Facility Audit Report
Town of Hollis Transfer Station

FINAL

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A. EXECUTIVE SUMMARY

Program Introduction

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

Figure 1: Hollis Transfer Station Sign

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

Procedure

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

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

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

On January 3rd, 2012, AEC personnel completed site surveys at the Hollis Transfer Station 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 transfer station function as a composite system.

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

Summary of Findings

The following significant findings are presented for the Hollis Transfer Station facility:

1. Heating of the main building is provided by a waste oil furnace fueled with household waste oils.
2. Several trash compaction units account for the majority of electric consumption at the facility.
3. The facility is used by many Townspeople providing opportunities for public awareness initiatives.

Notable Observations

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

- The building for employees uses a limited amount of electricity and heat is provided by recycled waste oil so no fuel is purchased.
- The NH Department of Environmental Services (NHDES) regulates air emissions from waste oil heating units (Env-A 1400). Based on the operating characteristics of the waste oil furnace at the Transfer Station, it appears to be exempt from the permit requirements pursuant to Env-A 1402.02(g) (this should be verified by the Town).
- The facility is visited by most residents on a weekly basis. The Transfer Station would be an ideal location to set up an information booth to display Town-wide energy improvements, retrofits and renewable technologies.
- The facility operates three (3) days a week and power consumption peaks during the winter because of holiday seasonal trash.
- Most of the electric consumption is used for three (3) compaction trailers with 30 horsepower (hp) motor in each and four (4) compactors with a 15 hp motor in each.

- There are two electric service meters at the facility (single-phase and three-phase).

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. Because heat fuel (waste oil) is provided at no cost, a current market value was assumed for the price of fuel oil. (NHOEP $3.977 March 29th, 2012.) 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 I.

Table 1: Energy Efficiency Measures Summary

EEM No.	EEM Description	Capital Cost	Annual Cost Savings	Payback (yrs.)	SIR
T1-1	Stagger operation of the compactor units by at least 30-minutes, OR, install a battery supply system to avoid peak electric grid demand charges.	$0	$800	0	-
T1-2	Replace refrigerator with a compact, ENERGY STAR® unit.	$300	$234	1.3	7.8
T1-3	Replace weather stripping on doorways and air seal all penetrations.	$65	$23	2.8	3.5
T1-4	Install a programmable thermostat on the waste oil burner and schedule for occupancy hours.	$75	$38	1.9	5.1
T1-5	Substitute waste motor oil in the waste oil furnace with B100 bio-fuel. (CO_2 reduction).	$0	$0	-	-
T2-1	Install solar powered information board with battery backup to demonstrate renewable technology and saving obtained throughout the Town.	$2,400	-	-	-
T3-1	Replace existing trash compactor with super energy efficient unit.	$25,000	$350	-	-
T3-2	Replace CFL yard light fixtures with brighter LED units (12). Install small deep cycle battery bank and solar panels to power all yard lighting off grid.	$9,000	$200	-	-
T3-3	Replace the waste oil furnace with a pellet-fired furnace with a 7-day programmable thermostat.	$2,622	$0	-	-

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
Biomass Heating	86%
Ground Photovoltaic	82%
Roof Photovoltaic	74%
Wind Turbine Generator	72%
Solar DHW	69%
Geothermal Heating/Cooling	65%
Combined Heat & Power	63%
Solar Thermal	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
Floor Area 1	NA	10	2.2
Wall Type 1	13.0 +3.8 ci	13.0 +3.8 ci	21.6
Roof	38	38	31.8

Master Planning Considerations

The Hollis Transfer Station facility is used by many Town residents. The current layout of the facility appears to meet the needs of the residents. Although there are few opportunities for significantly reducing energy consumption at the facility, it provides an excellent venue for presenting information and raising awareness about energy efficiency and renewable energy technologies. Such information may include energy usage and carbon emissions at Town facilities, current waste fees, bulk reimbursements for recycled materials, and locally applied renewable energy technologies.

A solar powered billboard could be installed in the center of the facility to display information entered from a remote internet connection. Since recycling is encouraged but not required at the transfer station, the billboard could also display the amount of recycled material and overall reduction in the Town's carbon footprint. Other options including solar powered yard lighting and a small vertical axis wind turbine (VAWT) could be installed on the site with live production monitoring.

These initiatives would attract more interest in recycling, energy conservation, and renewable energy technologies.

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 systems characteristics and integration.
- *Control*: The effectiveness in which the existing building systems controls are utilized.

Desktop Data Review

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

Facility Site Review

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

Data Measurements

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

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

Data Gap Review

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

Energy Modeling and Conservation Measures

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

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

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

Cost Estimating and Payback

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

C. FACILITY INFORMATION / EXISTING CONDITIONS

Setting

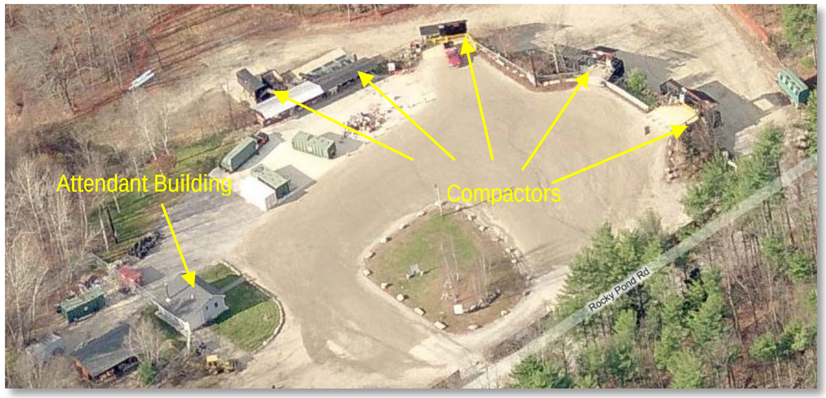


Figure 2: Aerial Photo of Hollis Transfer Station (2011)

The Hollis Transfer Station is located at 10 Rocky Pond Road in Hollis, NH. The grounds are located just north of Proctor Hill Road and approximately one mile northeast of the Town center. There is an attendant building at the south of the property which has one room for kitchen and office space with a single lavatory for employees. A small maintenance garage is attached to serve as storage. The total area of the grounds total 6.53 acres.

