
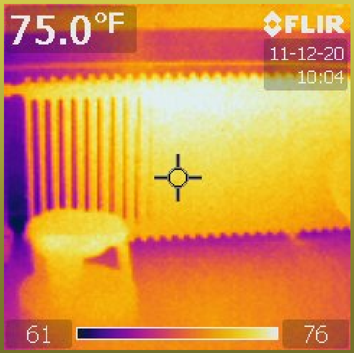


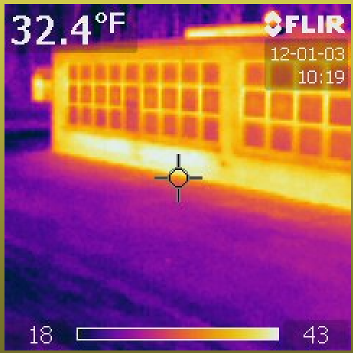

Facility Audit Report
Hollis Primary School – Hollis, NH

FINAL

May 2012

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A. EXECUTIVE SUMMARY

Program Introduction

Figure 1: Hollis Primary School

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.

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 Primary School (HPS) (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 December 20th and 27th, 2011 and January 3rd, 2012, AEC personnel completed site surveys at the HPS 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 HPD function as a composite system.

AEC completed a desktop review of the data provided by the School Administrative Unit 41 (SAU 41) 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 HPD 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 building performance evaluation at the HPS revealed that the building consumes more energy than expected for an elementary school facility. Factors attributing to this include:

1. Inefficient heating supply system comprised of three (3) dated low efficiency boilers.
2. An inefficient hydronic heating distribution system.
3. A poorly insulated envelope (floor, wall, and roof assemblies).
4. Over-ventilation of some building spaces.

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.

- Energy use intensities (EUI) for the building are higher than expected for a K-12 facility. The ENERGY STAR® rating for the Hollis Primary School facility is rather low (51).
- The Hollis Primary School facility is dated and the configuration and layout is not consistent with modern design standards for K-12 facilities. Construction methods and materials are below current building code standards and technologies. Significant facility improvements are required to modernize the building, improve occupant comfort, and reduce energy consumption consistent with current standards.
- The envelope is poorly insulated resulting in a significant amount of thermal transfer through the masonry walls, concrete footing walls, and roofing system. Substantially improving the existing envelope would be a costly initiative.

- Heating supply boilers have endured beyond their expected service life. Pumps, valves, and piping insulation are deteriorated.
- Dated steam registers are difficult to control and result in inefficient distribution of heating.
- Domestic hot water (DHW) equipment and capacity exceed the expected demand.
- Gaps in entry doors and windows provide a significant amount of thermal energy transfer (typical of older K-12 facility).
- Lighting densities in several spaces exceed the recommended industry standards for the prescribed space use.
- The chimney cap and flue are deteriorated.
- A roof window (skylight) is cracked.
- The roof exhaust fans extend approximately eight inches above the roof deck. When snow accumulates higher than eight inches and begins to melt, the melting snow goes through the exhaust and leaks into the school.
- Recorded temperatures throughout the building consistently exceed the recommended setpoint for a K-12 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.

Table 1: Energy Efficiency Measures Summary Table

EEM No.	EEM Description	Investment	Annual Cost Savings	Payback (yrs.)	SIR
TI-1	Disconnect three (3) water fountain condensers in the building.	$0	$240	0	-
TI-2	Replace two (2) vending machines in facility room with ENERGY STAR® rated units.	$0	$220	0	-
T1-3	Remove three (3) incandescent lamps and replace with CFL lamps.	$12	$25	0.5	14.6
T1-4	Complete air-sealing on all entry door jambs, partings, headers, thresholds, and moldings (interior and exterior).	$450	$890	0.5	13.8
T1-5	Consolidate ten (10) compact refrigerators and standard size refrigerator (1) with three (3) standard sized ENERGY STAR® rated units.	$1,500	$1,000	1.5	6.7
T1-6	Install additional interior lighting controllers to reduce lighting density and runtime (photosensors, dimming controls, motion sensors, timers).	$3,300	$1,230	2.7	5.6
TI-7	Replace old computer monitor in custodial closet with ENERGY STAR® rated LCD unit.	$80	$60	1.3	5.3
T1-8	Complete air-sealing on all window jambs, partings, and moldings (interior and exterior).	$1,200	$730	1.6	4.3
T2-1	Replace two (2) DHW tank units with two (2) demand-tankless electric condensing units.	$4,000	$700	5.7	2.6
T2-2	Replace walk-in freezer condenser units with high efficiency units with economizers.	$2,400	$350	6.9	2.2
T2-3	Install CO_2 demand controllers on ventilation equipment.	$8,500	$1,200	7.1	2.1
T2-4	Replace exterior HPS wallpack fixtures with induction or LED units (7).	$5,756	$485	11.2	1.7
T2-5	Install commercial thermal insulated shades on windows and close at night during heating periods.	$5,900	$550	10.7	1.4
T2-6	Replace the older low-efficiency packaged rooftop AHU servicing the administration offices (SEER=9) with a modern efficient unit rated with a SEER of 18 or higher.	$5,931	$287	20	1.0
T3-1	Replace all electrical transformers older than 15 years with high efficiency units.	$19,447	$3,307	5.9	3.0
T3-2	Consolidate existing oil-fired boiler units with two (2) new high efficiency units. Re-line flue. Connect the new system into the existing DDC system. Install VFD controls on main circulation pumps.	$145,245	$12,567	11.6	1.7
T3-3	Install EIFS (3" foil-faced polyisocyanurate rigid insulation w/ stucco veneer) over exterior wall sections to obtain R-value of +20.	$162,261	$7,456	21.8	1.1
T3-4	Replace built-up roof on 1967 addition w/ EPDM system with R-value of +30 (4" of foil-faced polyisocyanurate rigid insulation board) (*complete as part of roof maintenance program*).	$91,336	$2,432	37.6	0.8

The following table summarizes the renewable energy technologies that were considered for the Hollis Police 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).

Table 2: Renewable Energy Technology Feasibility Scoring Results

Renewable Energy Technology	Grade
Geothermal Heating/Cooling	84%
Ground Photovoltaic	76%
Roof Photovoltaic	76%
Biomass Heating	76%
Solar DHW	75%
Solar Thermal	66%
Combined Heat & Power	63%
Wind Turbine Generator	61%

Insulation resistance values (R-values) were determined based on given information, time of construction and visual observations. The industry standard *International Energy Conservation Code (IECC), 2009* for Commercial Buildings in Climate Zone 5 required values are provided along with the installed values in Table 3. The IECC values are for new construction only, however provide a guide as to how this facilities insulation compares with new construction.

Table 3: Facility Insulation Summary

	Insulation Values		
Space	Required (IECC, 2009)	Recommended	Installed
Ground Floor	NA	10	1.2
Concrete Wall	13.0 + 7.5 ci	13.0 + 7.5 ci	2.0
1952 Wall	13.0 + 7.5 ci	13.0 + 7.5 ci	3.6
1967 Wall	13.0 + 7.5 ci	13.0 + 7.5 ci	7.6
1978 Wall	13.0 + 7.5 ci	13.0 + 7.5 ci	14.0
EPDM Roof	38.0	38.0	20.3
Built-up Roof	38.0	38.0	8.9

Master Planning Considerations

The HPS facility was constructed in 1952 with later additions through 1978 when student populations were dramatically rising. In general, public school buildings of this era were designed and constructed on an expedited schedule and low budget. The designers and constructors did not adequately consider spatial layout and function, efficiency, or durability. Modern design considerations for K-12 facilities include energy efficiency, occupant comfort, indoor air quality, sustainability, accessibility, and an environment conducive to learning and social development.

Modernization of the HPS facility consistent with current K-12 facility standards would require a significant financial investment. Modern energy efficient and sustainable K-12 facilities are designed as multi-story buildings. This reduces the building footprint, reduces the roof area where most thermal transfer occurs, and reduces construction costs. The existing HPS structure is very flat in configuration and structural elements would likely not support vertical expansion. As presented herein, other issues include:

- Accessibility compliance.
- Inefficient heating and cooling systems and poor distribution.
- Inefficient and unbalanced ventilation systems.
- A building envelope with very low thermal integrity.
- Poor spatial layout and function.

The current facility full-time enrollment (FTE) density is high compared to other schools. That is, at 137 square feet (SF) per FTE there are relatively more students in the building compared to other regional elementary schools (average of 198 SF/FTE). However, consistent with most local communities, projected FTE numbers are declining over the foreseeable future. Master planning of the Hollis elementary school district should consider the following:

- Facilities operations and maintenance costs for the HPS are expectedly high.
- Modernizing the HPS facility to current standards will require a substantial cost investment.
- FTE density in the Hollis Upper Elementary School (HUES) is very low (292 SF/FTE).

Consolidating the HPS grades (pre-K-3) into the HUES (4-6) would provide a student density of 213 SF/FTE (lower student density than average). Modernizing and improving the efficiency of the HUES facility to accommodate additional grades and students is a practical consideration.

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. 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 4: 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 system characteristics and how each system integrates within the composite facility ultimately determining building function and energy usage.
- *Control*: The manner in which the facility manager utilizes the existing controls for building systems.

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 ECMs 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 ECM 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

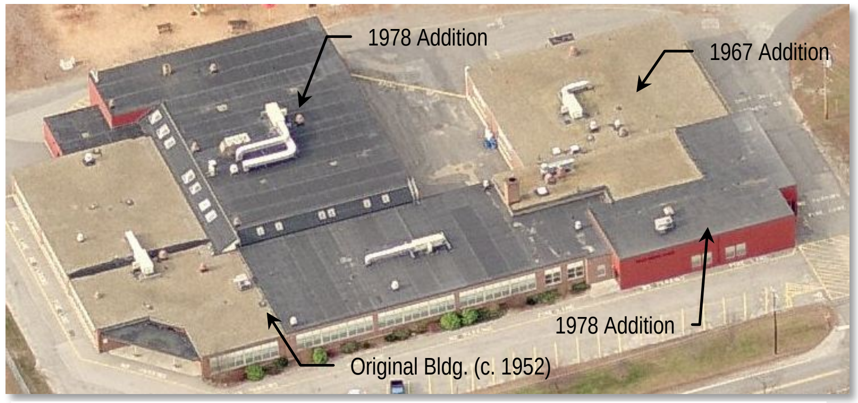


Figure 2: Aerial Photograph of HPS (2010)

The Hollis Primary School (HPS) is located in Hollis, NH within a semi-rural suburban setting. The building and facilities are located on a land parcel owned by the HESD. The school building is located on Silver Lake Road (State Route 122) immediately north of Drury Lane. Silver Lake Road defines the eastern boundary of the parcel and Drury Lane bounds the parcel to the south. The School Administration Building 41 (SAU41) is located directly to the north. The Hollis Upper Elementary School (HUES) is located about a quarter mile to the west on Drury Lane. Parking for the HPS is provided by a drive-through lot in the front of the building. There is a small playground to the west of the building. The gross area of the HPS is 46,918 square feet.

History

The HPS currently serves pre-kindergarten through third-grade (pre-K-3) students. According to archive records, the original school was constructed in 1952 and originally served students in kindergarten thru sixth grade (K-6). During that period the current middle school served as the high school for grades seven through twelve (7-12). Due to an increasing student population the current upper elementary school was constructed originally serving junior-high grades. Several years later the high school was built, allowing the elementary school to be split into two as it is today.

Several additions were constructed between 1967 and 1978 to accommodate increasing student populations. In 1967 a large addition was constructed on the northwest corner of the original building. Two major additions were constructed in 1978 including a section connecting the original building and the 1967 addition (northeast corner) and the large two-story section at the southwest side of the original building (Figure 2).

Use, Function & Occupancy Schedule

The HPS and the land it occupies are owned by the HESD. The building is comprised of one-level extending along the east (Silver Road) and north sides of the property. Space uses in this portion of the building include administrative offices, classrooms, gymnasium, kitchen, library and the nurse's office. At the rear (west) side of the facility is a split two-level structure. Space uses in the split level include classrooms, teacher work room, a boiler room, and several student aid rooms. The current full-time enrollment (FTE) for the HPS is approximately 339 students yielding a density of 138 square feet (SF) per FTE. The typical density for a modern K-6 facility is approximately 100 square feet per student indicating that the FTE population at the HPS is well below facility capacity.

The cafeteria/gymnasium space does not function as intended and there is crowding in sections of the building (notably the special education section). Overall, building facilities and spatial configuration appear to adequately support the current use and functions. The building use schedule follows a typical school schedule with the HPS schedule outlined in Table 5.

Table 5: HPS Operating Schedule (2011-2012)

Month	School Days	Breaks
August	1	Start 8/31
September	21	Labor Day (9/5)
October	19	Columbus Day (10/10) Teacher Professional Day (10/28)
November	17	Teacher Workshop Day (11/08) Veterans Day (11/11) Thanksgiving Recess (11/23-11/25)
December	17	Holiday Recess (12/26-01/02)
January	20	Holiday Recess (12/26-01/02) Teacher Workshop Day (01/10) Martin Luther King Day (01/16)
February	17	Teacher Workshop Day (02/03) Winter Recess (02/27-03/02)
March	20	Winter Recess (02/27-03/02)
April	16	Spring Recess (04/23-04/27)
May	22	Memorial Day (05/28)
June	11	End 6/22

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 HPS evaluation includes the following:

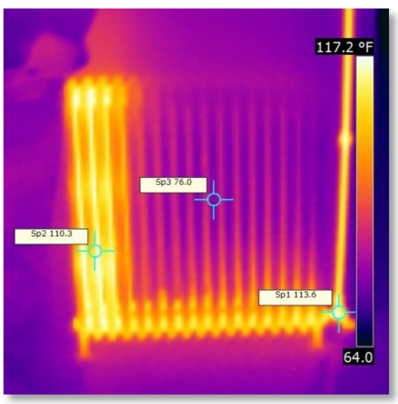


Figure 3: IR Reveals Heat Disbursement from Radiator

- Some of the roof exhaust vents leak because snow accumulates above the height of the vent.
- Heating distribution throughout the corridor is poor with only two (2) old cast iron radiators along the corridors in the single-story section of the building (Figure 3).

Utility Data

Utility data for the Hollis Primary School was provided by the District. Table 6 summarizes the total energy consumption for the year including electric and oil usage. Energy consumption and cost for electricity per pay period is shown in Table 7 and Figure 4. The regional electric utility supplier is Public Service Company of New Hampshire (PSNH) and heating fuel oil is provided by a local supplier.

Table 6: Annual Energy Consumption (2010 - 2011)

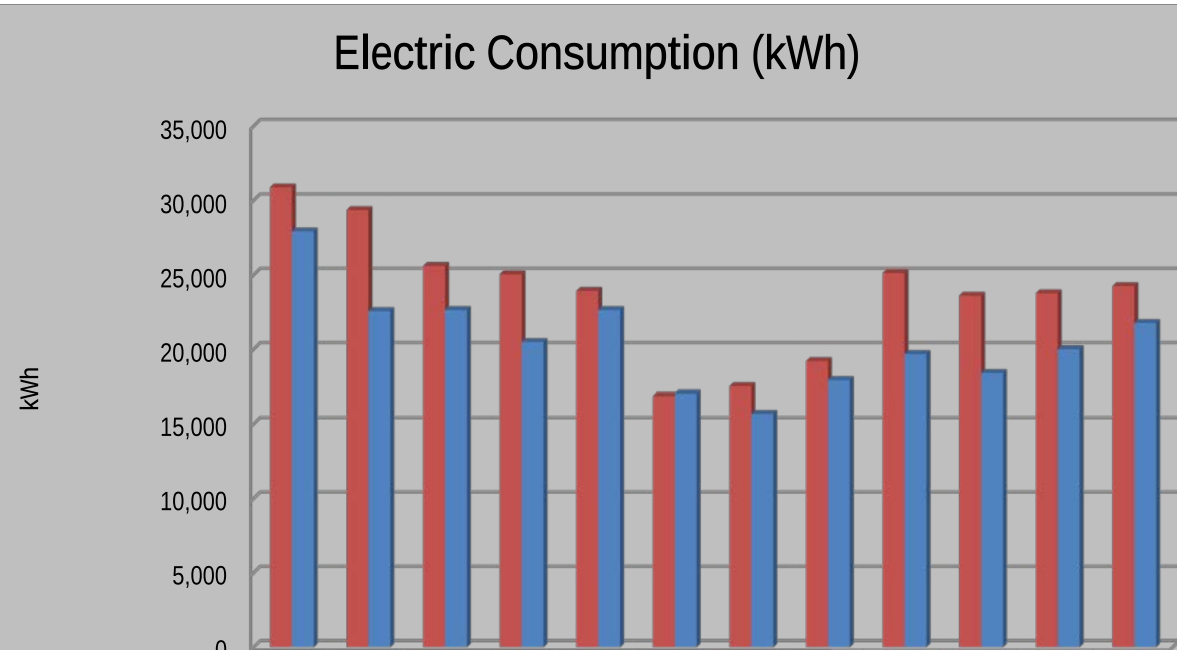
Energy	Period	Consumption	Units	Cost
Electric	February 2010 – January 2011	285,1210	Kilowatt hours	$45,032
Fuel Oil	February 2010 – January 2011	18,027	Gallons	$37,853
			Total Annual Energy Cost (2010 - 2011):	$82,885
Electric	February 2011 – January 2012	246,720	Kilowatt hours	$41,765
Fuel Oil	February 2011 – January 2012	19,720	Gallons	$52,403
			Total Annual Energy Cost (2011 – 2012):	$94,168

The monthly electrical usage (Figure 4) reveals that the usage peaks in the winter. This trend is typical for a K-12 facility. Over the twelve (12) month period (2010), February was the peak demand month, consuming 30,880 kWh of electricity. February was also the peak demand month in 2011, consuming 27,920 kWh of electricity.

Table 7: Monthly Electric Consumption (2010-2011)

Month	Year	Electric Consumption (kWh)	Electric Cost
Feb	2010	30,880	$4,590
Mar	2010	29,360	$4,359
Apr	2010	25,600	$3,972
May	2010	25,040	$3,883
June	2010	23,920	$3,736
July	2010	16,880	$2,903
Aug	2010	17,520	$2,718
Sep	2010	19,200	$3,258
Oct	2010	25,120	$3,980
Nov	2010	23,600	$3,844
Dec	2010	23,760	$3,866
Jan	2011	24,240	$3,924
Total:	*'10 – '11*	*285,120*	*$45,032*
Feb	2011	27,920	$5,248
Mar	2011	22,560	$4,240
Apr	2011	22,640	$4,255
May	2011	20,480	$3,849
June	2011	22,640	$4,255
July	2011	17,040	$3,203
Aug	2011	15,680	$2,947
Sep	2011	17,920	$3,368
Oct	2011	19,680	$3,699
Nov	2011	18,400	$3,701
Dec	2011	20,000	$3,815
Jan	2012	21,760	$4,029
Total:	*'11 – '12*	*246,720*	*$46,609*
Total:	*'10 – '12*	*531,840*	*$91,641*

Annual electric usage for the HPS based on the most recent data provided by the Hollis Elementary School District (HESD) (February 2010 through January 2012) is averaged at 265,920 kWh at a cost of $45,821. Based on the building size and function, this usage is high relative to similar use K-12 facilities.



	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan
Consumption (2010)	30,880	29,360	25,600	25,040	23,920	16,880	17,520	19,200	25,120	23,600	23,760	24,240
Consumption (2011)	27,920	22,560	22,640	20,480	22,640	17,040	15,680	17,920	19,680	18,400	20,000	21,760

Figure 4: Electric Consumption (2011)

To provide the most accurate recommendations for energy conservation, the energy consumption based on end use was determined. Table 8 presents the estimated electrical usage for each category including lighting, plug loads, and mechanical. 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 appliances observed throughout the building. A more detailed accounting of all electrical equipment by end-use is presented in Part C of this Report.

Table 8: Categorized Electrical Consumption (2011)

Equipment Type	Annual Consumption (kWh/yr)	% Total Consumption	Annual Cost
Mechanical Equipment	109,100	44%	$20,625
Lighting Fixtures	75,912	30%	$14,351
Plug Loads	63,962	26%	$12,092
Totals:	248,974	100%	$47,068

Mechanical loads consume the greatest amount of electricity at the HPS accounting for 44% of the electrical energy for the building and 109,100 kWh per year. This is largely a result of being an older system with poor uniformity in disbursement. Lighting systems represent 30% of the annual electrical energy or 75,912 kWh per year. At 63,962 kWh per year, plug loads account for 26% of the electrical demand in the building. Figure 5 presents the relative energy cost for each of the three categories.

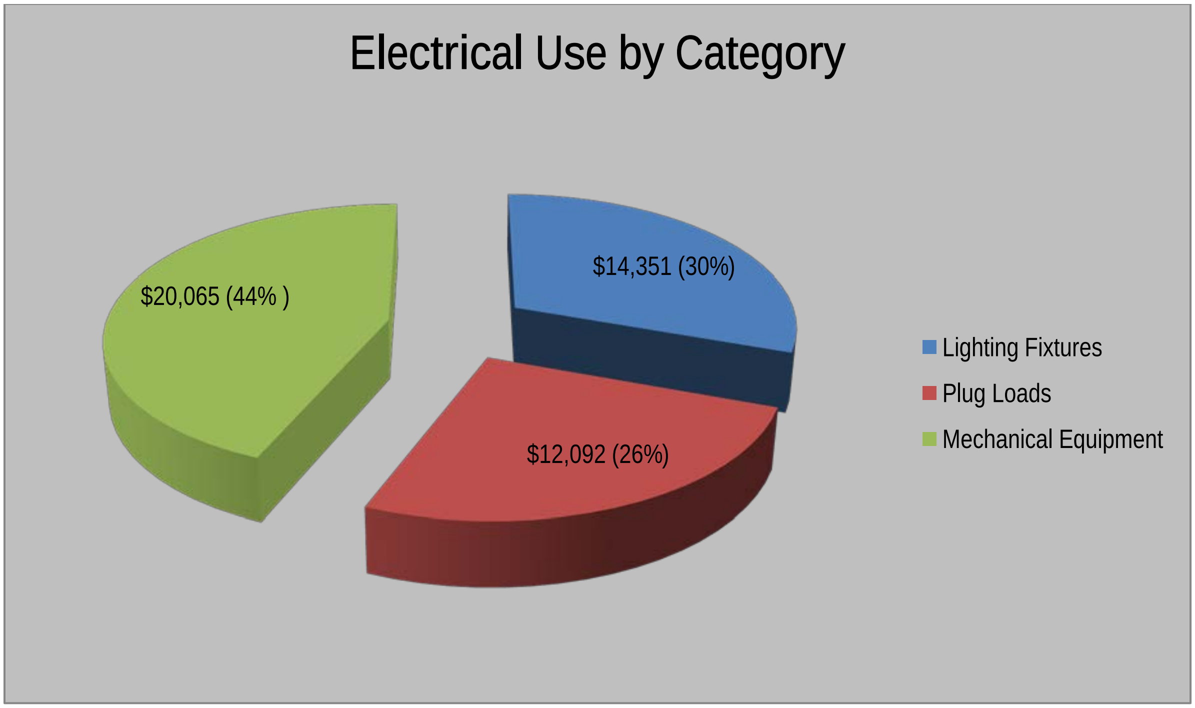


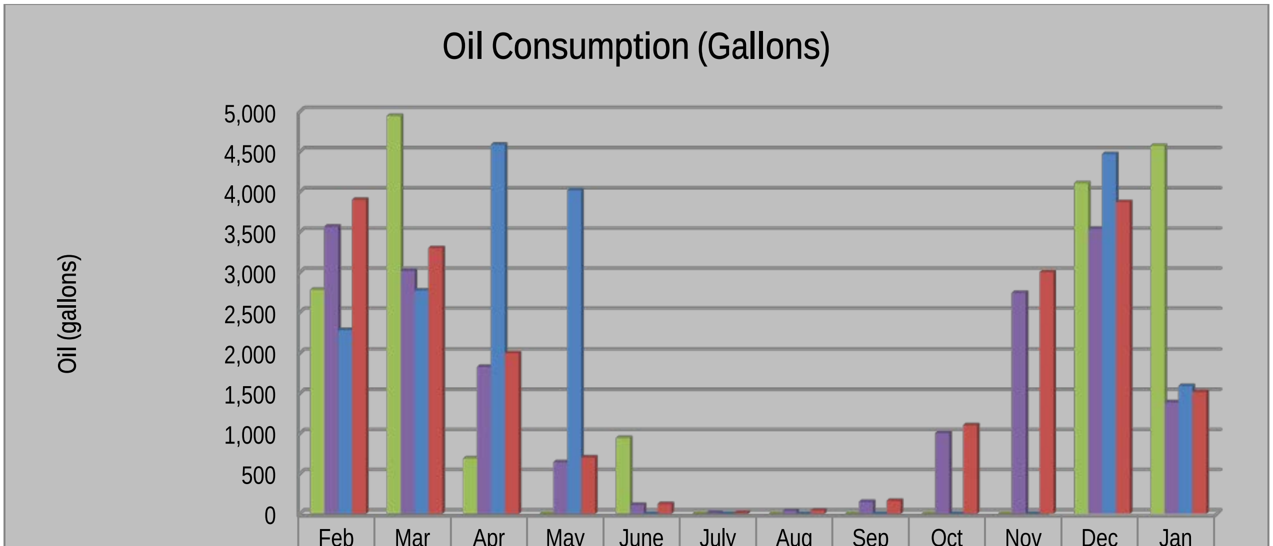
Figure 5: HPS Electrical Cost by Category (2011)

Mechanical equipment accounts for the highest annual cost of $20,065 (2011-2012). Considering the building age and use this usage is as expected. Lighting fixtures consume a moderate amount of electricity however consumption can be reduced with simple measures. Plug loads include office equipment, electronics, and appliances and account for the lowest cost of the three categories.

Table 9: Monthly Heating Fuel Consumption (2010 - 2012)

Month	Year	Oil Purchased (Gallons)	Cost of Purchase	Est. Oil Consumption (Gallons)	Est. Cost of Oil Consumed
Feb	2010	2,779	$4,891	3,565	$7,486
Mar	2010	4,943	$8,700	3,017	$6,334
Apr	2010	686	$1,208	1,828	$3,839
May	2010	0	$0	640	$1,344
June	2010	940	$2,124	110	$230
July	2010	0	$0	9	$19
Aug	2010	0	$0	37	$77
Sep	2010	0	$0	146	$307
Oct	2010	0	$0	1,006	$2,111
Nov	2010	0	$0	2,742	$5,759
Dec	2010	4,105	$9,900	3,540	$7,434
Jan	2011	4,573	$11,030	1,387	$2,912
Totals:	*2010*	*18,027*	*$37,853*	*18,027*	*$37,853*
Feb	2011	2,287	$5,515	3,900	$9,405
Mar	2011	2,770	$6,680	3,300	$7,959
Apr	2011	4,586	$11,059	2,000	$4,823
May	2011	4,019	$9,692	700	$1,688
June	2011	0	$0	120	$289
July	2011	0	$0	10	$24
Aug	2011	0	$0	40	$96
Sep	2011	0	$0	160	$386
Oct	2011	0	$0	1,100	$2,651
Nov	2011	0	$0	3,000	$7,773
Dec	2011	4,469	$14,351	3,873	$12,438
Jan	2012	1,590	$5,106	1,517	$4,872
Totals:	*2011*	*19,720*	*$52,403*	*19,720*	*$52,403*
Totals:	*'10 - '11*	*37,747*	*$90,256*	*37,747*	*$90,257*

Heating fuel for space heating and domestic hot water heating at the HPS is provided by a local supplier (Table 9, Figure 6). The building consumed an annual total of 18,027 gallons of number 2 fuel oil (2010 – 2011) and 19,720 gallons of number 2 fuel oil (February 2011 to January 2012) for an annual average of 18,874. The total annual heating fuel cost for the building is $37,853 (2010) and $52,403 (2011) for an average of $45,129.



	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan
Oil Purchased (2010)	2,779	4,943	686	0	940	0	0	0	0	0	4,105	4,573
Oil Consumed (2010)	3,565	3,017	1,828	640	110	9	37	146	1,006	2,742	3,540	1,387
Oil Purchased (2011)	2,287	2,770	4,586	4,019	0	0	0	0	0	0	4,469	1,590
Oil Consumed (2011)	3,900	3,300	2,000	700	120	10	40	160	1,100	3,000	3,873	1,517

Figure 6: Heating Fuel Consumption (2010 - 2012)

Considering the HPS building systems including the efficiencies of the boilers, envelope integrity (insulation and air leakage), lack of mechanical equipment and controls, and age of the building and systems, the heating fuel usage is expectedly high. There are three boilers which all have very low combustion efficiencies relative to modern standards. One had a maximum efficiency (AFUE) of 82% when installed 12 years ago (2000). The other two have efficiencies of 72% when they were installed 17 (1995) and 32 (1980) years ago. Based on the unit conditions and ages, the de-rated combustion efficiency of the 2000 model is 79% or less while the de-rated efficiencies of the two older models are less than 68%. Modern commercial oil-fired boilers can operate at efficiencies as high as 89%.

Other explanations for the high usage include heating setpoints that are higher than recommended and poor heating distribution throughout the building. For example, several areas exceeded 73°F and the average recorded temperature was 72.3°F. The recommended heating setpoint for an elementary school facility is between 67°F and 70°F.

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. A complete set of design plans (1967) were available and used to verify the building envelope sections.

Floor Systems

The concrete floor in the building is four (4) inches in thickness with a laminate floor covering or carpeting. The floor system has an installed assembly insulation R value of 1.2, as shown in Table 10. 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.

Table 10: Floor Insulation Values

Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Concrete slab	4.0	0.3	1.0	0.3
Floor Tile	0.1	0.1	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

Wall Systems

The building is a multi-level concrete masonry unit (CMU) structure with elevated ceilings in the multi-purpose room. The below grade foundation walls are steel reinforced cast-in-place concrete. With the exception of the 1978 multi-purpose wing addition (1½ inches of rigid insulation) none of the concrete foundation walls are insulated. Most of building exterior CMU walls are clad in brick. Exposed CMU sections exist in the two-story portion as well as on the exterior of the multipurpose-room wing of the building. Table 11 presents wall insulation values for all wall systems. None of the wall systems comply with current energy code standards (IECC, 2009) however they are presumed to comply with the building code in effect at the time of construction. Inspection of the walls with an infra-red (IR) thermal imaging camera did not reveal any notable issues and overall thermal integrity is consistent with the construction methods at the time of construction.

