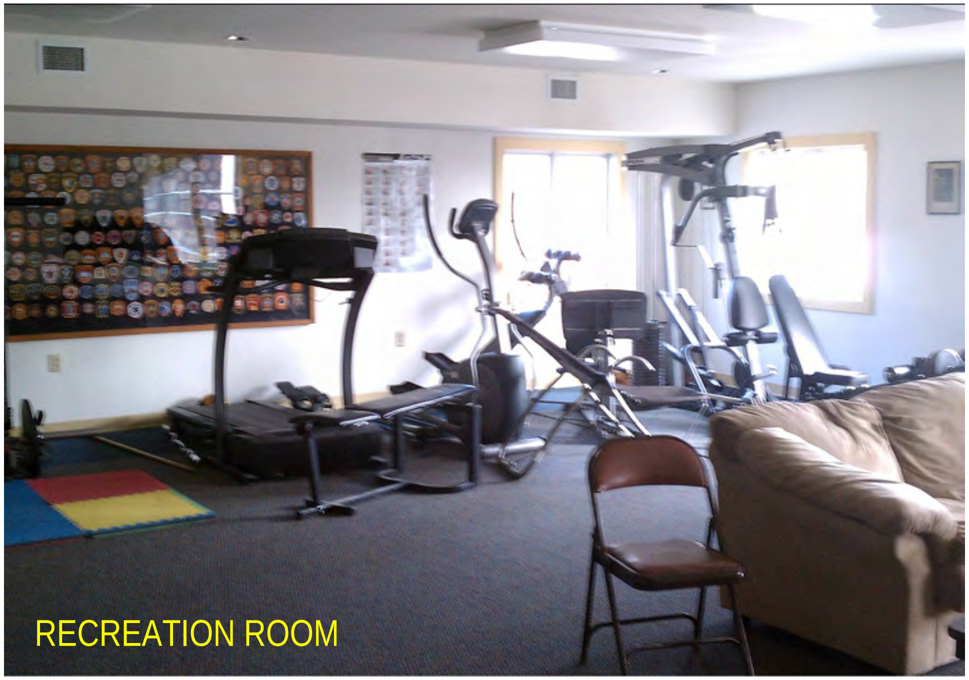

HALLWAY FIRE ALARM


MOTION DETECTOR TO UNLOCK DOOR

ALARM CONTROLS AT MAIN ENTRANCE

MOTION DETECTOR TO UNLOCK DOOR


HANDICAP ELEVATOR



RECREATION ROOM

BEDROOM

RECREATION ROOM

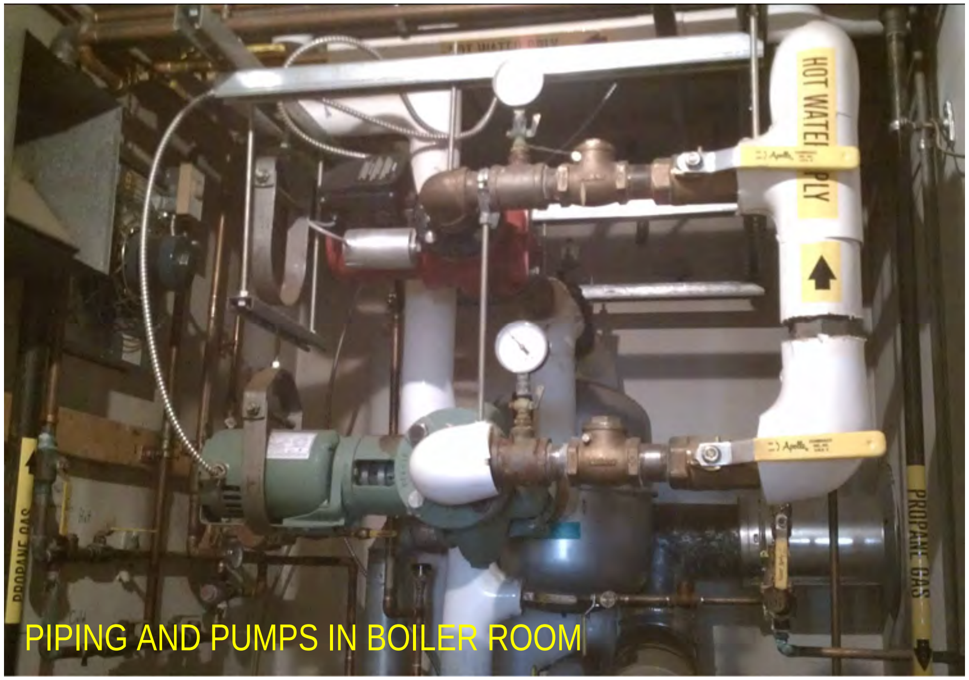
BACKUP GENERATOR CONTROLS

TWO OVENS WITH EXHAUST FANS

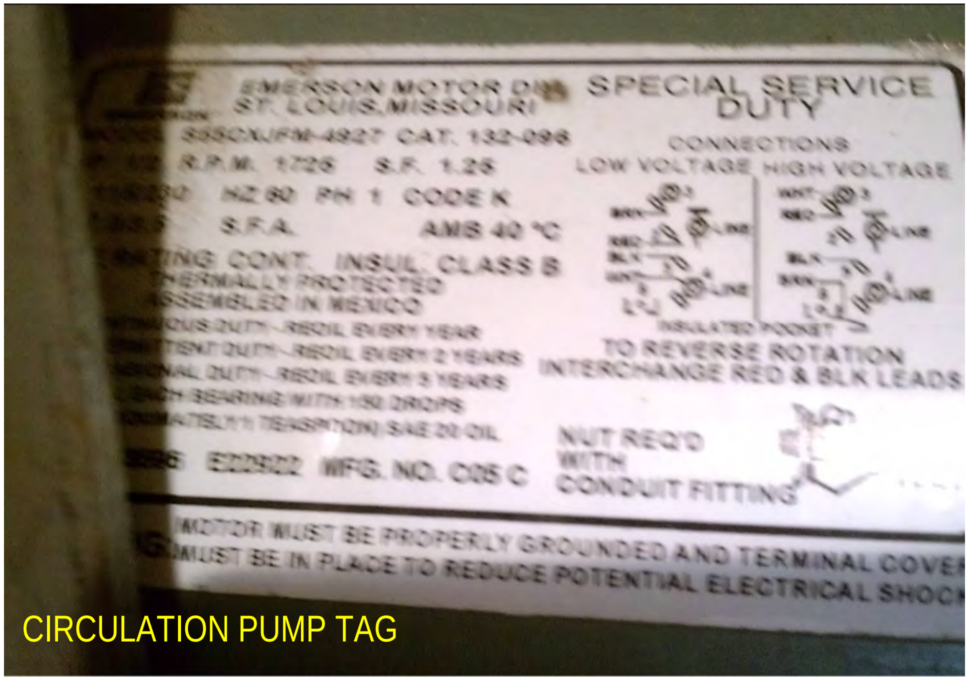
TWO DISHWASHERS

BEDROOM

TWO MICROWAVES

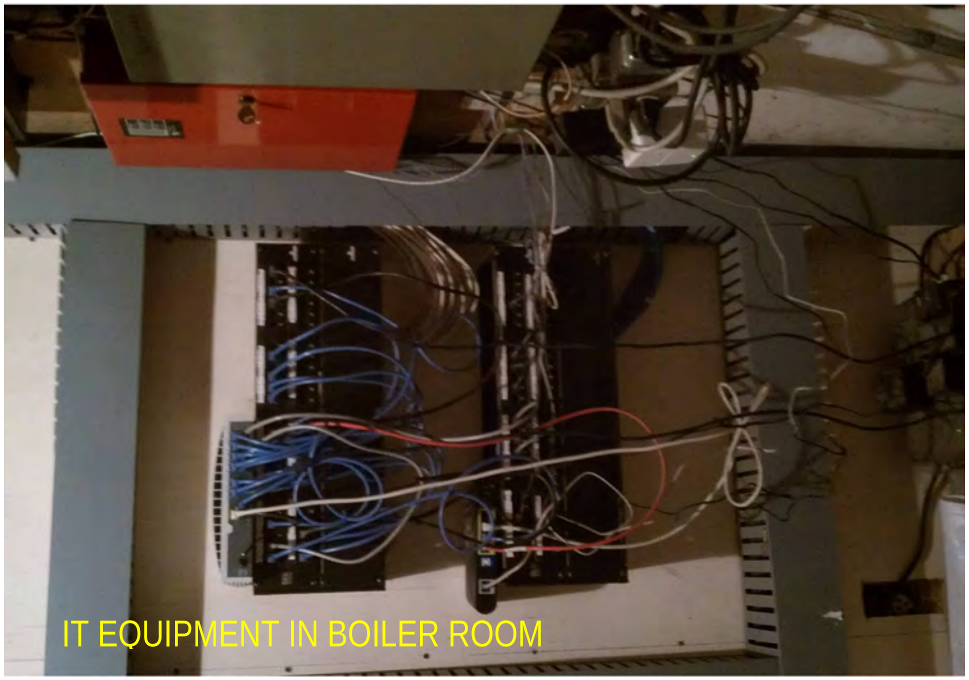


PIPING AND PUMPS IN BOILER ROOM



CIRCULATION PUMP TAG

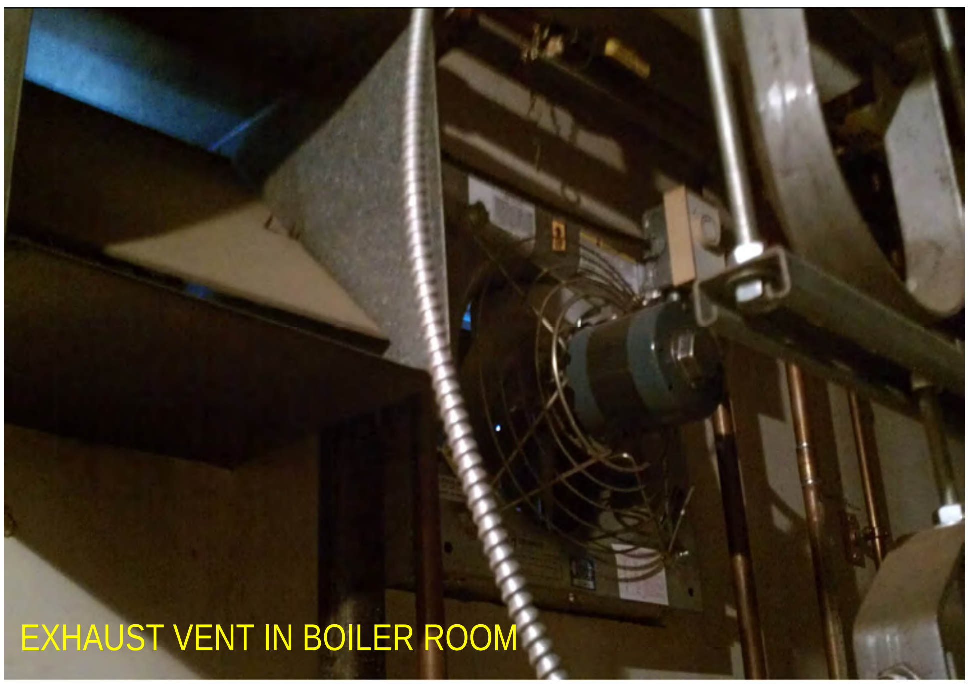
FIRST FLOOR OFFICE NEAR MEN'S LOCKER ROOM



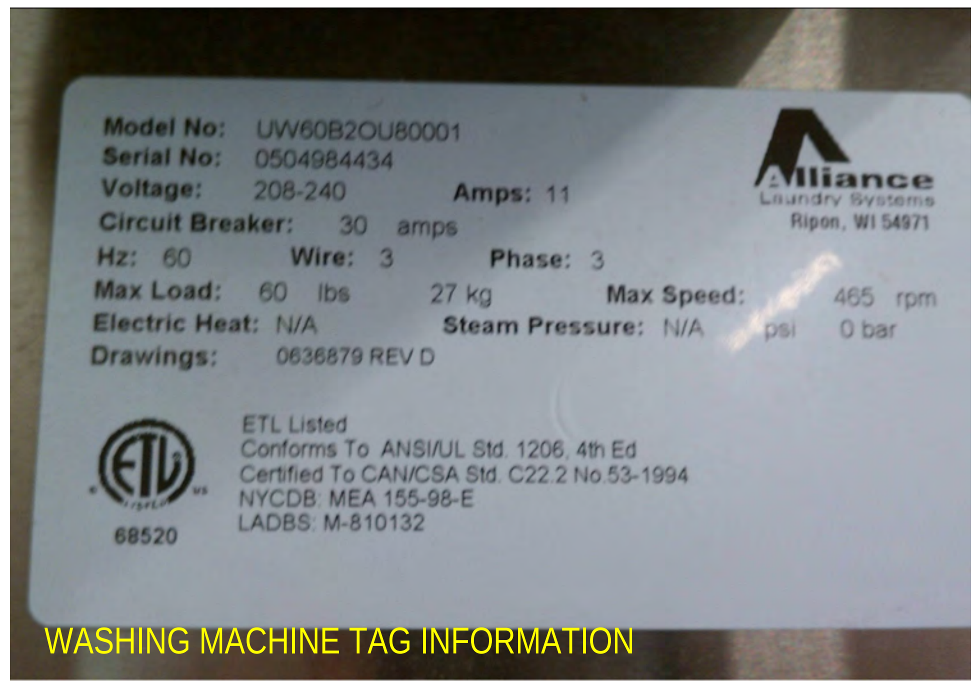
IT EQUIPMENT IN BOILER ROOM

EXHAUST VENT IN BOILER ROOM

COMMERCIAL WASHING MACHINE IN HIGH BAY

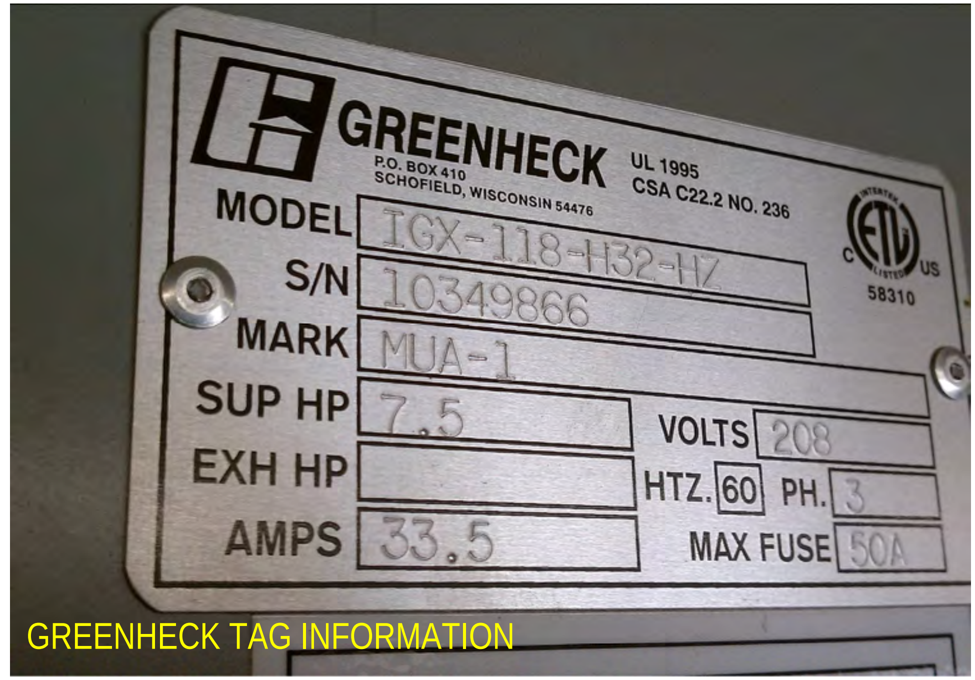


EXHAUST VENT IN BOILER ROOM

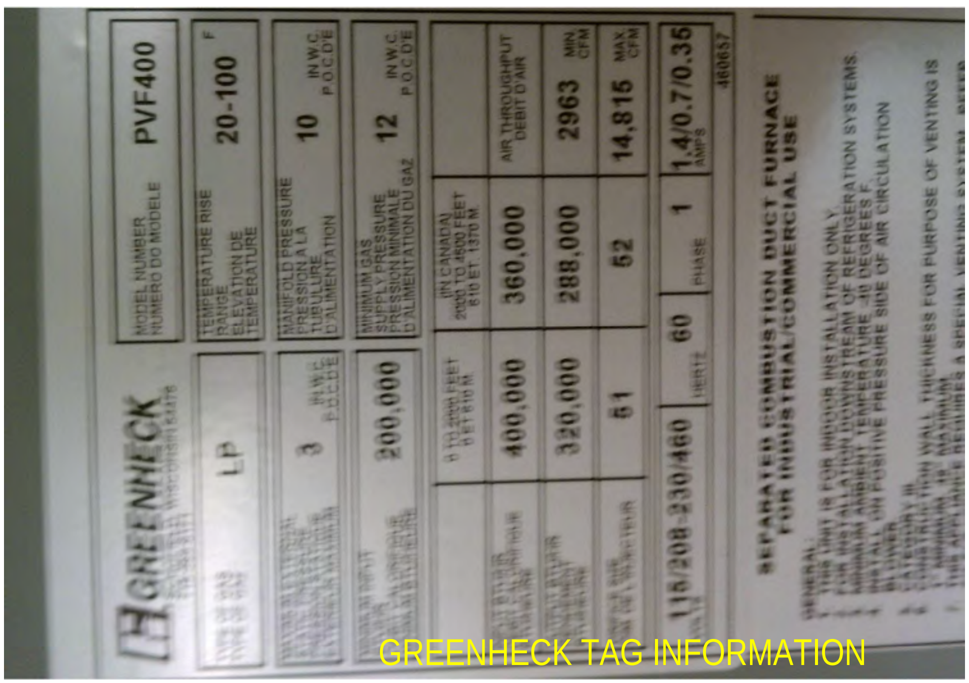


WASHING MACHINE TAG INFORMATION

GREENHECK TAG INFORMATION



GREENHECK TAG INFORMATION



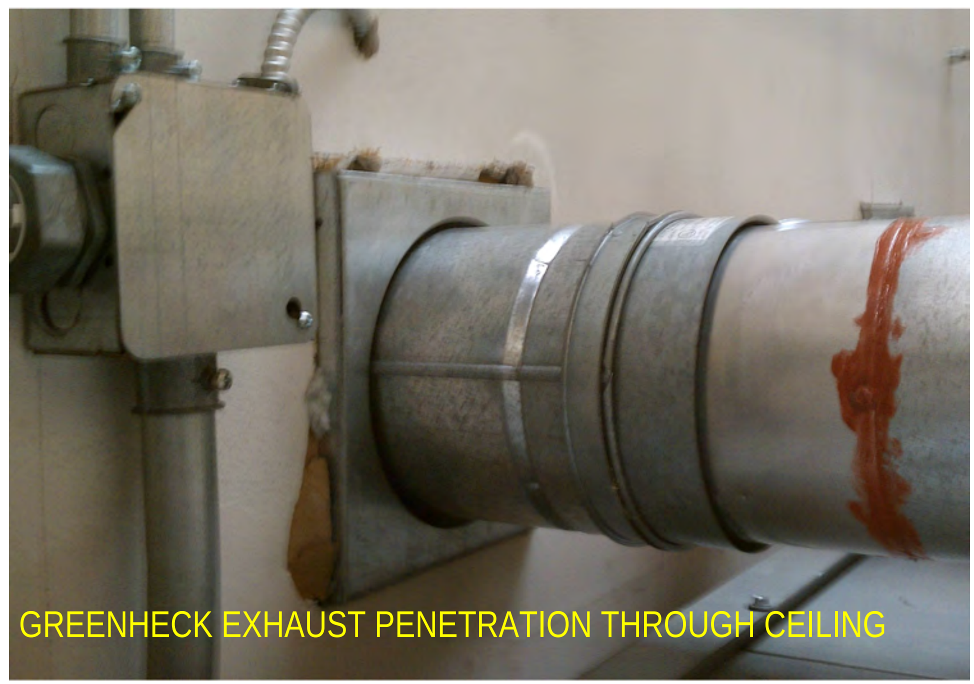
GREENHECK TAG INFORMATION

GREENHECK TAG INFORMATION

HIGH BAY AREA


GREENHECK EXHAUST PENETRATION THROUGH CEILING.
RECOMMEND BETTER SEAL.

HIGH BAY AREA


GREENHECK EXHAUST PENETRATION THROUGH CEILING

PROGRAMMABLE THERMOSTAT

FIRE DEPARTMENT IDENTIFICATION SIGN AT ROAD


GREENHECK ERV EQUIPMENT

FIRE ALARM CONTROLS


POND PUMP STATION


ELECTRICAL BOXES FOR WELL PUMP IN HIGH BAY


UTILITY POLE BY POND WITH ELECTRICAL BOX


SHALLOW MANHOLE

GOULD ELECTRICITY SAFETY SWITCH


SQUARE-D BREAKER BOX


PUMP IN HIGH BAY


WELL SYSTEM

WELL STORAGE TANK TO KEEP WATER CIRCULATING

HIGH BAY EXHAUST SYSTEM SENSOR

GREENHECK EXHAUST PENETRATION THROUGH CEILING

WELL WATER SOFTENER SYSTEM

PRESSURE GUAGE

TANK LEVEL SENSOR (NOT PLUGGED IN)

APPENDIX B

Thermal Imaging Survey Reports

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

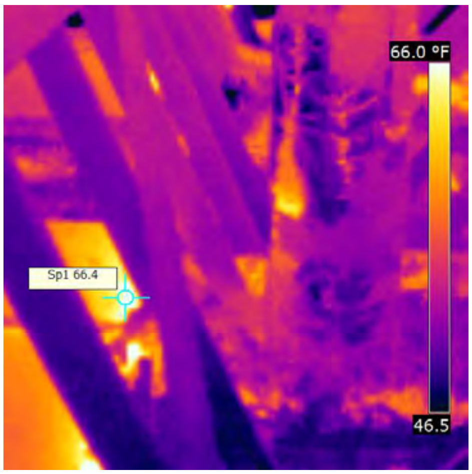


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:09:41 PM
Image Name	IR_2106.jpg
Emissivity	0.96