History

In 2001, the Town of Hollis purchased the land that is had leased for approximately thirty (30) years. Prior to that time municipal waste was recycled and transported offsite for a landfill. The attendant building was constructed in 2006 by the Hollis Department of Public Works.

Use, Function & Occupancy Schedule

The Transfer Station serves as a location for Hollis residents to dispose of household rubbish. All items are transported offsite to be disposed of or recycled. The facility is open to the public three (3) days a week, for a total of 25 hours. Employees work at the facility outside of these hours to maintain the grounds. The occupancy schedule is listed below.

Table 5: Facility Hours of Operation

Day	Hours of Operation	Total Hours
Monday	Closed	0
Tuesday	0800 – 1700	9
Wednesday	Closed	0
Thursday	1200 – 1900	7
Friday	Closed	0
Saturday	0800 - 1700	9
Sunday	Closed	0
	Total Hours per Week:	25

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 Transfer Station evaluation includes the following:

- New yard lighting fixtures do not provide adequate lighting for employees or patrons.
- Domestic water obtained from the on-site well is very high in mineral content and stains plumbing fixtures.
- The land was previously leased from the private owner until the Town purchased the land in 2001.
- Attendant building equipment and lighting are infrequently used. Exterior lighting is operated only when the grounds are open to the public and are turned off when unoccupied.

Utility Data

Utility data for the Hollis Transfer Station was provided by the Town. Table 6 summarizes the total energy consumption for the two-year period including electric and waste oil usage. Energy consumption and cost for electricity per pay period is shown in Table 7 and Figure 3. There are two separate meters at the facility: one meter supplies single phase service to most of the grounds and the second provided three-phase serves for the large compactor motors. The regional electric utility supplier is Public Service Company of New Hampshire (PSNH). Heating fuel is provided by waste oil which is collected onsite and total consumption is not monitored.

Table 6: Annual Energy Consumption (2010 – 2011)

Energy	Period	Consumption	Units	Cost
Electric	January 2010 – December 2010	9,260	Kilowatt hours	$3,413
Heating Fuel	January 2010 – December 2010	89(1)	Gallons	$0
			Total Annual Energy Cost	$3,413
Electric	January 2011 – December 2011	10,080	Kilowatt hours	$3,676
Heating Fuel	January 2011 – December 2011	89(1)	Gallons	$0
			Total Annual Energy Cost	$3,676

(1) Consumption estimated through eQUEST® based on building size, use and fuel source and equipment.

Over the twelve (12) month period (2010), January was the peak demand month, consuming 1,080 kWh of electricity. For the second 12 month period (2011), January and February were the peak demand months, consuming 1,300 kWh of electricity each. The electrical consumption follows a general trend of peaking in the winter months and at its lowest in the summer months. This is likely attributed to: increased lighting in the winter months; electrical power to the waste oil burner which runs most frequently in the coldest months; increased trash during the holiday season resulting in increased use of the compactors and heating (electric) of compaction hydraulic fluids.

Table 7: Total Monthly Electric Consumption (2010 – 2011)

Month	Year	Electric Consumption (kWh)	Electric Cost
Jan	2010	1,080	$440
Feb	2010	980	$442
Mar	2010	900	$316
Apr	2010	640	$187
May	2010	620	$203
June	2010	600	$188
July	2010	640	$197
Aug	2010	700	$227
Sep	2010	640	$265
Oct	2010	660	$337
Nov	2010	800	$248
Dec	2010	1,000	$363
Totals:	*2010*	*9,260*	*$3,413*
Jan	2011	1,300	$546
Feb	2011	1,300	$523
Mar	2011	1,000	$423
Apr	2011	960	$293
May	2011	720	$258
June	2011	640	$212
July	2011	700	$224
Aug	2011	680	$199
Sep	2011	560	$213
Oct	2011	600	$199
Nov	2011	760	$301
Dec	2011	860	$286
Totals:	*2011*	*10,080*	*$3,676*
Totals:	*'10 - '11*	*19,340*	*$7,089*

Average annual electric usage for the Hollis Transfer Station based on the most recent data provided by Town (January 2010 through December 2011) is 9,670 kWh at an average cost of $3,545. Based on the building size and function, this usage is as expected.