Table 11: Wall Assembly Insulation Values

Concrete Foundation Wall				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Concrete	8	1.1	1.0	1.1
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	2.0
			2009 IECC Requirement (mass wall):	13.0 + 7.5 c.i.
			Code Compliant?	NO
Brick Clad CMU Wall – Original Building (1952)				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Brick	4	0.8	0.8	0.6
Air Gap	2	1.0	1.0	1.0
CMU	8	1.1	1.0	1.1
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	3.6
			2009 IECC Requirement (mass wall):	13.0 + 7.5 c.i.
			Code Compliant?	NO
Brick Clad CMU Wall – 1967 Addition				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Brick	4	0.8	0.8	0.6
Air Gap	2	1.0	1.0	1.0
Urethane Insulation	1	6.0	0.7	4.2
CMU	8	1.1	0.8	0.9
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	7.6
			2009 IECC Requirement (mass wall):	13.0 + 7.5 c.i.
			Code Compliant?	NO
Exposed CMU Wall – 1978 Additions (2)				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Air Gap	2	1.0	1.0	1.0
CMU w/ Infill Insulation	12	15.2	0.8	12.1
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	14.0
			2009 IECC Requirement (mass wall):	13.0 + 7.5 c.i.
			Code Compliant?	NO

Ceiling Systems

Ceilings throughout the building are suspended acoustical tile (SAT) systems. The above ceiling plenum space is used for routing of ducting, piping, conduit, and cable.

Roofing Systems

The roofing system on the HPS consists of an adhered polyurethane membrane system (EPDM) with the exception of the 1967 addition which has built-up ballasted system. Roofing insulation values are presented in Table 12.

Table 12: Roof Systems Insulation

EPDM System (typ.)				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Polyisocyanurate Insulation Board	3	21.6	0.9	19.4
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	20.3
			2009 IECC Requirement (roof):	38.0 c.i.
			Code Compliant?	NO
Built-Up System – 1967 Addition				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Typ. Built-Up System	2	10.0	0.8	8.0
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	8.9
			2009 IECC Requirement (roof):	38.0 c.i.
			Code Compliant?	NO

Fenestration Systems

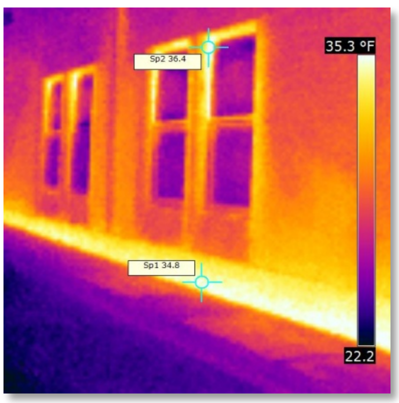


Figure 7: IR Image of Walls/Windows (typ.)

Fenestration systems on the HPS building include operable windows, fixed window units, glazed entry doors, and fixed storefront entry units. Window units in the building are aluminum framed units with double-pane glass. Based on the thermal infra-red imaging, the window and door frames are not insulated. 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 in the HPS and therefore compliance with IECC standards for commercial buildings located in Climate Zone 5 cannot be established.

In general, the glazed units perform reasonably well based on visual inspection and survey with the infra-red thermal camera. Most thermal transfer and air leakage occurs at the seals of operable windows and the interface between the window and the wall opening (Figure 7). Recommendations include exterior and interior inspection and re-caulking of window jambs, headers, moldings, and sills as needed. If the operable double-hung window units have adjustable jambs, they should be inspected and adjusted as necessary to maintain a complete air seal.

Doors

Glazed doors in HPS are hollow metal frame units with thermal breaks. Units include single and double door assemblies with full glazed sections. Frames on the glazed door units appear to be uninsulated providing high thermal transfer (Figure 8). Based on visual observations and thermal imaging, the seals on door jambs, partings, and thresholds are incomplete allowing substantial air leakage. Daylight can be seen through door thresholds and double-door partings.

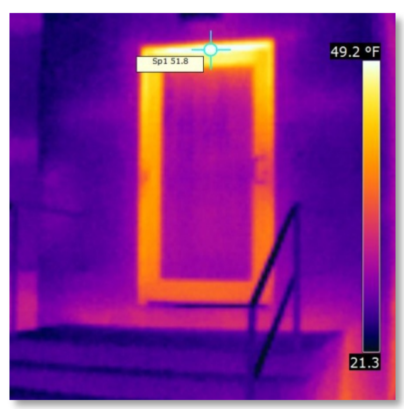


Figure 8: IR Image of Uninsulated Door Frame

Air Sealing

Based on the thermal imaging survey and visual observations, air leakage occurs through windows and entry doors. Although this is typical of most school 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 weather-stripping and sweeps. 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.

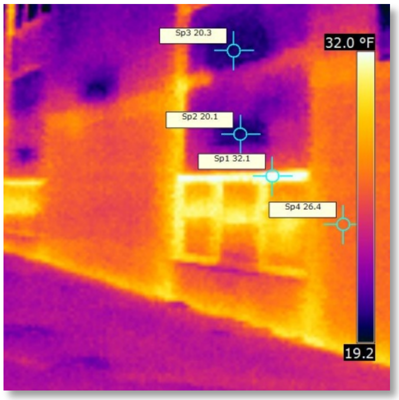


Figure 9: IR Image of West Exterior

Thermal Imaging Survey

The thermal imaging survey was completed on the morning of January 3rd, 2012. Outdoor ambient temperature was 28°F. 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 at the HPS:

- The thermal integrity of the envelope (walls and roof) is relatively good. Some areas of the exterior revealed more thermal transfer than others (Figure 9).
- Poorly sealed windows and doors provide a significant amount of thermal transfer and air leakage. Recommend installing weather stripping and thermal insulated shades
- The concrete foundation wall extending above grade provides thermal transfer.
- Uninsulated hot water piping throughout results in heat loss to a semi-conditioned space. (Figure 10)
- Cast-iron radiators distribute heat inefficiently.
- Electronic equipment including photocopiers, overhead LCD projectors, and computers/monitors operate at high temperatures and increase heat loading of the building.

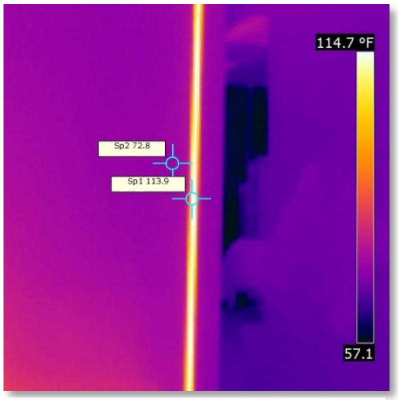


Figure 10: IR Image of Uninsulated Hot Water Pipe (typ.)

Electrical Systems

Supply & Distribution

Grid electricity is supplied to HPS via overhead transmission lines connecting to the electrical room located on the first floor of the split-level portion of the building. Several sub-distribution electrical panels are located in closets throughout the building.

Lighting Systems

As presented in Table 13, there are a variety of lighting fixtures and lamp types in the HPS. Lighting fixtures in the building consist primarily of recessed mounted high performance T8 fluorescent fixtures. Other interior fixtures include compact fluorescent (CFL) and incandescent. All exterior lights are high pressure sodium (HPS). Exit signs are LED units.

The estimated annual cost for lighting in the HPS is $14,351. Although a lighting upgrade was recently completed (2011), approximately half the lighting densities in the building exceed recommended standards. Improving lighting operation and control will significantly reduce energy consumption. As example, low-cost controls typically provide a 15% reduction in lighting operation –this would provide an annual savings of nearly $2,000 at the HPS.

Table 13: Lighting Fixture Schedule

Fixture Lamp Type	Location(s)	Control	No. Lamps	Watts	Qty.	Total Watts
T8 Fluorescent	Throughout	Switch	1-4	32	580	34,590
HPS	Exterior, Rm. 329	Switch	1	70, 150, 400	7	1,400
CFL	Throughout	Switch	1, 2, 4	17, 54	12	634
LED	Exit Signs	Switch	1	5	24	120
Incandescent	Rm. 156	Switch	1	60	3	225
				Totals:	626	36,969

Table 14 presents the energy consumption by lighting fixture type. The high performance T8 fluorescent fixtures are the main source of lighting and account for 91% of all lighting energy consumption annually. High pressure sodium (HPS) fixtures are the source of light on the exterior and account for 6% of total lighting energy consumption. CFL lamps are used in the north vestibule and room 117 and account for 2% of lighting use. LED lamps are used in exit signs and incandescent bulbs in the art room and two bathrooms account for 1% or less.

Table 14: Lighting Fixture Energy Consumption

Fixture Lamp Type	Location(s)	Est. Usage (KWH/yr)	% of Total
T8 Fluorescent	Throughout	69,180	91%
HPS	Exterior	4,477	6%
CFL	North Vestibule, Rm. 117	1,268	2%
LED	Exit Signs	806	1%
Incandescent	Art, Lavatory	180	<1%
	Totals:	75,912	100%

Lighting density measurements in HPS 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 December 20th, 2011 between the hours of 0900 and 1000. Table 15 presents the lighting density measurements obtained in units of foot-candles (FCs).

The T-8 lamp fixtures are relatively efficient units. Adding controls to reduce the frequency of operation is recommended especially in common spaces such as corridors. Time and motion controllers can be used in combination where the timer is the primary control device and the motion sensor is the secondary control –this also provides a security alert function where operating lights would indicate occupancy when the school is closed. Daylight controls could be used to control the light density output of fixtures in spaces which receive an ample amount of natural light through doors, windows, and skylights (Figure 11).

Figure 11: Illuminated Light Next to Window

As part of the lighting upgrade, most incandescent bulbs were removed from the building and upgraded to higher efficiency bulbs. Three bulbs still remain; one in the Art Room (116), one in the library lavatory and one in an office lavatory. All incandescent lamps should be replaced with compact fluorescent lamps.

The high pressure sodium (HPS) fixtures on the exterior are high wattage units that operate at very high temperatures. Replacing the HPS fixtures with LED or induction lamp fixtures will reduce energy consumption and improve lighting density and quality however the cost payback can be long. Refer to the energy efficiency measures (EEMs) in Table 25-27.

IESNA Standards

Lighting densities in some spaces in the building exceed IESNA recommended standards. Methods to reduce lighting densities include reducing the quantity of fixtures, de-lamping, installing new 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 daylighting controls and adding dimming controls. Newer technology fixtures provide higher lighting density per watt than the existing older fixtures and provide improved lighting quality. Additionally, the service life on new lamps is generally longer than older fixture lamps thereby reducing O&M costs. The lighting density data is included in Appendix C.

As part of the lighting upgrade project these fixtures were designed to be over-lit with the intention of losing their densities overtime. Increased lighting densities result in an unnecessary increase in electrical energy consumption. Particularly, lighting densities in the HPS corridors and lavatories are consistently high averaging around 26 footcandles (FCs) while the minimum standard is 5 FCs (15 FCs is recommended in corridors with lockers). Some measured lighting densities are slightly below the minimum standard however they are within the expected range and increasing density is not recommended for any space. A cost effective approach for the HPS would be to reduce the frequency in which these fixtures operate to maximize their life and minimize the consumption.

Table 15: Illumination Densities

Location	Lighting Density (FC)	Recommended Density (FC) (1)
Classroom 117	14	30
Multi-purpose room	29	30
Kitchen	37	50
Boys lavatory	27	5
Classroom 119	37	30
Classroom 121	29	30
Special education	32	30
Classroom 120	40	30
West hall off gym	32	5-15
Classroom 115	19	30
Special education	26	30
Classroom 116 (art room)	60	75
Library media	41	30
Classroom 114	25	30
NS main corridor	31	5-15
Classroom 113	50	30
Classroom 101	37	30
Nurse office	25	50
Classroom 104	40	30
Speech pathologist	16	30
Ramp corridor	26	5-15
Upper floor corridor EW	32	5-15
Classroom 207	20	30
Boys lavatory	26	5
Guidance	21	30
Classroom 205	28	30
Classroom 204	23	30
Maintenance	13	30
Classroom 109	26	30
Classroom 106	29	30
Girls lavatory	28	5
Classroom 100	43	30
Lower level EW corridor	35	5-15

(1) Based upon IESNA standards and AEC recommendations.

Plug Loads

Plug loads for the HPS 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 63,962 kWh. Office equipment, computers and electronics account for the majority of plug load energy consumption (75%). Appliances account for an estimated 25% of total energy consumption.

Table 16: Plug Load Energy Consumption

Category	Location(s)	Est. Usage (kWh/year)	% of Total
Appliances	Throughout	15,725	25%
Office Equipment, Computers, Electronics	Throughout	48,237	75%
	Subtotals	63,962	100%

Figure 12: Compact Refrigerator (typ.)

A total of ten (10) compact refrigerators are located in the building (Figure 12). These are energy intensive appliances consuming a substantial amount of energy annually. Recommendations include consolidating these units with fewer standard sized ENERGY STAR® rated units. A total of twenty (20) overhead LCD projectors were inventoried. Sixteen (16) computer printers were observed. A total of ninety-one (91) desktop computers and forty (40) notebook computers were inventoried. While this amount is not high considering the number of occupants (students and staff) for an elementary school, it is still recommended to remove any older and unused computer systems.

Motors

Electrical motors are used for the air handling unit (AHU) fan motors and water circulation pump units. Variable frequency drive (VFD) controllers are typically recommended for larger motors (over 5 horsepower). Recommendations include installing new digital programmable VFDs on all pumps greater than 5-HP in size. Replacement of failed motors with premium efficiency NEMA rated motors is recommended.

Emergency Power Systems

There are no emergency power systems at the HPS.

Plumbing Systems

Domestic Water Supply

Domestic water supply for the HPS is provided by the pump house behind the Hollis Upper Elementary School (HUES). Water demand for the building is expected to be moderately low and includes lavatory facilities (toilets and sinks) and kitchen uses (cooking and dish washing).

Domestic Water Pump Systems

Domestic water to the HPS is pumped from the pump house to the HUES and terminates at the HPS. According to records and personnel, the location, size and material of piping between the two schools is unknown. The HPS has its own pump station with an underground storage tank supplied by the pump house. There are two booster pumps within the HPS pump station to provide adequate water pressure for the school.

Domestic Water Treatment Systems

Domestic water is treated at the pump house by increasing pH levels with chemical treatment including adding soda ash and orthophosphate. The purpose of the water treatment is to minimize the corrosive potential of for piping and equipment. This treatment was required by the NH Department of Environmental Services (NHDES) after elevated levels of copper and/or lead were found in the drinking water.

Water quality as measured by alkalinity, pH, and mineral content also reduces the service life of hydronic systems and equipment resulting in increased maintenance and repair costs. High mineral content can also reduce equipment efficiency. For example, high mineral content will result in the formation of scale on an energy recovery wheel or chiller tower thereby reducing the capacity of the fins to accept energy from the water.


Figure 13: Electric Hot Water Heater

Domestic Hot Water Systems

Domestic hot water (DHW) is provided by a single (1) 40-gallon oil-fired tank unit and one (1) 40-gallon electric-fired (Figure 13) hot water heating tank. The DHW distribution piping in the building appears to be adequately well insulated; however improvements can always be made, such as hot water pipes in the corridors for the radiators. The system capacity appears to exceed occupant demand requirements. Recommendations include replacing the two DHW tanks with two demand-tankless electric condensing units which would be more efficient based on actual use.

Hydronic Systems

Space conditioning is provided by heat pumps and hot water coils connected to a hydronic loop. Water is circulated by two (2) 1½ horsepower circulation pumps located in the boiler room as well as one (1) additional ½ horsepower circulation pump and one (1) 1½ horsepower pump. Sections of piping insulation missing result in inefficient heat transfer. Recommendations include replacing the any missing insulation.

Mechanical Systems

Heating Systems

Heating systems at the HPS are relatively inefficient. There are two (2) Weil McLain® boilers with efficiencies of 72% which were manufactured in 1980 and 1995 (Figure 14). There is also one (1) Smith boiler with an efficiency of 82% with a manufactured date of 2000. Low boiler combustion efficiencies results in a substantial amount of heat loss, reduced system inefficiency, and increased CO_2e emissions. Based on accounts by building occupants and as evidenced during the evaluation, heating distribution throughout the building is inefficient. Over-heating and inconsistent temperatures of interior spaces is evident based on temperature measurements. There is also a unit heater located in the electrical room and one in the boiler room which are unnecessary. Table 17 details the boilers.


Figure 14: 1 of 2 Boiler Rooms with 1 of 2 Weil McLain Boilers

Table 17: Heating Supply Systems

Heating Unit	Unit Description	Area(s) Served	Output (MBH)	Age (yrs.)	AFUE (new)	Control Type
Boiler No. 1	Weil McLain / Boiler Room 1	Single-story section	1,582	32	72%	DDC
Boiler No. 2	SB Smith / Boiler Room 1	Single-story section	1,477	12	82%	DDC
Boiler No. 3	Weil McLain / Boiler Room 2	Split-level section	1,582	17	72%	DDC

The de-rated combustion efficiencies for the two older units is 68%. The third boiler rated at 82% efficiency when new has a de-rated efficiency of less than 79%. Modern oil-fired units can achieve combustion efficiencies as high as 89%. Thermal efficiency of the older boilers is also very low due to the thin jacket insulation.

Recommendations include replacing the three (3) boilers with two (2) high efficiency units. These two units could be connected to the existing Johnson Metasys® DDC system. Installing new NEMA premium rated circulation pumps with variable frequency drives (VFDs) controllers would further increase the efficiency of the system.

Figure 15: Packaged Rooftop AHU (typ.)

Cooling Systems

Cooling of the HPS is provided by DX condensing unit (kindergarten), a split wall-mounted system (data room), a packaged air handling unit (AHU) with condensing coils (administration offices), and four (4) packaged AHUs service the remainder of the building (Figure 15). The administration and kindergarten 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 condensing units are 11 or less. Operating efficiency tends to decrease with system age as well. As cooling condensing units fail, they should be replaced with the highest rated equipment available. 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

A total of five (5) hydronic pumps exist in the building with motor sizes ranging between ½ HP and 1½ HP (Figure 16). Visual inspection of the pumps revealed they are corroding due to their age. Maintenance of all pumps is recommended to eliminate leaks, increase service life, and to prevent catastrophic failure resulting from a ruptured pressure relief valve or failed valve packing.

Figure 16: Circulating Pumps in Boiler Room #1

Controls Systems

Heating, ventilation and cooling are controlled by an older Johnson Metasys® direct digital controls (DDC) system. Thermostats are located throughout the building to control each particular zone. The DDC system is dated and provided limited control. The dated cast-iron radiator units are particularly difficult to control further reducing system efficiency.

Mechanical Equipment Energy Consumption

The electrical energy consumption for mechanical equipment was determined according to nameplate information and building function and occupancy schedules. Table 18 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. Mechanical equipment represents the 44% of the electrical usage among the three categories including lighting and plug loads. Total mechanical consumption is 109,100 kWh per year compared to 75,912 kWh/yr for lighting and 63,962 kWh/yr for plug loads.

Table 18: Mechanical Equipment Electrical Consumption Summary

Equipment Type	Qty.	Item Manufacturer	Consumption (kWh/yr)	% of Total
Packaged Air Handling Units	5	Trane, Carrier	56,000	51%
DX Condensing Units	1	Carrier	5,000	5%
Hydronic Circulating Pumps	5	Bell & Gossett, Baldor	28,000	26%
Mini-Split Air Conditioner	1	Mitsubishi	3,600	3%
Unit Fan-Coil Heaters	1	Trane	2,500	2%
Walk-in Freezer Condensers	2	Keeprite	9,000	8%
Electric Hot Water Heater	1	State Select	5,000	5%
		Total:	109,100	100%

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 constantly 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.

Exhaust ventilation systems in the HPS include rooftop mounted fan units serving the kitchen and lavatories (Greenheck®). Control of all units appears to be adequately time scheduled. Fan ducting should have pressure actuated dampers to restrict air flow and heat loss when the units are not operating.

Exchange Air Ventilation Systems

Distribution and balancing of ventilation air throughout the building is reasonable considering the system type and age. Carbon dioxide (CO_2) levels were all below the maximum recommended standard indicating the ventilation systems are adequately sized for the building. Levels do vary and some spaces appear to be over-ventilated based on the low CO_2 concentrations. Recommendations include installing CO_2 demand controllers on all exchange air ventilation systems to optimize the building ventilation systems (this is a current IMC code requirement).

Energy Recovery Ventilation Systems

Energy recovery ventilator units (ERVs) improve the efficiency of heating and cooling systems by capturing and recycling conditioned air before it is exhausted to the atmosphere. There are currently no ERV units in the AHUs at the HPS. Retrofitting existing AHUs can be costly with a long payback term depending on unit configuration and age. However, recommendations include obtaining a quote from a HVAC vender to determine the cost associated with retrofitting the AHUs. New AHU units should include a packaged ERV unit.

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 HPS was measured on December 20th, 2011 between the hours of 0900 and 1000. The building was normally occupied when the measurements were obtained. Twenty-one (21) IAQ measurements were obtained at representative locations throughout the building. Appendix C presents all of the measurements. Results of the IAQ measurements are presented in Table 19 and summarized as follows:

- Temperatures in the HPS facility ranged from 67.4°F in the gymnasium to 74.8°F in Classroom 112. The average recorded temperature was 72.3°F.
- Relative humidity levels were relatively consistent throughout the building ranging from 13.2% in Classroom 102 to 18.9% in classroom 205. The average relative humidity was 15.4%.
- CO_2 concentrations ranged from 432 ppm in the Conference Room to 881 ppm in Classroom 205. The average concentration was 608 ppm.

Table 19: Summary IAQ Data

IAQ Metric	Low	High	Avg.	Range of Variance	Recommended
Temperature (°F)	67.4	74.8	72.3	7.4	67 – 70
Relative Humidity (%)	13.2	18.9	15.4	5.7	30 – 65
Carbon Dioxide (ppm)	432	881	608	449	<1,000

IAQ data varies dramatically throughout the building. This is indicative of poor distribution of conditioned air and unbalanced ventilation systems. The low CO_2 measurements indicated that many spaces in the HPS are over-ventilated. With the exception of the gymnasium, all rooms also exceeded the recommended range of heating setpoints. HVAC equipment was observed to be well maintained including routine air filter replacement, belt replacement, and fan wheel lubrication which improves occupant comfort, increases equipment service life, and improves operating efficiency.

Figure 17 presents the data trending for the three IAQ parameters. This trending graphically depicts the high variations in IAQ throughout the building. In summary:

- Temperatures significantly exceed recommended setpoint values resulting in increased energy consumption.
- Over-ventilation of the building results in increased operating frequency of ventilation equipment, increased energy consumption, increased maintenance and repair costs, and reduced equipment service life.
- Ventilation of the building is unbalanced.

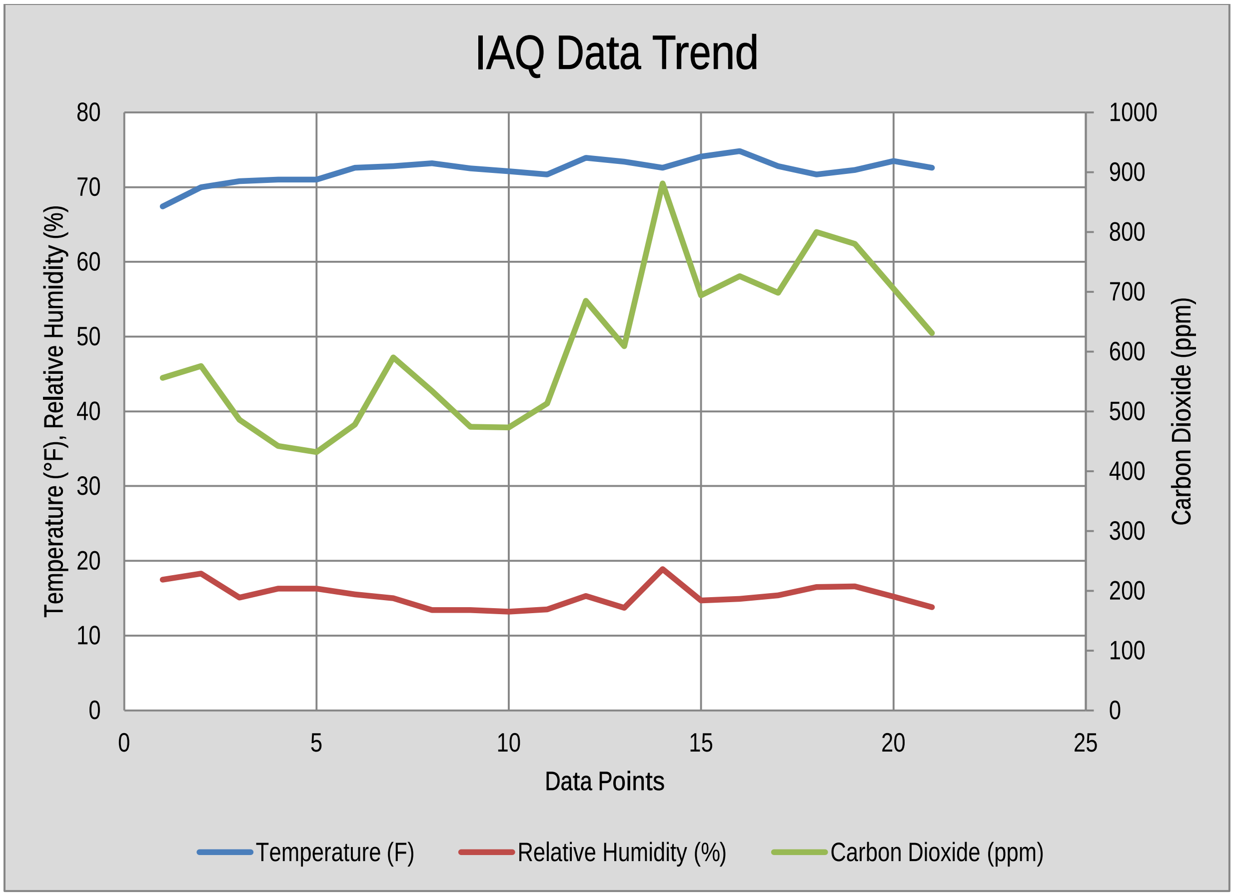


Figure 17: IAQ Data Trend

Secondary Observations

Figure 18: Deteriorating Flue
(note spalling section)

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 HESD consideration and may warrant further investigation.

Structural Systems

No structural system issues were noted during the audit.

Roofing Systems

With the exception of some minor ponding, the roofing systems appear to be in satisfactory condition. The vent servicing the first grade lavatory is not set high enough. Accumulated snow will block the vent from functioning and may leak into the building.

Building Code

No significant building code issues were identified during the audit. Minor items noted include the chimney flue which is deteriorating both at the exhaust point and down the flue (Figure 18). The concrete masonry unit (CMU) blocks supporting the chimney cap is also cracking (Figure 19).

Life Safety Code

No life safety code issues were identified during the audit.

Americans with Disabilities Act Accessibility

The HPS does not meet current ADA accessibility standards for new construction. The HPS facility does not comply with current ADA standards. Any major renovations or additions would require compliance. Examples of ADA non-compliance issues are presented for information only. Any initiatives to fully comply with current standards would require a more comprehensive and rigorous compliance evaluation of the existing facility.

Figure 19: Crack in Chimney Blocking

Because there are no elevators located in the HPS, wheelchair bound occupants must use a ramp to access the two split-level floors at the southwest side of the building. According to the design plans the ramp extending from the middle level to the second floor is sloped at 9% for 39 feet, has an 8 foot flat landing, and proceeds at 9% for the remaining 22 feet 8 inches for a total run of 69 feet 8 inches. From the middle level accessing the first floor, the ramp is sloped at 10% for approximately 45 feet. The maximum slope for new construction is 1:12, or 8.3%. For buildings with spatial constraints, a slope of 1:10 (10%) is allowed for a maximum rise of 6 inches (5 foot horizontal run). A slope of 1:8 (12.5%) is allowed for a maximum rise of 3 inches (2 foot horizontal run). If a slope between 1:12 (8.3%) and 1:16 (6.25%) can be obtained, the maximum rise is 2 feet 6 inches over 30 feet horizontally before a level landing is required. Level landings are required to have a minimum run of 5 feet. Based on the current layout and spatial constraints, the ramp could not be modified to meet current standards.

The ramp between the middle level and the upper level rises 5½ feet which would require two level landings as well as the extra horizontal run to decrease the slope from 9% to 8.3%. There is not enough horizontal run to meet this requirement. The ramp between the middle level and first floor rises 4½ feet which would require one level landing as well as extra horizontal run to decrease the slope from 10% to 8.3% and there currently is space to expand this ramp. Raising the landing between the two levels ½ foot resulting in a 5 foot rise between each level would only require one level landing on each ramp and with this extra rise and minimum landing run each ramp would span 65 feet. Constraints to this scenario include the exterior door at the landing, the speech therapist room at the landing, and the hallway leading into the landing which would all need to be modified for the change in elevation. Installing an elevator may be the most effective solution.

Hazardous Building Materials

Based upon the construction date of the original HPS building, hazardous building materials are suspected. This includes all painted surfaces on original portions of the building (1952) and older additions (pre-1978) which should be presumed to contain regulated levels of lead. Based on accounts by facility personnel, the glazing on the windows located on the second floor of original building southwest wing (north face) contains asbestos.

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 mainly from the building site review. Energy usage was provided by the Town for grid electricity and liquefied propane.

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 HPD facility was modeled using eQUEST© computer simulation program. Developing an accurate baseline model of the building presented certain challenges including a high quantity of HVAC equipment and a high occupancy schedule. Once the baseline calibration was completed, several major Energy Efficiency Measures (EEMs) were simulated within the model including:

- Replacing the boiler with a high-efficiency condensing gas unit.
- Replacing the boiler, condensing units, and ventilation systems with a air-source electric heat pump system.
- Replacing the condensing units with high efficiency units.
- Adding economizer units to the air handling units.
- Replace the DHW tank heater with a tankless 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 20 and 21 present a summary of the model predicted annual energy usage by category for electrical and heating fuel. The actual electrical consumption is slightly higher than predicted by the model.

Table 20: Model Predicted Baseline Electrical Usage

Electric Category	Annual Usage (kWh x 1,000)
Space Cooling	13.68
Hot Water	5.04
Ventilation	51.58
Pumps & Aux.	28.76
Exterior Lighting	4.46
Misc. Equipment	67.34
Area Lights	72.74
Total Predicted:	243.61
Total Actual:	246.72

Actual heating fuel consumption (2,835.3 MBtu) is slightly lower than the model predicted value (3,120.1 MBtu) based on available data through December 2011. This variation is within the expected range of deviation.

Table 21: Model Predicted Heating Fuel Usage

Electric Category	Annual Usage (MBtu)
Space Heating	3,110.1
Hot Water	10.0
Total Predicted:	3,120.1
Total Actual:	2,835.3

The energy modeling results are depicted graphically by a monthly bar graph (Figure 20) which breaks down the energy consumption for electricity and gas consumption separately by category. For example, "Area Lighting" is relatively consistent throughout the year while "Space Cooling" consumes a variable amount of electricity depending on the time of year.