Reflected apparent temperature	66.0 °F
Object Distance	8.0 ft

Text Comments

Description

IR in the attic reveals limited thermal energy lost through the air handling unit and between blown cellulous insulation. Insulation improvements could be made to reduce thermal transfer but are not a high priority at this time.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

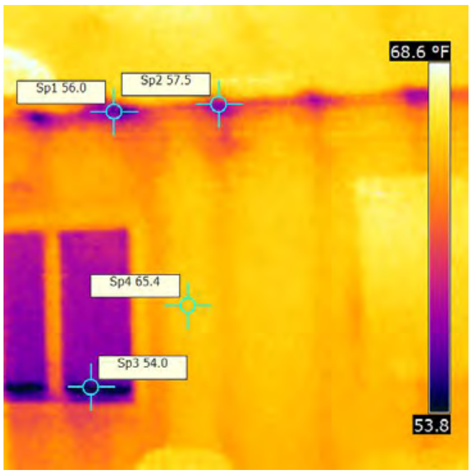


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:15:55 PM
Image Name	IR_2107.jpg
Emissivity	0.96
Reflected apparent temperature	57.0 °F
Object Distance	15.0 ft

Text Comments

Description

Thermal imaging in the meeting room at the top of the stairs reveals locations where thermal breaching is occuring at the seal between the wall and ceiling, notably at the studs (also visible) and through the window sill.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

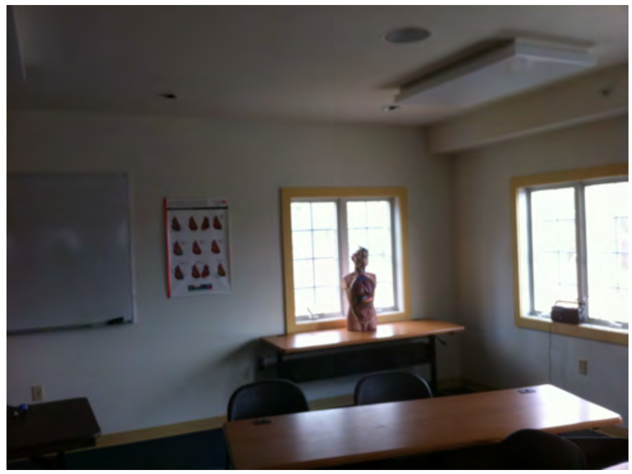


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:16:13 PM
Image Name	IR_2108.jpg
Emissivity	0.96
Reflected apparent temperature	57.0 °F
Object Distance	15.0 ft

Description

Thermal imaging in the meeting room at the top of the stairs reveals locations where thermal breaching is occuring at the seal between the wall and ceiling, notably at the studs (also visible).

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

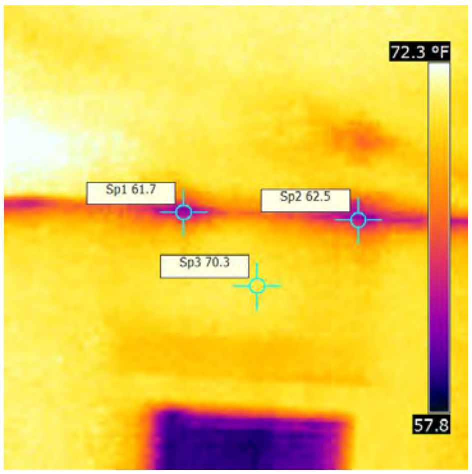


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:17:16 PM
Image Name	IR_2109.jpg
Emissivity	0.96
Reflected apparent temperature	62.0 °F
Object Distance	10.0 ft

Text Comments

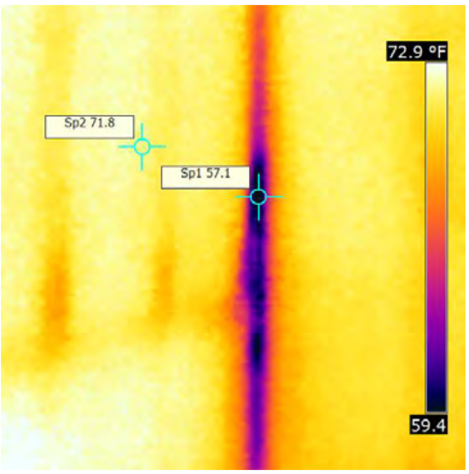
Description

Office IR reveals thermal breaching between wall and ceiling, much like other rooms.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	



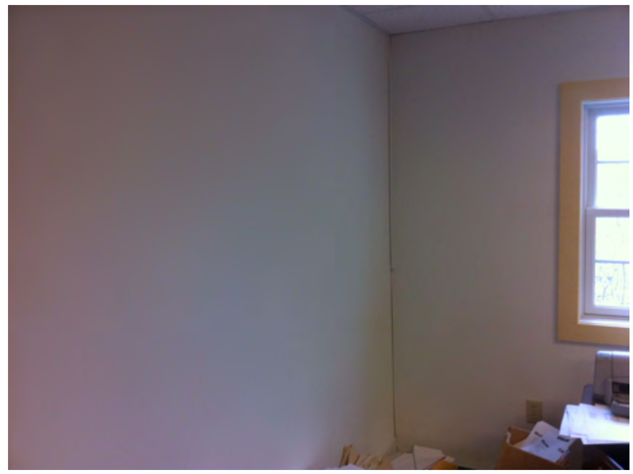


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:17:52 PM
Image Name	IR_2110.jpg
Emissivity	0.96
Reflected apparent temperature	57.0 °F
Object Distance	6.0 ft