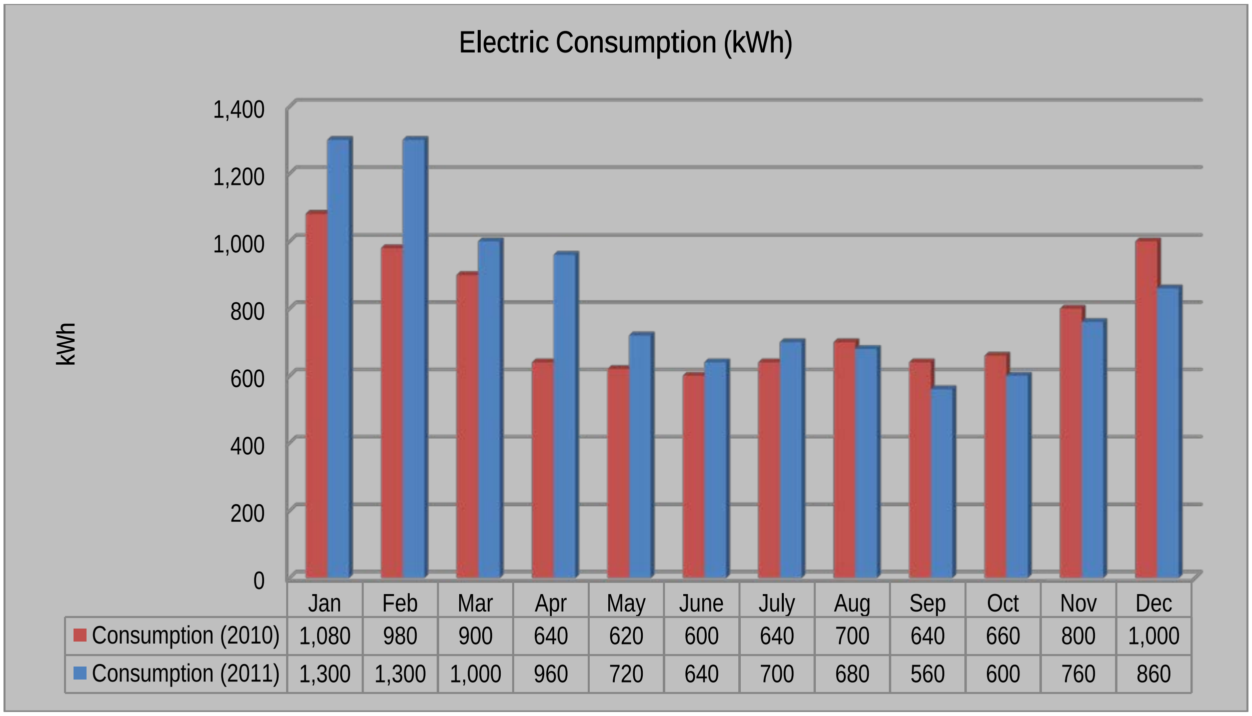


Figure 3: Electric Consumption (2010 – 2011)

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 categories including lighting, plug loads, and mechanical equipment. Mechanical equipment includes all hard-wired, permanently installed equipment including ventilation, exhaust, heating, cooling, pumps, etc. These values were determined using observations from the field audit and typical energy consumption data for appliances observed at the facility. 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)	% of Total Consumption	Annual Cost
Mechanical Equipment	8,299	82%	$3,029
Plug Loads	1,372	14%	$501
Lighting Fixtures	379	4%	$138
Totals:	10,049	100%	$3,668

Electrical consumption is largely consumed by mechanical equipment (trash compactors), at a predicted annual consumption of 8,299 kWh/yr. Plug loads are predicted to consume a moderate amount of electricity at an estimated 1,372 kWh/yr. Lighting fixtures are seldom used and consume the least amount of electricity at an estimated 379 kWh/yr. A lighting upgrade project was completed in 2011 which included retrofitting fixtures with more efficient units. Measures can still be taken to further reduce the cost to operate lighting fixtures including controls.

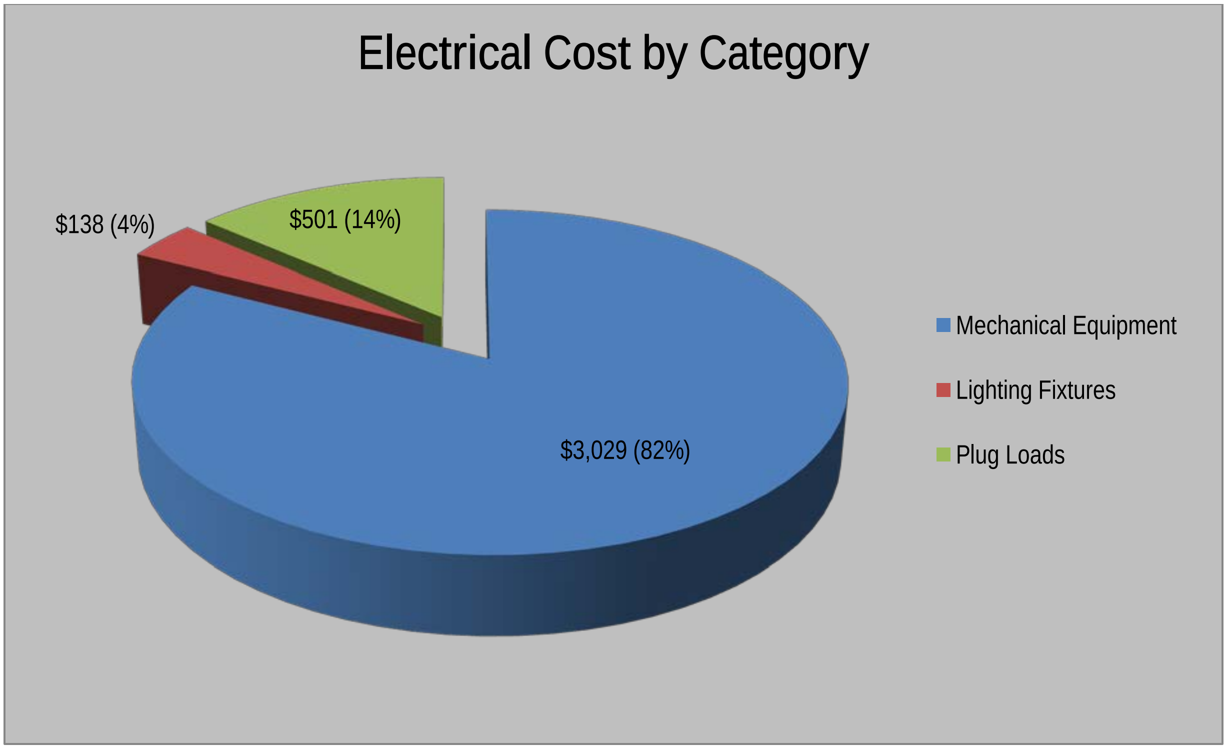


Figure 4: Hollis Transfer Station Electrical Cost by Category (2011)

Mechanical consumption is estimated at 83% of the annual consumption at a cost of $3,029 (2011) which is largely attributed to the compactor motors. The annual electric cost plug loads are estimated at $501 or 14%. Lighting fixtures consume the least amount of energy at 4% and a cost of $138.