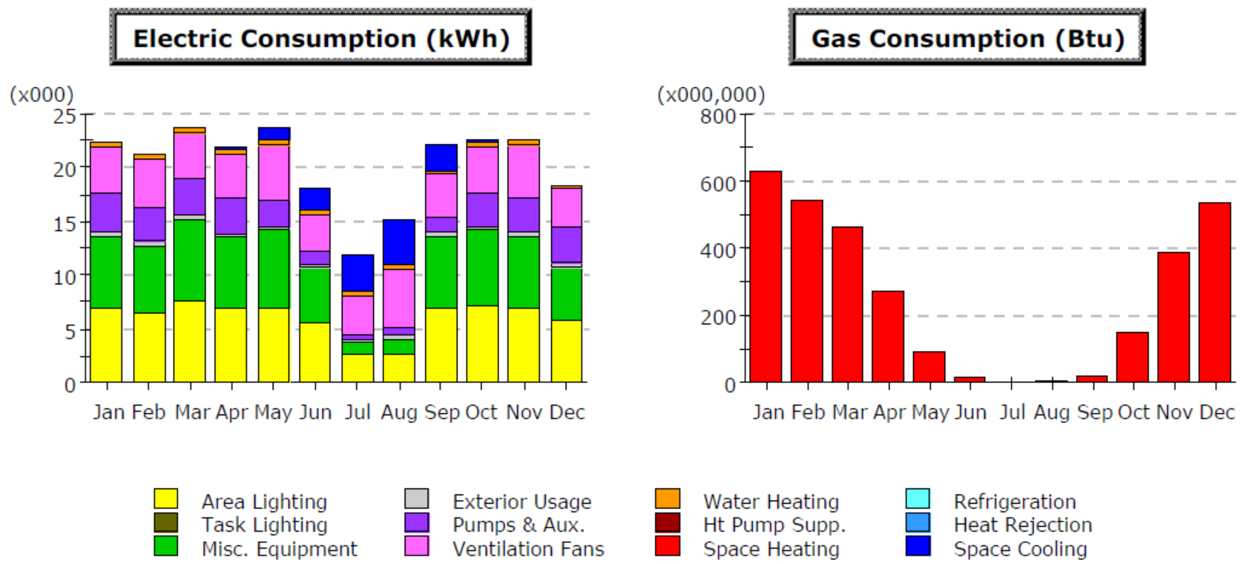


Figure 20: Monthly Energy Use by Category (Baseline)

Annual energy consumption by category is also graphed using eQUEST® (Figure 21). This information is depicted in a pie graph and helps determine the largest overall use categories. For the HPS the "Area Lighting" category is determined to use the most electrical energy (30%) while "Space Heating" consumes the most amount of oil with "Water Heating" consuming less than 1%. 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. This provides an indication of where the EEM savings occur and any possible increased energy use from the new measure. That information is then used to formulate whether the EEM is economically sound for the particular application.

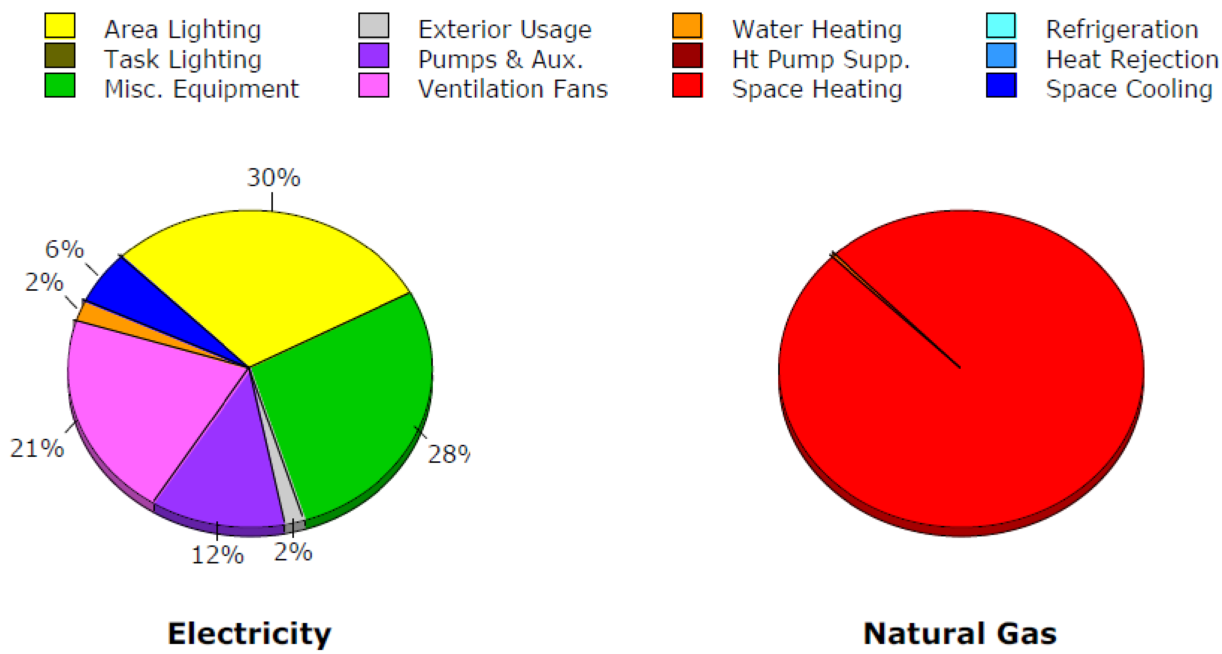


Figure 21: Annual Energy Use by Category (Baseline)

F. FACILITY BENCHMARKING

ENERGY STAR for Commercial Buildings

The HPS 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 Primary School is defined as a "K-12 School" use building and it is not currently certified in the Commercial Building ENERGY STAR® program. Utility data for electric and heating fuel for the preceding twelve (12) months was input into the benchmarking program. Table 22 presents the annual energy use (February 2011 – January 2012) and Table 23 presents a summary of the Statement of Energy Performance (SEP) benchmarking results. The SEP is presented in Appendix G.

Table 22: Annual Energy Consumption

Energy	Site Usage (kBtu)
Electric – Grid	841,802
Fuel Oil (No. 2)	2,735,004
Total Energy:	3,576,813

Table 23: SEP Benchmarking Summary

Location	Site EUI (kBtu/ft²/yr)	Source EUI (kBtu/ft²/yr)
HPS	76	119
National Median (K-12 School)	83	130
	% Difference:	-8%
	Portfolio Manager Score:	59

Compared to the school facilities that have entered data into Portfolio Manager to date, the HPS energy use is at the national average. The source EUI for the HPS is 119 kBtu/ft²/yr while the national average is 130 kBtu/ft²/yr, meaning the HPS uses 8% less site energy than the average school facility. With a score (59) below the minimum threshold of 75, the HPS does not currently qualify for ENERGY STAR® certification.

Regional Benchmarking

Regional benchmarking provides a valuable comparison of local facilities that are similar in use, function, and size. Two data groups were used to complete independent benchmark comparisons for:

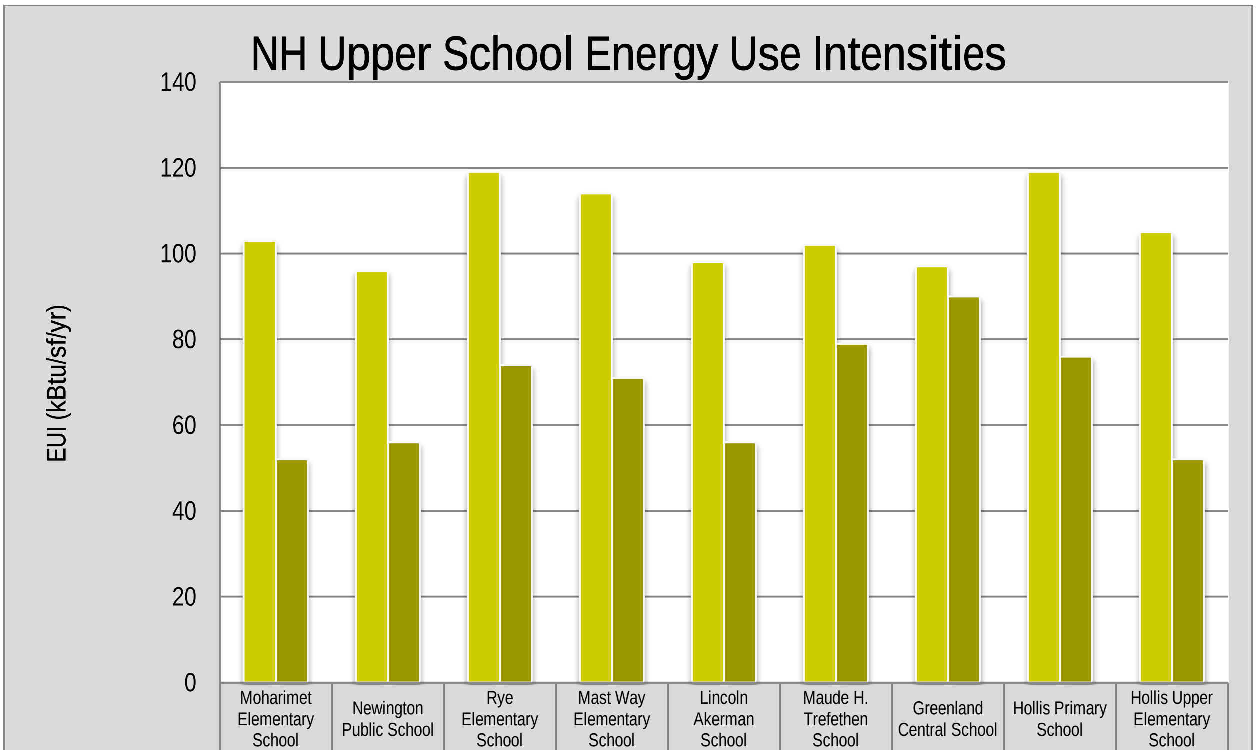
1. ENERGY STAR Ratings and Energy Use Intensities (source and site).
2. Total Energy Costs by Student and Building Area.

Table 24 below compares the density of the building square footage (sf) to full time enrolment (FTE) to each representative school facility.

Table 24: Regional School FTE Densities

School	Location	Area (SF)	FTE	Density (SF/FTE)
Newington Public School	Newington, NH	14,300	40	358
Hollis Upper Elementary School	Hollis, NH	96,258	330	292
Greenland Central School	Greenland, NH	91,226	361	253
Lincoln Akerman School	Hampton Falls, NH	46,736	271	172
Maude H. Trefethen School	New Castle, NH	8,700	54	161
Rye Elementary School	Rye, NH	50,500	317	159
Hollis Primary School	Hollis, NH	46,918	343	137
Mast Way Elementary School	Lee, NH	43,700	334	131
Moharimet Elementary School	Madbury, NH	43,740	372	118
			Average:	198

Figure 23 presents the source and site Energy Use Intensities (EUIs) for the nine schools. EUIs are measured in units of energy per area or kBtu per square foot (kBtu/SF). Source EUIs consider all of the energy required to develop the energy and distribute the energy to the site location including inefficiency losses such as electrical distribution grids. Site energy is the energy consumed at the point of service or meter. The source EUI of 119 kBtu/SF/yr for HPS is one of the highest of the schools compared. The site EUI is more along the average for the schools compared with an EUI of 76 kBtu/SF/yr.



	Moharimet Elementary School	Newington Public School	Rye Elementary School	Mast Way Elementary School	Lincoln Akerman School	Maude H. Trefethen School	Greenland Central School	Hollis Primary School	Hollis Upper Elementary School
Source EUI (kBtu/sf/yr)	103	96	119	114	98	102	97	119	105
Site EUI (kBtu/sf/yr)	52	56	74	71	56	79	90	76	52

Figure 22: NH Upper School Energy Use Intensities

G. RECOMMENDATIONS

Energy Conservation Measures

Based on the observations and measurements of the HPS, several energy conservation measures (EEMs) are proposed for consideration (Tables 25 to 27). 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. A Savings-to-Investment Ratio (SIR) is also calculated by multiplying the energy cost savings by the expected life of the measure and is divided by the cost of the implementation. This provides the best qualitative benchmark when determining if the measure makes financial sense. Results with a SIR greater than one (1.0) indicate a financially viable option. Other qualitative considerations that do not influence the Simple Payback Method 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 on the current net electric utility charge of $0.14 per kWh (PSNH) and a heating fuel cost of $3.87 per gallon.

Tier I Energy Efficiency Measures

Tier I EEMs are measures that can be quickly implemented with little effort for zero or little cost (Table 25). They include routine maintenance items that can often be completed by facility maintenance personnel, and changes to occupant behavior or building operation. Eight (8) Tier I EEMs are recommended which all have a savings-to-investment ratio of over 4.3 which make them all very economically viable.

There are three water fountains throughout the HPS which have condensers to keep the water cool. These are commonly found in schools to seldom be used and it is recommended the condensers be unplugged (increasing temperature from approximately 40°F to 50°F) which is estimated to save $240 a year. There are two drink vending machines, one in the teacher's lounge and one in the hallway, which are energy intensive units which could yield a savings of $220 if unplugged. There are three incandescent bulbs that were not changed over during the recent lighting upgrade and it is estimated replacing these could save $25 a year.

Table 25: Tier I Energy Efficiency Measures

EEM No.	EEM Description	Investment	Annual Cost Savings	Payback (yrs.)	SIR
TI-1	Disconnect three (3) water fountain condensers in the building.	$0	$240	0	-
TI-2	Replace two (2) vending machines in facility room with ENERGY STAR® rated units.	$0	$220	0	-
T1-3	Remove three (3) incandescent lamps and replace with CFL lamps.	$12	$25	0.5	0.5
T1-4	Complete air-sealing on all entry door jambs, partings, headers, thresholds, and moldings (interior and exterior).	$450	$890	0.5	13.8
T1-5	Consolidate ten (10) compact refrigerators and standard size refrigerator (1) with three (3) standard sized ENERGY STAR® rated units.	$1,500	$1,000	1.5	6.7
T1-6	Install additional interior lighting controllers to reduce lighting density and runtime (photosensors, dimming controls, motion sensors, timers).	$3,300	$1,230	2.7	5.6
TI-7	Replace old computer monitor in custodial closet with ENERGY STAR® rated LCD unit.	$80	$60	1.3	5.3
T1-8	Complete air-sealing on all window jambs, partings, and moldings (interior and exterior).	$1,200	$730	1.6	4.3

Air sealing on all entry door jambs, partings, headers, thresholds, and moldings will reduce air leakage providing an estimated savings of $890. There are ten (10) compact refrigerators and one (1) full-sized refrigerator located throughout the school which consume a considerable amount of energy and are underutilized. Compact refrigerators cost around $100 per year each to run. Consolidating these units to three (3) ENERGY STAR® refrigerators is projected to save $1,000 a year with a SIR of 6.7. Interior lighting controls can be installed to control the lighting more efficiently based on different means such as photosensors, dimming controls, motion sensors and timers which would reduce lighting time and/or densities and is estimated to save $1,230 a year with a 5.6 SIR. One of the custodial closets uses an old CRT monitor which uses approximately five-times the amount of electricity an LCD monitor uses. Replacing the monitor has a simple payback of 1.3 years with a 5.3 SIR. Air sealing of windows in HPS is predicted to save $730 annually with a SIR of 4.3.

If the school 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 school 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. Five (5) Tier II EEMs are provided in Table 26 for the HPS.

Table 26: Tier II Energy Efficiency Measures

EEM No.	EEM Description	Investment	Annual Cost Savings	Payback (yrs.)	SIR
T2-1	Replace two (2) DHW tank units with two (2) demand-tankless electric condensing units.	$4,000	$700	5.7	2.6
T2-2	Replace walk-in freezer condenser units with high efficiency units with economizers.	$2,400	$350	6.9	2.2
T2-3	Install CO_2 demand controllers on ventilation equipment.	$8,500	$1,200	7.1	2.1
T2-4	Replace exterior HPS wallpack fixtures with induction or LED units (7).	$5,756	$485	11.2	1.7
T2-5	Install commercial thermal insulated shades on windows and close at night during heating periods.	$5,900	$550	10.7	1.4
T2-6	Replace the older low-efficiency packaged rooftop AHU servicing the administration offices (SEER=9) with a modern efficient unit rated with a SEER of 18 or higher.	$5,931	$287	20	1.0

There are two (2) 40-gallon hot water tanks which supply water for minimal use in the lavatories and kitchen. Replacing these with two (2) demand-tankless electric condensing units is estimated to save $700 annually and provide a simple payback of 5.7 years. The walk-in freezer condenser is energy intensive and replacing it with a high efficiency unit with economizers is estimated to have a 6.9 year payback and a 2.2 SIR. The building was found to have CO_2 levels consistently below the EPA recommended levels of 1,000 ppm. Installing CO_2 demand controls on all ventilation equipment will reduce the runtime of the equipment, saving both energy costs and wear on the equipment and is estimated to save $1,200 a year. The exterior HPS fixtures are high wattage fixtures with poor lighting quality. Replacing them with induction or LED lamp units would yield a savings of $485 a year, in addition to longer lamp service life these fixtures produce superior lighting quality. Installing thermally-insulated operable shades will reduce heating fuel use by retaining interior heat during nighttime periods, will reduce solar heating load to the building interior in warmer months, and will improve occupant comfort. This is estimated to save $550 annually with a SIR of 1.4. The packaged rooftop AHU servicing the Administration Offices is an older inefficient unit (SEER<10). Replacing this with a modern unit having a minimum SEER of 18 will reduce electric consumption by 50% providing an annual savings of $287 with a SIR of 1.0.

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 27 for the HPS. EEM number 2 includes total retro-commissioning of all mechanical and DDC systems. The costs assume a phased approach including a comprehensive engineering evaluation, developing a list of corrective actions that reduce energy consumption and improve occupant comfort, and implementation of the corrective actions.

Table 27: Tier III Energy Efficiency Measures

EEM No.	EEM Description	Investment	Annual Cost Savings	Payback (yrs.)	SIR
T3-1	Replace all electrical transformers older than 15 years with high efficiency units.	$19,447	$3,307	5.9	3.0
T3-2	Consolidate existing oil-fired boiler units with two (2) new high efficiency units. Re-line flue. Connect the new system into the existing DDC system. Install VFD controls on main circulation pumps.	$145,245	$12,567	11.6	1.7
T3-3	Install EIFS (3" foil-faced polyisocyanurate rigid insulation w/ stucco veneer) over exterior wall sections to obtain R-value of +20.	$162,261	$7,456	21.8	1.1
T3-4	Replace built-up roof on 1967 addition w/ EPDM system with R-value of +30 (4" of foil-faced polyisocyanurate rigid insulation board) (*complete as part of roof maintenance program*).	$91,336	$2,432	37.6	0.8

There are two larger electrical transformers in the school which are presumed to be older than 15 years. Replacing these with high efficiency units would have a simple payback of 5.9 years and a SIR of 3.0. Replacing the inefficient boilers with a new high efficiency unit is estimated to save $12,567 a year and have a simple payback of 11.6 years and SIR of 1.7. The built-up roof on the 1967 addition is dated and does not comply with current energy code standards. Recommendations include replacing the built-up system with a 30-year IB PVC white (high-albedo) roof system. Although the SIR is less than 1.0, the existing system may be ready for replacement.

The energy cost savings and resulting payback are based upon each independent measure implemented for the building in its current condition and function. 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.

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.

Measures 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 practicality and payback term and occupant comfort concerns.

1. As evidenced in the thermal imaging survey, the exposed concrete foundation walls have low thermal performance resulting in significant heat loss. Typical methods to improve thermal integrity of foundation walls include adding rigid foam insulation to the wall. Adding insulation would be a costly measure with a long payback term.
2. Most of the interior lighting fixtures were recently retrofitted with high-efficiency units. These units should be reevaluated for replacement in 7-10 years as lighting fixture technology continues to improve.
3. Thermal performance of the existing window and door units is low. Replacing these units with super-efficient triple pane units would provide a substantial reduction in heating fuel, however the payback period is significant (greater than 30 years). Air sealing and continued maintenance of the existing window and door units is a more practical measure.

O&M Considerations

O&M and considerations are provided for existing systems and for proposed EEMs. They are intended to identify any changes to current O&M practices and/or costs.

- Replacing older mechanical equipment with modern equipment generally reduces maintenance and repair requirements and costs. Most significantly, it reduces repair costs for outside vendors.
- Installing demand CO_2 controllers on the ventilation equipment will reduce the operating frequency of the units, reduce maintenance and repair costs, and extend the service life of the equipment.
- Replacing the existing heating systems will significantly reduce maintenance and repair costs. Servicing the new boiler units will be much easier with readily available parts.
- Induction and LED lamps have much longer service life than HPS lamps. While induction lamps are more expensive than LED lamps, they have the longest service life.
- Replacing the older built-up roof system on the 1967 addition will reduce maintenance and repair costs and reduce the potential for roof failure resulting in damage to the building interior.
- Replacing the older electrical transformers reduces the potential for failure resulting in impacts to facility operations.
- Installing an EIFS system on the exterior walls would not necessarily reduce maintenance or repair costs.

Indoor Air Quality Considerations

IAQ considerations identify any potential changes to existing conditions as EEMs are implemented. Periodic monitoring of IAQ conditions including temperature, relative humidity, and CO_2 concentrations is recommended to ensure that minimum IAQ standards are maintained as EEMs are implemented and the building systems are optimized. IAQ data also directly correlates to the performance efficiency of building conditioning and ventilation systems.

- Improving the building envelope by air sealing will reduce the volume of air exchanged through passive leakage. Mechanical ventilation becomes more critical as air leakage is reduced.
- Installing demand CO_2 controllers on the ventilation systems will optimize the system operation. Location of the sensors is critical to ensure that minimum indoor air quality standards are met.

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 28 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 HPS. 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 HESD is considering implementing any renewable energy system.

Table 28: Renewable Energy Considerations

Renewable Energy System	System Description & Site Feasibility
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 define the practicality.
Score: 84%	***Site Feasibility:*** *A geothermal heating and cooling system is a practical consideration for the building. The parcel provides adequate area for well installation and spacing. Considering the existing hydronic heating and cooling equipment is compatible with a ground-source water heat pump system, it is a practical technology for the building. Considering the high heating and cooling costs for the building, payback for the system is relatively low.*
Roof-Mounted Solar Photovoltaic Systems *Score: 76%*	*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. Evaluation of a roof-mount system should also consider the condition of the existing roof –generally, installation on a roof with less than 20 years of expected service life is not recommended.
	Site Feasibility: *Based on the large open flat roof, a medium to large sized (20kw-100kw) roof-mounted system may be practical. This would require a design and permitting process with the local utility. 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.*
Ground-Mounted Solar Photovoltaic Systems	*System Description:* A ground-mounted PV system composed of the same collector panels that are electrically connected to a DC/AC inverter(s). The collectors are mounted on a frame support system on the ground verses the roof. This is advantageous when roof framing can no accommodate the increased load of the collector panel and the ease of installation. Access to the panel array for inspection, maintenance, and repair is easier than a roof-mount system. Installed costs for ground-mount systems are generally higher than roof-mount systems.
Score: 76%	***Site Feasibility:*** *Based on the available land to the south of the building currently used as one of two playgrounds, a medium-sized (20kw-50kw) system may be practical. This would require a design and permitting process with the local utility. Current utility incentives and renewable energy grants would help offset the capital cost for the system.*
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: 76%	***Site Feasibility:*** *Considering the constrained location of the building and site and area required for storing and managed woodchips, a woodchip furnace may not be practical. A pellet unit is a more practical heating system for the building however this requires additional effort for procurement of pellets, storing pellets, and periodic filling the pellet hopper during the heating season.*

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: 75%	*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.*
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 lack of natural gas and moderate electrical demand, a CHP unit may not be practical. The unit could be tied into the existing hydronic heating systems. Costs associated with the infrastructure development may not be practical.*
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 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. Smaller pole-mounted units (5kW or less) and building mounted units are a more practical application for many sites.
Score: 61%	*Site Feasibility:* *Considering the small parcel that the building is sited on, a pole-mounted WTG unit may not be practical. However, a feasibility assessment should be completed as part of an evaluation. As described above, there are many constraints that determine if WTG is prudent for a particular site including:* • *Local zoning restrictions.* • *Detraction of the local landscape and abutter opinion.* • *Permitting requirements (local, state, FAA).* • *Local wind characteristics.* *Wind potential in Hollis is rated at poor to marginal (NREL maps) and locating a wind turbine would require a feasibility study of the site. A small system that doesn't require any zoning variances or FAA permitting (less than 200 feet tall) is a practical technology however the installed cost is relatively high. Other benefits include public awareness and education opportunities.*

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 a current listing of advertised programs and initiatives, visit www.dsireusa.org.

Northeast Energy Efficiency Partnerships

Northeast Collaborative for High Performance Schools (NE-CHPS)

NE-CHPS is a set of building and design standards for all schools from pre-K through community colleges tailored specifically for NH state code requirements, the New England climate, and the environmental priorities of the region. NH Department of Education offers up to a 3% reimbursement for New Construction School projects. To learn more about NE-CHPS and incentive programs please visit: http://neep.org/public-policy/hpse/hpse-nechps .

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, HV AC 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

Schools Program

For major renovation or equipment replacement projects, this program offers prescriptive and custom rebates for energy efficient lighting, motors, HVAC, chillers, and variable frequency drives to towns or cities that install energy efficient equipment at their schools. Financial incentives are available for qualifying energy efficient equipment. Technical assistance is also offered through the Schools Program. http://w.Ytw.psnh.com/SaveEnergy MoneylLarge-Power/Schools-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 .

Environmental Protection Agency (EPA)

ENERGY STAR Challenge for Schools

EPA is challenging school administrators and building managers to improve energy efficiency throughout their facilities. More than 500 school districts across the country are helping to fight climate change by committing to reducing their energy use with help from ENERGY STAR. Schools that take the ENERGY STAR Challenge can use energy tracking tools, technical guidance, case studies and other ENERGY STAR tools and resources to help them improve their energy efficiency. More information can be found at: http://www.energystar.gov/index.cfm?c=challenge.bus_challenge

Cool School Challenge

The Cool School Challenge is a program of the Puget Sound Clean Air Agency, developed in collaboration with Redmond High School environmental science teacher Mike Town, and Puget Sound Energy's Powerful Choices for the Environment program.

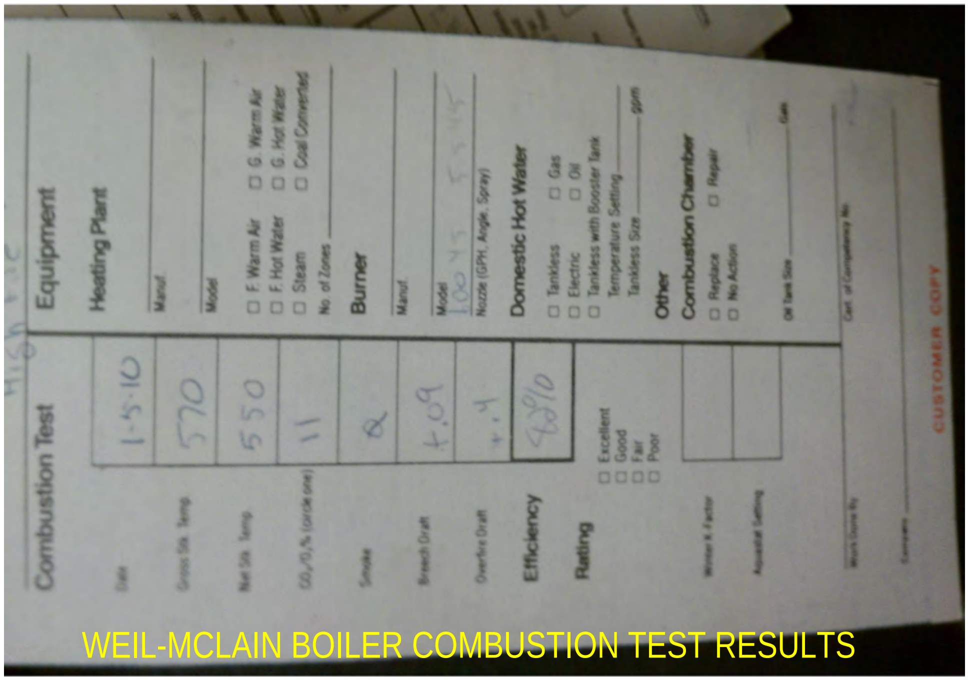
Conceptually modeled after the U.S. Mayor's Climate Protection Agreement, the Cool School Challenge aims to motivate students, teachers, and school districts to reduce carbon dioxide and other greenhouse gas emissions schoolwide. At the heart of the Cool School Challenge is the philosophy that big changes start with small steps, and that taken together, simple individual actions create a world of difference.

The goals of the Cool School Challenge are to:

- Educate young people, and by proxy their families, about climate change and everyday actions they can take to reduce their impact locally and globally;
- Reduce carbon dioxide emissions and other greenhouse gas emissions in and around schools;
- Encourage student leadership and empowerment;
- Foster a community of teachers/students working together to reduce their greenhouse gas emissions; and
- Foster a new generation of environmental/air quality advocates.
- Learn more about the Cool School Challenge at: http://www.coolschoolchallenge.org/.

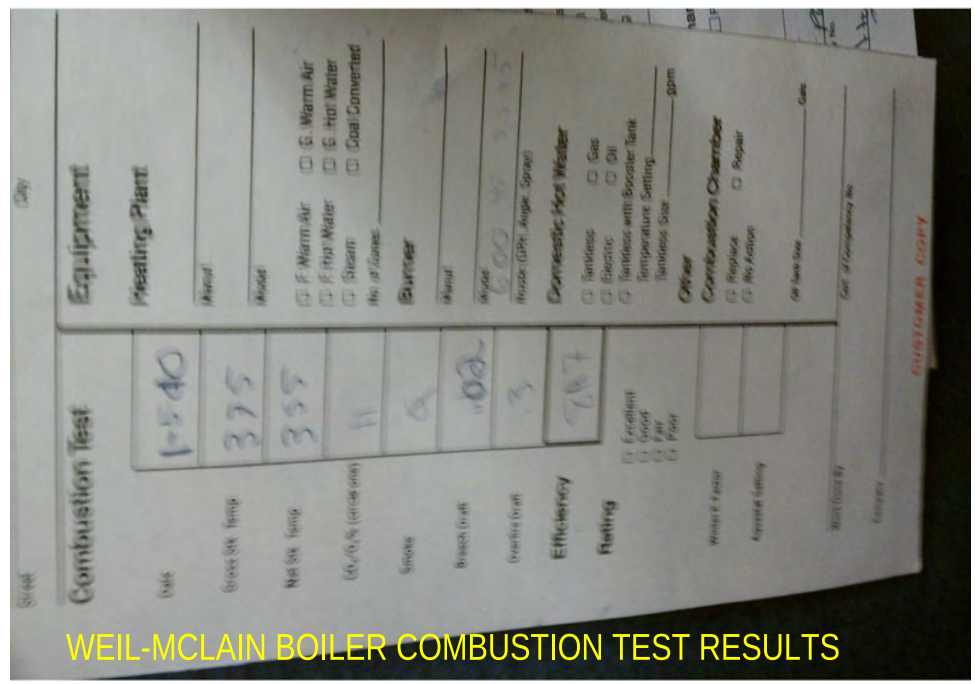
APPENDIX A

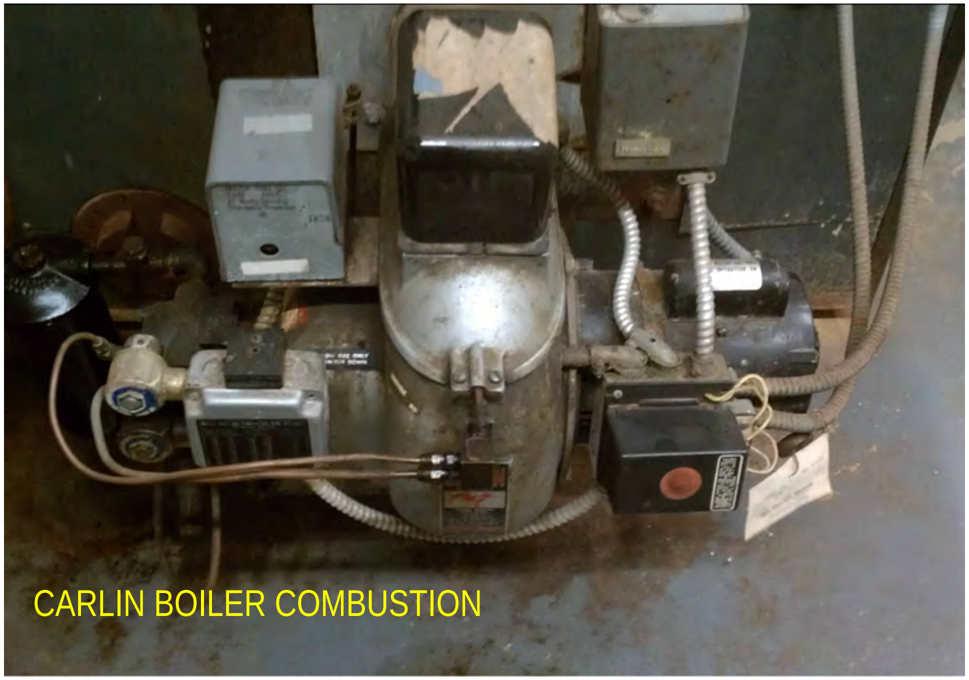
Photographs


WEIL-MCLAIN BOILER COMBUSTION TEST RESULTS

WEIL-MCLAIN TAG INFORMATION


LIGHT ON WITH NATURAL SUNLIGHT. RECOMMEND ADDING DAYLIGHT CONTROLS.