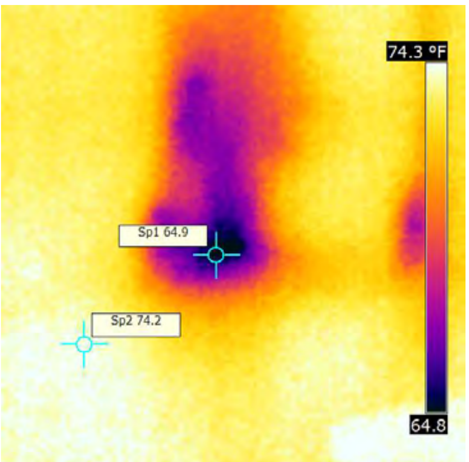
Text Comments

Description

Crack visible in wall at joint of two walls reveals thermal breaching.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	



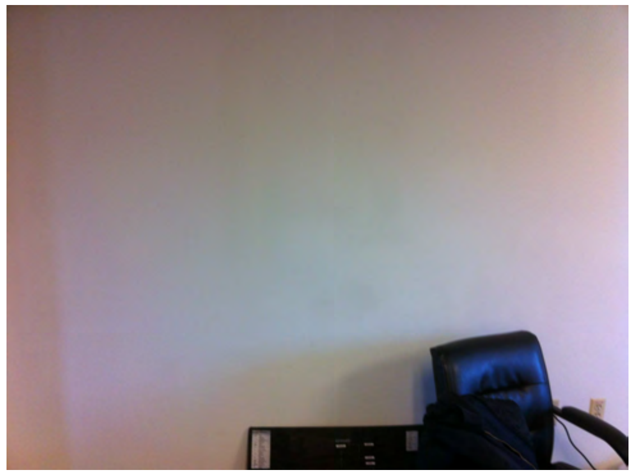


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:18:37 PM
Image Name	IR_2111.jpg
Emissivity	0.96
Reflected apparent temperature	65.0 °F
Object Distance	6.0 ft

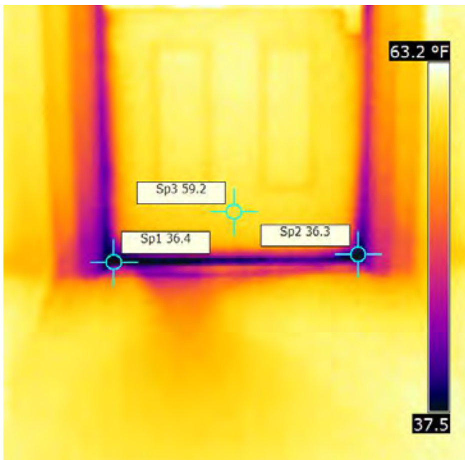
Description

IR of office wall reveals area of missing insulation and thermal trasnfer occuring.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	



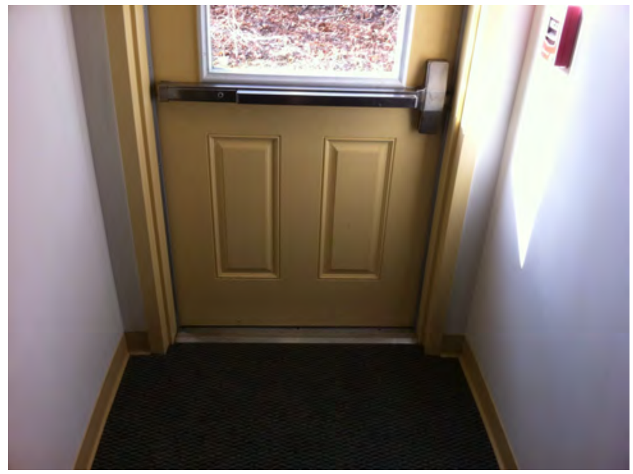


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:22:31 PM
Image Name	IR_2112.jpg
Emissivity	0.96
Reflected apparent temperature	35.0 °F
Object Distance	5.0 ft

Text Comments

Description

Inside of exterior door at the end of the bedroom hallway reveals poor seal around door and thermal transfer occuring. Recommend weather stripping all entry doors and windows.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

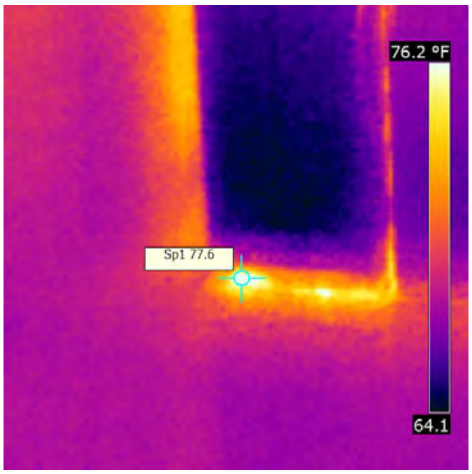


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:23:10 PM
Image Name	IR_2113.jpg
Emissivity	0.96
Reflected apparent temperature	78.0 °F
Object Distance	10.0 ft

Text Comments

Description

IR of freezer reveals thermal energy produced by the motor and lost around door by poor seals.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

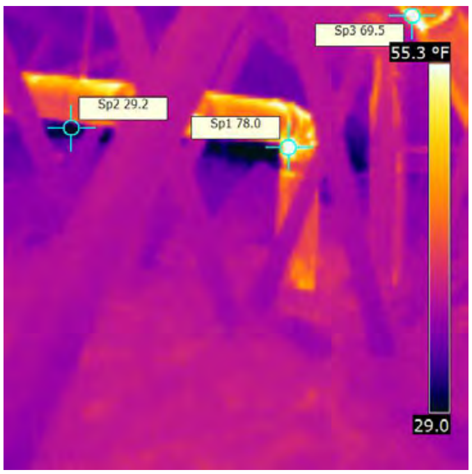


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:35:36 PM
Image Name	IR_2114.jpg
Emissivity	0.96
Reflected apparent temperature	78.0 °F
Object Distance	8.0 ft

Text Comments

Description

IR in the attic reveals thermal loss through ductwork (foreground) and thermal breaching through the exterior wall (dark background).

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

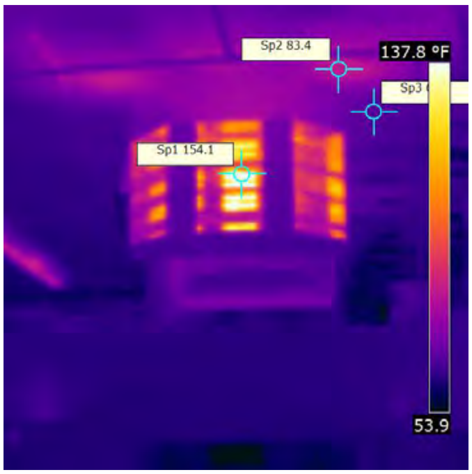


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:41:10 PM
Image Name	IR_2115.jpg
Emissivity	0.96
Reflected apparent temperature	157.0 °F
Object Distance	15.0 ft

Text Comments

Description

IR at the end of the large Greenheck unit in the high bay revelas heat being produced and radiated through unit.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

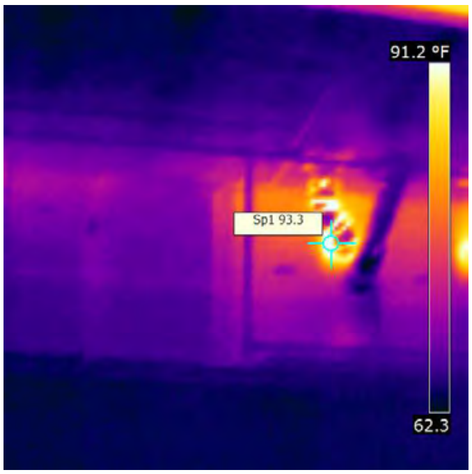


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:41:48 PM
Image Name	IR_2116.jpg
Emissivity	0.96
Reflected apparent temperature	94.0 °F
Object Distance	15.0 ft

Text Comments

Description

IR of side of Greenheck unit in the high bay reveals thermal loss through exhaust duct.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

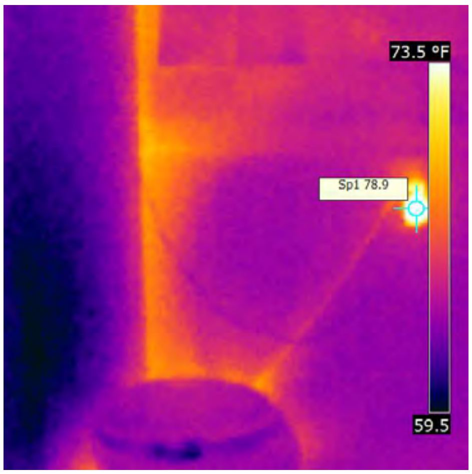


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:43:02 PM
Image Name	IR_2117.jpg
Emissivity	0.96
Reflected apparent temperature	79.0 °F
Object Distance	8.0 ft

Text Comments

Description

Thermal energy produced from plug of radio charging station.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

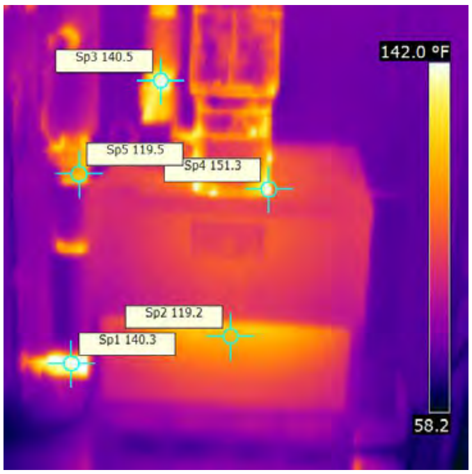


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:43:37 PM
Image Name	IR_2118.jpg
Emissivity	0.96
Reflected apparent temperature	154.0 °F
Object Distance	7.0 ft

Text Comments

Description

IR in the boiler room in the back of the high bay reveals thermal transfer through the furnace, exhaust and uninsulated piping.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

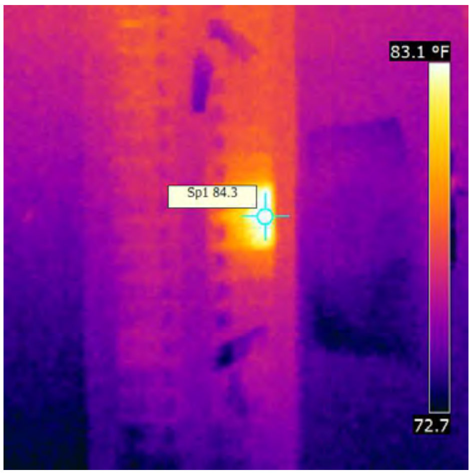


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:44:28 PM
Image Name	IR_2119.jpg
Emissivity	0.96
Reflected apparent temperature	85.0 °F
Object Distance	4.0 ft

Description

One of two electrical breaker panel IR in boiler room shows a high load on circuits on the right which are labeled for the high bay lighting, indicating they may be overloaded.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

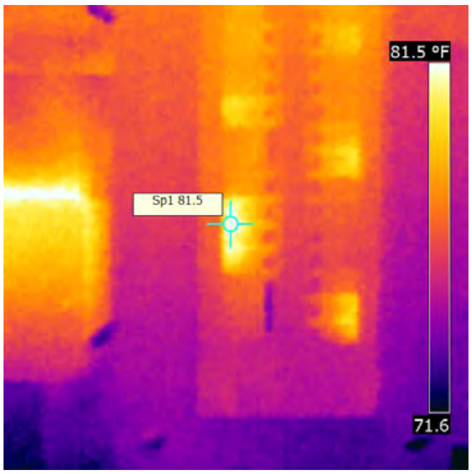


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:45:25 PM
Image Name	IR_2120.jpg
Emissivity	0.96
Reflected apparent temperature	81.0 °F
Object Distance	4.0 ft

Text Comments

Description

One of two electrical breaker panel IR in boiler room shows a high load on circuits on the left indicating they may be overloaded.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

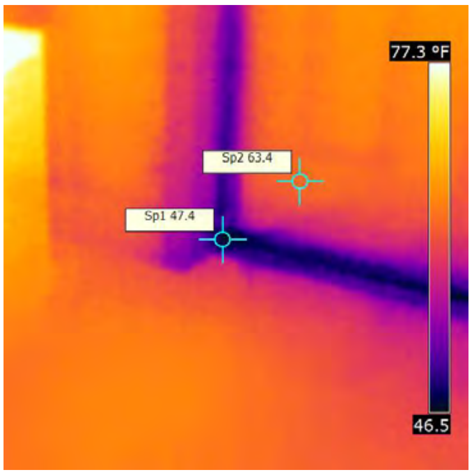


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:50:42 PM
Image Name	IR_2121.jpg
Emissivity	0.96
Reflected apparent temperature	47.0 °F
Object Distance	4.0 ft

Description

IR of inside of exterior door reveals thermal breaching between door and door frame. Recommend weather stripping all entry doors and windows.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

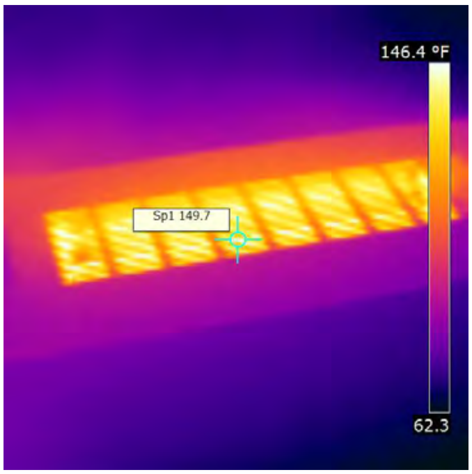


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 12:50:57 PM
Image Name	IR_2122.jpg
Emissivity	0.96
Reflected apparent temperature	153.0 °F
Object Distance	3.0 ft