Table 9: Monthly Heating Fuel Consumption (typ.)

Month	Oil Consumed (Est. Gallons)	Cost if Purchased
January	18	$71
February	15	$60
March	14	$56
April	10	$40
May	3	$12
June	0	-
July	0	-
August	0	-
September	0	-
October	3	$12
November	10	$40
December	16	$64
Totals:	89	$535

Heating fuel for the Hollis Transfer Station is provided by waste oil resident's dispose at the transfer station (Table 9, Figure 5). The total consumed volume of oil is not recorded therefore actual fuel usage data is not available. Through the building modeling software eQUEST® fuel usage is estimated based on all attributing factors to heating and is estimated to use 89 gallons annually at no cost (typical). For the purposed of this report it was assumed that fuel oil was purchased. In the event the Transfer Station does not generate enough waste oil, purchased heating fuel (No. 2 oil) can be used.

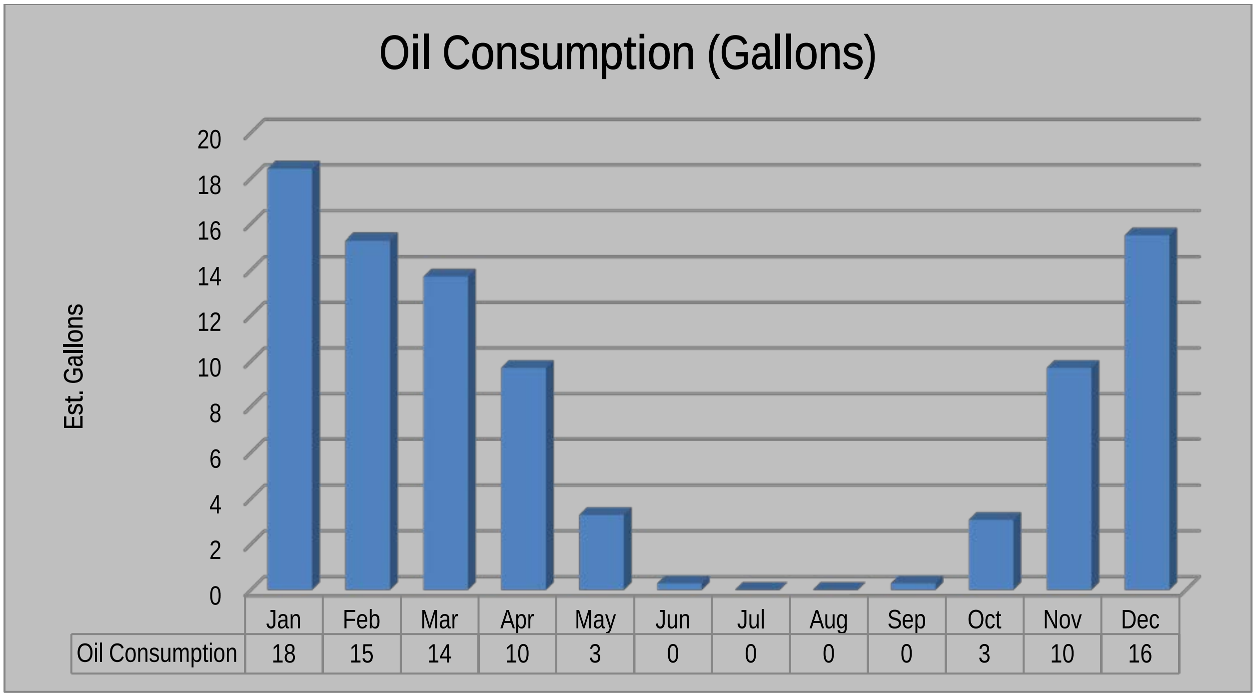


Figure 5: Fuel Oil Consumption (typ.)

Considering the building systems including the envelope integrity (insulation and air leakage), mechanical equipment, and use of the facility, the heating fuel usage is within the expected range.

D. FACILITY SYSTEMS

Building Envelope

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

Floor Systems

The building is built on a slab on grade concrete pad. 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

Floor Area 1 (Vinyl Covering)				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Concrete slab	4.0	0.3	1.0	0.3
Carpet	NA	1.2	1.0	1.2
Interior air film	NA	0.7	NA	0.7
			Installed Assembly	2.2
			2009 IECC Requirement:	NR

Figure 6: Exterior of Building

Wall Systems

The building is a single story structure framed in 2x6 timber members. Wall cavities are insulated with fiberglass batt insulation. The exterior is clad in cedar clapboard siding and the interior is finished in gypsum board.

Table 11: Wall Assembly Insulation Values

Wall Type 1				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Cedar Clapboard siding	½	0.8	0.9	0.7
Plywood Sheathing	½	0.6	1.0	0.6
Cavity Wall Insulation	6	21.0	0.9	18.9
Gypsum Board	5/8	0.5	0.9	0.5
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	21.6
			2009 IECC Requirement:	13+3.8ci
			Code Compliant?	NO

Ceiling Systems

Ceilings throughout the building are covered in gypsum board and insulated with fiberglass batt insulation.