WEIL-MCLAIN BOILER COMBUSTION TEST RESULTS

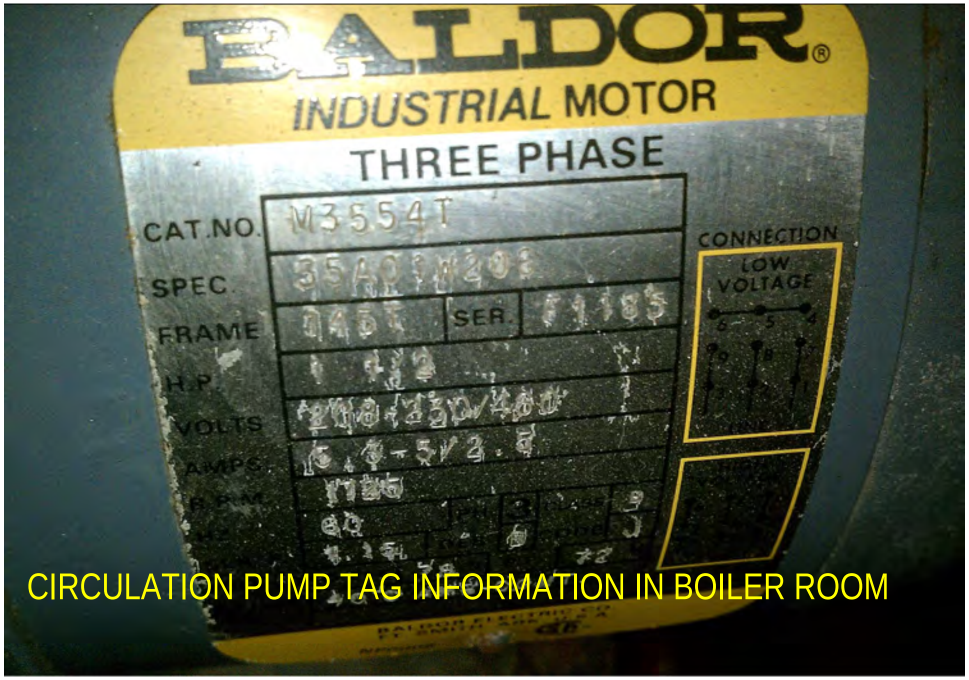


CARLIN BOILER COMBUSTION

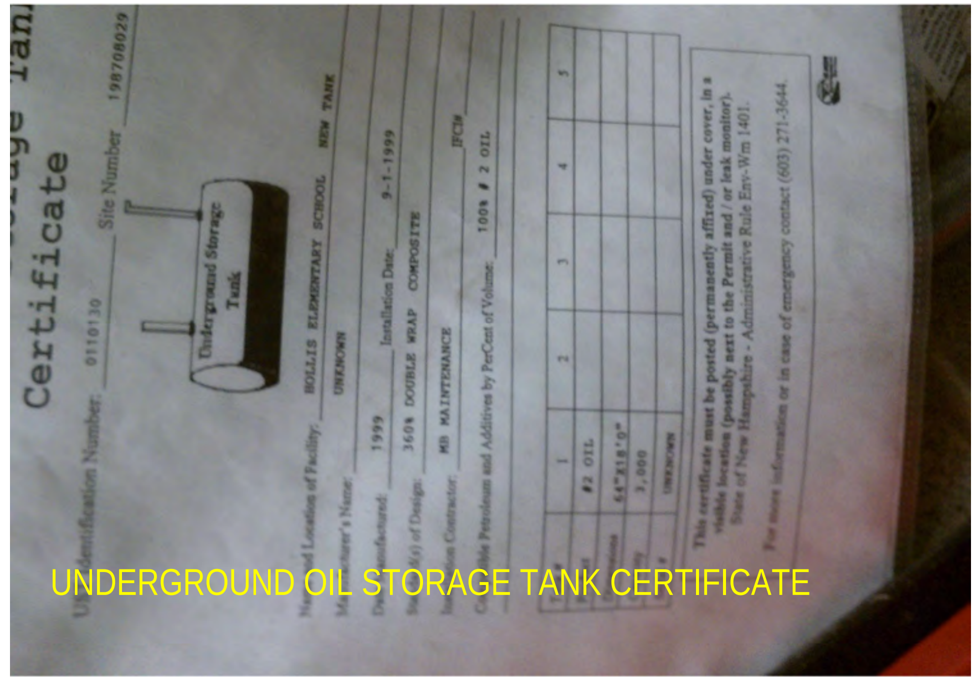
BELL & GOSSETT PUMP IN BOILER ROOM

WEIL-MCLAIN BOILER TAG INFORMATION

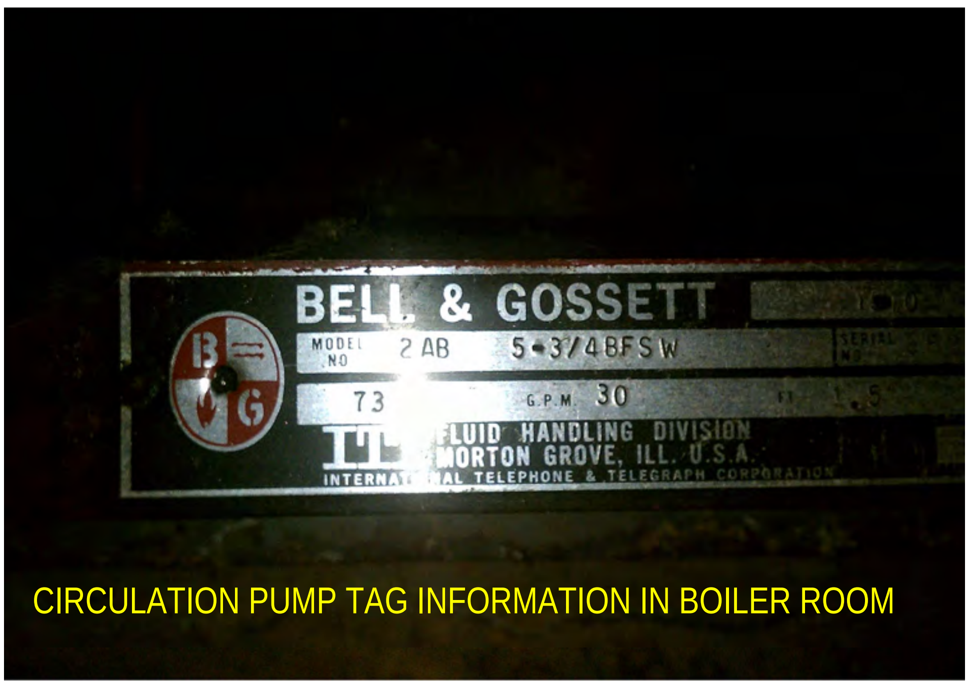
CIRCULATION PUMPS FOR HOT WATER IN BOILER ROOM



CIRCULATION PUMP TAG INFORMATION IN BOILER ROOM

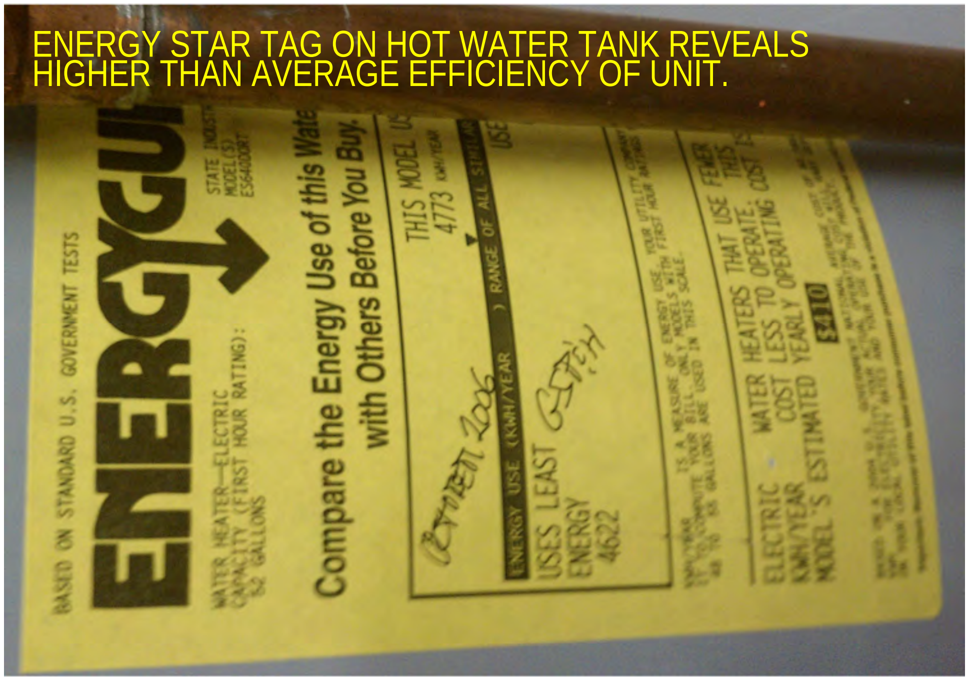


UNDERGROUND OIL STORAGE TANK CERTIFICATE

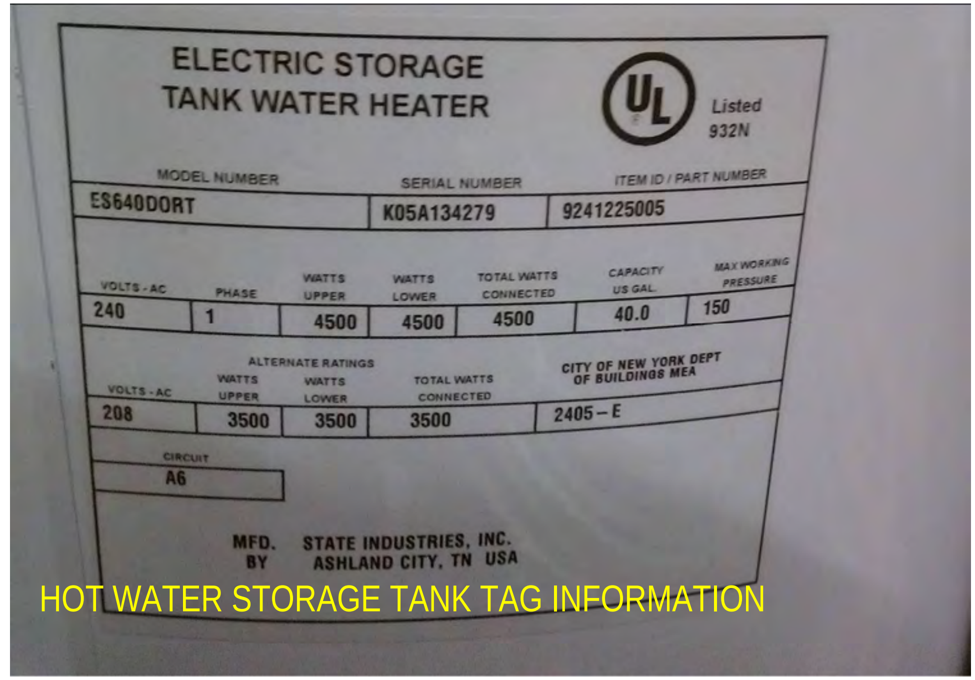


CIRCULATION PUMP TAG INFORMATION IN BOILER ROOM


WATER PRESSURE TANK



ENERGY STAR TAG ON HOT WATER TANK REVEALS HIGHER THAN AVERAGE EFFICIENCY OF UNIT.



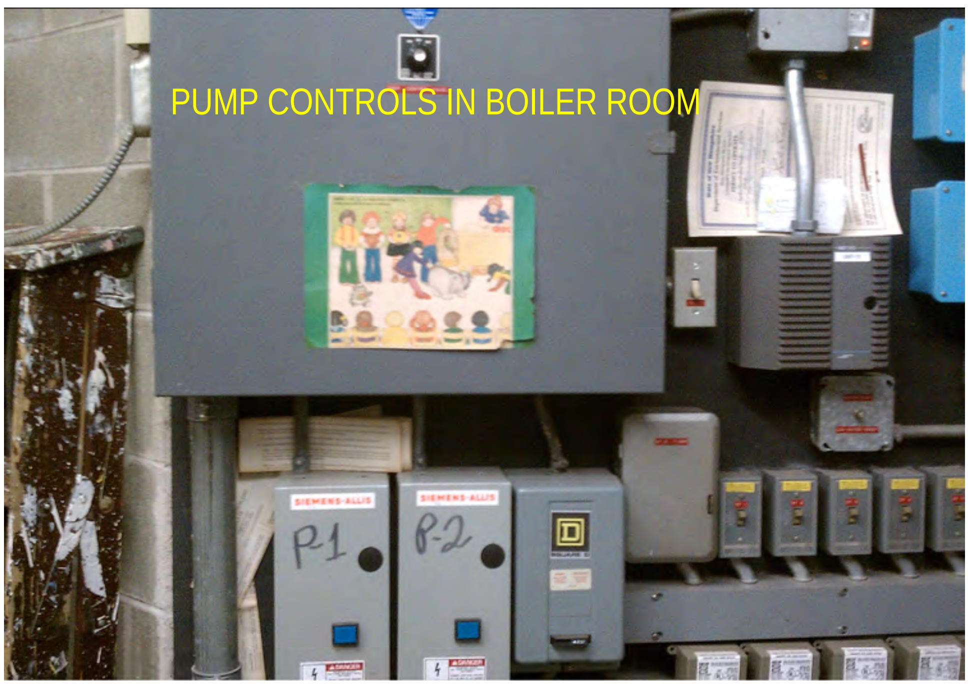
HOT WATER STORAGE TANK TAG INFORMATION

WEBSTER PUMP IN BOILER ROOM

STATE SELECT HOT WATER TANK

ELECTICAL PANEL IN BOILER ROOM

CONTROL PANEL IN BOILER ROOM



PUMP CONTROLS IN BOILER ROOM

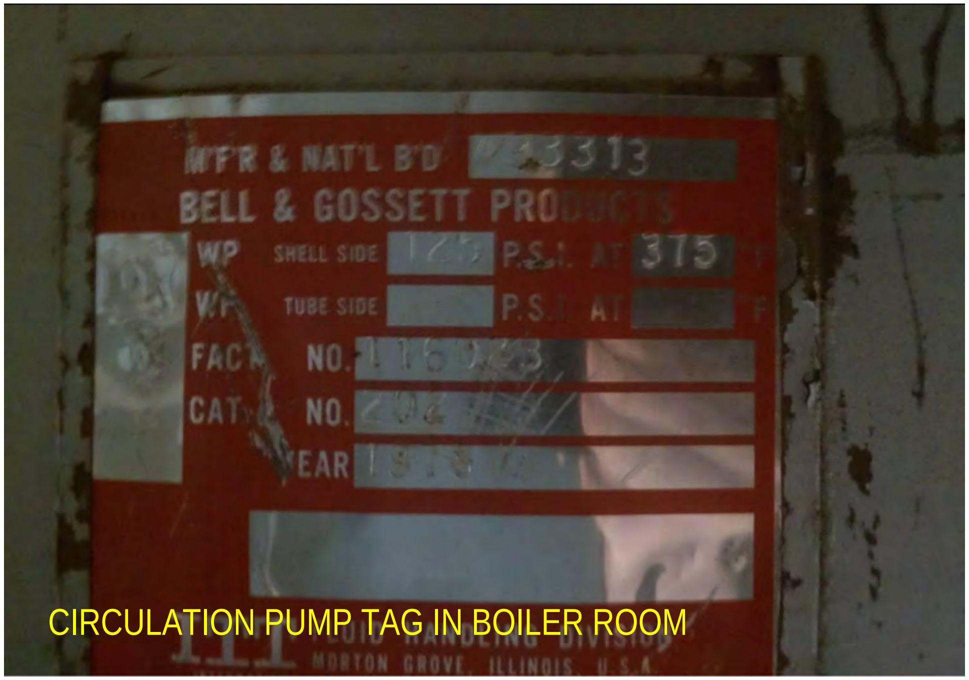
TEMPERATURE CONTROL PANEL IN BOILER ROOM


EXHAUST FAN AND UNIT HEATER IN BOILER ROOM


THERMOSTAT IN BOILER ROOM

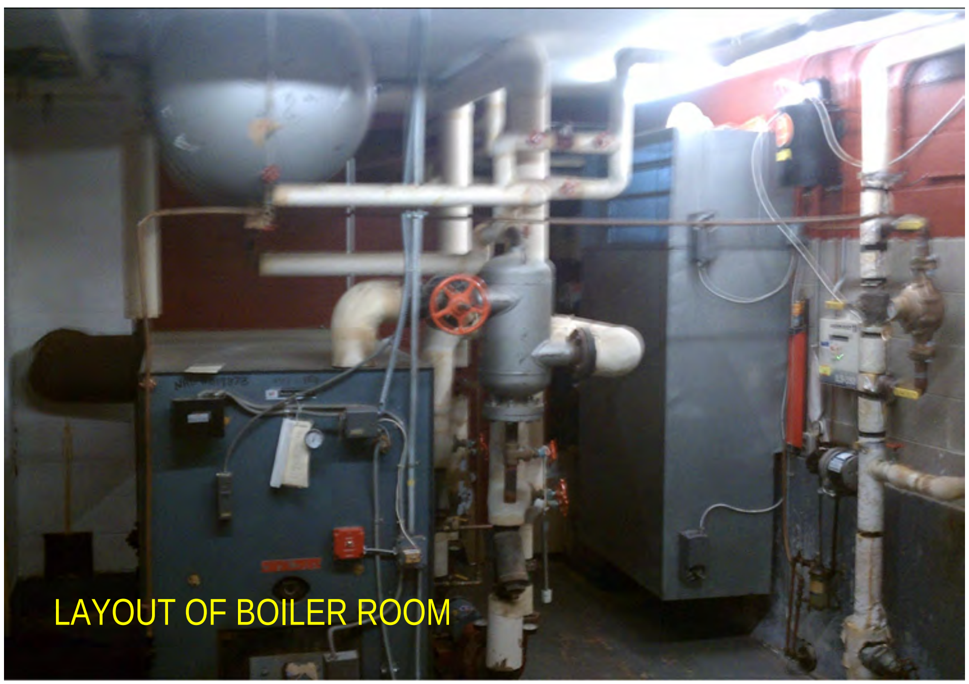
WATER TANK GUAGE IN BOILER ROOM

OIL BURNER FUEL STORAGE TANK IN BOILER ROOM



CIRCULATION PUMP TAG IN BOILER ROOM

MAIN ENTRANCE AT SOUTHEAST CORNER OF BUILDING


LAYOUT OF BOILER ROOM


NEW HAMPSHIRE DEPARTMENT OF LABOR

CERTIFICATE OF INSPECTION

BOILER

OWNER/LESSEE
HOLLIS BROOKLINE SAU 41
PO BOX 1588
HOLLIS NH 03049

BOILER
NH # ID:019878
NB/SER. # 000000000

LOCATION
BLRM ELEMENTARY
35 SILVER LAKE RD
HOLLIS NH 03049

TYPE BOILER
CI

INSP. NO.	INSP. NAME	CO. NAME	INSP. DATE	EXP. DATE	MAWP	SV/RV	YR BUILT	MFG
107	MCCARTHY	TRAVELERS	08/11/2010	08/11/2012	00030	0000030	1978	W MCLAIN

DEPUTY LABOR COMMISSIONER

COMMISSIONER OF LABOR

POST THIS CERTIFICATE IN A CONSPICUOUS PLACE NEAR THE BOILER.
THIS CERTIFICATE AUTHORIZES OPERATION OF THE ABOVE LISTED EQUIPMENT UNTIL DATE INDICATED UNLESS SUSPENDED OR REVOKED UNDER PROVISION OF RSA 157-A.

BOILER INSPECTION CERTIFICATE


WEST SIDE OF ELEMENTARY SCHOOL

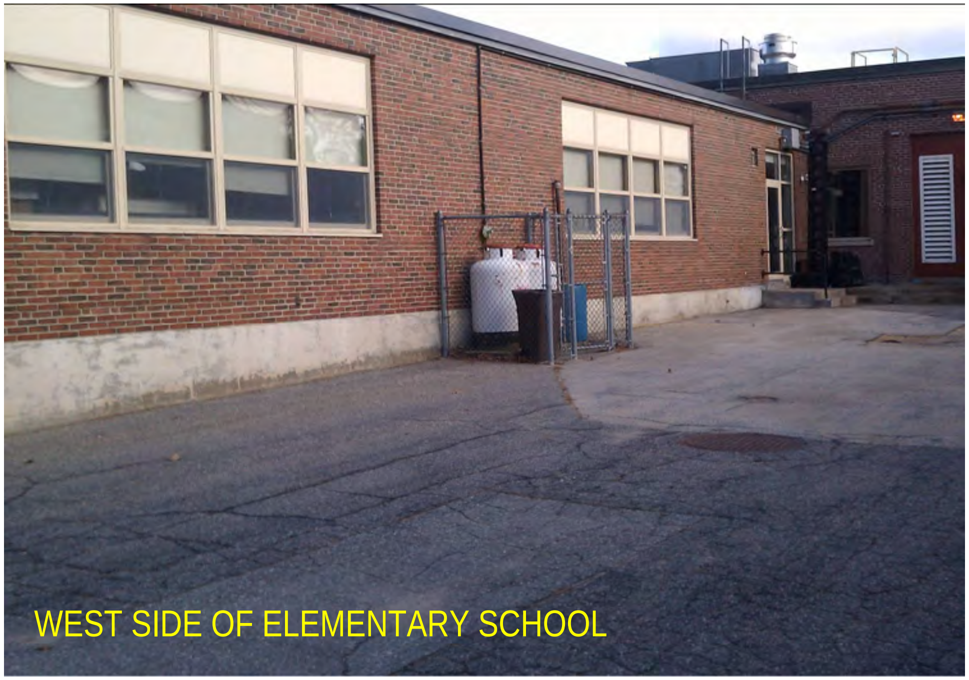

WEST SIDE OF ELEMENTARY SCHOOL


SOUTHWEST ENTRANCE TO ELEMENTARY SCHOOL


WEST SIDE OF ELEMENTARY SCHOOL


WEST ENTRACE TO THE SCHOOL


NORTH SIDE OF THE ELEMENTARY SCHOOL


WEST SIDE OF ELEMENTARY SCHOOL


NORTH SIDE OF THE ELEMENTARY SCHOOL

EAST SIDE OF THE ELEMENTARY SHCOOL

MAIN BREAKER SWITCH IN CAFETERIA CLOSET

NORTHEAST ENTRANCE TO THE SCHOOL

SECONDARY EAST ENTRANCE TO THE ELEMENTARY SCHOOL

ELECTRICAL PANELS IN ELECTRICAL CLOSET OFF CAFETERIA

ROOF WITH MECHANICAL EQUIPMENT


Unit heater in electrical room


CAFETERIA / MULTI-PURPOSE ROOM


DEBRIS BUILDUP AROUND SCUPPER DRAIN

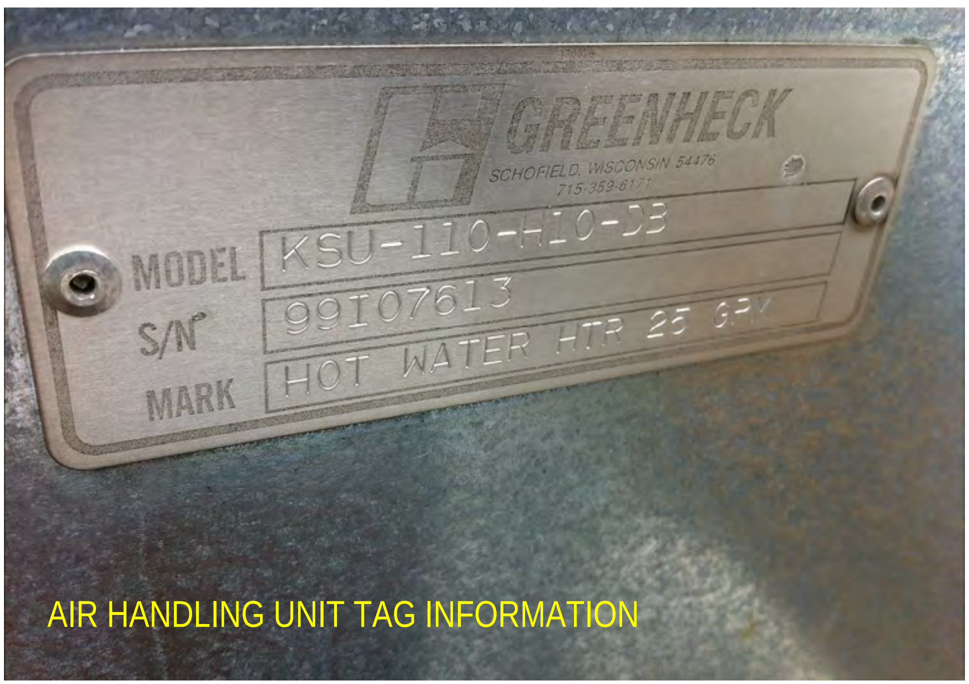

GREENHECK
ROOFTOP AIR HANDLING UNIT


ROOFTOP AIR HANDLING UNIT


Kitchen fan

ROOFTOP WITH MECHANICAL EQUIPMENT

ROOFTOP AIR HANDLING UNIT FOR LIBRARY



AIR HANDLING UNIT TAG INFORMATION

ROOFTOP AIR HANDLING UNIT


FILTERS ARE CLEAN WITH DATE OF INSTALLATION LABELED
ANDERS
PRECISIONAIRE
MODEL 40


Admin AHU

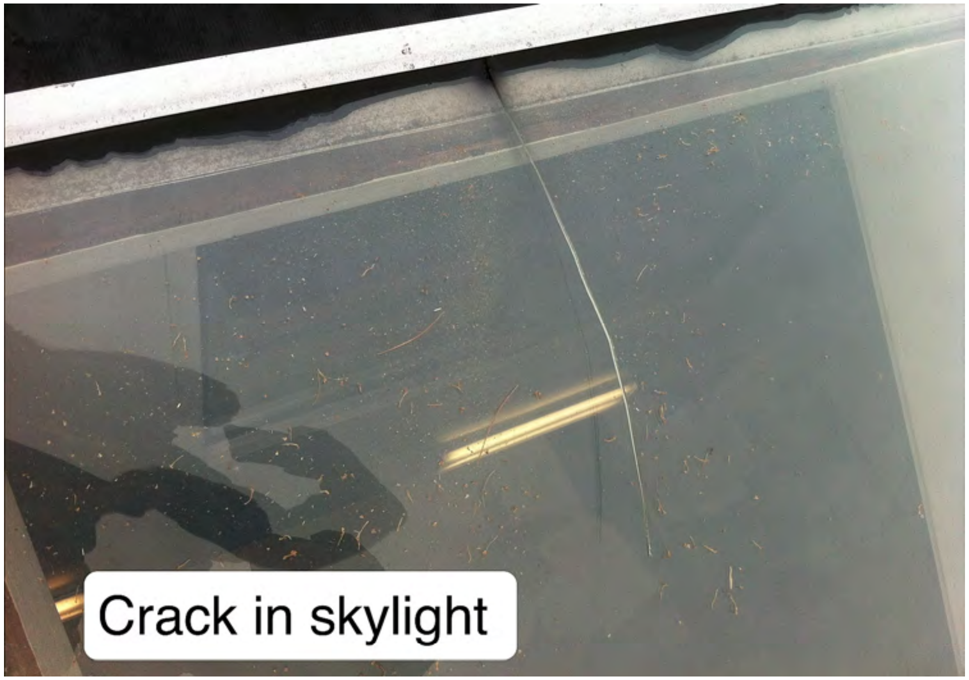

FILTERS ARE CLEAN WITH DATE OF INSTALLATION LABELED


DEBRIS BUILDUP AROUND SCUPPER DRAIN


First grade bathroom vents not high enough


DETERIORATING FLUE


FILTERS ARE CLEAN WITH DATE OF INSTALLATION LABELED


Crack in skylight


CRACK IN CHIMNEY


SPLIT AIR-CONDITION UNIT ON THE ROOF


DETERIORATING FLUE


ROOFTOP AIR HANDLING UNIT


COMPACT REFRIGERATOR CLOSE TO EMPTY. RECOMMEND REPLACING ALL COMPACT REFRIGERATORS AND CONSOLIDATING TO FULL SIZE UNIT.


OLD REFRIGERATOR IN STAFF ROOM. RECOMMEND REPLACING WITH ENERGY STAR RATED UNIT.