Text Comments

Description

IR of cabinet heater reveals thermal energy being emitted through heater and high temperature at the sourece.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

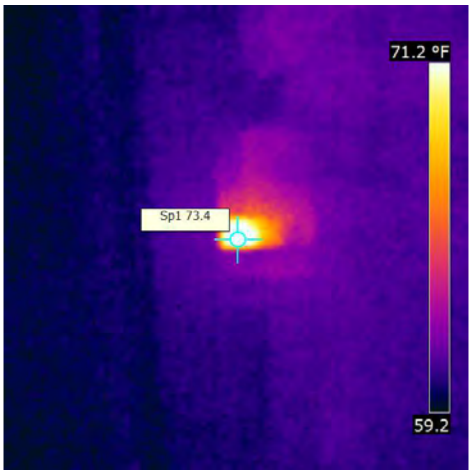


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 1:19:19 PM
Image Name	IR_2124.jpg
Emissivity	0.96
Reflected apparent temperature	73.0 °F
Object Distance	2.0 ft

Text Comments

Description

IR of circuit board whos high load on the few circuits that are connected.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

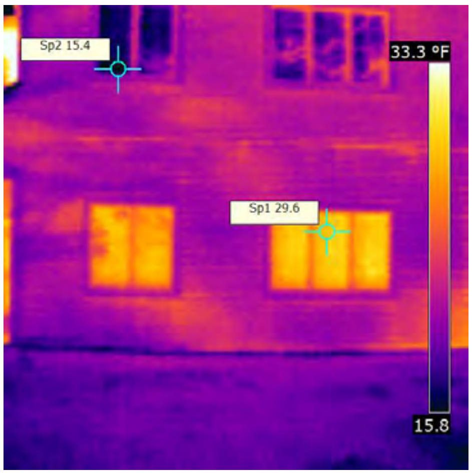


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:36:41 AM
Image Name	IR_2386.jpg
Emissivity	0.96
Reflected apparent temperature	27.0 °F
Object Distance	15.0 ft

Description

Exterior IR reveals thermal transfer through first floor window but cooler termperatures through upstairs window.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

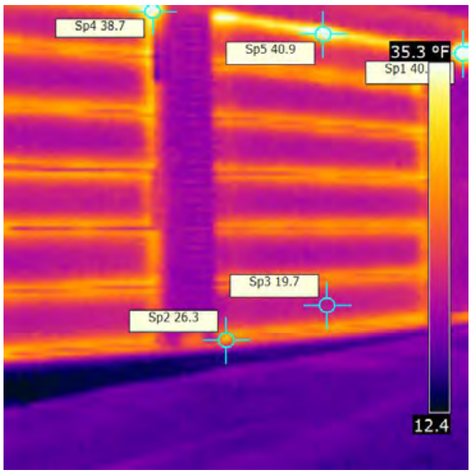


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:37:00 AM
Image Name	IR_2387.jpg
Emissivity	0.96
Reflected apparent temperature	39.0 °F
Object Distance	10.0 ft

Text Comments

Description

IR of exterior of high bay doors reveals some thermal transfer through slats in door with higher transfer through poor seal at the top of the door as well as thermal energy from the wallpack light (far right) that was not illuminated at the time.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

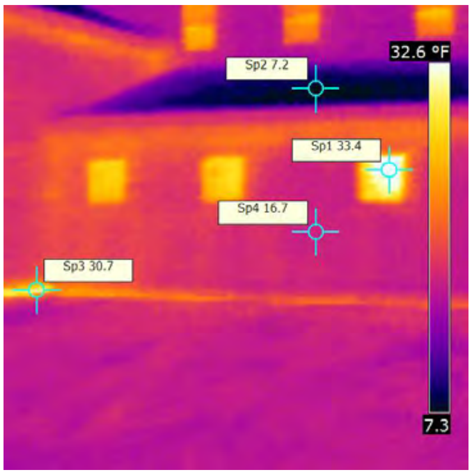


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:37:06 AM
Image Name	IR_2388.jpg
Emissivity	0.96
Reflected apparent temperature	31.0 °F
Object Distance	20.0 ft

Text Comments

Description

IR of exterior of building reveals some thermal breaching at the building foundation and a "cold" roof. Thermal transfer at window may be due to poor sealing or from solar glare.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

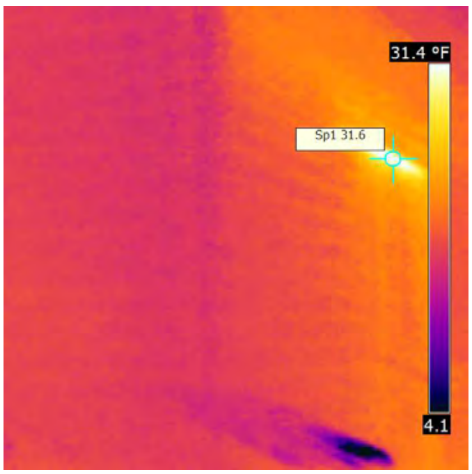


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:37:37 AM
Image Name	IR_2390.jpg
Emissivity	0.96
Reflected apparent temperature	29.0 °F
Object Distance	10.0 ft

Text Comments

Description

IR of outside of exterior door revelas thermal breaching between top of door and door frame. Recommend weather striping all entry doors and windows.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

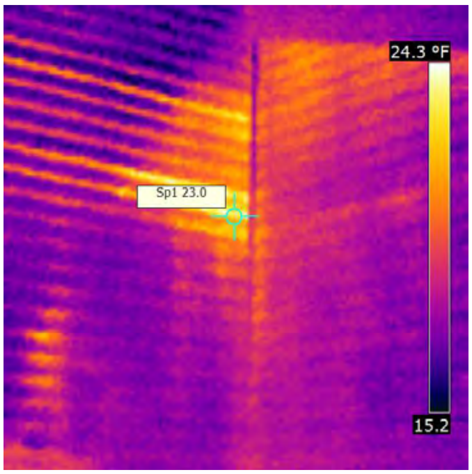


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:37:41 AM
Image Name	IR_2391.jpg
Emissivity	0.96
Reflected apparent temperature	20.0 °F
Object Distance	8.0 ft

Description

IR of building corner reveals areas of wall where thermal breaching occurs.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

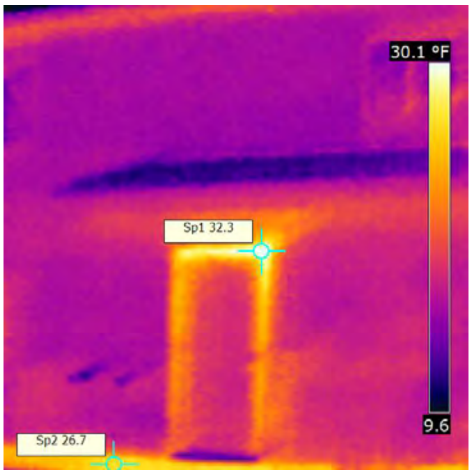


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:38:07 AM
Image Name	IR_2392.jpg
Emissivity	0.96
Reflected apparent temperature	30.0 °F
Object Distance	12.0 ft

Text Comments

Description

IR of outside of exterior door reveals area of thermal breaching between door and door frame as well as thermal transfer occuring through the concrete slab. Recommend weather striping all entry doors and windows.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

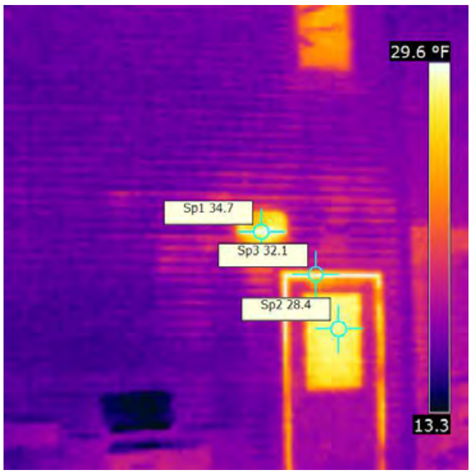


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:38:13 AM
Image Name	IR_2393.jpg
Emissivity	0.96
Reflected apparent temperature	33.0 °F
Object Distance	12.0 ft

Description

IR of exterior of the building reveals thermal breaching between door and frame and through the door window. Thermal energy also radiating from the exterior light which was not illuminated during the picture.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

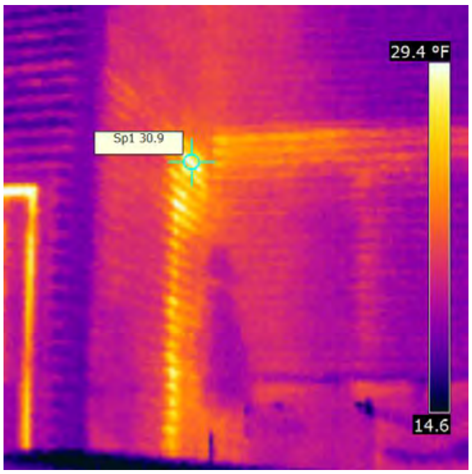


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:38:35 AM
Image Name	IR_2394.jpg
Emissivity	0.96
Reflected apparent temperature	29.0 °F
Object Distance	10.0 ft

Text Comments

Description

IR at the corner of the building reveals area of wall where thermal breaching is occuring. There was no solar glare on the building during the picture.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

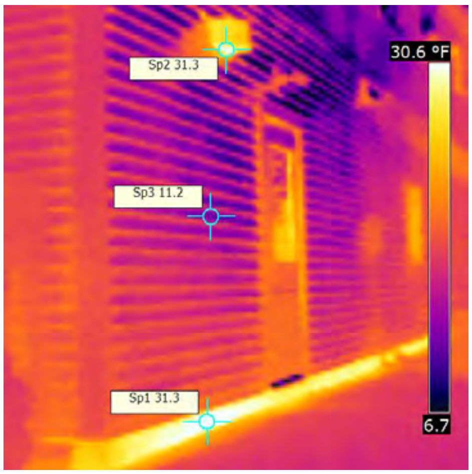


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:38:56 AM
Image Name	IR_2395.jpg
Emissivity	0.96
Reflected apparent temperature	29.0 °F
Object Distance	7.0 ft

Description

IR of exterior of hte building reveals thermal breaching through the concrete slab foundation as well as thermal energy from the exterior light (above) that was not illuminated. The siding is cold indicating good insulation.

Inspection Report

Report Date	5/16/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

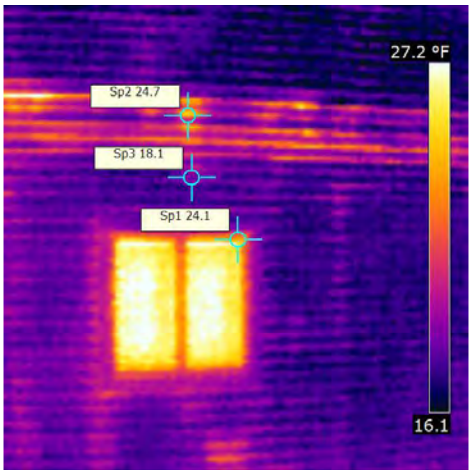


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:39:30 AM
Image Name	IR_2397.jpg
Emissivity	0.96
Reflected apparent temperature	22.0 °F
Object Distance	10.0 ft

Text Comments

Description

IR of exterior window shows thermal breaching through the window as well as a horizontal strip along the side of the building where higher thermal transfer is occuring, possibly due to a lack of insulation.

Inspection Report

Report Date	5/16/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Fire Department
Address	90 Main Street, Newmarket, NH 03857	Site Address	10 Glenice Drive, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

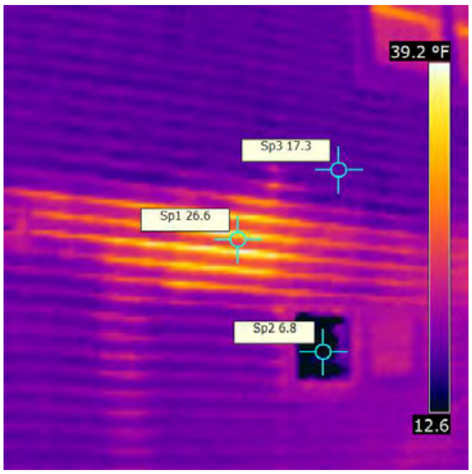


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/20/2012 7:39:59 AM
Image Name	IR_2398.jpg
Emissivity	0.96
Reflected apparent temperature	24.0 °F
Object Distance	10.0 ft

Text Comments

Description

IR of the exterior of the building shows another area where thermal transfer is occuring through a horizontal ban between the first and second floors of the building. IR of closed louver (below) also shows good seal.