Table 12: Ceiling Assembly Insulation Values

Roof				
Material	Thickness (in.)	R-value	Integrity Factor	Installed R-value
Exterior Air Film	NA	0.2	NA	0.2
Cavity Wall Insulation	12.0	38.0	0.8	30.4
Gypsum Board	5/8	0.5	0.9	0.5
Interior Air Film	NA	0.7	NA	0.7
			Installed Assembly:	31.8
			2009 IECC Requirement:	38.0
			Code Compliant?	NO

Roofing Systems

The attendant building is cover in asphalt shingles that appear to be in good condition. The roof in timber framed and coved in plywood.

Fenestration Systems

Fenestration systems on the Transfer Station building include operable double hung, double pane windows, and half-glazed entry doors. 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 remaining windows or doors therefore compliance with IECC standards for commercial buildings located in Climate Zone 5 cannot be established.

Figure 7: Window (typ.)

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

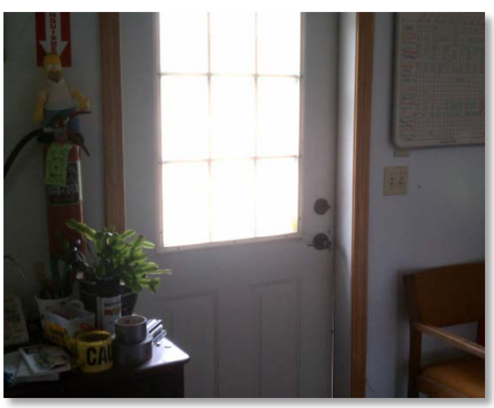


Figure 8: Exterior Door

Doors

The door units in Transfer Station building include fiberglass half-glazed entry doors and a metal framed overhead door for the garage. Seals on door jambs, partings, and thresholds are incomplete allowing air leakage. Recommendations include exterior and interior inspection, weather stripping and re-caulking around doors as needed.

Air Sealing

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

Air sealing of all door units can be improved with commercial weather-stripping. All door and window units should be regularly inspected (every 2 to 3 years) to ensure proper operation, identify faulty seals, and to identify any deteriorated caulking requiring replacement. Other air sealing recommendations include inspecting all exhaust and ventilation ducts to determine if they have a positive pressure actuated damper. Dampers are recommended on all exterior ducting to prevent passive air leakage.

Electrical Systems

Supply & Distribution

Grid electricity is supplied to Transfer Station by two meters. The Attendant building and most yard lighting is serviced by a single phase meter located on the west side of the building. The large trash compactors and two (2) pole lights are connected to a three-phase service meter located at the north end of the yard. All power is supplied to the grounds by PSNH via overhead transmission lines.

Lighting Systems

As presented in Table 13, there are three (3) types of lighting fixtures and lamp types at the Transfer Station. Lighting fixtures in the building consist of T8 fixtures and a standup lamp with a compact fluorescent light (CFL) bulb. Exterior fixtures include CFL, high performance T8 and metal halide (MH) fixtures.

Table 13: Lighting Fixture Schedule

Fixture Lamp Type	Location(s)	Control	No. Lamps	Watts	Qty.	Total Watts
T8	Attendant Building, Exterior	Switch	1-2	28	12	560
CFL	Attendant Building, Exterior	Switch	1	17, 42	13	521
MH	Exterior	Switch	1	70	1	70
				Totals:	26	1,151

Table 14 presents the predicted energy consumption by lighting fixture type. Lighting fixtures are seldom used and account for an estimated 379 kWh of electricity per year. The CFL fixtures are estimated to consume the most amount of electricity of the fixtures at an estimated 271 kWh/yr which is mostly attributed to exterior lighting fixtures. High performance T8 fixtures are located on the interior and exterior but are seldom used and account for an estimated 71 kWh per year. The MH fixture is a single fixture and consumes the least amount of electricity for lighting loads at 9%.

Figure 9: Exterior CFL Light

Table 14: Lighting Fixture Energy Consumption

Fixture Lamp Type	Location(s)	Est. Usage (KWH/yr)	% of Total
CFL	Main Building, Exterior	271	72%
T8	Main Building, Exterior	71	19%
MH	Exterior	36	9%
	Totals:	379	100%

Lighting density measurements in Transfer Station building were obtained to establish if building illumination is consistent with the *Illuminating Engineer Society of North America* (IESNA) standards for the prescribed use. These measurements were obtained during normal operating conditions on January 3rd, 2012 at 1645. Table 15 presents the lighting density measurement obtained in units of foot-candles (FCs).

IESNA Standards

A lighting density was recorded in the Attendant Building. The lighting density was within the recommended levels and because of the limited lighting fixtures, no energy efficiency measures are recommended at this time. The lighting density data is included in Appendix B. While overhead lighting is installed, the occupants generally keep these lights off and instead use a single floor lamp for their source of lighting.

Table 15: Illumination Densities

Location	Lighting Density (FC)	Recommended Density (FC) (1)
Attendant Building	42	40

(1) Based upon IESNA standards and AEC recommendations.

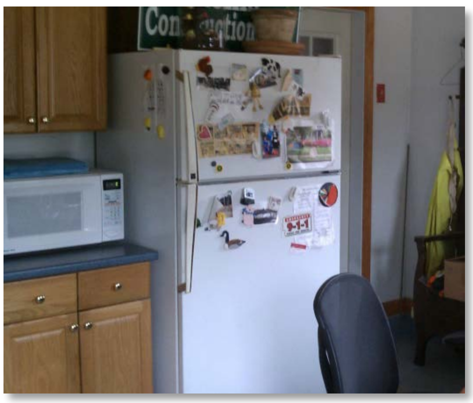


Figure 10: Old Refrigerator

Plug Loads

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

Based on this analysis, the total annual plug load is 1,363 kWh/yr. This accounts for 14% of annual consumption for the facility. Appliances account for most of the plug load consumption at an estimated 1,349 kWh/yr or 99% of plug load consumption. Office equipment, computers and electronics consume the other 1%. The high appliance load is mostly attributed to an aging refrigerator which is estimated to consume 1,270 kWh/yr. It is recommended this be replaced with a new ENERGY STAR® rated compact unit.