ROOFTOP AIR HANDLING UNIT

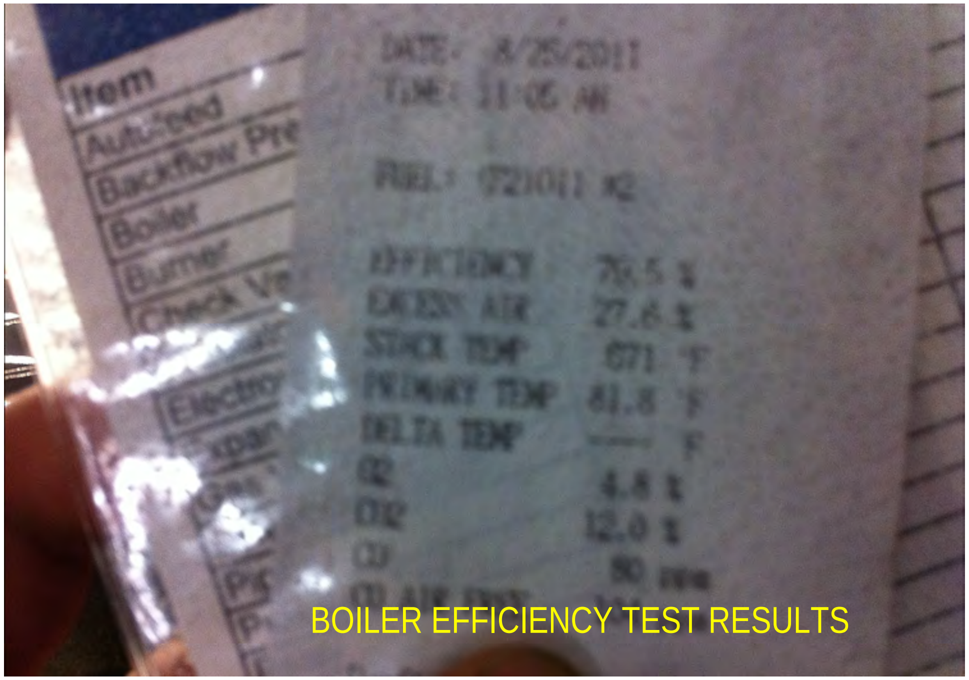

Cord cover in library. Tripping hazard.

COMPACT REFRIGERATOR CLOSE TO EMPTY. RECOMMEND REPLACING ALL COMPACT REFRIGERATORS AND CONSOLIDATING TO FULL SIZE UNIT.

TWO BOILERS IN SECOND BOILER ROOM

VENDING MACHINES IN STAFF ROOM

UNIT HEATER IN A CLASSROOM


BOILER EFFICIENCY TEST RESULTS

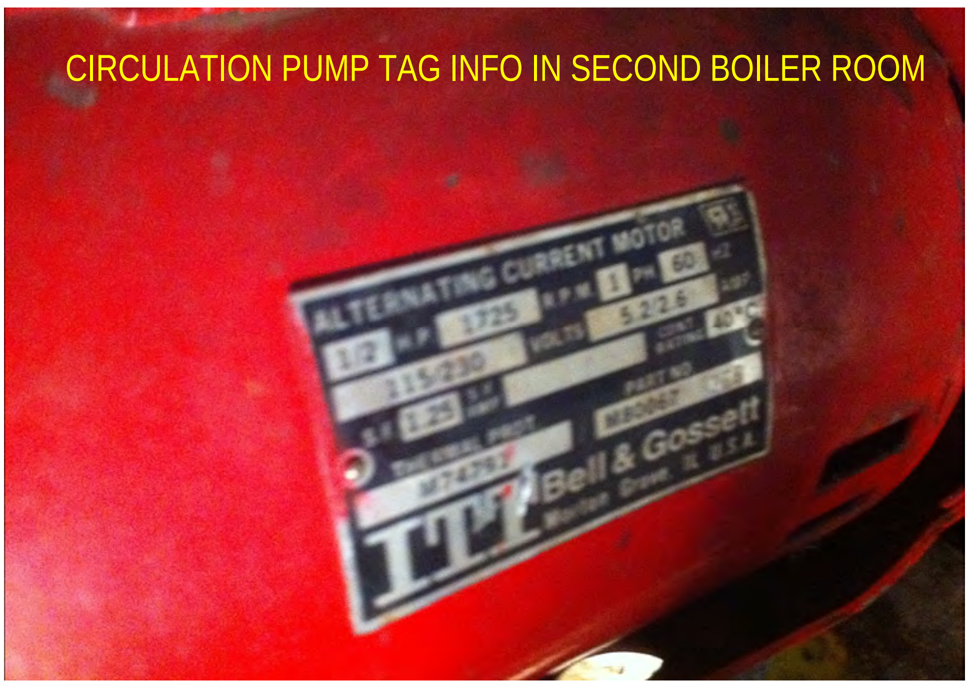

CIRCULATION PUMPS IN SECOND BOILER ROOM

BOILER BURNER

HOT WATER HEATER IN SECOND BOILER ROOM


CIRCULATION PUMPS IN SECOND BOILER ROOM

PIPING LABELED IN BOILER ROOM



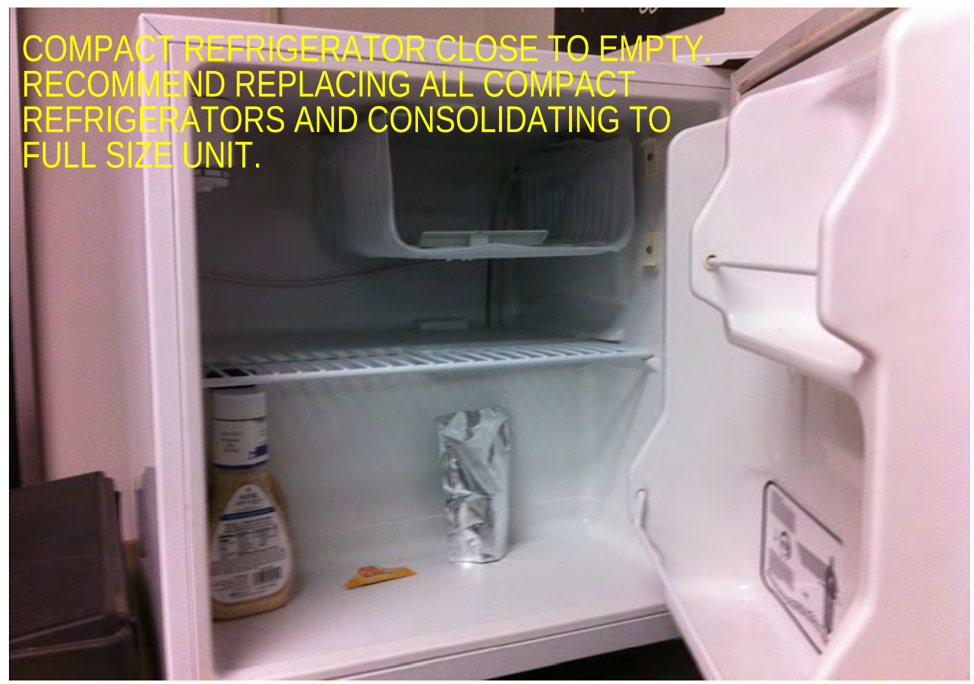
CIRCULATION PUMP TAG INFO IN SECOND BOILER ROOM


CIRCULATION PUMP TAG INFO IN SECOND BOILER ROOM

AIR CONDITION SPLIT UNIT IN CLASSROOM

COMPACT REFRIGERATOR CLOSE TO EMPTY. RECOMMEND REPLACING ALL COMPACT REFRIGERATORS AND CONSOLIDATING TO FULL SIZE UNIT.

EXPANSION TANK IN SECOND BOILER ROOM



COMPACT REFRIGERATOR CLOSE TO EMPTY. RECOMMEND REPLACING ALL COMPACT REFRIGERATORS AND CONSOLIDATING TO FULL SIZE UNIT.

APPENDIX B

Thermal Imaging Survey Reports

Inspection Report

Report Date	5/24/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

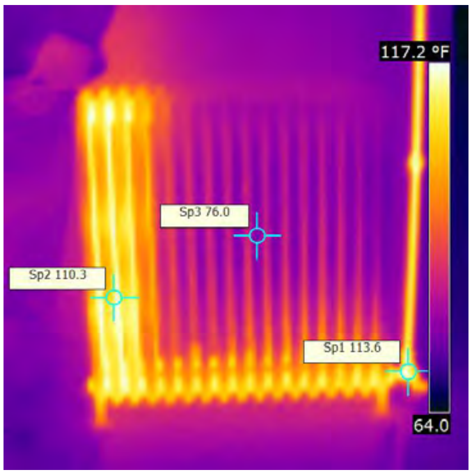


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	12/20/2011 10:01:19 AM
Image Name	IR_1872.jpg
Emissivity	0.96
Reflected apparent temperature	110.0 °F
Object Distance	5.0 ft

Text Comments

Description

IR of radiator in the hallway shows where heat is being dispersed through the unit and thermal transfer through the uninsulated feeding pipe.

Inspection Report

Report Date	5/24/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

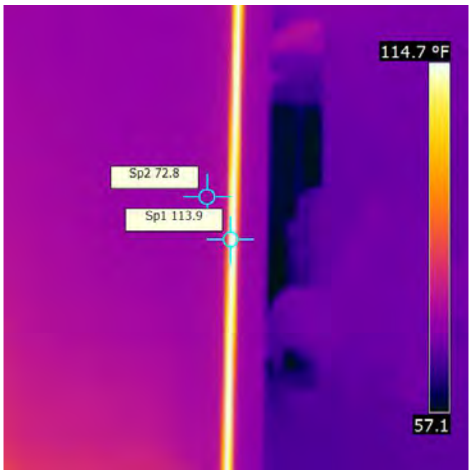


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	12/20/2011 10:01:34 AM
Image Name	IR_1874.jpg
Emissivity	0.96
Reflected apparent temperature	116.0 °F
Object Distance	5.0 ft

Text Comments

Description

Uninsulated hot water pipe allows for thermal transfer. Since this pipe leads to the radiator, the thermal energy is lost to the space calling for heat therefore it is not wasted and not necessary to insulate this pipe.

Inspection Report

Report Date	5/24/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

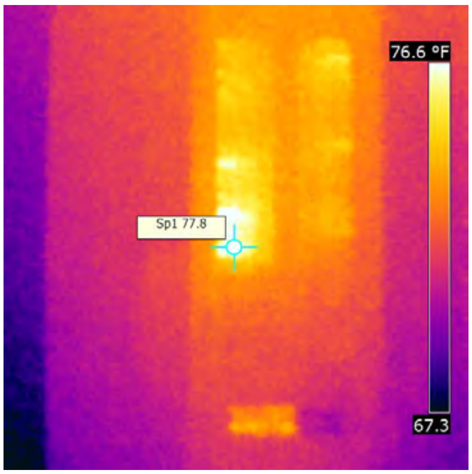


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	12/20/2011 10:36:42 AM
Image Name	IR_1877.jpg
Emissivity	0.96
Reflected apparent temperature	77.0 °F
Object Distance	4.0 ft

Description

IR of electrical circuit box shows some circuits which may be overloaded.

Inspection Report

Report Date	5/24/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

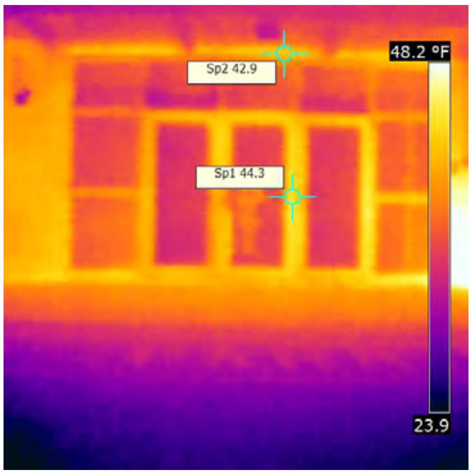


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:19:07 AM
Image Name	IR_2082.jpg
Emissivity	0.96
Reflected apparent temperature	42.0 °F
Object Distance	15.0 ft

Text Comments

Description

IR of entrance to building shows some thermal transfer between door frames and window frames. Recommend air-sealing all exterior doors and frames. Refer to EEM T1-4 for associated cost and savings.

Inspection Report

Report Date 5/24/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

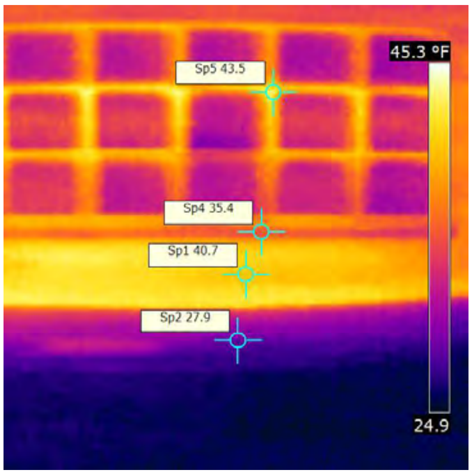


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:19:27 AM
Image Name	IR_2083.jpg
Emissivity	0.96
Reflected apparent temperature	34.0 °F
Object Distance	15.0 ft

Text Comments

Description

IR of the side of the building reveals thermal transfer through building fascade and window frames. Recommend air-sealing all exterior doors and frames and installing EIFS wall system. Refer to EEM T1-4 and T3-3 for associated cost and savings.

Inspection Report

Report Date	5/24/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

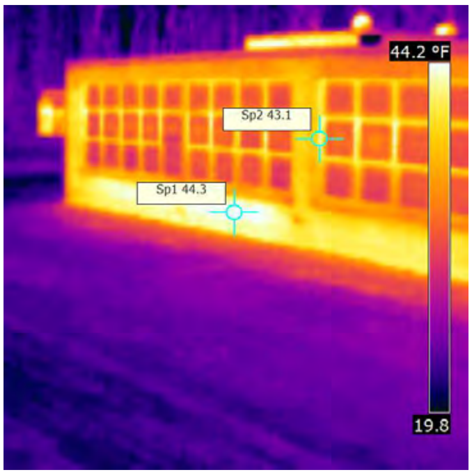


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:19:34 AM
Image Name	IR_2084.jpg
Emissivity	0.96
Reflected apparent temperature	43.0 °F
Object Distance	25.0 ft

Description

IR of building exterior reveals thermal transfer through building fascade and window frames. Recommend air-sealing all exterior windows, installing EIFS wall system and thermal insulating shades. Refer to EEM T1-4, T3-3 and T2-5 for cost and savings.

Inspection Report

Report Date	5/24/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

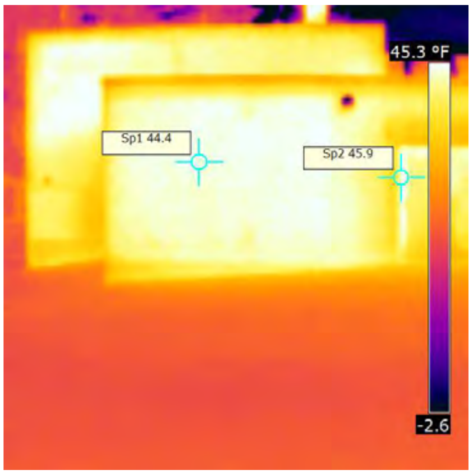


Image and Object Parameters

Text Comments

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:20:01 AM
Image Name	IR_2085.jpg
Emissivity	0.96
Reflected apparent temperature	44.0 °F
Object Distance	40.0 ft

Description

IR of building exterior CMU wall reveals thermal transfer through the wall and door frame (right). Recommend air sealing door and installing EIFS wall system. Refer to EEMs T1-4 and T3-3 for cost and savings.

Inspection Report

Report Date	5/24/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:20:30 AM
Image Name	IR_2086.jpg
Emissivity	0.96
Reflected apparent temperature	33.0 °F
Object Distance	40.0 ft

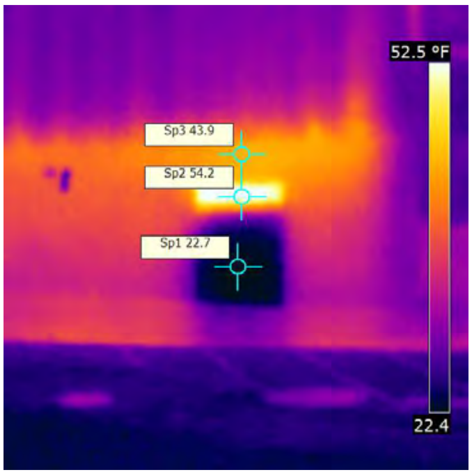
Text Comments

Description

IR of back of the building reveals thermal transfer through exhaust vents, window frames and CMU wall. Recommend installing EIFS wall system. Refer to EEM T3-3 for cost and savings.

Inspection Report

Report Date	5/24/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	



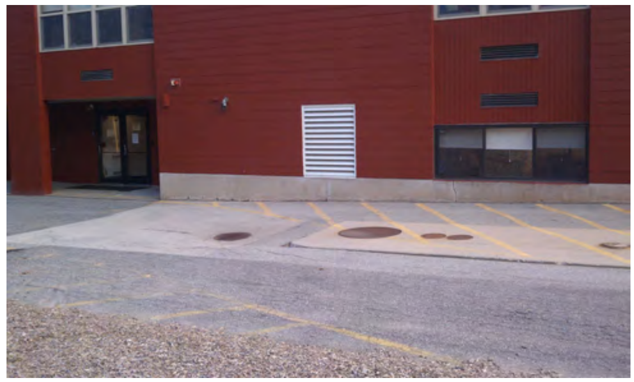


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:20:52 AM
Image Name	IR_2087.jpg
Emissivity	0.96
Reflected apparent temperature	53.0 °F
Object Distance	25.0 ft

Text Comments

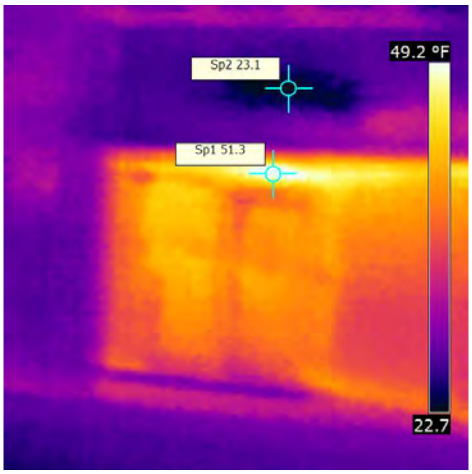
Description

IR of back wall shows thermal transfer through exhaust and return vent.

Inspection Report

Report Date	5/24/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	



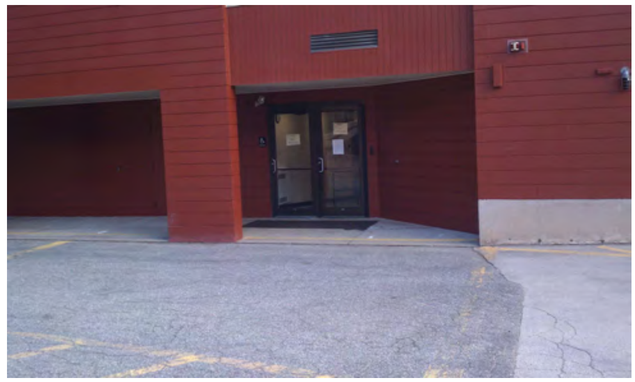


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:21:04 AM
Image Name	IR_2088.jpg
Emissivity	0.96
Reflected apparent temperature	50.0 °F
Object Distance	20.0 ft

Text Comments

Description

IR of rear entrance reveals thermal transfer through exterior vent and through door frame. Recommend air-sealing exterior door frame. Refer to EEM T1-4 for associated cost and savings.

Inspection Report

Report Date	5/24/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

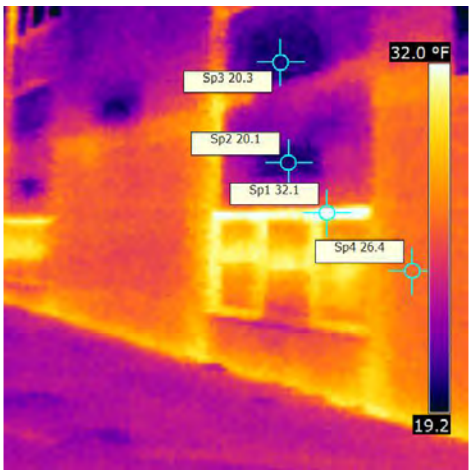


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:21:23 AM
Image Name	IR_2089.jpg
Emissivity	0.96
Reflected apparent temperature	25.0 °F
Object Distance	30.0 ft

Text Comments

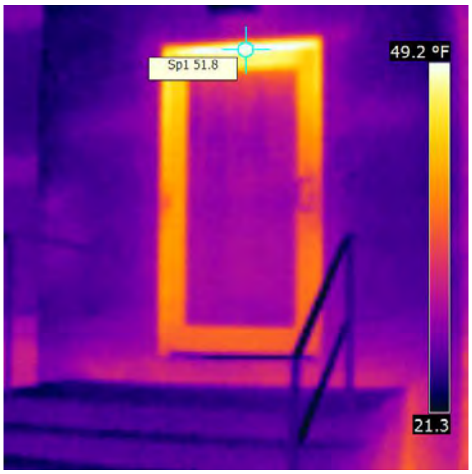
Description

IR of back of the building reveals thermal transfer through window frames and exterior vents as well as through exterior walls. Recommend air-sealing windows and instaling EIFS wall system. Refer to EEMs T1-4 and T3-3 for associated cost and savings.

Inspection Report

Report Date	5/24/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	



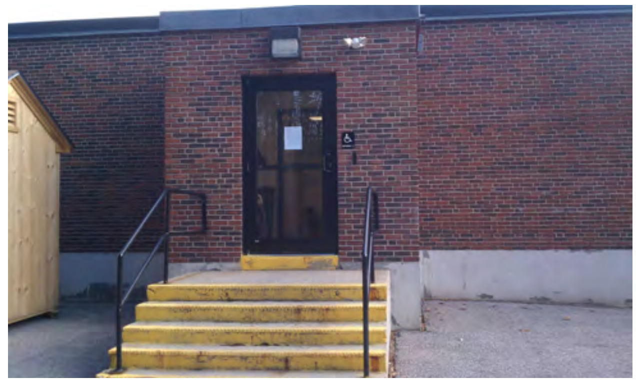


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:22:06 AM
Image Name	IR_2092.jpg
Emissivity	0.96
Reflected apparent temperature	51.0 °F
Object Distance	12.0 ft

Text Comments

Description

IR of rear door reveals thermal transfer through door frame. Recommend air-sealing all exterior doors. Refer to EEM T1-4 for associated cost and savings.

Inspection Report

Report Date	5/24/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

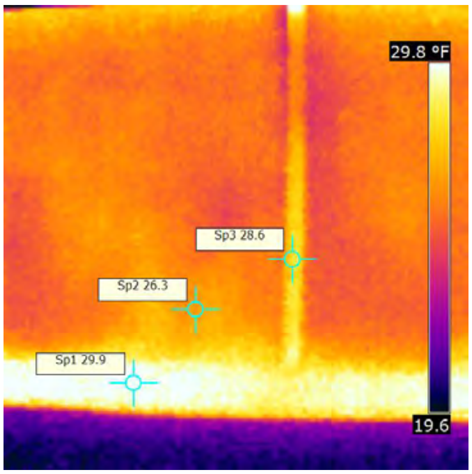


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:22:58 AM
Image Name	IR_2094.jpg
Emissivity	0.96
Reflected apparent temperature	27.0 °F
Object Distance	15.0 ft

Text Comments

Description

IR of side of the building reveals thermal transfer through different types of siding. Recommend installing an EIFS wall system. Refer to EEM T3-3 for associated cost and savings.

Inspection Report

Report Date	5/24/2012

Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

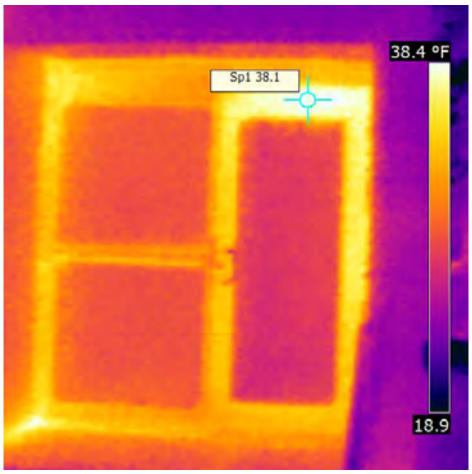


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:23:18 AM
Image Name	IR_2095.jpg
Emissivity	0.96
Reflected apparent temperature	36.0 °F
Object Distance	15.0 ft

Text Comments

Description

IR of side entrance to building reveals thermal transfer through door frame. Recommend air-sealing around all exterior doors. Refer to EEM T1-4 for associated cost and savings.

Inspection Report

Report Date	5/24/2012		
Company	Acadia Engineers and Constructors	Customer	Hollis Primary School
Address	90 Main Street, Newmarket, NH 03857	Site Address	36 Silver Lake Road, Hollis, NH 03049
Thermographer	Hans Kuebler	Contact Person	

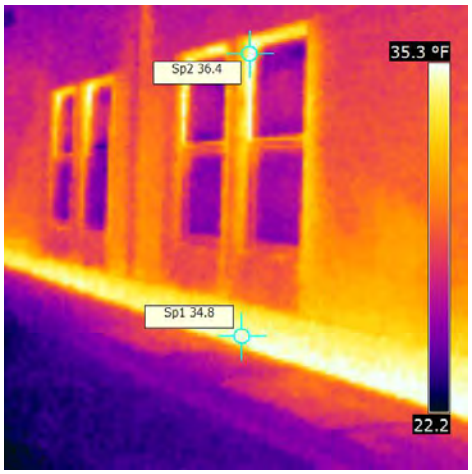


Image and Object Parameters

Camera Model	B-CAM Western S
Image Date	1/3/2012 10:23:25 AM
Image Name	IR_2096.jpg
Emissivity	0.96
Reflected apparent temperature	33.0 °F
Object Distance	15.0 ft

Text Comments

Description

IR of front of the building reveals thermal transfer through window frame and through different types of siding. Recommend air-sealing windows, installing thermally insulated shades and EIFS wall system. Refer to EEMS T1-4, T2-5 and T3-3.

APPENDIX C

Indoor Metering Data

INDOOR METERING DATA

Facility:	Location:	Date:	Ambient Outdoor:
HPS	Hollis, NH	12/20/2011	Temp= 60 RH= 40 CO2= 325

Location /Use Description	Time	Occupied	Air Quality			Lighting Density		Notes
			Temp (°F)	RH (%)	CO2 (ppm)	Horiz (FC)	Vert (FC)	
Gym	900	N	67.4	17.5	556		31	
Preschool	902	Y		18.3	576		34	2/3 on
Library	904	Y	70.8	15.1	486		51.3	
Teacher room	907	N	71	16.3	442		24.6	2/3
Conference Room	912	N	71	16.3	432		40.3	
Front Office	914	Y	72.6	15.5	478		34.6	
113	915	Y	72.8	15	590		70	
101	917	Y	73.2	13.4	534		71.4	
NS corridor	918	N	72.5	13.4	474		10	
102	920	Y	72.1	13.2	473		80	
104	922	Y	71.7	13.5	513		72.5	
Second floor boys room	924	N	73.9	15.3	685		30	
215	926	Y	73.4	13.7	609		34.7	Empty
205	928	Y	72.6	18.9	881		34.1	
Computer lab	932	Y	74.1	14.7	694		34	
112	934	Y	74.8	14.9	726		31.4	2/3
Print room	936	N	72.8	15.4	698			
Art	945	Y	71.7	16.5	800		60	
Kitchen	948	Y	72.3	16.6	780			
119	959	Y	73.5	15.2	705		49.5	
120	1000	Y	72.6	13.8	631		37.2	
Averages			**72.3**	**15.4**	**608**		**44**	

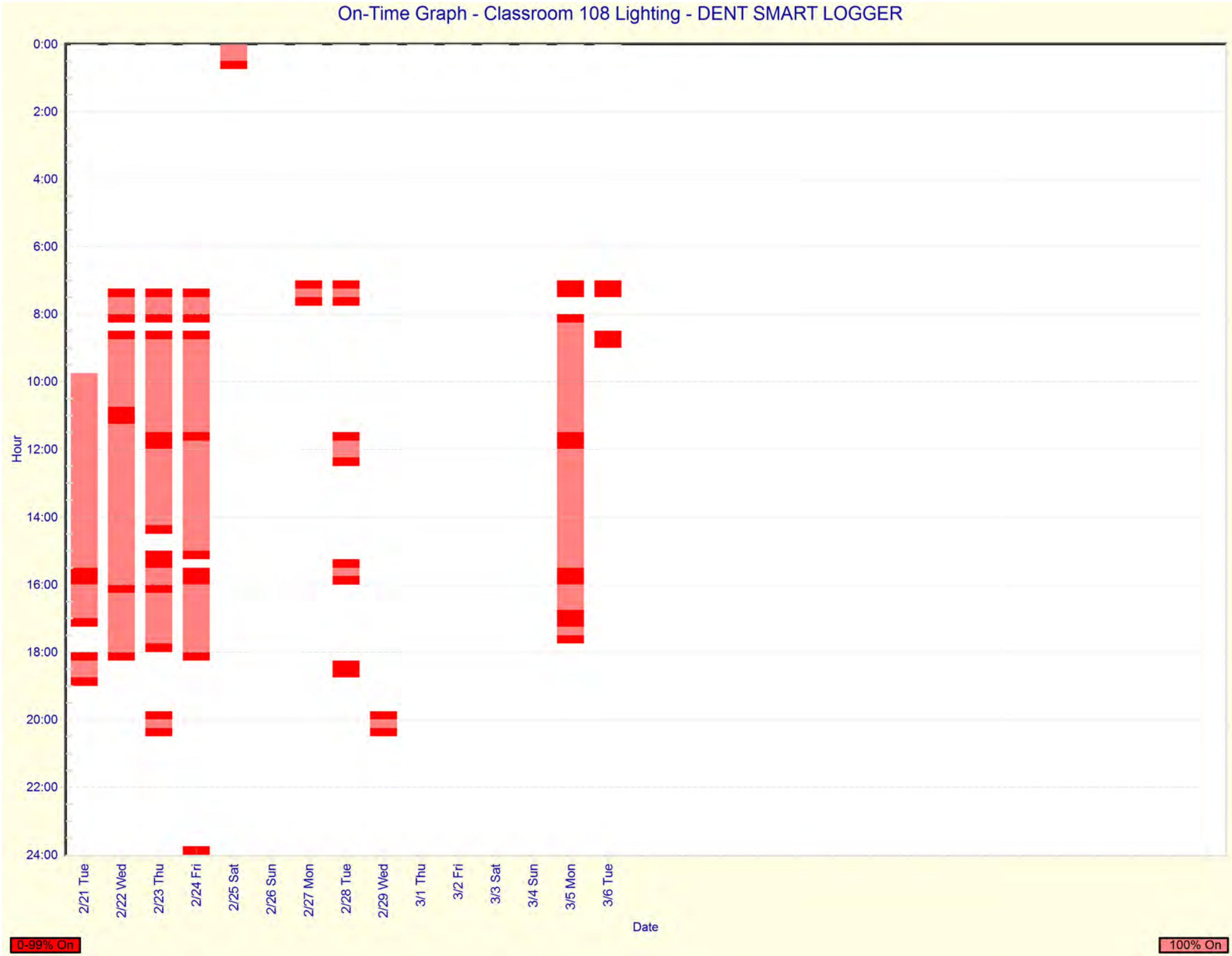
Summary
HPS_HALL1G.log

Data File Name:	HPS_HALL1G.log	
Logger Serial Number:	LL11060039	
Description:	DENT SMART LOGGER	
Logger Reset:	2/21/2012	6:39:50 AM
Elapsed Time Since Reset:	335.38	hrs
On-Time Since Reset:	83.30	hrs
Percent On Since Reset:	24.84 %	
Connected Load:	No Load Define	
Energy Cost:	Unknown	
Data Starts:	2/21/2012	6:39:50 AM
Data Ends:	3/6/2012	6:03:45 AM
Data Elapsed Time:	335.40	hrs
Estimated Annual Hours On	2176	hrs
Number of Turn Ons:	12	
Percent On:	24.84	%
Data On-Time:	83.30	hrs
Average On-Time:	6.94	hrs
Longest On-Time:	12.62	hrs
Shortest On-Time:	< 0.01	hrs
Number of Turn Offs:	12	
Percent Off:	75.16	%
Data Off-Time:	252.10	hrs
Average Off-Time:	21.01	hrs
Longest Off-Time:	82.84	hrs
Shortest Off-Time:	< 0.01	hrs