APPENDIX C

Indoor Metering Data

INDOOR METERING DATA

Facility:	Location:	Date:	Ambient Outdoor:
Hollis Fire Department	Hollis, NH	01/03/2012	Temp= 28 RH= 30 CO2= 310

Location /Use Description	**Time**	**Occupied**	**Air Quality**			**hting Dens**	**Notes**
			Temp (°F)	**RH (%)**	**CO2 (ppm)**	**Vert (FC)**	
2nd floor meeting room	1303	N	65.6	23.1	524	70.7	35.7 half
Entrance stairs	1332	N	66.2	22.8	543		
Weight room	1334	Y	69.4	17.4	564	34.6	
Bedroom	1335	N	68.5	18.2	444	6.4	
Bedroom hallway	1335	N	69.9	18.2	468	23.3	
Dining room	1336	N	68.9	18.4	560	18.8	
Kitchen	1337	N	68.1	18.4	593	34	
1st fl hall	1338	N	68.7	19.8	602	21.6	
Office 1	1338	N	69.2	20.1	621	14.9	
Office 2	1339	N	68.5	18.4	602	15.1	
Locker room	1339	N	69.4	18.5	590	65.2	
Mens	1340	N	70.7	22.7	584		
High bay	1341	N	67.4	15.0	515	22.5	
Back stairs	1344	N	71.7	12.5	495	9.3	Temp set to 60
Upstairs hall	1324	N	73.5	19.4	579	32.7	
Storage room	1324	N	73.0	18.9	563	18.9	
Office 1	1325	N	72.6	18.9	568	36.1	
Office 3	1326	N	73.9	19.0	600	31.2	
Bathroom	1327	N	74.1	18.2	623	12.3	
Office 4	1328	Y	74.1	18.2	603	51.8	
Conference room	1329	N	74.3	18.2	617	56.8	
Office 5	1331	Y	74.3	18.1	625	67.1	
Receptionist	1332	Y	74.6	17.9	635	57.1	
Averages:			**70.7**	**18.7**	**570**		

APPENDIX D

Lighting Fixture Inventory

LIGHTING FIXTURE INVENTORY

Facility:		Location:				Date:		
Hollis Fire Department		Hollis, NH				01/03/2012		

Location /Use Description	Fixture	Watts/fixture	Qty	Controls	Total watts	Est. Hr/Wk	Est. KWH Consumption/Yr	Notes
1st fl hall	Cfl	17	6	Motion	102	10	53	
Bathroom	Cfl	34	1	Switch	34	2	4	
Bedroom 1	Cfl	17	1	Switch	17	1.5	1	
Bedroom 2	Cfl	17	1	Switch	17	1.5	1	
Bedroom 3	Cfl	17	1	Switch	17	1.5	1	
Bedroom 4	Cfl	17	1	Switch	17	1.5	1	
Bedroom 5	Cfl	17	1	Switch	17	1.5	1	
Bedroom hallway	Cfl	17	3	Motion	51	1	3	
Exterior	Cfl	17	3	Switch	51	61	162	
Mens room	Cfl	34	1	Switch	34	2	4	
Men's room	Cfl	17	2	Switch	34	7	12	
Office 1	Cfl	14	1	Switch	14	35	25	
Storage room	Cfl	17	1	Switch	17	0.5	0	
Storage room	Cfl	17	1	Switch	17	0.5	0	
Storage room 2	Cfl	17	1	Switch	17	0.5	0	
Storage room 3	Cfl	17	1	Switch	17	0.5	0	
Weight room	Cfl	60	9	Switch	540	25	702	
Women's room	Cfl	17	2	Switch	34	7	12	
Women's room	Cfl	34	1	Switch	34	2	4	
Exterior	MH	50	4	Switch	200	61	634	
2nd fl meeting room	Inc	60	11	Switch	660	5	172	
Boiler room	Inc	60	1	Switch	60	0.5	2	
2nd fl meeting room	Led	13	3	Switch	39	5	10	
Exit	Led	5	13	Switch	65	168	568	
2nd fl back hall	T8	34	3	Switch	102	40	212	
2nd fl meeting room	T8	84	9	Switch	756	5	197	
Back stairs	T8	28	3	Switch	84	1	4	
Bathroom	T8	28	1	Switch	28	2	3	
Dining room	T8	17	4	Motion	68	15	53	
Entrance stairs	T8	28	3	Switch	84	80	349	
High bay	T8	56	50	Switch	2800	17.5	2,548	
Kitchen	T8	56	2	Switch	112	17.5	102	
Kitchen	T8	28	2	Switch	56	17.5	51	
Kitchen	T8	17	1	Switch	17	15	13	
Locker room	T8	84	2	Switch	168	5	44	
Meeting room	T8	112	1	Switch	112	4	23	
Meeting room storage	T8	56	2	Switch	112	0.5	3	
Mens room	T8	28	1	Switch	28	2	3	
Men's room	T8	28	1	Motion	28	7	10	
Men's room	T8	51	2	Switch	102	7	37	
Office 1	T8	56	2	Switch	112	35	204	

Office 2	T8	28	3	Switch	84	35	153
Office 2	T8	56	2	Switch	112	35	204
Office 3	T8	56	2	Switch	112	60	349
Office 4	T8	56	2	Switch	112	55	320
Office 5	T8	56	2	Switch	112	55	320
Receptionist	T8	56	2	Switch	112	55	320
Tank filling	T8	112	3	Switch	336	2	35
Upstairs main hall	T8	34	6	Switch	204	80	849
Upstairs storage	T8	56	2	Switch	112	0.5	3
Upstairs storage 2	T8	56	2	Switch	112	0.5	3
Weight room	T8	84	6	Switch	504	25	655
Women's room	T8	28	1	Motion	28	7	10
Women's room	T8	51	2	Switch	102	7	37
Women's room	T8	28	1	Switch	28	2	3
Totals:			**185**		**8,757**		**9,432**

APPENDIX E

Mechanical Equipment Inventory

MECHANICAL EQUIPMENT INVENTORY

Facility:		Location:				Date:	
Hollis Fire Department		Hollis, NH				01/03/12	
Location /Use Description	**Qty**	**Affiliated System**	**BTU**	**SEER**	**Cooling (ton)**	**Model**	**Est KwH/Year**
Exterior/ AC	5	Cooling	NA	12	3	H1RC036S25G	7,105
Attic/AHU	5	HVAC	131,700			60-HBXB-HW	10,920

HEATING DATA SHEET

Facility:	Location:	Date:
Hollis Fire Department	Hollis, NH	01/03/2012

Location /Use Description	Manufacturer	Model Number	Qty	Year	Capacity (mbh)	Efficiency (AFUE)	Circ Pump	Est. kWh/yr
Boiler Room/Hydonic Heating	Peerless	MI-06-STDG-WPC	1		175,000	80.3	Yes	1,170
High Bay/ Heatin	Greenheck	PVF400	1	2006	500,000	80	NO	1,200
Boiler Room/DHW Heating	State Select		1	2008		80	NO	NA

PUMPS DATA SHEET

Facility:		Location:		Date:			
Hollis Fire Department		Hollis, NH		01/03/2012			
Location /Use Description	**Manufacturer**	**Qty**	**GPM**	**HP**	**Volt**	**Phase**	**Consumption**
Boiler Room/Hydronic Heating	Taco	2		2	208	1	2,700
Well Pump	NA	1		1	240	1	1,500

APPENDIX F

Plug Load Inventory

PLUG LOAD INVENTORY

Facility:			Location:			Date:		
Hollis Fire Department			Hollis, NH			01/03/2012		

Location / Use Description	Category	Description	Watts/ fixture	Qty	Total watts	Est. Hr/Wk	Est. kWh/Yr	Notes
Kitchen	AC - Commercial Appliance	Commercial freezer	575	1	575	60.0	1,794	
Kitchen	AC - Commercial Appliance	Commercial fridge	575	2	1,150	60.0	3,588	
High bay	AC - Commercial Appliance	Commercial washing mach.	2,288	1	2,288	2.4	281	
Kitchen	AL - Large Appliance	Dishwasher	1,000	2	2,000	5.0	520	
Kitchen	AS - Small Appliance	Breadmaker	1,650	1	1,650	1.0	86	
Kitchen	AS - Small Appliance	Coffee grinder	130	1	130	1.0	7	
Kitchen	AS - Small Appliance	Coffee pot	1,200	1	1,200	1.0	62	
Kitchen	AS - Small Appliance	George foreman	1,000	1	1,000	1.0	52	
Kitchen	AS - Small Appliance	Keurig	1,500	1	1,500	2.0	156	
Office 3	AS - Small Appliance	Keurig	1,500	1	1,500	2.0	156	
Dining storage	AS - Small Appliance	Coffee dispenser	1,090	3	3,270	0.1	17	
Kitchen	AS - Small Appliance	Microwave	1,000	3	3,000	2.0	312	
Kitchen	AS - Small Appliance	Toaster	1,200	1	1,200	1.0	62	
Office 2	CD - Desktop Computer	Computer	95	1	95	70.0	346	
2nd fl meeting	CD - Desktop Computer	Computer	95	4	380	3.0	59	
Office 4	CD - Desktop Computer	Computer	95	1	95	70.0	346	
Office 5	CD - Desktop Computer	Computer	95	1	95	70.0	346	
Receptionist	CD - Desktop Computer	Computer	95	1	95	70.0	346	
Office 4	CM - Computer Monitor	LCD	20	1	20	70.0	73	
Office 5	CM - Computer Monitor	LCD	20	1	20	70.0	73	
Receptionist	CM - Computer Monitor	LCD	20	1	20	70.0	73	
2nd fl meeting	CM - Computer Monitor	Old monitor	85	4	340	10.0	177	
Office 2	CM - Computer Monitor	Old monitor	85	1	85	60.0	265	
Weight room	CN - Notebook Computer	Laptop	35	1	35	168.0	306	
Office 1	CN - Notebook Computer	Laptop	35	1	35	168.0	306	
Office 2	CN - Notebook Computer	Laptop	35	1	35	168.0	306	
High bay	EL - Electronics	Battery charger	300	1	300	10.0	156	
2nd fl meeting	EL - Electronics	Cb radio	204	4	816	10.0	424	
Office 1	EL - Electronics	iPod clock	35	1	35	10.0	18	
Office 5	EL - Electronics	Phone charger	3	1	3	10.0	2	
2nd fl meeting	EL - Electronics	Radio	25	1	25	1.0	1	
Receptionist	EL - Electronics	Radio	25	1	25	10.0	13	
High bay	EL - Electronics	Radio	25	1	25	15.0	20	
Bedroom 1	EL - Electronics	CB radio charger	5	1	5	40.0	10	
Bedroom 2	EL - Electronics	CB radio charger	5	1	5	40.0	10	
Bedroom 4	EL - Electronics	CB radio charger	5	1	5	40.0	10	
Office 5	EL - Electronics	CB radio charger	5	1	5	40.0	10	
Receptionist	EL - Electronics	CB radio charger	5	3	15	40.0	31	
Office 2	EL - Electronics	Tablet	5	1	5	20.0	5	

Weight room	FE - Fitness Equipment	Bike	42	1	42	5.0	11	
Weight room	FE - Fitness Equipment	Treadmill	1,125	1	1,125	3.0	176	
Weight room	FN - Fan	Fan	15	2	30	5.0	8	
Bedroom 2	FN - Fan	Fan	15	1	15	40.0	10	Summertime
Office 1	FN - Fan	Fan	15	1	15	5.0	4	Summertime
Office 3	OE - Office Equipment	Laminator	1,500	1	1,500	0.5	39	
Receptionist	OE - Office Equipment	Modem	5	1	5	168.0	44	
Conference room	OE - Office Equipment	Shredder	200	1	200	1.0	10	
Receptionist	OE - Office Equipment	Shredder	200	1	200	1.0	10	
High bay	OT - Other (describe)	Airvac	550	4	2,200	2.0	229	
High bay	OT - Other (describe)	Automatic door	100	8	800	2.0	83	
Kitchen	OT - Other (describe)	Stove exhaust	40	2	80	1.0	4	
Kitchen	OT - Other (describe)	Stove overhead light	60	4	240	1.0	12	
High bay	OT - Other (describe)	Truck power	100	10	1,000	150.0	7,800	
Office 3	PC - Photocopier	Copier	1,440	1	1,440	10.0	749	
Storage room	PR - Computer Printer	Deskjet	35	1	35	0.5	1	
Office 2	PR - Computer Printer	Deskjet	35	1	35	1.0	2	
Office 5	PR - Computer Printer	Deskjet	35	1	35	1.0	2	
Office 1	PR - Computer Printer	Laserjet	500	1	500	1.0	26	
Receptionist	PR - Computer Printer	Officejet	32	1	32	3.0	5	
Office 3	RM - Mini Refrigerator	Mini fridge	400	1	400	60.0	1,248	
2nd fl meeting	TV - Television	Old tv	185	1	185	1.0	10	
2nd fl meeting	TV - Television	Old tv, VCR combo	90	1	90	1.0	5	
Office 4	TV - Television	Small tube tv	125	1	125	5.0	33	
Weight room	TV - Television	Rear projection TV	35	1	35	15.0	27	
2nd fl meeting	VE - Video Equipt/Projector	Projector	240	1	240	1.0	12	
2nd fl meeting	VE - Video Equipt/Projector	Vcr	26	1	26	0.5	1	
High bay	VM - Vending Machine	Vending machine	1,080	1	1,080	60.0	3,370	
Totals:				**108**	**34,792**	**2,036**	**24,754**	

APPENDIX G

ENERGY STAR® Statement of Energy Performance

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Fire Station

Building ID: 1713369
For 12-month Period Ending: December 31, 2011[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 16, 2012

Facility
Fire Station
10 Glenice Road
Hollis, NH 03049

Facility Owner
Town of Hollis
7 Monument Square
Hollis, NH 03049

Primary Contact for this Facility
Troy Brown
7 Monument Square
Hollis, NH 03049

Year Built: 1978
Gross Floor Area (ft²): 13,090

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	204,413
Propane (kBtu)	337,034
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	541,447

Energy Intensity[4]	
Site (kBtu/ft²/yr)	41
Source (kBtu/ft²/yr)	78

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	44

Electric Distribution Utility
Public Service Co of New Hampshire [Northeast Utilities]

National Median Comparison	
National Median Site EUI	82
National Median Source EUI	146
% Difference from National Median Source EUI	-46%
Building Type	Fire Station/Police Station

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[5] for Indoor Environmental Conditions:	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
Timothy Nichols
20 Madbury Road STE 3
Durham, NH 03824