Table 16: Plug Load Energy Consumption

Category	Location(s)	Est. Usage (kWh/year)	% of Total
Appliances	Throughout	1,349	99%
Office Equipment, Computers, Electronics	Throughout	14	1%
	Subtotals	1,363	100%

Motors

Electrical motors are used for the compactors. There are 15-hp motors installed in the four (4) roll off compactors and 30-hp motors installed in the three (3) trailer compactors.

Emergency Power Systems

There is no emergency power system at the Transfer Station

Plumbing Systems

Domestic Water Supply

Domestic water supply for the Transfer Station is provided by an onsite well. Water demand is limited to lavatory usage.

Domestic Water Treatment Systems

There is no domestic water treatment system at the Hollis Transfer Station. Occupants stated that the water is hard (high mineral content) and stains plumbing fixtures (iron).

Domestic Hot Water Systems

Domestic hot water (DHW) is heated by a 10 gallon electric water heater. Water usage is expected to be limited.

Hydronic Systems

There is no hydronic system at the Hollis Transfer Station.

Mechanical Systems

Heating Systems

Heat is provided to the Attendant building by a small waste oil furnace. All waste fuel oil is supplied by residents recycling used motor oil. If there is not enough supply from the Transfer Station then No. 2 fuel oil purchased from a local supplier is used to fuel the furnace. Currently the volume of waste oil is not metered and actual consumption cannot be determined.

Figure 11: Waste Oil Furnace

Based on the air emissions, waste oil furnace units are regulated by NHDES under statute Env-A 1400. Units that meet the following criteria are exempt from formal compliance with the rule.

- *The sum of all units are rated at 500,000 Btu per hour or less heat input.*
- *The sums of all units are rated at 3.6 gallons per hour or less of fuel use.*
- *All units burn 8,640 gallons per year or less of waste oil.*
- *Each exhaust stack is 8 inches or less inside diameter.*
- *Each exhaust stack outlet is 20 feet or more above the ground.*
- *Each exhaust stack is vertical.*
- *All units are operated and maintained in accordance with manufacturer's specifications.*

Additional compliance requirements as stated by NHDES: *"If the facility operates recycled oil burners meeting all of the above criteria, NHDES has determined that its emissions are in compliance with Env-A 1400 and the unit would be exempt. However, records such as annual fuel use, number of days of operation, and maintenance records must be kept on-site to document that the above criteria are being met. Owners/operators of recycled oil burners that do not meet all of the criteria listed above should contact NHDES and conduct a source specific compliance determination as soon as possible in order to verify the compliance status of the installation."*

Table 17: Heating Supply Systems

Heating Unit	Unit Description	Area(s) Served	Output (MBH)	Age (yrs.)	AFUE (new)	Control Type
Waste Oil Furnace	Clean-burn®	Attendant Building	100	6	80%	Thermostat

Cooling Systems

Cooling is provided to the Attended building by one (1) through window air conditioning unit. The unit was not installed during the field audit, however, it is recommended that if the unit is not an ENERGY STAR® rated unit that it be replaced with one.

Pumps

There is one (1) domestic well pump located at the transfer station. Water usage is expected to be limited to lavatory usage.

Controls Systems

Heating is controlled by one (1) non programmable thermostat in the building. Since heating fuel is provided to the Town at no cost is recommend that this be replaced by a programmable unit only to reduce emissions.

Refrigeration

There is no commercial refrigeration at the Transfer Station.

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 D presents the detailed inventory and the associated energy consumption for each piece of mechanical equipment. Total mechanical consumption per year is estimated to be 8,299 kWh per year compared to 1,363 kWh for plug loads and 379 kWh for light fixture loads.

Table 18: Mechanical Equipment Energy Consumption

Equipment Type	Qty.	Item Manufacturer(s)	Consumption (kWh/yr)	% of Total
Roll off Compactor	4	Marathon®	4,088	49%
Trailer Compactor	3	NA	3,721	45%
DHW Heater	1	NA	400	5%
Waste Oil Burner	1	Clean Burn®	90	1%
		Totals:	8,299	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 continuously at a low rate during occupied periods. Spaces equipped with exhaust fans are commonly over-ventilated resulting in increased energy consumption. All exhaust controls and rates should be consistent with ASHRAE Standard 62.1. Fan ducting should have pressure actuated dampers to restrict air flow and heat loss when the units are not operating.

There are no exhaust ventilation systems in the Attendant Building.

Exchange Air Ventilation Systems

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

There is no ventilation equipment installed in the Attendant Building.

Energy Recovery Ventilation Systems

There are no energy recovery ventilation systems installed in the Attendant Building.

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 Transfer Station was measured on January 3rd, 2011 at 1645. The building was normally occupied when the measurements were obtained. One (1) IAQ measurements were obtained at a representative location in the building. Measurements revealed the IAQ of the building is acceptable. Appendix B presents all of the measurements. Results of the IAQ measurements are summarized as follows:

- Temperature in the building was 62°F.
- Relative humidity was 31%.
- CO_2 concentration was 450 ppm.

Secondary Observations

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

Structural Systems

There were no structural system issues noted within the Transfer Station.

Roofing Systems

There were no roofing system issues observed at the Transfer Station.

Building Code

No building code were observed at the Transfer Station

Life Safety Code

No life safety codes were observed during the field audit.

ADA Accessibility

The Transfer Station facility complies with current ADA standards. If a resident is not able to move large objects an attendant is available to assist them.