On-Time Graph - 1st Grade Hallway Lighting - DENT SMART LOGGER
Hour
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
2/21 Tue
2/22 Wed
2/23 Thu
2/24 Fri
2/25 Sat
2/26 Sun
2/27 Mon
2/28 Tue
2/29 Wed
3/1 Thu
3/2 Fri
3/3 Sat
3/4 Sun
3/5 Mon
3/6 Tue
Date
0-99% On
100% On

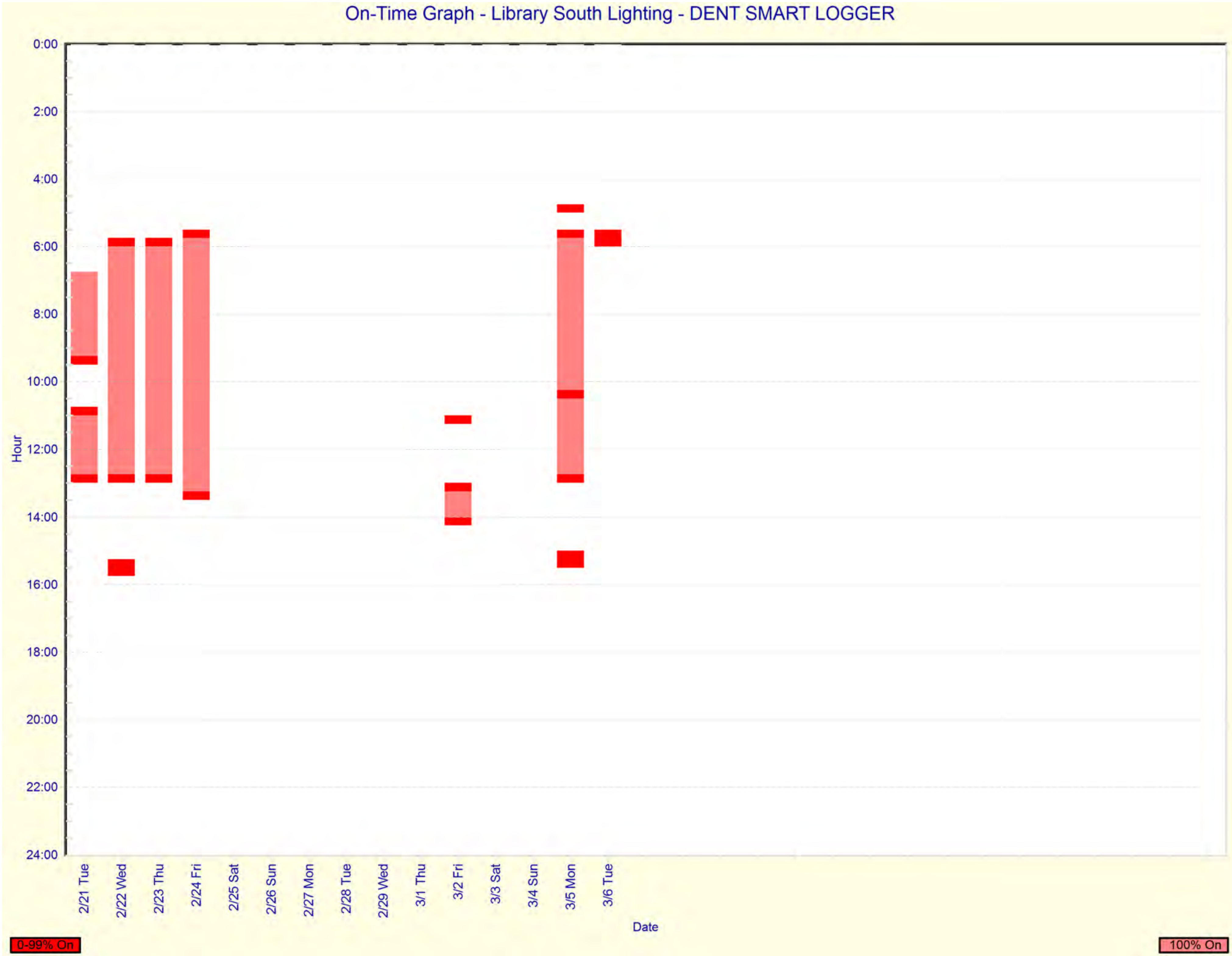
Summary
HPS_108.log

Data File Name:	HPS_108.log	
Logger Serial Number:	LL11040189	
Description:	DENT SMART LOGGER	
Logger Reset:	2/21/2012	9:38:50 AM
Elapsed Time Since Reset:	335.40	hrs
On-Time Since Reset:	51.10	hrs
Percent On Since Reset:	15.24 %	
Connected Load:	No Load Define	
Energy Cost:	Unknown	
Data Starts:	2/21/2012	9:38:50 AM
Data Ends:	3/6/2012	9:03:43 AM
Data Elapsed Time:	335.41	hrs
Estimated Annual Hours On	1335	hrs
Number of Turn Ons:	37	
Percent On:	15.24	%
Data On-Time:	51.10	hrs
Average On-Time:	1.38	hrs
Longest On-Time:	5.95	hrs
Shortest On-Time:	< 0.01	hrs
Number of Turn Offs:	37	
Percent Off:	84.76	%
Data Off-Time:	284.31	hrs
Average Off-Time:	7.68	hrs
Longest Off-Time:	106.66	hrs
Shortest Off-Time:	< 0.01	hrs


On-Time Graph - Classroom 108 Lighting - DENT SMART LOGGER
Hour
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
2/21 Tue
2/22 Wed
2/23 Thu
2/24 Fri
2/25 Sat
2/26 Sun
2/27 Mon
2/28 Tue
2/29 Wed
3/1 Thu
3/2 Fri
3/3 Sat
3/4 Sun
3/5 Mon
3/6 Tue
Date
0-99% On
100% On

Summary
HPS_LIB.log

Data File Name:	HPS_LIB.log	
Logger Serial Number:	LL11060004	
Description:	DENT SMART LOGGER	
Logger Reset:	2/21/2012	6:34:37 AM
Elapsed Time Since Reset:	335.45	hrs
On-Time Since Reset:	35.50	hrs
Percent On Since Reset:	10.58 %	
Connected Load:	No Load Define	
Energy Cost:	Unknown	
Data Starts:	2/21/2012	6:34:37 AM
Data Ends:	3/6/2012	6:02:36 AM
Data Elapsed Time:	335.47	hrs
Estimated Annual Hours On	928	hrs
Number of Turn Ons:	19	
Percent On:	10.60	%
Data On-Time:	35.55	hrs
Average On-Time:	1.87	hrs
Longest On-Time:	7.68	hrs
Shortest On-Time:	< 0.01	hrs
Number of Turn Offs:	19	
Percent Off:	89.40	%
Data Off-Time:	299.91	hrs
Average Off-Time:	15.78	hrs
Longest Off-Time:	165.79	hrs
Shortest Off-Time:	< 0.01	hrs


On-Time Graph - Library South Lighting - DENT SMART LOGGER
Hour
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
2/21 Tue
2/22 Wed
2/23 Thu
2/24 Fri
2/25 Sat
2/26 Sun
2/27 Mon
2/28 Tue
2/29 Wed
3/1 Thu
3/2 Fri
3/3 Sat
3/4 Sun
3/5 Mon
3/6 Tue
Date
0-99% On
100% On

Summary
HPS_LIB_AHU.log

Data File Name:	HPS_LIB_AHU.log	
Logger Serial Number:	ML11040014	
Description:	DENT SMART LOGGER	
Logger Reset:	2/21/2012	9:32:14 AM
Elapsed Time Since Reset:	335.53	hrs
On-Time Since Reset:	175.20	hrs
Percent On Since Reset:	52.22 %	
Connected Load:	No Load Define	
Energy Cost:	Unknown	
Data Starts:	2/21/2012	9:32:14 AM
Data Ends:	3/6/2012	9:04:16 AM
Data Elapsed Time:	335.53	hrs
Estimated Annual Hours On	4575	hrs
Number of Turn Ons:	9	
Percent On:	52.23	%
Data On-Time:	175.24	hrs
Average On-Time:	19.47	hrs
Longest On-Time:	98.81	hrs
Shortest On-Time:	6.53	hrs
Number of Turn Offs:	10	
Percent Off:	47.77	%
Data Off-Time:	160.29	hrs
Average Off-Time:	16.03	hrs
Longest Off-Time:	62.01	hrs
Shortest Off-Time:	0.01	hrs

On-Time Graph - 1st Grade Hallway Lighting - DENT SMART LOGGER
Hour
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
2/21 Tue
2/22 Wed
2/23 Thu
2/24 Fri
2/25 Sat
2/26 Sun
2/27 Mon
2/28 Tue
2/29 Wed
3/1 Thu
3/2 Fri
3/3 Sat
3/4 Sun
3/5 Mon
3/6 Tue
Date
0-99% On
100% On

APPENDIX D

Lighting Fixture Inventory

LIGHTING FIXTURE INVENTORY

Facility:	Location:	Date:
HPS	Hollis, NH	12/20/2011

Location /Use Description	Fixture	Watts/fixture	Qty	Controls	Total watts	Est. Hr/Wk	Est. KWH Consumption/Yr
Exit	LED	5	24	Always On	120	168	806
North Vestibule	CFL	17	2	Motion	34	50	68
Multi-Purpose Storage	T8	30	4	Switch Dual	120	50	240
Utility	T8	30	3	Switch Dual	90	50	180
114	T8	30	4	Switch Dual	120	50	240
Principal	T8	30	4	Switch Dual	120	50	240
Middle Stairs	T8	30	4	Switch Dual	120	50	240
Utility	T8	30	2	Switch Dual	60	50	120
Maintenance	T8	30	2	Switch Dual	60	50	120
Utility	T8	30	2	Switch Dual	60	50	120
117	CFL	60	10	Motion	600	50	1,200
Electrical	T8	60	2	Switch Dual	120	50	240
Kitchen	T8	60	14	Switch Dual	840	50	1,680
Staff Bath	T8	60	1	Switch Dual	60	50	120
Boy's Bath	T8	60	2	Switch Dual	120	50	240
Girl's Bath	T8	60	2	Switch Dual	120	50	240
Mrs. Mora Room	T8	60	2	Switch Dual	120	50	240
119	T8	60	12	Switch Dual	720	50	1,440
Occupational Therapist	T8	60	3	Switch Dual	180	50	360
121	T8	60	12	Switch Dual	720	50	1,440
Special Ed.	T8	60	2	Switch Dual	120	50	240
Resource Room	T8	60	2	Switch Dual	120	50	240
120	T8	60	12	Switch Dual	720	50	1,440
118	T8	60	12	Switch Dual	720	50	1,440
Occupational Therapist Office	T8	60	2	Switch Dual	120	50	240
Entrance Vestibule West	T8	60	1	Switch Dual	60	50	120
West Hall Off Gym	T8	60	11	Switch Dual	660	50	1,320
115	T8	60	12	Switch Dual	720	50	1,440
EW Hall North	T8	60	2	Switch Dual	120	50	240
Special Ed.	T8	60	3	Switch Dual	180	50	360
Staff Bath	T8	60	1	Switch Dual	60	50	120
Boy's Bath	T8	60	3	Switch Dual	180	50	360
Girl's Bath	T8	60	3	Switch Dual	180	50	360
Utility	T8	60	1	Switch Dual	60	50	120
116 Art	T8	60	16	Switch Dual	960	50	1,920
Library Media	T8	60	48	Switch Dual	2,880	50	5,760
114	T8	60	9	Switch Dual	540	50	1,080
Conference Room	T8	60	5	Switch Dual	300	50	600
Principal	T8	60	1	Switch Dual	60	50	120
Assistant Principal	T8	60	2	Switch Dual	120	50	240

Main Office	T8	60	3	Switch Dual	180	50	360
Office Copy	T8	60	2	Switch Dual	120	50	240
Lounge	T8	60	10	Switch Dual	600	50	1,200
NS Main Hall	T8	60	8	Switch Dual	480	50	960
113	T8	60	16	Switch Dual	960	50	1,920
Entrance Vestibule	T8	60	4	Switch Dual	240	50	480
101	T8	60	16	Switch Dual	960	50	1,920
Nurse	T8	60	4	Switch Dual	240	50	480
Nurse	T8u	60	3	Switch Dual	180	50	360
Nurse Bath	T8	60	1	Switch Dual	60	50	120
102	T8	60	16	Switch Dual	960	50	1,920
103	T8	60	16	Switch Dual	960	50	1,920
105	T8	60	16	Switch Dual	960	50	1,920
104	T8	60	16	Switch Dual	960	50	1,920
EW Main Hall	T8	60	5	Switch Dual	300	50	600
Speech Pathologist	T8	60	4	Switch Dual	240	50	480
Ramp Hallway	T8	60	5	Switch Dual	300	50	600
Upper Floor Hall EW	T8	60	6	Switch Dual	360	50	720
207	T8	60	9	Switch Dual	540	50	1,080
Boy's Bath	T8	60	1	Switch Dual	60	50	120
Girl's Bath	T8	60	1	Switch Dual	60	50	120
Special Ed.	T8	60	3	Switch Dual	180	50	360
208	T8	60	9	Switch Dual	540	50	1,080
Staff Bath	T8	60	1	Switch Dual	60	50	120
Guidance	T8	60	5	Switch Dual	300	50	600
206	T8	60	9	Switch Dual	540	50	1,080
205	T8	60	9	Switch Dual	540	50	1,080
204	T8	60	9	Switch Dual	540	50	1,080
203	T8	60	9	Switch Dual	540	50	1,080
202	T8	60	9	Switch Dual	540	50	1,080
201	T8	60	9	Switch Dual	540	50	1,080
111	T8	60	11	Switch Dual	660	50	1,320
112	T8	60	9	Switch Dual	540	50	1,080
110	T8	60	9	Switch Dual	540	50	1,080
109	T8	60	11	Switch Dual	660	50	1,320
107	T8	60	11	Switch Dual	660	50	1,320
108	T8	60	9	Switch Dual	540	50	1,080
106	T8	60	12	Switch Dual	720	50	1,440
Utility	T8	60	1	Switch Dual	60	50	120
Bottom Of Ramp	T8	60	2	Switch Dual	120	50	240
Girl's Bath	T8	60	1	Switch Dual	60	50	120
Boy's Bath	T8	60	1	Switch Dual	60	50	120
100	T8	60	15	Switch Dual	900	50	1,800
100	T8	60	1	Switch Dual	60	50	120
Lower Level EW Hall	T8	60	10	Switch Dual	600	50	1,200

Custodian	T8	60	1	Switch Dual	60	50	120
Mechanical Room	T8	60	1	Switch Dual	60	50	120
116 Art	INC	75	1	Switch	75	20	60
Library Bath	INC	75	1	Switch	75	20	60
Office Bath	INC	75	1	Switch	75	20	60
Multi Purpose Room	T8	90	18	Switch Dual	1,620	50	3,240
Exterior	HPS	200	7	Switch One	1,400	61.5	4,477
		Totals:	**626**		**36,969**		**75,912**

APPENDIX E

Mechanical Equipment Inventory

MECHANICAL EQUIPMENT INVENTORY

Facility:		Location:		Date:					
HPS		Hollis, NH		12/20/2011					
Location /Use Description	**Qty**	**Affiliated System**	**Power Rating (amps)**	**V**	**phase**	**Cooling (ton)**	**EER**	**Model**	**Est. kWh/yr**
Electrical room / unit heater	1	Heat	16	208	1	NA	NA	Trane UHEC032AACA	2,500
Roof / ACC Kindergarden	1	Vent, AC, heat	16 RLA (compr), Fan mtr 1.4 FLA (outdoor) 5.2 FLA (indoor)	208	3	6	10	Carrier 50TFF006---501GA	5,000
Roof / AHU Admin	1	Vent, AC, heat	15.4 RLA (compr), Fan mtr 1.9 FLA (outdoor) 4.9 FLA (indoor)	208	3	5	10	Carrier 50TJ-005---511GA	5,000
Roof / Split system Data	1	AC	12 RLA (compr), Fan mtr 0.75 FLA	208	1	1.5	11.3	Mitsubishi PUY-A36NHA	3,600
Roof/Walk in Condensor	2	Walk in Freezer	20	208	1	2	10	KeepRight	9,000
AHU/Trane	4		20	208	1	NA	NA		51,000

BOILER DATA SHEET

Facility:	Location:	Date:
HPS	Hollis, NH	12/20/2011

Location /Use Description	Manufacturer	Model Number	Details				
			Qty	Year	Capacity (mbh)	Efficiency	Circ Pump
Boiler room 1 / Hydronic Heat	Weil McLain		1	1980	1582	72%	Yes,2, 1.5hp
Boiler Room 1 /Hydronic Heat	SB Smith	28A-SW-07	1	2000	1477	82%	Yes,2, 1.5hp
Boiler room 2 /Hydronic Heat	Weil Mclain		1	1995	1582	72%	Yes,2, 1.5hp

DOMESTIC HOT WATER HEATERS

Location /Use Description	Manufacturer	Model Number	Details			
			Qty	Year	Capacity (gallon)	Efficiency
Boiler room 1 /DHW Oil Fired	Boch	Cglass Turboflue	1	2000	40	72%
Boiler room 2 /DHW Electric	State Select	ES640DORT	1	2006	40	100%

PUMPS DATA SHEET

Facility: HPS

Location: Hollis, NH

Location /Use Description	Manufacturer	Model Number	Qty	GPM	HP	Amps	Volt	Phase	Phase
Boiler room / hot water circulation	Bell & Gossett		1		1/2	5.2	115	1	5600
Boiler room / hot water circulation	Bell & Gossett	2AB 5-3/4BFSW	2	73	1 1/2				11200
Boiler room	Baldor	M3554T	1		1/2	5.3	208	3	5600
Boiler room / hot water circulation	Bell & Gossett	175300 LV	1		1 1/2	6	200	3	5600

FAN DATA SHEET

Facility:			Location:			Date:	
HPS			Hollis, NH			12/20/2011	
Location /Use Description	**Manufacturer**	**Qty**	**CFM**	**HP**	**Volt**	**Phase**	**Est. kWh/yr**
Roof / EF-1	ILG	1	1500	1/4	120	1	386
Roof / EF-2	ILG	1	1140	1/4	120	1	386
Roof / EF-3	ILG	1	600	1/12	120	1	129
Roof / EF-4	ILG	1	1050/2100	3/8	120	1	579
Roof / EF-5	ILG	2	600	1/12	120	1	257

APPENDIX F

Plug Load Inventory

PLUG LOAD INVENTORY

Facility:			Location:			Date:	
HPS			Hollis, NH			12/20/2011	
Location /Use Description	**Category**	**Description**	**Watts/ fixture**	**Qty**	**Total watts**	**Est. Hr/Wk**	**Est. kWh/Yr**
Kitchen	AC - Commercial Appliance	Food Heaters	300	1	300	40	624
Kitchen	AC - Commercial Appliance	Freezers	40	2	80	60	250
114	AS - Small Appliance	Microwave	1,000	2	2,000	1	104
114	AS - Small Appliance	Coffee Maker	1,200	3	3,600	2	374
121	AS - Small Appliance	Microwave	1,000	1	1,000	1	52
208	AS - Small Appliance	Microwave	1,000	1	1,000	1	52
Guidance	AS - Small Appliance	Microwave	1,000	1	1,000	1	52
Library	AS - Small Appliance	Microwave	1,000	1	1,000	1	52
Lounge	AS - Small Appliance	Toaster	1,000	2	2,000	1	104
Lounge	AS - Small Appliance	Microwave	1,000	1	1,000	1	52
Nurse	AS - Small Appliance	Coffee Maker	1,200	1	1,200	2	125
100	CD - Desktop Computer	Computer Desktop	110	2	220	60	686
101	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
102	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
104	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
105	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
106	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
107	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
108	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
109	CD - Desktop Computer	Computer Desktop	110	3	330	60	1,030
110	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
111	CD - Desktop Computer	Computer Desktop	110	2	220	60	686
112	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
113	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
114	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
116	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
118	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
201	CD - Desktop Computer	Computer Desktop	110	2	220	60	686
203	CD - Desktop Computer	Computer Desktop	110	24	2,640	60	8,237
203	CD - Desktop Computer	COW	30	2	600	60	1,872
204	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
205	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
206	CD - Desktop Computer	Computer Desktop	110	2	220	60	686
207	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
208	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
Assistance Principal	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
Guidance	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
Kindergarden	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
Library	CD - Desktop Computer	Computer Desktop	110	26	2,860	60	8,923

Main Office	CD - Desktop Computer	Computer Desktop	110	2	220	60	686
Maintenance	CD - Desktop Computer	Computer Desktop	110	2	220	60	686
Nurse	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
Nurse	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
OT	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
PE Office	CD - Desktop Computer	Computer Desktop	110	1	110	60	343
Speech	CD - Desktop Computer	Computer Desktop	110	2	220	60	686
100	CM - Computer Monitor	Computer Monitor LCD	30	2	60	60	187
101	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
102	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
104	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
105	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
106	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
107	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
108	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
109	CM - Computer Monitor	Computer Monitor LCD	30	3	90	60	281
110	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
111	CM - Computer Monitor	Computer Monitor LCD	30	2	60	60	187
112	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
113	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
114	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
116	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
118	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
201	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
203	CM - Computer Monitor	Computer Monitor LCD	30	24	720	60	2,246
204	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
205	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
206	CM - Computer Monitor	Computer Monitor LCD	30	2	60	60	187
207	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
208	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
Assistance Principal	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
Guidance	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
Kindergarden	CM - Computer Monitor	Computer Monitor LCD	30	2	60	60	187
Library	CM - Computer Monitor	Computer Monitor LCD	30	26	780	60	2,434
Main Office	CM - Computer Monitor	Computer Monitor LCD	30	2	60	60	187
Maintenance	CM - Computer Monitor	Computer Monitor LCD	30	2	60	60	187
Nurse	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
Nurse	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
OT	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
PE Office	CM - Computer Monitor	Computer Monitor LCD	30	1	30	60	94
Speech	CM - Computer Monitor	Computer Monitor LCD	30	2	60	60	187
102	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
103	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
104	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
106	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
107	CN - Notebook Computer	Computer Laptop	30	1	30	60	94

108	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
110	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
117	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
119	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
121	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
206	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
207	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
Kindergarden	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
OT	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
Principal	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
Special Ed.	CN - Notebook Computer	Computer Laptop	30	1	30	60	94
Special Ed.	CN - Notebook Computer	Computer Laptop	30	2	60	60	187
Guidance	DL - Desk Lamp	Lamp	60	1	60	40	125
101	EL - Electronics	Radio	15	1	15	5	4
102	EL - Electronics	Radio	15	1	15	5	4
113	EL - Electronics	Radio	15	1	15	5	4
118	EL - Electronics	Radio	15	1	15	5	4
120	EL - Electronics	Radio	15	1	15	5	4
Kindergarden	EL - Electronics	Radio	15	1	15	5	4
100	FN - Fan	Fan	20	1	20	3	3
101	FN - Fan	Fan	20	2	40	3	6
102	FN - Fan	Fan	20	2	40	3	6
103	FN - Fan	Fan	20	2	40	3	6
105	FN - Fan	Fan	20	2	40	3	6
106	FN - Fan	Fan	20	1	20	3	3
107	FN - Fan	Fan	20	1	20	3	3
109	FN - Fan	Fan	20	2	40	3	6
110	FN - Fan	Fan	20	1	20	3	3
112	FN - Fan	Fan	20	1	20	3	3
113	FN - Fan	Fan	20	1	20	3	3
116	FN - Fan	Fan	20	2	40	3	6
117	FN - Fan	Fan	20	1	20	3	3
118	FN - Fan	Fan	20	1	20	3	3
119	FN - Fan	Fan	20	2	40	3	6
120	FN - Fan	Fan	20	1	20	3	3
121	FN - Fan	Fan	20	2	40	3	6
201	FN - Fan	Fan	20	3	60	3	9
202	FN - Fan	Fan	20	1	20	3	3
204	FN - Fan	Fan	20	1	20	3	3
205	FN - Fan	Fan	20	2	40	3	6
206	FN - Fan	Fan	20	2	40	3	6
Assistance Principal	FN - Fan	Fan	20	1	20	3	3
Confrence	FN - Fan	Fan	20	1	20	3	3
Kitchen	FN - Fan	Fan	20	2	40	3	6
Main Office	FN - Fan	Fan	20	1	20	3	3
Maintenance	FN - Fan	Fan	20	1	20	3	3

Nurse	FN - Fan	Fan	20	1	20	3	3
OT	FN - Fan	Fan	20	1	20	3	3
PE Office	FN - Fan	Fan	20	1	20	3	3
Principal	FN - Fan	Fan	20	1	20	3	3
Resource Officer	FN - Fan	Fan	20	1	20	3	3
SPED	FN - Fan	Fan	20	1	20	3	3
SPED	FN - Fan	Fan	20	1	20	3	3
Speech	FN - Fan	Fan	20	1	20	3	3
109	OE - Office Equipment	Laminator	1,600	1	1,600	2	166
Main Office	OE - Office Equipment	Fax	30	1	30	2	3
116	OT - Other (describe)	Kiln	12,000	1	12,000	1	624
116	OT - Other (describe)	Pottery Wheel	375	1	375	0.25	5
109	PC - Photocopier	Photocopier	1,440	1	1,440	10	749
120	PC - Photocopier	Photocopier	1,440	1	1,440	10	749
Main Office	PC - Photocopier	Photocopier	1,440	1	1,440	10	749
100	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
102	PR - Computer Printer	Printer	500	1	500	2	52
104	PR - Computer Printer	Printer	500	1	500	2	52
110	PR - Computer Printer	Printer	500	1	500	2	52
114	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
203	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
205	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
Assistance Principal	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
Confrence	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
Main Office	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
Maintenance	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
PE Office	PR - Computer Printer	Printer	500	1	500	2	52
Principal	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
Resource Officer	PR - Computer Printer	Printer	500	1	500	2	52
SPED	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
Speech	PR - Computer Printer	Printer Laser Jet	500	1	500	2	52
Kitchen	RD - Display Refrigerator	Milk Bin	500	1	500	60	1,560
100	RM - Mini Refrigerator	Refrigerator Compact	150	1	150	60	468
113	RM - Mini Refrigerator	Refrigerator Compact	150	1	150	60	468
117	RM - Mini Refrigerator	Refrigerator Compact	150	1	150	60	468
207	RM - Mini Refrigerator	Refrigerator Compact	150	1	150	60	468
208	RM - Mini Refrigerator	Refrigerator Compact	150	1	150	60	468
Guidance	RM - Mini Refrigerator	Refrigerator Compact	150	1	150	60	468
Library	RM - Mini Refrigerator	Refrigerator Compact	150	1	150	60	468
Nurse	RM - Mini Refrigerator	Refrigerator Compact	150	1	150	60	468
Nurse	RM - Mini Refrigerator	Refrigerator Compact	150	1	150	60	468
Principal	RM - Mini Refrigerator	Refrigerator Compact-Old	200	1	200	60	624
119	RS - Standard Refrigerator	Refrigerator Full	360	1	360	60	1,123
Guidance	TV - Television	TV	160	1	160	1	8
101	VE - Video Equipt/Projector	Projector	240	1	240	3	37
102	VE - Video Equipt/Projector	Projector	240	1	240	3	37

103	VE - Video Equipt/Projector	Projector	240	1	240	3	37
104	VE - Video Equipt/Projector	Projector	240	1	240	3	37
105	VE - Video Equipt/Projector	Projector	240	1	240	3	37
106	VE - Video Equipt/Projector	Projector	240	1	240	3	37
107	VE - Video Equipt/Projector	Projector	240	1	240	3	37
108	VE - Video Equipt/Projector	Projector	240	1	240	3	37
112	VE - Video Equipt/Projector	Projector	240	1	240	3	37
117	VE - Video Equipt/Projector	Projector	240	1	240	3	37
119	VE - Video Equipt/Projector	Projector	240	1	240	3	37
121	VE - Video Equipt/Projector	Projector	240	1	240	3	37
202	VE - Video Equipt/Projector	Projector	240	1	240	3	37
204	VE - Video Equipt/Projector	Projector	240	1	240	3	37
205	VE - Video Equipt/Projector	Projector	240	1	240	3	37
206	VE - Video Equipt/Projector	Projector	240	1	240	3	37
207	VE - Video Equipt/Projector	Projector	240	1	240	3	37
208	VE - Video Equipt/Projector	Projector	240	1	240	3	37
Kindergarden	VE - Video Equipt/Projector	Projector	240	1	240	3	37
Library	VE - Video Equipt/Projector	Projector	240	1	240	3	37
114	VM - Vending Machine	Vending machine	1,080	1	1,080	40	2,246
Stairs	VM - Vending Machine	Vending Machine	1,080	1	1,080	40	2,246
Cafeteria	WF - Water Fountain	Water Fountain	300	1	300	40	624
Corridor	WF - Water Fountain	Water Fountain	300	2	600	40	1,248
Totals:				**334**	**65,925**		**63,962**

APPENDIX G

ENERGY STAR® Statement of Energy Performance

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Hollis Primary School

Building ID: 1721898
For 12-month Period Ending: January 31, 2012[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 16, 2012

Facility
Hollis Primary School
36 Silver Lake Rd
Hollis, NH 03049

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1975
Gross Floor Area (ft²): 46,918

Energy Performance Rating[2] (1-100) 59

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	841,809
Fuel Oil (No. 2) (kBtu)	2,735,004
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	3,576,813

Energy Intensity[4]	
Site (kBtu/ft²/yr)	76
Source (kBtu/ft²/yr)	119

Emissions (based on site energy use)
Greenhouse Gas Emissions ($MtCO_2e$/year) 295

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

National Median Comparison	
National Median Site EUI	83
National Median Source EUI	130
% Difference from National Median Source EUI	-8%
Building Type	K-12 School

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
N/A

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.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, Licensed Professional facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

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	Hollis Primary School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	36 Silver Lake Rd, 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.		☐

Hollis Primary School, Nh (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	46,918 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.		☐
Open Weekends?	No	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	45	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	2	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	0 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Months	9(Optional)	Is this school in operation for at least 8 months of the year?		☐

High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

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: hollis_primary_electric (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
01/01/2012	01/31/2012	21,760.00
12/01/2011	12/31/2011	20,000.00
11/01/2011	11/30/2011	18,400.00
10/01/2011	10/31/2011	19,680.00
09/01/2011	09/30/2011	17,920.00
08/01/2011	08/31/2011	15,680.00
07/01/2011	07/31/2011	17,040.00
06/01/2011	06/30/2011	22,640.00
05/01/2011	05/31/2011	20,480.00
04/01/2011	04/30/2011	22,640.00
03/01/2011	03/31/2011	22,560.00
02/01/2011	02/28/2011	27,920.00
hollis_primary_electric Consumption (kWh (thousand Watt-hours))		**246,720.00**
hollis_primary_electric Consumption (kBtu (thousand Btu))		**841,808.64**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**841,808.64**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Fuel Oil (No. 2)		
Meter: Hollis Primary School-Oil (Gallons) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (Gallons)**
01/01/2012	01/31/2012	1,589.80
12/01/2011	12/31/2011	4,468.50
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	4,019.10
04/01/2011	04/30/2011	4,586.00

03/01/2011	03/31/2011	2,770.00
02/01/2011	02/28/2011	2,286.80
Hollis Primary School-Oil Consumption (Gallons)		**19,720.20**
Hollis Primary School-Oil Consumption (kBtu (thousand Btu))		**2,735,004.40**
Total Fuel Oil (No. 2) Consumption (kBtu (thousand Btu))		**2,735,004.40**
Is this the total Fuel Oil (No. 2) consumption at this building including all Fuel Oil (No. 2) 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
Hollis Primary School
36 Silver Lake Rd
Hollis, NH 03049

Facility Owner
N/A

Primary Contact for this Facility
N/A

General Information

Hollis Primary School	
Gross Floor Area Excluding Parking: (ft²)	46,918
Year Built	1975
For 12-month Evaluation Period Ending Date:	January 31, 2012

Facility Space Use Summary

Hollis Primary School, Nh	
Space Type	K-12 School
Gross Floor Area(ft²)	46,918
Open Weekends?	No
Number of PCs	45
Number of walk-in refrigeration/freezer units	2
Presence of cooking facilities	Yes
Percent Cooled	0
Percent Heated	100
Months°	9
High School?	No
School District°	SAU41

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 01/31/2012)	**Baseline** (Ending Date 10/31/2007)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	59	77	75	N/A	50
Energy Intensity					
Site (kBtu/ft²)	76	64	65	N/A	83
Source (kBtu/ft²)	119	98	102	N/A	130
Energy Cost					
$/year	$ 94,167.32	$ 28,408.17	$ 80,457.23	N/A	$ 102,887.43
$/ft²/year	$ 2.01	$ 0.61	$ 1.72	N/A	$ 2.20
Greenhouse Gas Emissions					
$MtCO_2e$/year	295	247	252	N/A	322
$kgCO_2e$/ft²/year	6	5	5	N/A	7

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Median column presents energy performance data your building would have if your building had a median rating of 50.