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) or a Registered Architect (RA) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE or RA in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Fire Station	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Fire Station/Police Station	Is this an accurate description of the space in question?		☐
Location	10 Glenice Road, Hollis, NH 03049	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of a hospital, k-12 school, hotel and senior care facility) nor can they be submitted as representing only a portion of a building.		☐

Fire Station (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	13,090 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	7(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	140Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	8(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist
for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Public Service Co of New Hampshire [Northeast Utilities]

Fuel Type: Electricity		
Meter: 8004809-01-4-8 PSNH (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
12/01/2011	12/31/2011	4,480.00
11/01/2011	11/30/2011	4,630.00
10/01/2011	10/31/2011	4,280.00
09/01/2011	09/30/2011	5,320.00
08/01/2011	08/31/2011	5,680.00
07/01/2011	07/31/2011	5,920.00
06/01/2011	06/30/2011	4,560.00
05/01/2011	05/31/2011	4,240.00
04/01/2011	04/30/2011	5,200.00
03/01/2011	03/31/2011	4,760.00
02/01/2011	02/28/2011	5,400.00
01/01/2011	01/31/2011	5,440.00
8004809-01-4-8 PSNH Consumption (kWh (thousand Watt-hours))		**59,910.00**
8004809-01-4-8 PSNH Consumption (kBtu (thousand Btu))		**204,412.92**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**204,412.92**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Propane		
Meter: 14861 Propane (Gallons) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (Gallons)**
12/01/2011	12/31/2011	564.30
11/01/2011	11/30/2011	0.00
10/01/2011	10/31/2011	0.00
09/01/2011	09/30/2011	0.00
08/01/2011	08/31/2011	0.00
07/01/2011	07/31/2011	0.00
06/01/2011	06/30/2011	0.00
05/01/2011	05/31/2011	400.20
04/01/2011	04/30/2011	833.30
03/01/2011	03/31/2011	225.20

02/01/2011	02/28/2011	821.30
01/01/2011	01/31/2011	833.20
14861 Propane Consumption (Gallons)		**3,677.50**
14861 Propane Consumption (kBtu (thousand Btu))		**337,034.05**
Total Propane Consumption (kBtu (thousand Btu))		**337,034.05**
Is this the total Propane consumption at this building including all Propane meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same PE or RA that signed and stamped the SEP.)

Name: ____ Date: ____________

Signature: ______________________________________

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Fire Station
10 Glenice Road
Hollis, NH 03049

Facility Owner
Town of Hollis
7 Monument Square
Hollis, NH 03049

Primary Contact for this Facility
Troy Brown
7 Monument Square
Hollis, NH 03049

General Information

Fire Station	
Gross Floor Area Excluding Parking: (ft²)	13,090
Year Built	1978
For 12-month Evaluation Period Ending Date:	December 31, 2011

Facility Space Use Summary

Fire Station	
Space Type	Other - Fire Station/Police Station
Gross Floor Area(ft²)	13,090
Number of PCs°	7
Weekly operating hours°	140
Workers on Main Shift°	8

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2011)	**Baseline** (Ending Date 12/31/2008)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft²)	41	53	0	N/A	82
Source (kBtu/ft²)	78	89	0	N/A	146
Energy Cost					
$/year	$ 14,931.87	$ 20,686.26	N/A	N/A	$ 29,603.80
$/ft²/year	$ 1.14	$ 1.58	N/A	N/A	$ 2.26
Greenhouse Gas Emissions					
$MtCO_2e$/year	44	54	0	N/A	87
$kgCO_2e/ft^2$/year	3	4	0	N/A	6

More than 50% of your building is defined as Fire Station/Police Station. This building is currently ineligible for a rating. Please note the National Median column represents the CBECS national median data for Fire Station/Police Station. This building uses 46% less energy per square foot than the CBECS national median for Fire Station/Police Station.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

APPENDIX H

Renewable Energies Screening Worksheets

RENEWABLE ENERGY SCREENING SUMMARY

Building/Facility:	Hollis Fire Department	Location:	Hollis, NH
Gross Area (sf):	13,090	Date:	3/12/2012
Use Category:	Fire Station/Police Station	EUI (kBtu/sf/yr):	78
Heating Fuel(s):	Propane	PM Grade:	NA
Heating System(s):	Hydronic	Cooling System(s):	Outdoor Air Condensers

RE Technology	Score (out of 70 pts.)	Grade	Notes/Comments
Biomass Heating	57.5	82%	Pellet feed system recommended.
Ground Photovoltaic	55.0	79%	Medium (10kw-30kw) system.
Geothermal Heating/Cooling	54.5	78%	Closed-loop GSHP system.
Roof Photovoltaic	53.5	76%	Medium (10kw-30kw) system.
Solar DHW	53.5	76%	DHW demand should be confirmed.
Solar Thermal	50.5	72%	Medium-temperature collector.
Wind Turbine Generator	49.5	71%	Permit requirements are height dependent.
Combined Heat & Power	44.0	63%	75kW system.

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Fire Department	Location:	Hollis, NH
Gross Area (sf):	13,090	Date:	3/12/2012
Use Category:	Fire Station/Police Station	EUI (kBtu/sf/yr):	78
Heating Fuel(s):	Propane	PM Grade:	NA
Heating System(s):	Hydronic	Cooling System(s):	Outdoor Air Condensers

Technology: **Biomass Heating Systems (wood, chips, pellets)**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	4.5	Well demonstrated technology. Some woodchip and pellet feed units are newer technology.
2	Expected service life/durability	4	Expected service life is 20 yrs.
3	Geographical considerations	3	Limited fuel in Southern NH
4	Energy demand	4.5	Heating energy is relatively high in the building.
5	Facility/systems conditions	4.5	Woodchips/pellets could find a place to be stored inside or outside.
6	Facility/systems compatibility	4.5	Woodchips/pellets could find a place to be stored inside or outside.
7	Permitting constraints	5	No special permits required.
8	Abutter concerns	4.5	Systems are located inside building. Wood or chip feedstock located outside could be a concern.
9	Capital investment	4.5	Low capital cost.
10	O&M requirements	4.5	Wood and woodchip units require constant attending and feedstock must be sourced. Pellet systems with hoppers are less intensive and feedstock is commercially available. Recommend auto-feed system but if manual building is occupied 24/7.
11	Financial incentives	2.5	Limited incentives.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	3.5	Biomass does emit CO2 but the net reduction from the oil system will be significant.
14	Public awareness/education	4	Moderate public use. Information could be displayed in the building so users are aware of biomass heating system.
	Total Score:	**57.5**	
	Total Possible Score:	**70**	
	Grade:	**82%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility: Hollis Fire Department
Location: Hollis, NH
Gross Area (sf): 13,090
Date: 3/12/2012
Use Category: Fire Station/Police Station
EUI (kBtu/sf/yr): 78
Heating Fuel(s): Propane
PM Grade: NA
Heating System(s): Hydronic
Cooling System(s): Outdoor Air Condensers

Technology: **Ground-Mounted Solar PV**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	5	Well demonstrated technology with more efficient panel systems in development.
2	Expected service life/durability	3	Expected service life of collector panels is 15 years.
3	Geographical considerations	3.5	Limited solar availability in New England.
4	Energy demand	4	Moderate grid electrical demand.
5	Facility/systems conditions	5	Newer facility and systems.
6	Facility/systems compatibility	5	Ample amount of open space provided to the south of the building.
7	Permitting constraints	2.5	Utility grid connection permit is long-lead and may require a designed/engineered system.
8	Abutter concerns	4.5	Commercial setting.
9	Capital investment	3	High capital cost.
10	O&M requirements	3.5	Vegetative cutting and panel replacement.
11	Financial incentives	2.5	Limited incentives in NH.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	4.5	Electrical source energy is NH has lower than average CO2 emissions.
14	Public awareness/education	5	High visibility from the main road (NH Rt. 130).
	Total Score:	**55**	
	Total Possible Score:	**70**	
	Grade:	**79%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Fire Department	Location:	Hollis, NH
Gross Area (sf):	13,090	Date:	3/12/2012
Use Category:	Fire Station/Police Station	EUI (kBtu/sf/yr):	78
Heating Fuel(s):	Propane	PM Grade:	NA
Heating System(s):	Hydronic	Cooling System(s):	Outdoor Air Condensers

Technology: **Geothermal Heating & Cooling**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	4.5	Well demonstrated technology but does require engineering design.
2	Expected service life/durability	4.5	Well field and loop system has +50 year service life. Equipment has +20 yr service life.
3	Geographical considerations	4	Abundant geothermal energy reserves.
4	Energy demand	4	Heating and cooling energy consumption is relatively high.
5	Facility/systems conditions	4	Newer building and systems.
6	Facility/systems compatibility	4	Newer building and systems.
7	Permitting constraints	5	No special permitting required for a closed-loop system (open-loop would require state permit and is not recommended).
8	Abutter concerns	5	Abutters with water supply wells can be sensitive to geothermal wells but a closed-loop system will have no impact.
9	Capital investment	2.5	High capital cost.
10	O&M requirements	4.5	Very low O&M except routine equipment maintenance.
11	Financial incentives	2	Limited incentives in NH.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	4	The building currently uses a moderately high amount of fuel.
14	Public awareness/education	2.5	Low public use. Information could be displayed in the building so users are aware of geothermal system.
	Total Score:	**54.5**	
	Total Possible Score:	**70**	
	Grade:	**78%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility: Hollis Fire Department
Location: Hollis, NH
Gross Area (sf): 13,090
Date: 3/12/2012
Use Category: Fire Station/Police Station
EUI (kBtu/sf/yr): 78
Heating Fuel(s): Propane
PM Grade: NA
Heating System(s): Hydronic
Cooling System(s): Outdoor Air Condensers

Technology: **Roof-Mounted Solar PV**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	5	Well demonstrated technology with more efficient panel systems in development.
2	Expected service life/durability	3	Expected service life of collector panels is 15 years.
3	Geographical considerations	3.5	Limited solar availability in New England.
4	Energy demand	4	Moderate grid electrical demand.
5	Facility/systems conditions	5	The roof to the high bay has a very large south facing area.
6	Facility/systems compatibility	4.5	Roof is in good shape and electrical systems are modern. A structural study would be needed to ensure it is capable of supporting the extra load.
7	Permitting constraints	2.5	Utility grid connection permit is long-lead and may require a designed/engineered system.
8	Abutter concerns	4.5	Commercial setting.
9	Capital investment	2.5	High capital cost.
10	O&M requirements	3	Increased roof maintenance and panel replacement.
11	Financial incentives	2.5	Limited incentives in NH.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO_2e emissions	4.5	Electrical source energy is NH has lower than average CO_2 emissions.
14	Public awareness/education	5	Roof is viewable from the main road (NH Rt. 130).
	Total Score:	**53.5**	
	Total Possible Score:	**70**	
	Grade:	**76%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Fire Department	Location:	Hollis, NH
Gross Area (sf):	13,090	Date:	3/12/2012
Use Category:	Fire Station/Police Station	EUI (kBtu/sf/yr):	78
Heating Fuel(s):	Propane	PM Grade:	NA
Heating System(s):	Hydronic	Cooling System(s):	Outdoor Air Condensers

Technology: **Solar Domestic Hot Water**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	4	Well demonstrated technology although system design and function can vary.
2	Expected service life/durability	3	Expected service life of heating panels is 15 years.
3	Geographical considerations	3.5	Limited solar availability in New England.
4	Energy demand	4.5	Expected DHW demand is low.
5	Facility/systems conditions	4	System could utilize the existing tank.
6	Facility/systems compatibility	4	System could utilize the existing tank.
7	Permitting constraints	5	No special permitting required.
8	Abutter concerns	5	Low visibility/impact.
9	Capital investment	2.5	High capital cost.
10	O&M requirements	4	Panel replacement and normal DHW system maintenance.
11	Financial incentives	2.5	Limited incentives in NH.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	3.5	Low reduction of oil use based on DHW demand.
14	Public awareness/education	4	High public visibility but minimal public use.
	Total Score:	**53.5**	
	Total Possible Score:	**70**	
	Grade:	**76%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility: Hollis Fire Department
Location: Hollis, NH
Gross Area (sf): 13,090
Date: 3/12/2012
Use Category: Fire Station/Police Station
EUI (kBtu/sf/yr): 78
Heating Fuel(s): Propane
PM Grade: NA
Heating System(s): Hydronic
Cooling System(s): Outdoor Air Condensers

Technology: **Solar Thermal HVAC**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	3.5	Well demonstrated technology but supply limited. More efficient than regular PV.
2	Expected service life/durability	4	Expected service life of system is 20-25 years.
3	Geographical considerations	3	Limited solar availability in New England.
4	Energy demand	4.5	Heating and cooling is high percentage of building energy consumption.
5	Facility/systems conditions	4.5	Five (5) air handling units currently installed which could be integrated into system. Systems not brand new. Building may not be big enough to be viable.
6	Facility/systems compatibility	4	Considerable space required. Plumbing complex to protect against freezing. Building may not be big enough to be viable.
7	Permitting constraints	2.5	Utility grid connection permit is long-lead and may require a designed/engineered system.
8	Abutter concerns	4	Commercial setting.
9	Capital investment	2	High capital cost.
10	O&M requirements	3	Vegetative cutting for ground mount, roof maintenance for roof mount, panel replacement.
11	Financial incentives	2.5	Limited incentives in NH.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	4	Electrical source energy in NH has lower than average CO2 emissions.
14	Public awareness/education	5	High visibility.
	Total Score:	**50.5**	
	Total Possible Score:	**70**	
	Grade:	**72%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Fire Department	Location:	Hollis, NH
Gross Area (sf):	13,090	Date:	3/12/2012
Use Category:	Fire Station/Police Station	EUI (kBtu/sf/yr):	78
Heating Fuel(s):	Propane	PM Grade:	NA
Heating System(s):	Hydronic	Cooling System(s):	Outdoor Air Condensers