Hazardous Building Materials

No hazardous building materials are installed in the buildings. Waste stations are clearly labeled to maintain separation of materials that contain potentially hazardous materials.

E. BUILDING ENERGY MODELING

Source Data

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

Model Calibration

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

Summary of Model Results

The Transfer Station facility was modeled using eQUEST© computer simulation program. Developing an accurate baseline model of the building presented certain challenges including accounting for the high electrical usage and the high heating fuel usage.

The resulting energy savings and costs for these measures are presented in Section G (Recommendations) and the model output is provided in Appendix H. Tables 19 and 20 present a summary of the model predicted annual energy usage by category for electrical and heating fuel. The actual electrical consumption of 10,080 kWh/yr is slightly lower than the model prediction of 10,090 kWh/yr.

Table 19: Model Predicted Baseline Electrical Usage

Electric Category	Annual Usage (kWh)
Space Cooling	50
Water Heating	400
Vent. Fans	90
Pumps & Aux.	7,480
Exterior Lighting	340
Plug Loads	1,320
Area Lights	430
Total Predicted:	10,090
Total Actual:	10,080

Predicted heating fuel consumption for the building is 12.49 MBtu. No consumption data was available for the waste heating oil used to fuel the furnace.

Table 20: Model Predicted Heating Fuel Usage

Electric Category	Annual Usage (MBtu)
Space Heating	12.49
Total Predicted:	12.49

The energy modeling results are depicted graphically by a monthly bar graph (Figure 16) 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 "Pumps & Aux." for the compactor motors consumes a variable amount of electricity depending on the time of year.

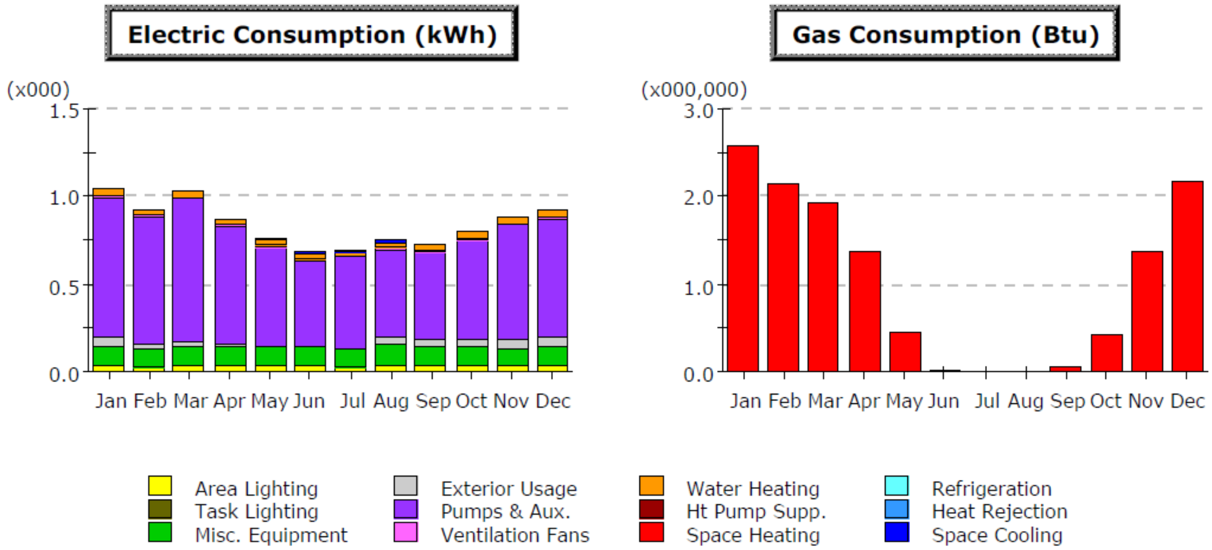


Figure 12: Monthly Energy Use by Category (Baseline)

F. FACILITY BENCHMARKING

ENERGY STAR for Commercial Buildings

The Transfer Station 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 Transfer Station is defined as an "Other" use building and cannot be certified in the Commercial Building ENERGY STAR® program do to its use category. Utility data for electric and heating fuel for the preceding twelve (12) months was input into the benchmarking program. Table 21 presents the annual energy use (through December 2011) and Table 22 presents a summary of the Statement of Energy Performance (SEP) benchmarking results. The SEP is presented in Appendix F.

Table 21: Annual Energy Consumption

Energy	Site Usage (kBtu)
Electric – Grid	35,262
Total Energy:	35,262

Table 22: SEP Benchmarking Summary

Facility	Site EUI (kBtu/ft^2/yr)	Source EUI (kBtu/ft^2/yr)
Hollis Transfer Station	10	32
National Median (Other)	70	127
	% Difference:	-75%
	Portfolio Manager Score:	NA

Compared to the "other" type buildings that have entered data into Portfolio Manager to date, the Transfer Station facility energy use is considerably lower than the national average. The source EUI for the Transfer Station is 32 kBtu/ft^2/yr while the national average is 127 kBtu/ft^2/yr, meaning it uses 75% less energy than the average "other" use building.

G. RECOMMENDATIONS

Energy Conservation Measures

Based on the observations and measurements of the Transfer Station, several energy conservation measures (EEMs) are proposed for consideration (Tables 23 to 25). These recommendations are grouped into three tiers based on the cost and effort required to implement the EEM. EEMs are ranked within each tier based on the capital cost for implementation versus the net estimated energy cost savings.

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

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

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

Energy cost savings are based cost of electricity paid at the Transfer Station at $0.36 per kWh (PSNH) and the current price of oil of $3.97 per gallon (NHOEP March 29, 2012). The unusually high electric rate is presumably due to demand charges. Because the compacters are operated during typical demand periods and the compacters represent over 80% of electric consumption, the mean monthly rate is high.