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 Primary School	Location:	Hollis, NH
Gross Area (sf):	46,918	Date:	2/15/2012
Use Category:	K-12 School	EUI (kBtu/sf/yr):	119
Heating Fuel(s):	Oil (No. 2)	PM Grade:	59
Heating System(s):	Hydronic	Cooling System(s):	Limited (DX Coils)

RE Technology	Score (out of 70 pts.)	Grade	Notes/Comments
Geothermal Heating/Cooling	58.5	84%	Closed-loop GSHP system.
Ground Photovoltaic	53.5	76%	Medium system 10kw-30kw.
Roof Photovoltaic	53.0	76%	Medium system 10kw-30kw.
Biomass Heating	53.0	76%	Pellet feed system recommended.
Solar DHW	52.5	75%	DHW demand should be confirmed.
Solar Thermal	46.0	66%	Medium-temperature collectors.
Combined Heat & Power	44.0	63%	75kW system.
Wind Turbine Generator	43.0	61%	Permit requirements are height dependent.

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Primary School	Location:	Hollis, NH
Gross Area (sf):	46,918	Date:	2/15/2012
Use Category:	K-12 School	EUI (kBtu/sf/yr):	119
Heating Fuel(s):	Oil (No. 2)	PM Grade:	59
Heating System(s):	Hydronic	Cooling System(s):	Limited (DX Coils)

Technology: **Geothermal Heating & Cooling**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	5	Well demonstrated technology but does require engineering design.
2	Expected service life/durability	5	Well field and loop system has +50 year service life. Equipment has +20 yr service life.
3	Geographical considerations	5	Abundant geothermal energy reserves.
4	Energy demand	4.5	Heating and cooling energy consumption is relatively high.
5	Facility/systems conditions	3	Existing system is functioning.
6	Facility/systems compatibility	3	Building system is old and out dated but a heat pump can be installed.
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	3	High capital cost.
10	O&M requirements	5	Very low O&M except routine equipment maintenance.
11	Financial incentives	2.5	Limited incentives in NH.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	4.5	The building currently uses a moderately high amount of oil.
14	Public awareness/education	4	Moderate public use. Information could be displayed in the building so users are aware of geothermal system.
	Total Score:	**58.5**	
	Total Possible Score:	**70**	
	Grade:	**84%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Primary School	Location:	Hollis, NH
Gross Area (sf):	46,918	Date:	2/15/2012
Use Category:	K-12 School	EUI (kBtu/sf/yr):	119
Heating Fuel(s):	Oil (No. 2)	PM Grade:	59
Heating System(s):	Hydronic	Cooling System(s):	Limited (DX Coils)

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	4.5	Relatively high grid electrical demand.
5	Facility/systems conditions	3.5	Older facility and systems.
6	Facility/systems compatibility	4.5	Portion of southern green space could be used.
7	Permitting constraints	2.5	Utility grid connection permit is long-lead and may require a designed/engineered system.
8	Abutter concerns	4.5	Residential 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.
	Total Score:	**53.5**	
	Total Possible Score:	**70**	
	Grade:	**76%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Primary School	Location:	Hollis, NH
Gross Area (sf):	46,918	Date:	2/15/2012
Use Category:	K-12 School	EUI (kBtu/sf/yr):	119
Heating Fuel(s):	Oil (No. 2)	PM Grade:	59
Heating System(s):	Hydronic	Cooling System(s):	Limited (DX Coils)

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	4.5	Relatively high grid electrical demand.
5	Facility/systems conditions	5	Ample amount of south facing roof space.
6	Facility/systems compatibility	3	Roof is in fair condition.
7	Permitting constraints	2.5	Utility grid connection permit is long-lead and may require a designed/engineered system.
8	Abutter concerns	4.5	Residential setting.
9	Capital investment	2.5	High capital cost.
10	O&M requirements	3.5	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	CO2e emissions	4.5	Electrical source energy in NH has lower than average CO2 emissions.
14	Public awareness/education	5	High visibility.
	Total Score:	**53**	
	Total Possible Score:	**70**	
	Grade:	**76%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Primary School	Location:	Hollis, NH
Gross Area (sf):	46,918	Date:	2/15/2012
Use Category:	K-12 School	EUI (kBtu/sf/yr):	119
Heating Fuel(s):	Oil (No. 2)	PM Grade:	59
Heating System(s):	Hydronic	Cooling System(s):	Limited (DX Coils)

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

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	4	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	3.5	Woodchips/pellets could be stored in rear of building.
6	Facility/systems compatibility	3.5	Woodchips/pellets could be stored in rear of building.
7	Permitting constraints	5	No special permits required.
8	Abutter concerns	4	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	3	Wood and woodchip units require constant attending and feedstock must be sourced. Pellet systems with hoppers are less intensive and feedstock is commercially available.
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:	**53**	
	Total Possible Score:	**70**	
	Grade:	**76%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Primary School	Location:	Hollis, NH
Gross Area (sf):	46,918	Date:	2/15/2012
Use Category:	K-12 School	EUI (kBtu/sf/yr):	119
Heating Fuel(s):	Oil (No. 2)	PM Grade:	59
Heating System(s):	Hydronic	Cooling System(s):	Limited (DX Coils)

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	3	System could utilize the existing 40-gal storage tank.
6	Facility/systems compatibility	4	System could utilize the existing 40-gal storage 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	Moderate reduction of oil use based on DHW demand.
14	Public awareness/education	4	Moderatly high public use.
	Total Score:	**52.5**	
	Total Possible Score:	**70**	
	Grade:	**75%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Primary School	Location:	Hollis, NH
Gross Area (sf):	46,918	Date:	2/15/2012
Use Category:	K-12 School	EUI (kBtu/sf/yr):	119
Heating Fuel(s):	Oil (No. 2)	PM Grade:	59
Heating System(s):	Hydronic	Cooling System(s):	Limited (DX Coils)

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	Heating and cooling relatively high.
5	Facility/systems conditions	2.5	Existing mechanical system is limited.
6	Facility/systems compatibility	3	Considerable space required but could be made available. Plumbing complex to protect against freezing.
7	Permitting constraints	2.5	Utility grid connection permit is long-lead and may require a designed/engineered system.
8	Abutter concerns	3.5	Light residential and 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 is NH has lower than average CO2 emissions.
14	Public awareness/education	4.5	High visibility depending on placement.
	Total Score:	**46**	
	Total Possible Score:	**70**	
	Grade:	**66%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Primary School	Location:	Hollis, NH
Gross Area (sf):	46,918	Date:	2/15/2012
Use Category:	K-12 School	EUI (kBtu/sf/yr):	119
Heating Fuel(s):	Oil (No. 2)	PM Grade:	59
Heating System(s):	Hydronic	Cooling System(s):	Limited (DX Coils)

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	3.5	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 relatively high.
5	Facility/systems conditions	2.5	Older 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	CO_2e emissions	1	CHPs consume a large amount of fuel and emissions relative to the re-used energy.
14	Public awareness/education	4	Moderate 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%**	

RENEWABLE ENERGY SCREENING WORKSHEET

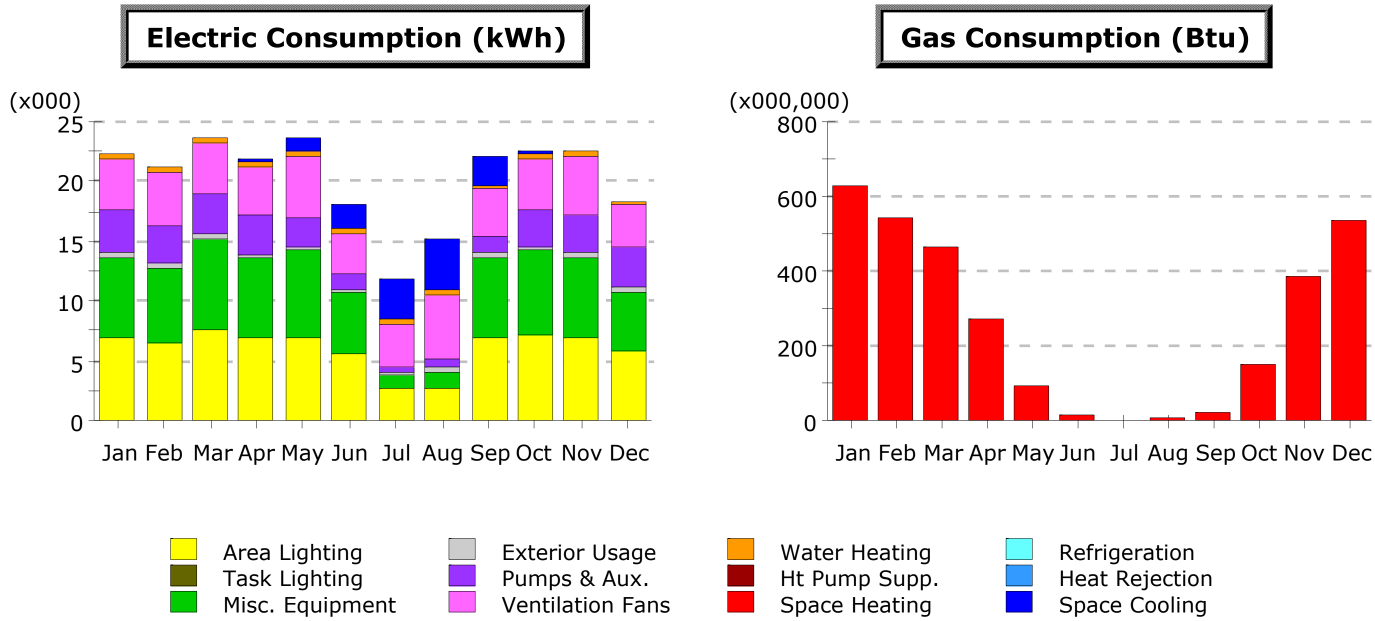
Building/Facility:	Hollis Primary School	Location:	Hollis, NH
Gross Area (sf):	46,918	Date:	2/15/2012
Use Category:	K-12 School	EUI (kBtu/sf/yr):	119
Heating Fuel(s):	Oil (No. 2)	PM Grade:	59
Heating System(s):	Hydronic	Cooling System(s):	Limited (DX Coils)

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	Limited wind energy but a feasibility study is required.
4	Energy demand	3.5	Electric energy consumption is moderate.
5	Facility/systems conditions	3	Modern systems
6	Facility/systems compatibility	3	Modern 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	2	Pole-mounted turbines have a large visual impact.
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	2.5	Unknown / neutral.
13	CO2e emissions	4	Electrical source energy is NH has lower than average CO2 emissions.
14	Public awareness/education	5	High visibility.
	Total Score:	**43**	
	Total Possible Score:	**70**	
	Grade:	**61%**	

APPENDIX I

eQUEST® Energy Efficiency Measure Modeling



Electric Consumption (kWh x000)

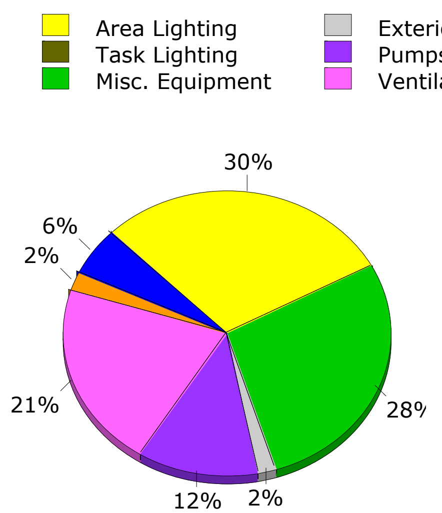
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	0.17	1.12	2.11	3.53	4.19	2.31	0.22	0.04	-	13.68
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.43	0.47	0.43	0.40	0.54	0.30	0.32	0.56	0.36	0.42	0.50	0.29	5.04
Vent. Fans	4.36	4.53	4.36	4.16	5.14	3.51	3.72	5.27	3.90	4.36	4.81	3.46	51.58
Pumps & Aux.	3.42	3.09	3.39	3.15	2.40	1.33	0.30	0.62	1.50	2.96	3.22	3.38	28.76
Ext. Usage	0.45	0.34	0.38	0.37	0.26	0.25	0.26	0.43	0.41	0.43	0.43	0.45	4.46
Misc. Equip.	6.71	6.32	7.55	6.67	7.27	4.99	1.10	1.38	6.67	6.99	6.67	5.02	67.34
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	6.98	6.51	7.62	6.90	6.98	5.61	2.72	2.72	6.90	7.20	6.90	5.70	72.74
Total	22.35	21.27	23.74	21.83	23.72	18.11	11.94	15.16	22.06	22.58	22.57	18.30	243.61

Gas Consumption (Btu x000,000)

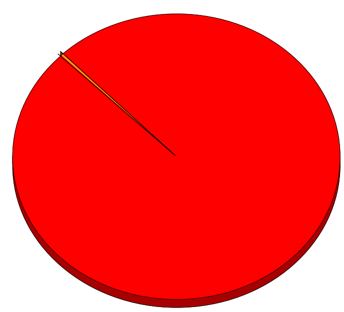
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	628.7	544.4	460.6	272.9	93.9	15.3	0.7	4.5	20.5	150.1	387.0	531.5	3,110.1
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.9	0.8	0.9	0.8	0.9	0.7	0.7	0.9	0.8	0.9	0.9	0.8	10.0
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	629.6	545.3	461.5	273.8	94.8	16.1	1.4	5.4	21.3	150.9	387.8	532.3	3,120.1

Annual Energy Consumption by Enduse

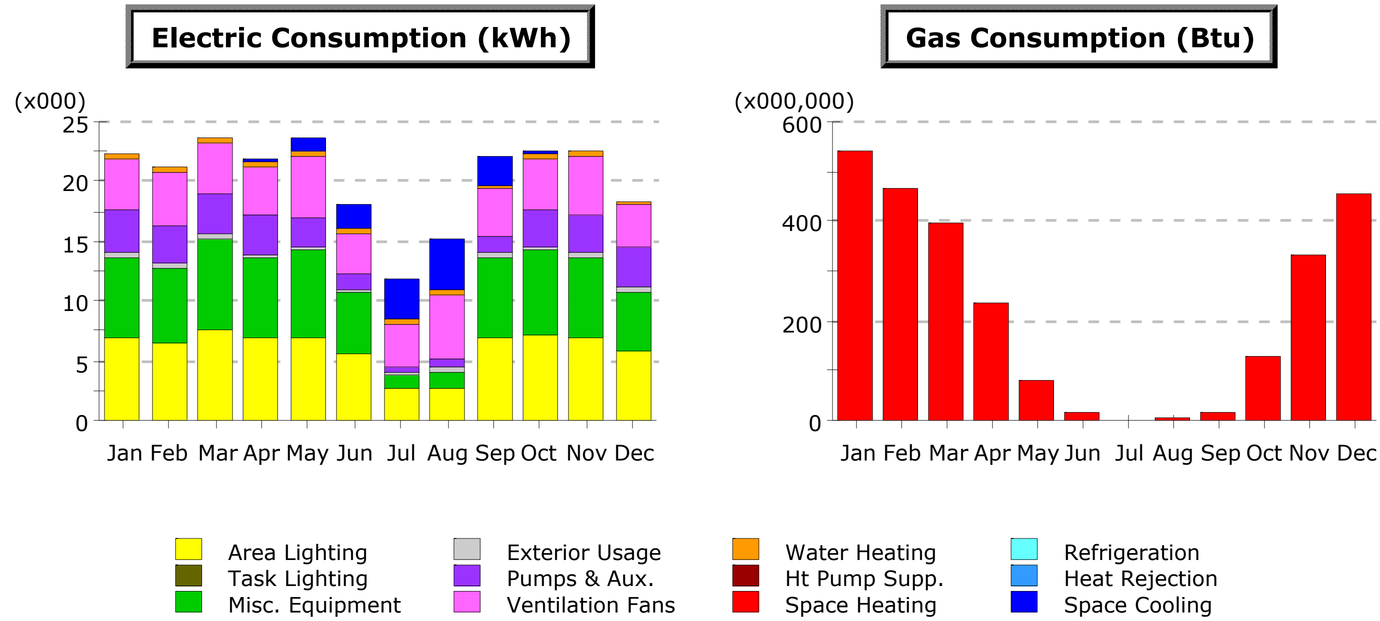
	Electricity kWh (x000)	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	13.68	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	3,110.1	-	-
HP Supp.	-	-	-	-
Hot Water	5.04	10.0	-	-
Vent. Fans	51.58	-	-	-
Pumps & Aux.	28.76	-	-	-
Ext. Usage	4.46	-	-	-
Misc. Equip.	67.34	-	-	-
Task Lights	-	-	-	-
Area Lights	72.74	-	-	-
Total	243.61	3,120.1	-	-



Electricity



Natural Gas



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	0.17	1.12	2.11	3.53	4.19	2.31	0.22	0.04	-	13.68
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.43	0.47	0.43	0.40	0.54	0.30	0.32	0.56	0.36	0.42	0.50	0.29	5.04
Vent. Fans	4.36	4.53	4.36	4.16	5.14	3.51	3.72	5.27	3.90	4.36	4.81	3.46	51.58
Pumps & Aux.	3.42	3.09	3.39	3.15	2.40	1.33	0.30	0.62	1.50	2.96	3.22	3.38	28.76
Ext. Usage	0.45	0.34	0.38	0.37	0.26	0.25	0.26	0.43	0.41	0.43	0.43	0.45	4.46
Misc. Equip.	6.71	6.32	7.55	6.67	7.27	4.99	1.10	1.38	6.67	6.99	6.67	5.02	67.34
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	6.98	6.51	7.62	6.90	6.98	5.61	2.72	2.72	6.90	7.20	6.90	5.70	72.74
Total	22.35	21.27	23.74	21.83	23.72	18.11	11.94	15.16	22.06	22.58	22.57	18.30	243.61

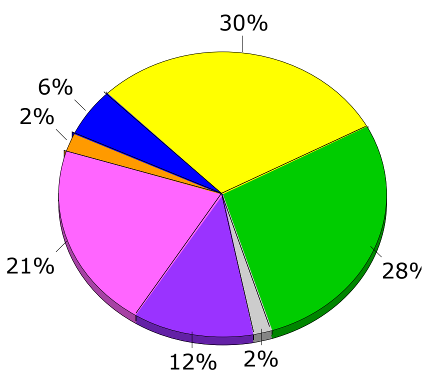
Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	538.9	466.7	394.8	233.9	80.5	13.1	0.6	3.9	17.6	128.6	331.7	455.6	2,665.8
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.9	0.8	0.9	0.8	0.9	0.7	0.7	0.9	0.8	0.9	0.9	0.8	10.0
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	539.7	467.5	395.7	234.8	81.4	13.9	1.3	4.7	18.4	129.5	332.6	456.4	2,675.8

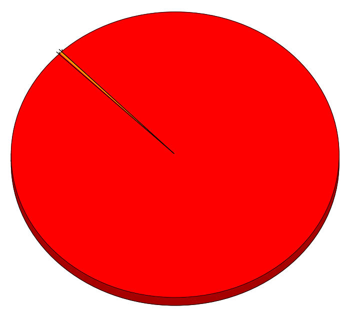
Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	13.68	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	2,665.8	-	-
HP Supp.	-	-	-	-
Hot Water	5.04	10.0	-	-
Vent. Fans	51.58	-	-	-
Pumps & Aux.	28.76	-	-	-
Ext. Usage	4.46	-	-	-
Misc. Equip.	67.34	-	-	-
Task Lights	-	-	-	-
Area Lights	72.74	-	-	-
Total	243.61	2,675.8	-	-

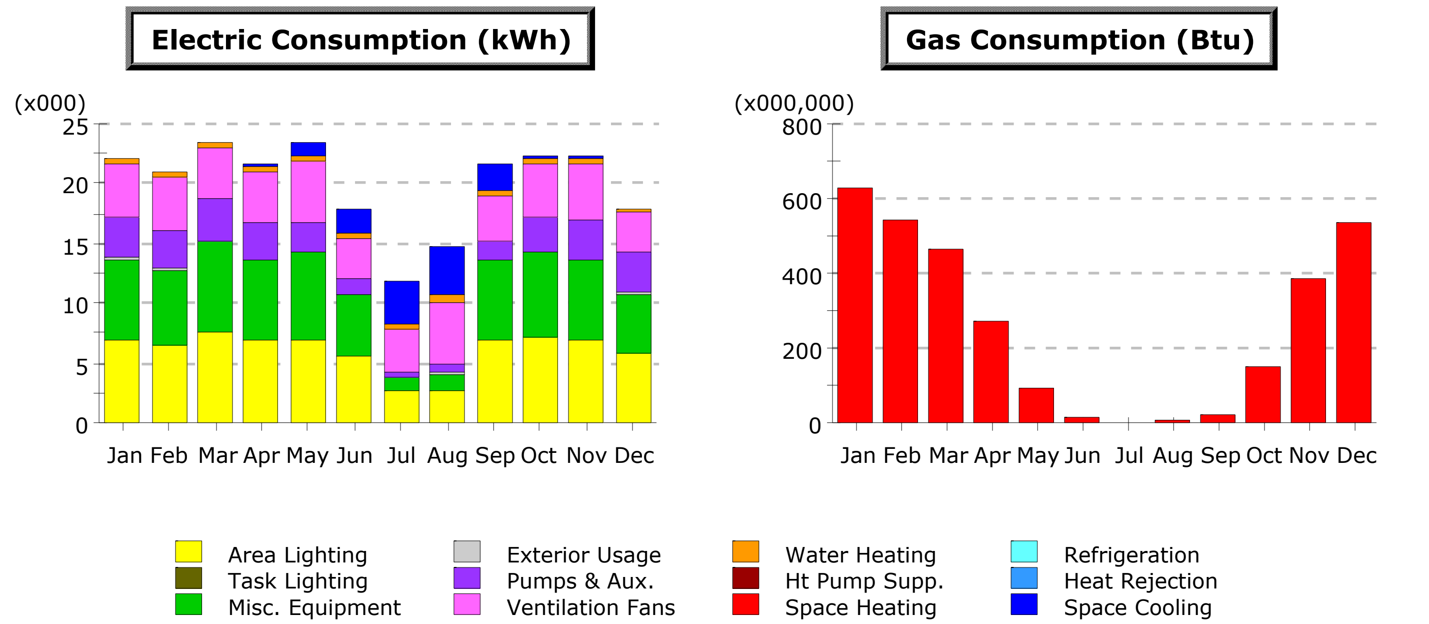
Area Lighting
Task Lighting
Misc. Equipment
Exterior Usage
Pumps & Aux.
Ventilation Fans
Water Heating
Ht Pump Supp.
Space Heating
Refrigeration
Heat Rejection
Space Cooling



Electricity



Natural Gas



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	0.17	1.12	2.11	3.53	4.19	2.31	0.22	0.04	-	13.68
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.43	0.47	0.43	0.40	0.54	0.30	0.32	0.56	0.36	0.42	0.50	0.29	5.04
Vent. Fans	4.36	4.53	4.36	4.16	5.14	3.51	3.72	5.27	3.90	4.36	4.81	3.46	51.58
Pumps & Aux.	3.42	3.09	3.39	3.15	2.40	1.33	0.30	0.62	1.50	2.96	3.22	3.38	28.76
Ext. Usage	0.11	0.08	0.09	0.09	0.06	0.06	0.06	0.10	0.10	0.10	0.10	0.11	1.05
Misc. Equip.	6.71	6.32	7.55	6.67	7.27	4.99	1.10	1.38	6.67	6.99	6.67	5.02	67.34
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	6.98	6.51	7.62	6.90	6.98	5.61	2.72	2.72	6.90	7.20	6.90	5.70	72.74
Total	22.01	21.01	23.45	21.54	23.52	17.92	11.74	14.83	21.74	22.25	22.24	17.96	240.19

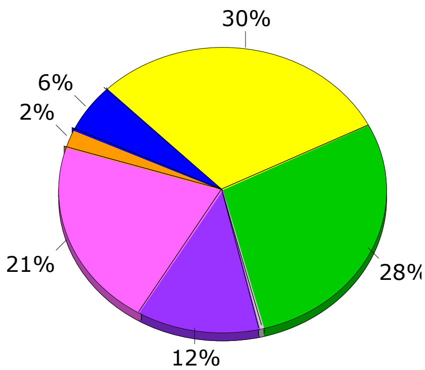
Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	628.7	544.4	460.6	272.9	93.9	15.3	0.7	4.5	20.5	150.1	387.0	531.5	3,110.1
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.9	0.8	0.9	0.8	0.9	0.7	0.7	0.9	0.8	0.9	0.9	0.8	10.0
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	629.6	545.3	461.5	273.8	94.8	16.1	1.4	5.4	21.3	150.9	387.8	532.3	3,120.1

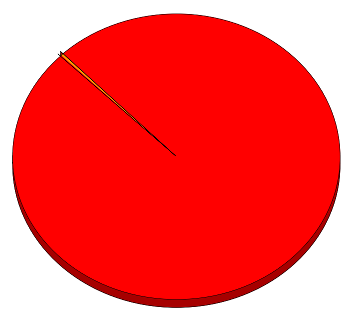
Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	13.68	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	3,110.1	-	-
HP Supp.	-	-	-	-
Hot Water	5.04	10.0	-	-
Vent. Fans	51.58	-	-	-
Pumps & Aux.	28.76	-	-	-
Ext. Usage	1.05	-	-	-
Misc. Equip.	67.34	-	-	-
Task Lights	-	-	-	-
Area Lights	72.74	-	-	-
Total	240.19	3,120.1	-	-

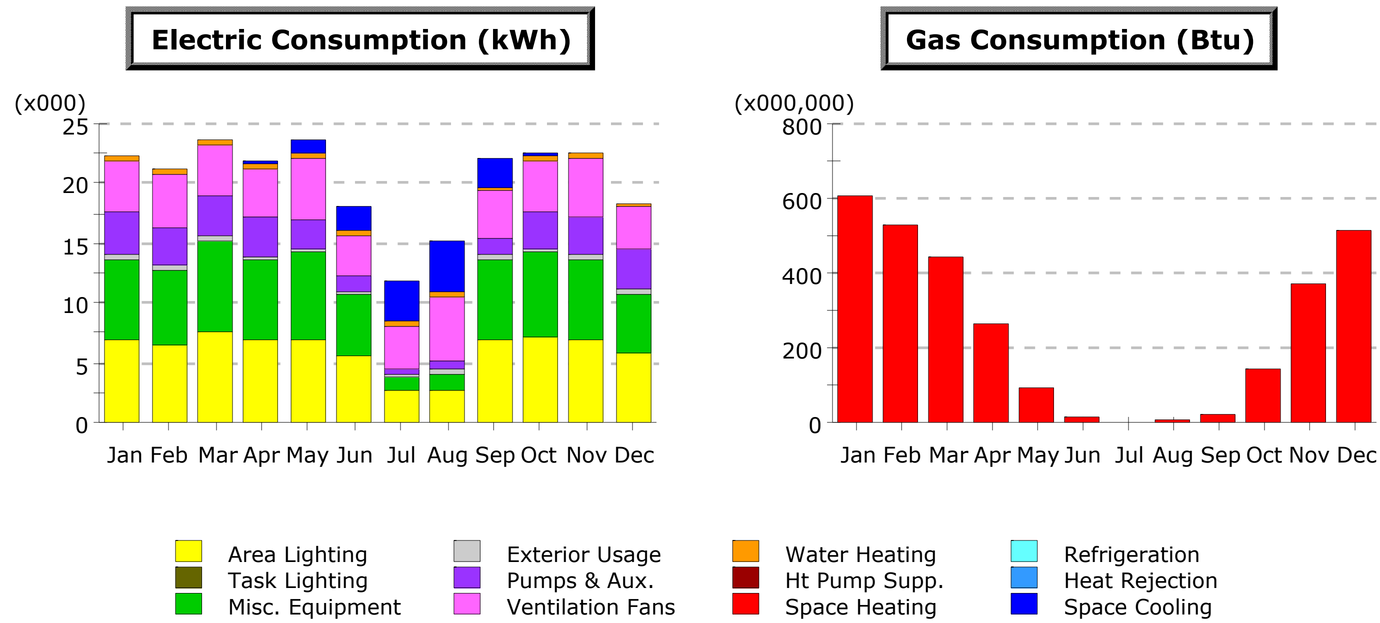
Area Lighting
Task Lighting
Misc. Equipment
Exterior Usage
Pumps & Aux.
Ventilation Fans
Water Heating
Ht Pump Supp.
Space Heating
Refrigeration
Heat Rejection
Space Cooling