Technology: **Wind Turbine Generator**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	4	A well demonstrated technology but proper site selection is critical.
2	Expected service life/durability	3	Some turbine units have proven unreliable (design flaws). Selection of a reputable manufacturer is critical.
3	Geographical considerations	2.5	Limited wind energy but a feasibility study is required.
4	Energy demand	4	Electrical energy consumpition is moderate.
5	Facility/systems conditions	4.5	Newer systems.
6	Facility/systems compatibility	4.5	Newer systems.
7	Permitting constraints	2	Special permits are required depending on the height of the pole-mounted turbine. Roof-mounted turbines may be practical however they provide less energy.
8	Abutter concerns	3	Pole-mounted turbines have a large visual impact. Located in commercial setting.
9	Capital investment	3.5	Moderate capital cost.
10	O&M requirements	3	Routine maintenance required. Units are subject to damage from elements.
11	Financial incentives	2.5	Limited incentives in NH.
12	Owner initiatives	4	Owner open to renewable options.
13	CO2e emissions	4	Electrical source energy is NH has lower than average CO2 emissions.
14	Public awareness/education	5	High visibility.
	Total Score:	**49.5**	
	Total Possible Score:	**70**	
	Grade:	**71%**	

RENEWABLE ENERGY SCREENING WORKSHEET

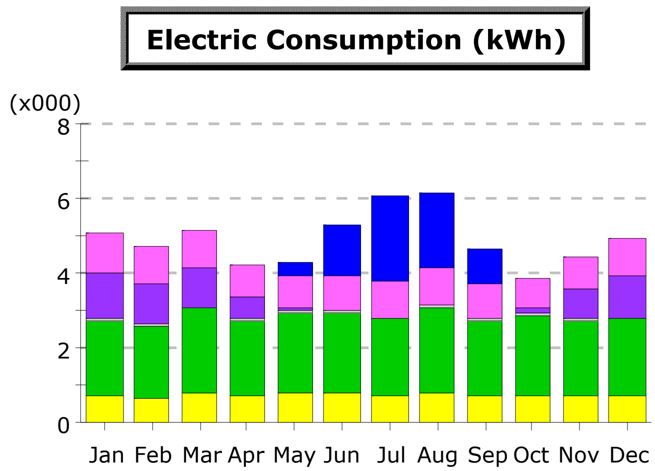
Building/Facility: Hollis Fire Department
Location: Hollis, NH
Gross Area (sf): 13,090
Date: 3/12/2012
Use Category: Fire Station/Police Station
EUI (kBtu/sf/yr): 78
Heating Fuel(s): Propane
PM Grade: NA
Heating System(s): Hydronic
Cooling System(s): Outdoor Air Condensers

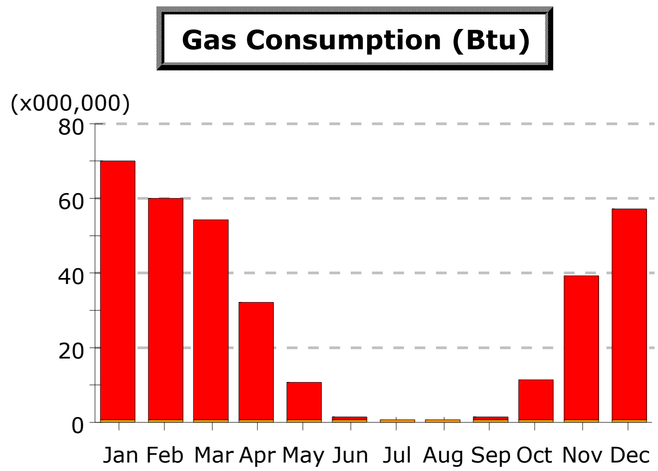
Technology: **Combined Heat & Power System**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	5	Smaller CHP units are relatively new technology. Larger units (+75kW) are more reliable.
2	Expected service life/durability	2.5	Expected service life for a small CHP unit is 10 yrs. Large CHPs have a 20 yr. service life.
3	Geographical considerations	3	NH has a low electrical energy cost.
4	Energy demand	4	Electric energy consumption is moderate.
5	Facility/systems conditions	4.5	Newer building.
6	Facility/systems compatibility	1	No renewables currently on site.
7	Permitting constraints	5	No special permits required.
8	Abutter concerns	5	Modern CHPs are relatively quiet and would be inside of the building.
9	Capital investment	2	High capital cost.
10	O&M requirements	2	Frequent maintenance required. Large system manufacturers require that they complete maintenance for warranty validation.
11	Financial incentives	2	Limited incentives.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	1	CHPs consume a large amount of fuel and emissions relative to the re-used energy.
14	Public awareness/education	3	Limited public use. Information could be displayed in the building so users are aware of CHP system. However CHP is not entirely renewable.
	Total Score:	**44**	
	Total Possible Score:	**70**	
	Grade:	**63%**	

APPENDIX I

eQUEST® Energy Efficiency Measure Modeling





Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	0.32	1.36	2.35	2.06	0.96	-	-	-	7.05
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	1.05	0.95	1.00	0.85	0.83	0.94	0.96	1.00	0.89	0.74	0.86	0.99	11.06
Pumps & Aux.	1.23	1.11	1.02	0.56	0.12	0.01	-	0.00	0.02	0.21	0.83	1.10	6.21
Ext. Usage	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.06	0.64
Misc. Equip.	2.01	1.90	2.26	2.02	2.18	2.17	2.03	2.26	2.01	2.09	2.00	2.03	24.95
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.71	0.67	0.79	0.73	0.76	0.76	0.73	0.79	0.73	0.74	0.71	0.73	8.85
Total	5.06	4.68	5.12	4.21	4.26	5.28	6.10	6.17	4.66	3.84	4.46	4.90	58.75

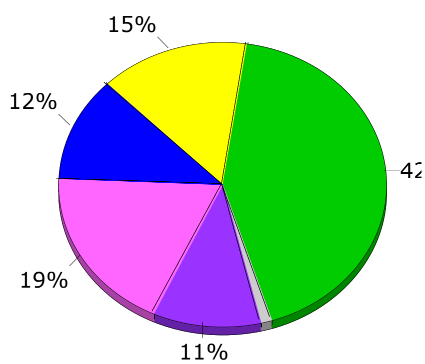
Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	68.74	59.19	53.02	31.19	9.54	0.55	-	-	0.47	10.76	38.27	56.57	328.30
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.73	0.70	0.82	0.71	0.71	0.65	0.56	0.60	0.54	0.60	0.62	0.68	7.91
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	0.18	0.17	0.21	0.23	0.28	0.29	0.30	0.30	0.29	0.28	0.23	0.21	2.96
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	69.65	60.06	54.05	32.14	10.53	1.48	0.86	0.90	1.29	11.64	39.12	57.46	339.17

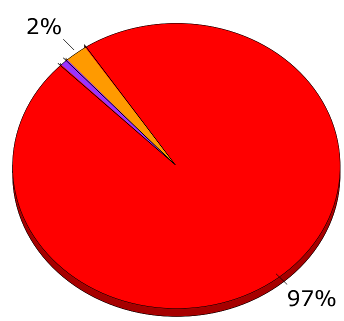
Annual Energy Consumption by Enduse

	Electricity kWh	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	7,048	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	328.30	-	-
HP Supp.	-	-	-	-
Hot Water	-	7.91	-	-
Vent. Fans	11,057	-	-	-
Pumps & Aux.	6,205	2.96	-	-
Ext. Usage	638	-	-	-
Misc. Equip.	24,953	-	-	-
Task Lights	-	-	-	-
Area Lights	8,849	-	-	-
Total	58,749	339.17	-	-

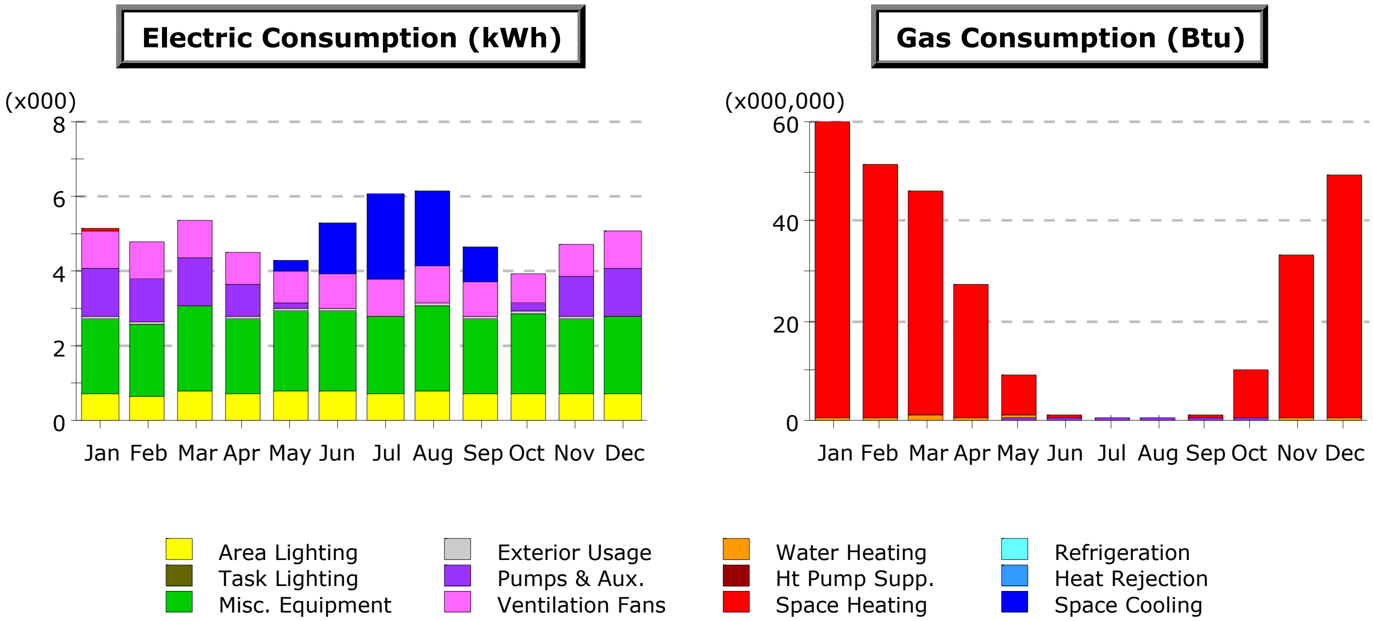
Area Lighting
Task Lighting
Misc. Equipment
Exterior Usage
Pumps & Aux.
Ventilation Fans
Water Heating
Ht Pump Supp.
Space Heating
Refrigeration
Heat Rejection
Space Cooling



Electricity



Natural Gas



Electric Consumption (kWh x000)

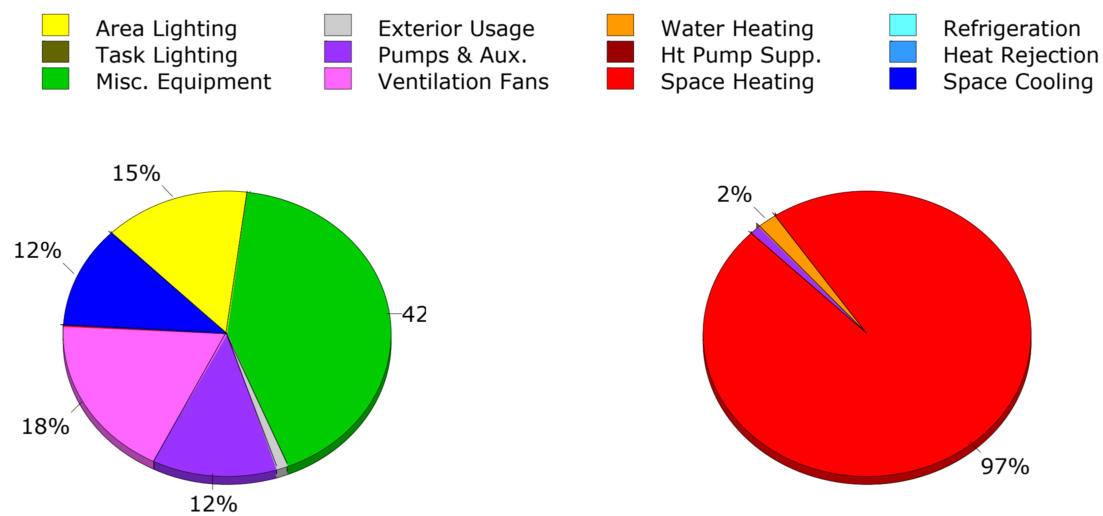
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	0.32	1.36	2.35	2.06	0.96	-	-	-	7.05
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.01	0.01	0.01	0.01	0.00	-	-	-	-	0.00	0.01	0.01	0.06
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	1.05	0.95	1.00	0.85	0.83	0.94	0.96	1.00	0.89	0.74	0.86	0.99	11.06
Pumps & Aux.	1.26	1.20	1.27	0.83	0.17	0.01	-	0.00	0.02	0.28	1.08	1.24	7.36
Ext. Usage	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.06	0.64
Misc. Equip.	2.01	1.90	2.26	2.02	2.18	2.17	2.03	2.26	2.01	2.09	2.00	2.03	24.95
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.71	0.67	0.79	0.73	0.76	0.76	0.73	0.79	0.73	0.74	0.71	0.73	8.85
Total	5.11	4.78	5.38	4.48	4.30	5.29	6.10	6.17	4.66	3.91	4.72	5.06	59.96

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	59.26	50.89	45.31	26.60	8.21	0.48	-	-	0.41	9.21	32.57	48.54	281.47
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.53	0.52	0.61	0.52	0.52	0.48	0.41	0.44	0.40	0.44	0.46	0.50	5.84
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	0.18	0.17	0.21	0.23	0.28	0.29	0.30	0.30	0.29	0.28	0.23	0.21	2.96
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	59.97	51.57	46.13	27.35	9.02	1.24	0.71	0.74	1.09	9.93	33.26	49.25	290.27

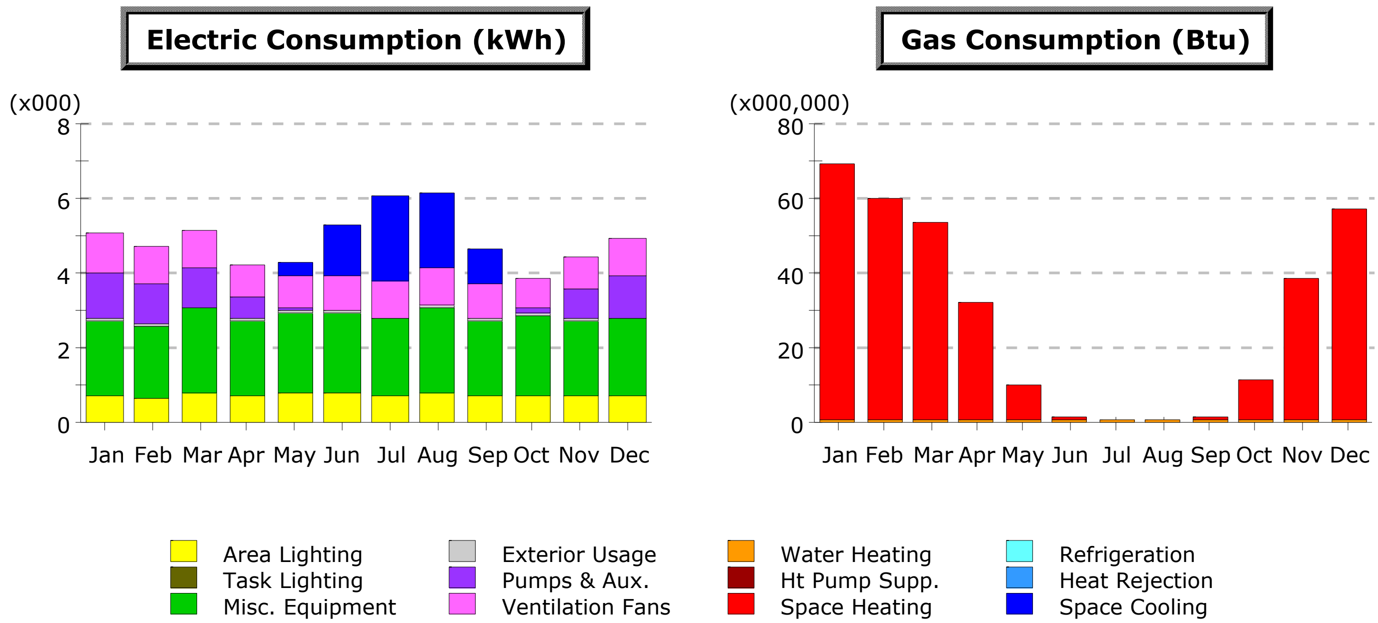
Annual Energy Consumption by Enduse

	Electricity kWh	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	7,048	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	61	281.47	-	-
HP Supp.	-	-	-	-
Hot Water	-	5.84	-	-
Vent. Fans	11,057	-	-	-
Pumps & Aux.	7,356	2.96	-	-
Ext. Usage	638	-	-	-
Misc. Equip.	24,953	-	-	-
Task Lights	-	-	-	-
Area Lights	8,849	-	-	-
Total	59,961	290.27	-	-



Electricity

Natural Gas



Electric Consumption (kWh x000)

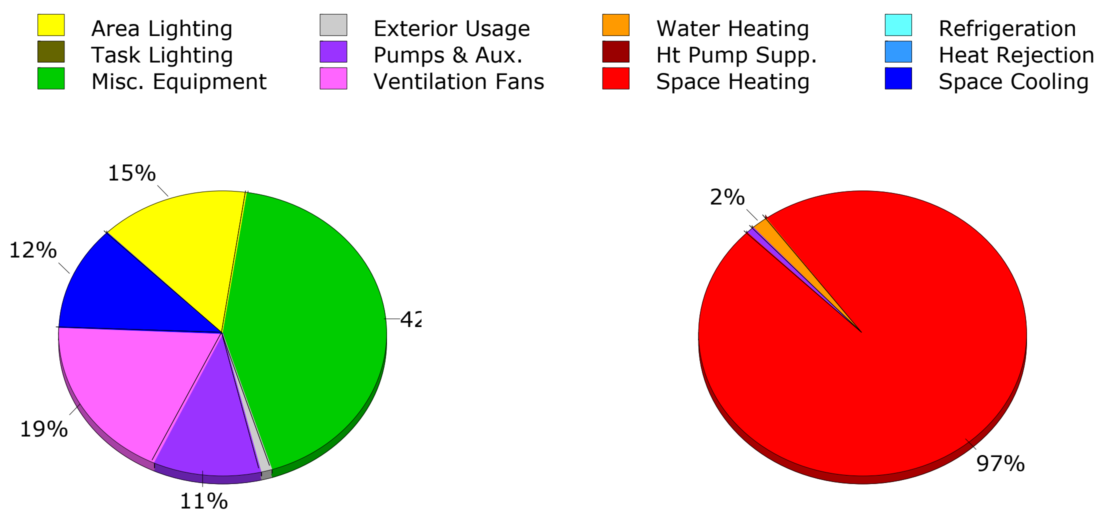
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	0.32	1.36	2.35	2.06	0.96	-	-	-	7.05
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	1.05	0.95	1.00	0.85	0.83	0.94	0.96	1.00	0.89	0.74	0.86	0.99	11.06
Pumps & Aux.	1.23	1.11	1.02	0.56	0.12	0.01	-	0.00	0.02	0.21	0.83	1.10	6.21
Ext. Usage	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.06	0.64
Misc. Equip.	2.01	1.90	2.26	2.02	2.18	2.17	2.03	2.26	2.01	2.09	2.00	2.03	24.95
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.71	0.67	0.79	0.73	0.76	0.76	0.73	0.79	0.73	0.74	0.71	0.73	8.85
Total	5.06	4.68	5.12	4.21	4.26	5.28	6.10	6.17	4.66	3.84	4.46	4.90	58.75

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	68.74	59.19	53.02	31.19	9.54	0.55	-	-	0.47	10.76	38.27	56.57	328.30
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.50	0.48	0.57	0.49	0.50	0.46	0.39	0.42	0.38	0.42	0.43	0.47	5.50
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	0.18	0.17	0.21	0.23	0.28	0.29	0.30	0.30	0.29	0.28	0.23	0.21	2.96
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	69.42	59.84	53.80	31.92	10.32	1.29	0.69	0.72	1.13	11.45	38.93	57.25	336.76

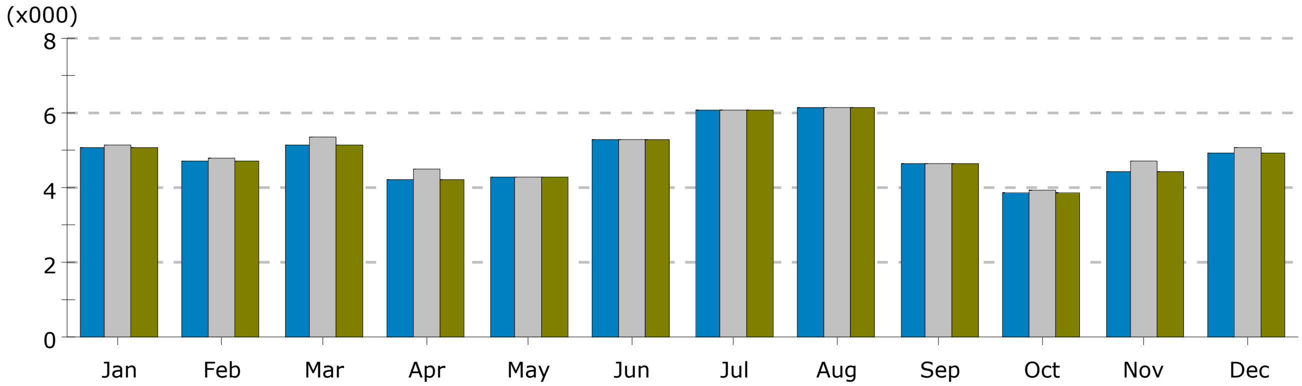
Annual Energy Consumption by Enduse

	Electricity kWh	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	7,048	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	328.30	-	-
HP Supp.	-	-	-	-
Hot Water	-	5.50	-	-
Vent. Fans	11,057	-	-	-
Pumps & Aux.	6,205	2.96	-	-
Ext. Usage	638	-	-	-
Misc. Equip.	24,953	-	-	-
Task Lights	-	-	-	-
Area Lights	8,849	-	-	-
Total	58,749	336.76	-	-



Electricity **Natural Gas**

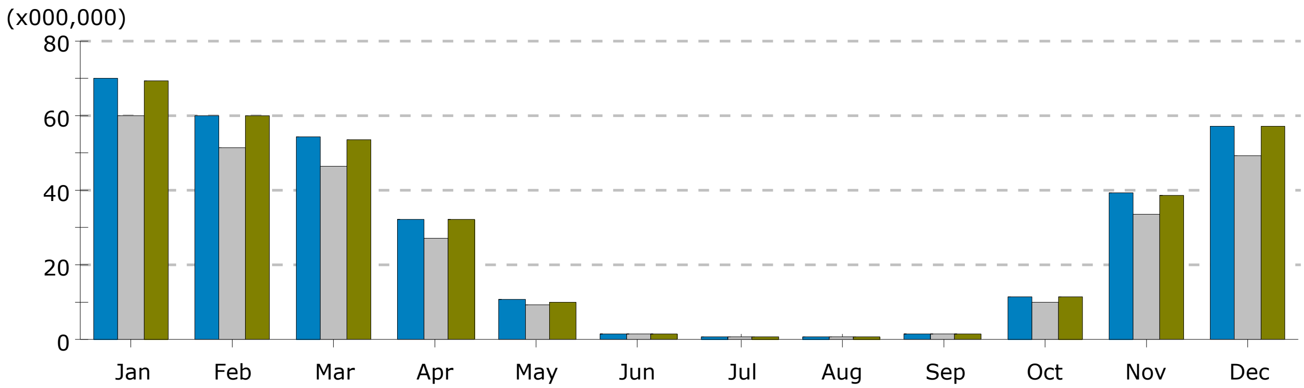
Electric Consumption (kWh)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	5.06	4.68	5.12	4.21	4.26	5.28	6.10	6.17	4.66	3.84	4.46	4.90	58.75
Run 2.	5.11	4.78	5.38	4.48	4.30	5.29	6.10	6.17	4.66	3.91	4.72	5.06	59.96
Run 3.	5.06	4.68	5.12	4.21	4.26	5.28	6.10	6.17	4.66	3.84	4.46	4.90	58.75
Run 4.													
Run 5.													

1. Hollis Fire Department - Baseline Design (03/12/12 @ 16:47)
2. Hollis Fire Department - New Boiler (03/12/12 @ 16:47)
3. Hollis Fire Department - DHW Heater (03/12/12 @ 16:47)

Gas Consumption (Btu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	69.65	60.06	54.05	32.14	10.53	1.48	0.86	0.90	1.29	11.64	39.12	57.46	339.17
Run 2.	59.97	51.57	46.13	27.35	9.02	1.24	0.71	0.74	1.09	9.93	33.26	49.25	290.27
Run 3.	69.42	59.84	53.80	31.92	10.32	1.29	0.69	0.72	1.13	11.45	38.93	57.25	336.76
Run 4.													
Run 5.													

APPENDIX J

Cost Estimates

BUDGETARY COST ESTIMATE

Facility: **Hollis Fire Department**

Date: **3/13/2012**

EEM	Design + Engineering	Installed Cost				Construction Management	Contingency (15%)	Total Investment
		Pricing Unit	Price	Qty	Subtotal			
Install occupancy sensor in garage to turn off lights	$ 200	EA	$ 400	1	**$ 400**	$ 40	$ 96	**$ 736**
Replace existing domestic hot water heater with mini-tank LP-fired hot water heater, OR, a condensing tank unit.	$ 450	EA	$ 1,510	1	**$ 1,510**	$ 151	$ 317	**$ 2,428**
Replace LP-fired boiler with high-efficiency LP-fired modulating condensing unit. Install NEMA premium rated circulation pumps with VFD controllers.	$ 1,200	EA	$ 21,000	1	**$ 21,000**	$ 2,100	$ 3,645	**$ 27,945**
Replace LP-fired boiler with wood pellet-fueled hot-water boiler Install NEMA premium rated circulation pumps with VFD controllers.	$ 1,200	EA	$ 28,500	1	**$ 28,500**	$ 2,850	$ 4,883	**$ 37,433**
Replace exterior metal halide light fixtures with LED units (4).	$ 500	EA	$ 472	4	**$ 1,888**	$ 189	$ 387	**$ 2,963**
Install de-stratification fan units (6) in high-bay to create a air curtain along overhead doors.	$ 500	EA	$ 520	6	**$ 3,120**	$ 312	$ 590	**$ 4,522**
Replace existing air condition condensers (5) with fewer (2 or 3) high-efficiency units (min. SEER 20 / EER 13).	$ 750	EA	$ 1,720	3	**$ 5,160**	$ 516	$ 964	**$ 7,390**
Augment LP-fired air furnace in high-bay with LP-fired IR heaters (6).	$ 750	EA	$ 1,423	6	**$ 8,538**	$ 854	$ 1,521	**$ 11,663**
Add an additional 6 inches of blown cellulous insulation to the garage attic (6,300 SF).	$ 500	BF	$ 0.40	37,800	**$ 15,120**	$ 1,512	$ 2,570	**$ 19,702**