Electricity



Natural Gas



Electric Consumption (kWh x000)

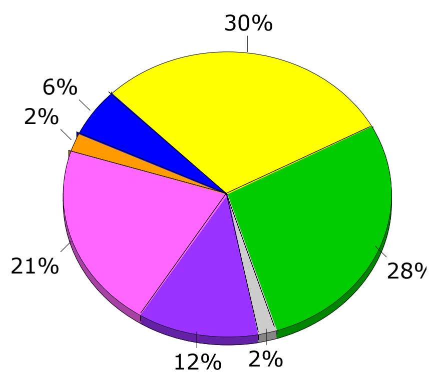
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	0.17	1.12	2.11	3.53	4.19	2.31	0.22	0.04	-	13.68
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.43	0.47	0.43	0.40	0.54	0.30	0.32	0.56	0.36	0.42	0.50	0.29	5.04
Vent. Fans	4.36	4.53	4.36	4.16	5.14	3.51	3.72	5.27	3.90	4.36	4.81	3.46	51.58
Pumps & Aux.	3.42	3.09	3.39	3.15	2.40	1.33	0.30	0.62	1.50	2.96	3.22	3.38	28.75
Ext. Usage	0.45	0.34	0.38	0.37	0.26	0.25	0.26	0.43	0.41	0.43	0.43	0.45	4.46
Misc. Equip.	6.71	6.32	7.55	6.67	7.27	4.99	1.10	1.38	6.67	6.99	6.67	5.02	67.34
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	6.98	6.51	7.62	6.90	6.98	5.61	2.72	2.72	6.90	7.20	6.90	5.70	72.74
Total	22.35	21.27	23.74	21.83	23.71	18.11	11.94	15.16	22.05	22.58	22.57	18.30	243.60

Gas Consumption (Btu x000,000)

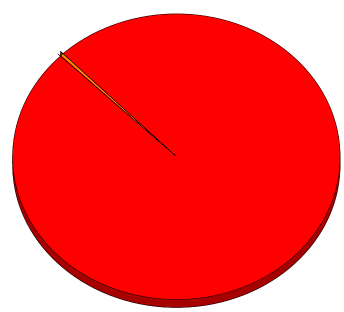
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	608.4	526.9	443.8	260.2	88.8	13.4	0.5	4.0	18.7	141.3	370.3	511.1	2,987.4
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.9	0.8	0.9	0.8	0.9	0.7	0.7	0.9	0.8	0.9	0.9	0.8	10.0
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	609.3	527.8	444.7	261.1	89.7	14.2	1.2	4.9	19.5	142.1	371.2	511.9	2,997.5

Annual Energy Consumption by Enduse

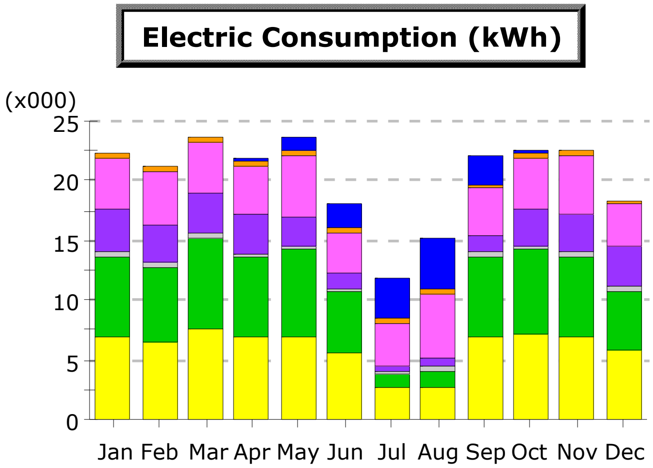
	Electricity kWh (x000)	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	13.68	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	2,987.4	-	-
HP Supp.	-	-	-	-
Hot Water	5.04	10.0	-	-
Vent. Fans	51.58	-	-	-
Pumps & Aux.	28.75	-	-	-
Ext. Usage	4.46	-	-	-
Misc. Equip.	67.34	-	-	-
Task Lights	-	-	-	-
Area Lights	72.74	-	-	-
Total	243.60	2,997.5	-	-

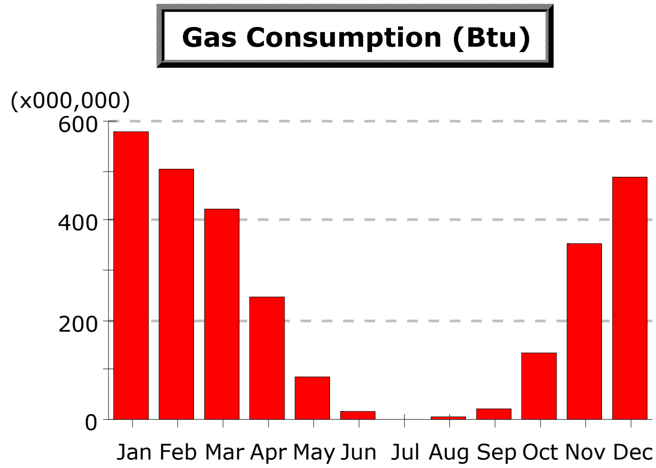


Electricity



Natural Gas





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

Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	0.17	1.13	2.12	3.52	4.21	2.35	0.23	0.04	-	13.78
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.43	0.47	0.43	0.40	0.54	0.30	0.32	0.56	0.36	0.42	0.50	0.29	5.04
Vent. Fans	4.34	4.50	4.34	4.14	5.11	3.49	3.70	5.24	3.88	4.34	4.78	3.44	51.29
Pumps & Aux.	3.41	3.08	3.38	3.15	2.39	1.32	0.30	0.62	1.49	2.95	3.21	3.37	28.66
Ext. Usage	0.45	0.34	0.38	0.37	0.26	0.25	0.26	0.43	0.41	0.43	0.43	0.45	4.46
Misc. Equip.	6.71	6.32	7.55	6.67	7.27	4.99	1.10	1.38	6.67	6.99	6.67	5.02	67.34
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	6.98	6.51	7.62	6.90	6.98	5.61	2.72	2.72	6.90	7.20	6.90	5.70	72.74
Total	22.31	21.23	23.70	21.80	23.69	18.10	11.91	15.15	22.06	22.56	22.53	18.27	243.32

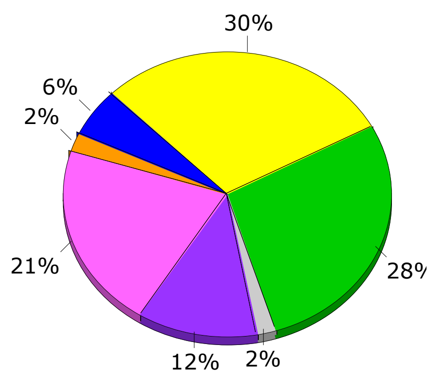
Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	579.3	503.6	422.4	247.2	85.3	14.3	0.7	4.2	18.7	134.4	351.7	484.8	2,846.5
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.9	0.8	0.9	0.8	0.9	0.7	0.7	0.9	0.8	0.9	0.9	0.8	10.0
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	580.1	504.4	423.3	248.0	86.2	15.0	1.4	5.1	19.5	135.3	352.6	485.6	2,856.5

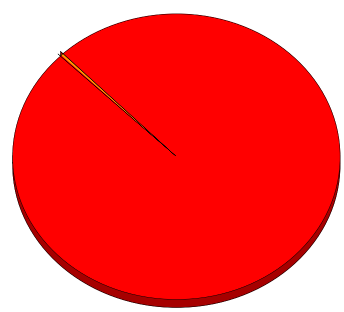
Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	13.78	-	-	-
Heat Reject.	-	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	2,846.5	-	-
HP Supp.	-	-	-	-
Hot Water	5.04	10.0	-	-
Vent. Fans	51.29	-	-	-
Pumps & Aux.	28.66	-	-	-
Ext. Usage	4.46	-	-	-
Misc. Equip.	67.34	-	-	-
Task Lights	-	-	-	-
Area Lights	72.74	-	-	-
Total	243.32	2,856.5	-	-

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

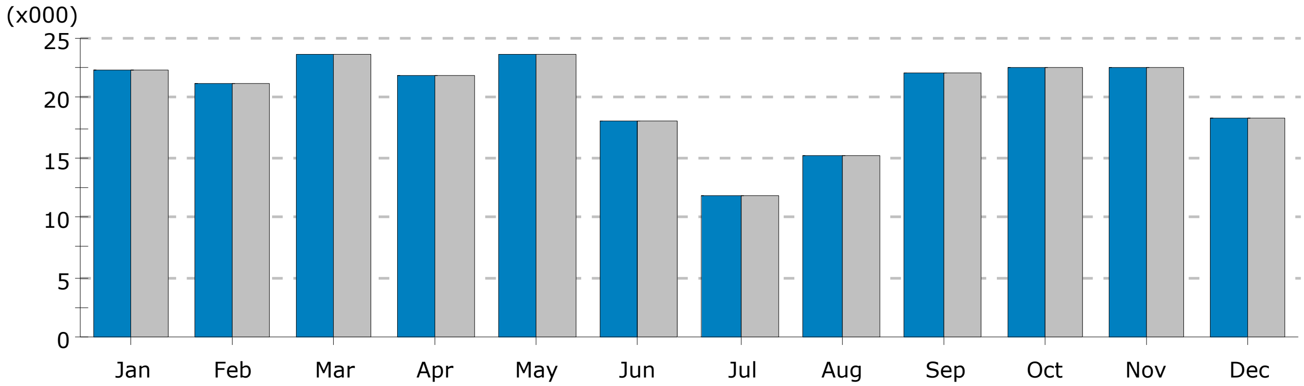


Electricity



Natural Gas

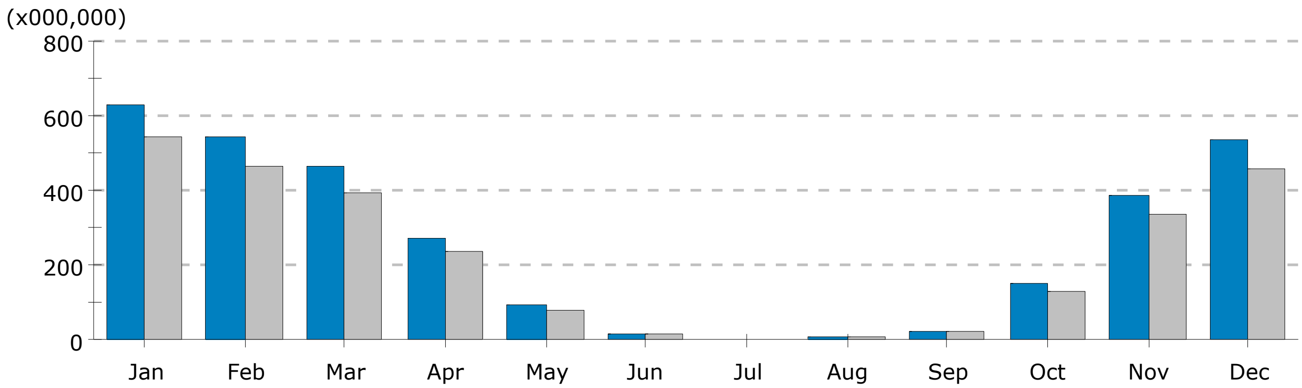
Electric Consumption (kWh)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	22.35	21.27	23.74	21.83	23.72	18.11	11.94	15.16	22.06	22.58	22.57	18.30	243.61
Run 2.	22.35	21.27	23.74	21.83	23.72	18.11	11.94	15.16	22.06	22.58	22.57	18.30	243.61
Run 3.													
Run 4.													
Run 5.													

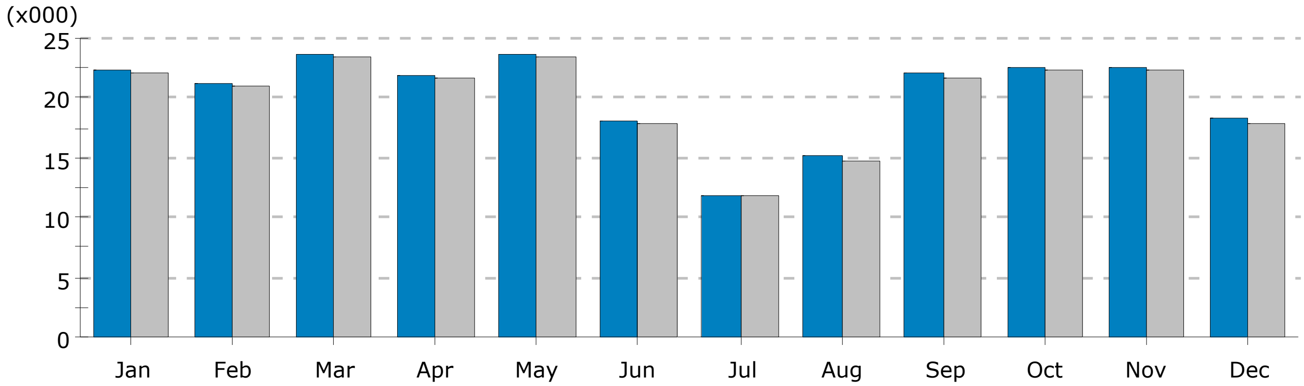
1. Hollis Primary School baseline - Baseline Design (02/22/12 @ 09:05)
2. Hollis Primary School Boiler Replacement (02/22/12 @ 09:05)

Gas Consumption (Btu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	629.6	545.3	461.5	273.8	94.8	16.1	1.4	5.4	21.3	150.9	387.8	532.3	3,120.1
Run 2.	539.7	467.5	395.7	234.8	81.4	13.9	1.3	4.7	18.4	129.5	332.6	456.4	2,675.8
Run 3.													
Run 4.													
Run 5.													

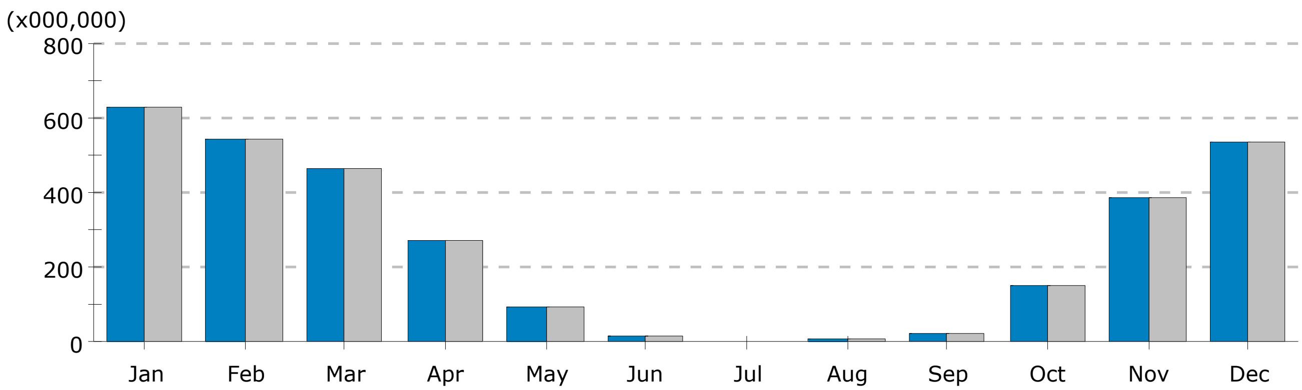
Electric Consumption (kWh)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	22.35	21.27	23.74	21.83	23.72	18.11	11.94	15.16	22.06	22.58	22.57	18.30	243.61
Run 2.	22.01	21.01	23.45	21.54	23.52	17.92	11.74	14.83	21.74	22.25	22.24	17.96	240.19
Run 3.													
Run 4.													
Run 5.													

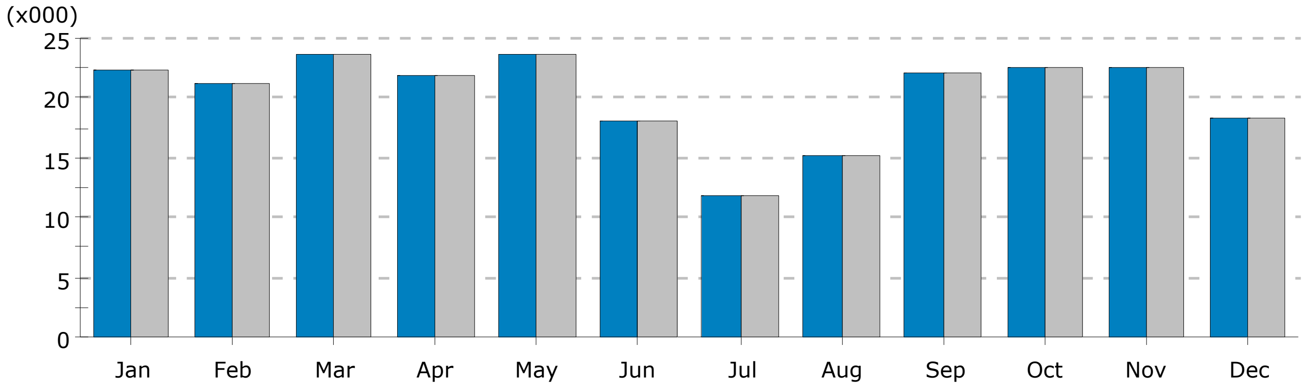
1. Hollis Primary School baseline - Baseline Design (02/22/12 @ 09:05)
2. Hollis Primary School- Exterior Light Replacement (02/22/12 @ 08:40

Gas Consumption (Btu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	629.6	545.3	461.5	273.8	94.8	16.1	1.4	5.4	21.3	150.9	387.8	532.3	3,120.1
Run 2.	629.6	545.3	461.5	273.8	94.8	16.1	1.4	5.4	21.3	150.9	387.8	532.3	3,120.1
Run 3.													
Run 4.													
Run 5.													

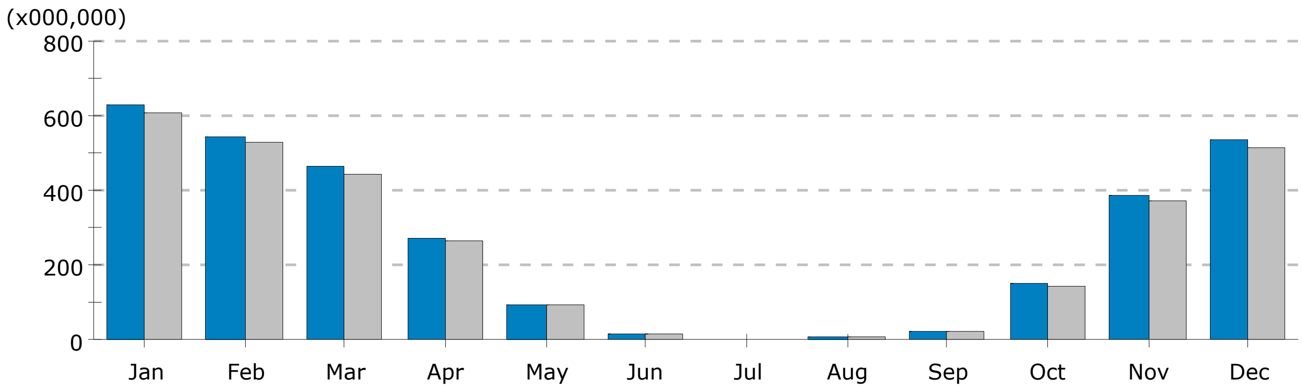
Electric Consumption (kWh)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	22.35	21.27	23.74	21.83	23.72	18.11	11.94	15.16	22.06	22.58	22.57	18.30	243.61
Run 2.	22.35	21.27	23.74	21.83	23.71	18.11	11.94	15.16	22.05	22.58	22.57	18.30	243.60
Run 3.													
Run 4.													
Run 5.													

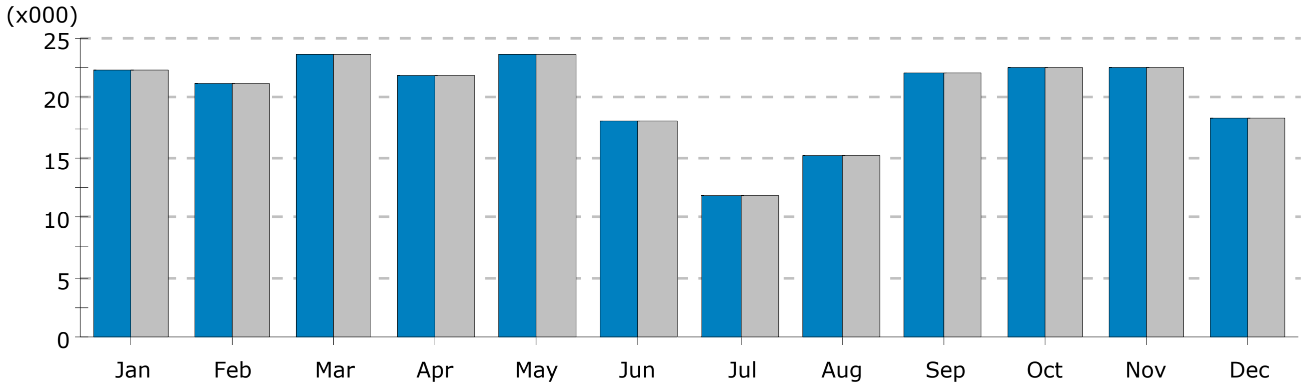
1. Hollis Primary School baseline - Baseline Design (02/24/12 @ 13:17)
2. Hollis Primary School baseline - Roof Insulation (02/24/12 @ 13:17)

Gas Consumption (Btu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	629.6	545.3	461.5	273.8	94.8	16.1	1.4	5.4	21.3	150.9	387.8	532.3	3,120.1
Run 2.	609.3	527.8	444.7	261.1	89.7	14.2	1.2	4.9	19.5	142.1	371.2	511.9	2,997.5
Run 3.													
Run 4.													
Run 5.													

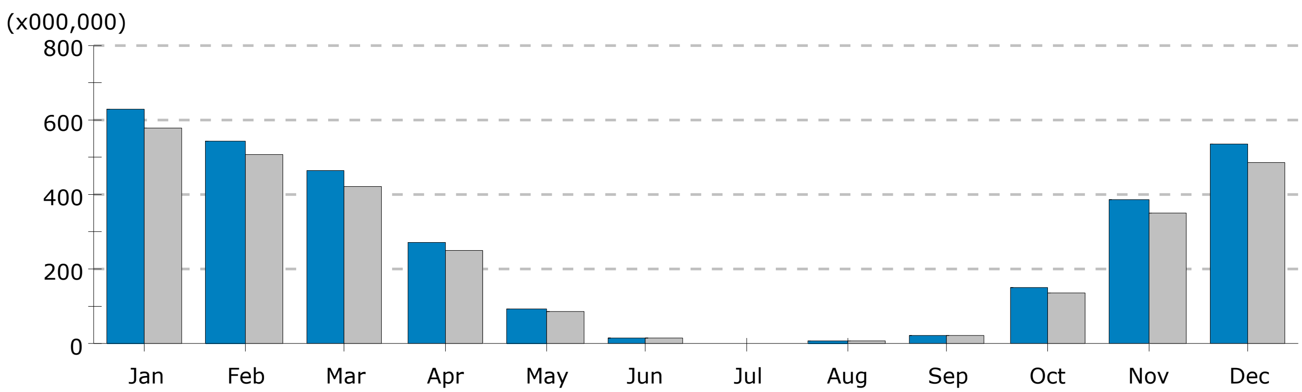
Electric Consumption (kWh)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	22.35	21.27	23.74	21.83	23.72	18.11	11.94	15.16	22.06	22.58	22.57	18.30	243.61
Run 2.	22.31	21.23	23.70	21.80	23.69	18.10	11.91	15.15	22.06	22.56	22.53	18.27	243.32
Run 3.													
Run 4.													
Run 5.													

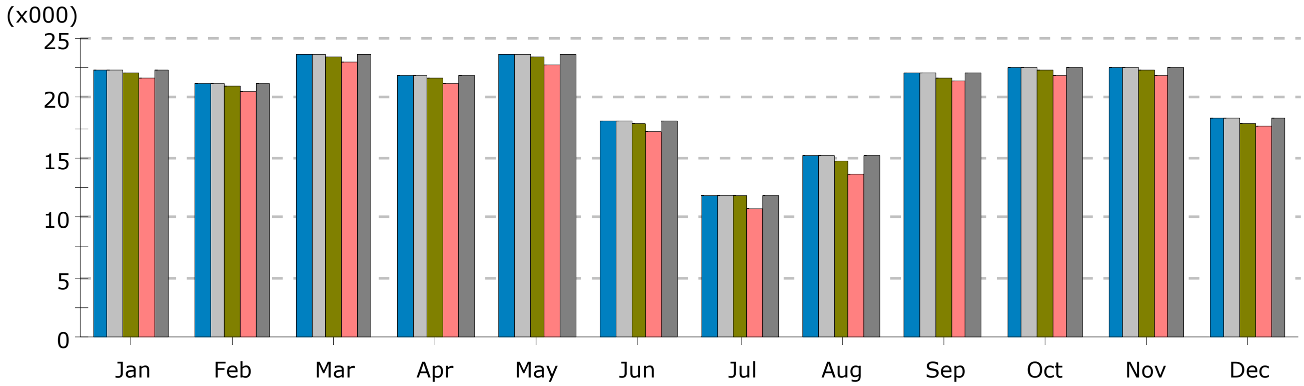
1. Hollis Primary School baseline - Baseline Design (02/22/12 @ 09:05)
2. Hollis Primary School Insulate Walls (02/22/12 @ 09:06)

Gas Consumption (Btu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	629.6	545.3	461.5	273.8	94.8	16.1	1.4	5.4	21.3	150.9	387.8	532.3	3,120.1
Run 2.	580.1	504.4	423.3	248.0	86.2	15.0	1.4	5.1	19.5	135.3	352.6	485.6	2,856.5
Run 3.													
Run 4.													
Run 5.													

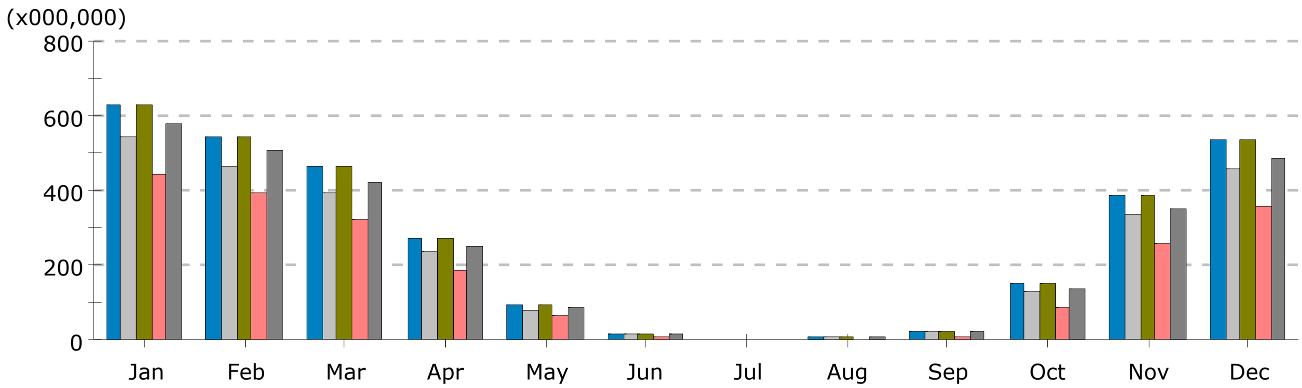
Electric Consumption (kWh)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	22.35	21.27	23.74	21.83	23.72	18.11	11.94	15.16	22.06	22.58	22.57	18.30	243.61
Run 2.	22.35	21.27	23.74	21.83	23.72	18.11	11.94	15.16	22.06	22.58	22.57	18.30	243.61
Run 3.	22.01	21.01	23.45	21.54	23.52	17.92	11.74	14.83	21.74	22.25	22.24	17.96	240.19
Run 4.	21.65	20.57	23.05	21.13	22.75	17.25	10.78	13.71	21.33	21.89	21.83	17.73	233.66
Run 5.	22.31	21.23	23.70	21.80	23.69	18.10	11.91	15.15	22.06	22.56	22.53	18.27	243.32

1. Hollis Primary School baseline - Baseline Design (02/22/12 @ 09:05)
2. Hollis Primary School Boiler Replacement (02/22/12 @ 09:05)
3. Hollis Primary School Exterior Lights (02/22/12 @ 08:40)
4. Hollis Primary School Roof Insulation (02/22/12 @ 09:05)
5. Hollis Primary School Insulate Walls (02/22/12 @ 09:06)

Gas Consumption (Btu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	629.6	545.3	461.5	273.8	94.8	16.1	1.4	5.4	21.3	150.9	387.8	532.3	3,120.1
Run 2.	539.7	467.5	395.7	234.8	81.4	13.9	1.3	4.7	18.4	129.5	332.6	456.4	2,675.8
Run 3.	629.6	545.3	461.5	273.8	94.8	16.1	1.4	5.4	21.3	150.9	387.8	532.3	3,120.1
Run 4.	445.0	392.3	324.7	184.2	63.0	9.9	1.2	2.2	9.7	86.7	257.8	360.6	2,137.3
Run 5.	580.1	504.4	423.3	248.0	86.2	15.0	1.4	5.1	19.5	135.3	352.6	485.6	2,856.5

APPENDIX J

Cost Estimates

BUDGETARY COST ESTIMATE

Facility: Hollis Primary School

Date: 2/24/2012

EEM	Design + Engineering	Installed Cost				Construction Management	Contingency (15%)	Total Investment
		Pricing Unit	Price	Qty	Subtotal			
Replace walk-in freezer condenser units with high efficiency units with economizers.	$ 630	EA	$ 1,830	2	$ 3,660	$ 366	$ 698	$ 5,354
Replace exterior HPS wallpack fixtures with LED units (7).	$ -	EA	$ 650	7	$ 4,550	$ 455	$ 751	$ 5,756
Replace the packaged rooftop AHU servicing the administration offices (SEER=9) with a modern efficient unit rated with a SEER of 18 or higher.	$ 350	SF	$ 4,370	1	$ 4,370	$ 437	$ 774	$ 5,931
Replace built-up roof on 1967 addition w/ white IB PVC system with R-value of +50 (4” of foil-faced polyisocyanurate rigid insulation board).	$ 2,500	SF	$ 11.10	6,300	$ 69,930	$ 6,993	$ 11,913	$ 91,336
Replace all electrical transformers older than 15 years with high efficiency units.	$ 850	EA	$ 7,300	2	$ 14,600	$ 1,460	$ 2,537	$ 19,447
Consolidate existing oil-fired boiler units with two (2) new high efficiency units. Re-line flue. Connect the new system into the existing DDC system. Install VFD controls on main circulation pumps.	$ 10,800	EA	$ 105,000	1	$ 105,000	$ 10,500	$ 18,945	$ 145,245
Add 3” foil-faced Add 4” foil-faced polyisocyanurate rigid insulation board to exterior wall sections to obtain R-value of +20 (*recommend completing as part of building renovation*).	$ 13,500	SF	$ 8.65	13,410	$ 115,997	$ 11,600	$ 21,164	$ 162,261