Tier I Energy Efficiency Measures

Tier I EEMs are measures that can be quickly implemented with little effort for zero or little cost (Table 23). They include routine maintenance items that can often be completed by facility maintenance personnel, and changes to occupant behavior or building operation. Four (4) Tier I EEMs are recommended.

Table 23: Tier I Energy Efficiency Measures

EEM No.	EEM Description	Investment	Annual Cost Savings	Payback (yrs.)	SIR
T1-1	Stagger operation of the compactor units by at least 30-minutes, OR, install a battery supply system to avoid peak electric grid demand charges.	$0	$800	0	-
T1-2	Replace refrigerator with a compact, ENERGY STAR® unit.	$300	$234	1.3	7.8
T1-3	Replace weather stripping on doorways and air seal all penetrations.	$65	$23	2.8	3.5
T1-4	Install a programmable thermostat on the waste oil burner and schedule for occupancy hours.	$75	$38	1.9	5.1
T1-5	Substitute waste motor oil in the waste oil furnace with B100 bio-fuel. (CO_2 reduction).	$0	$0	-	-

Based on the electric charges and usage provided by the Town, the facility incurs significant peak demand charges. This is presumably a result of compactors operating during peak demand periods. By staggering the operation of the units, or installing a battery supply system, the demand charges could be substantially reduced. Other recommended Tier I EEMs include reducing the plug load replacing the dated refrigerator with a compact sized ENERGY STAR® rated model. Weather-stripping on doors was observed to be poor repairing the weather stripping is estimated to save $23 annually. Installing a programmable thermostat would decrease heating loads and decrease excess carbon emissions. CO_2 emissions can be reduced by using B100 bio-fuel instead of waste motor oil and would have a zero net cost if the building was paying for heating fuel.

Figure 13: Solar Powered Information Board

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. One (1) recommended Tier II EEMs are presented in Table 24.

Table 24: Tier II Energy Efficiency Measures

EEM No.	EEM Description	Investment	Annual Cost Savings	Payback (yrs.)	SIR
T2-1	Install solar powered information board with battery backup to demonstrate renewable technology and saving obtained throughout the Town.	$2,400	-	-	-

A solar powered information board (Figure 12) would provide residences information about renewable energies and Transfer Station information such as amount of waste going to the landfill verses the amount of waste recycled. The information board could be off-grid with battery backup. Paper consumption would decrease as the information board could be updated electronically.

Tier III Energy Efficiency Measures

EEMs that require large capital expenditure and budgetary planning (one year or greater) are categorized as Tier III measures. Three (3) Tier III EEMs are provided in Table 25 for the Transfer Station facility.

The trash compactors are energy intensive units which consume the bulk of the energy consumed at the facility. Replacing these is a costly measure which would not be economically viable. However when these units fail and are in need of replacement it would be a good time to implement an energy efficient model. The cost difference between a new energy efficient compactor versus a typical compactor is nominal and resulting savings would be realized. The CFL fixtures are already energy efficient units however LED fixtures are more efficient and provide a better light quality. Replacing these fixtures is a costly measure as well however replacing them when they fail and powering them with solar panels would minimize the overall expenditure and provide users with better lighting. Air emissions from the waste oil furnace are an air quality concern. Replacing the unit with a pellet-fired furnace will not provide an annual cost savings but it will reduce harmful emissions and provide a renewable source of heating fuel.

Figure 14: Solar Powered Exterior Pole Light

Table 25: Tier III Energy Efficiency Measures

EEM No.	EEM Description	Capital Cost	Annual Cost Savings	Payback (yrs.)	SIR
T3-1	Replace existing trash compactor with super energy efficient unit.	$25,000	$350	-	-
T3-2	Replace CFL yard light fixtures with brighter LED units (12). Install small deep cycle battery bank and solar panels to power all yard lighting off grid.	$9,000	$200	-	-
T3-3	Replace the waste oil furnace with a pellet-fired furnace with a 7-day programmable thermostat.	$2,622	$0	-	-

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

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

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

EEMs Considered but not Recommended

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

1. A lighting retrofit project was recently completed (2011) and replacing the modern fixtures with higher efficiency units is not cost practical at this time. Other lighting measures as recommended herein should be considered prior to replacing fixtures.
2. Improving envelope insulation in the Attendant Building would not provide a reasonable cost payback.

O&M Considerations

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

Indoor Air Quality Measures

Based upon the measured indoor air quality in the Hollis Transfer Station, adequate ventilation is provided through passive measures. The CO_2 concentration in the Attendant building is 450 ppm.

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 26 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 Transfer Station. Additionally, each renewable energy technology is scored and graded based on technology and facility specific characteristics. Appendix G presents the criteria used to develop the score and grade for each renewable energy technology. A more rigorous engineering evaluation should be completed if the Town is considering implementing any renewable energy system.

Table 26: Renewable Energy Considerations

Renewable Energy System	System Description & Site Feasibility
Biomass Heating Systems	System Description: Biomass heating systems include wood chip fueled furnaces and wood pellet fueled furnaces. For several reasons, wood chip systems are generally practical only in large scale applications. Wood pellet systems can be practical in any size. Wood chip systems are maintenance intensive based on the market availability and procurement of woodchip feedstock and variability of woodchip characteristics (specie, size, moisture content, bark content, Btu value) which affect the operating efficiency of the furnace and heating output. They require a constant feed via a hopper and conveyor system and feed rates must vary according to feedstock Btu value and heating demand. For these reasons they typically require full-time maintenance and are practical only in large scale applications. Wood pellet systems are much less maintenance intensive and feedstock availability and consistency is less of an issue. Both systems reduce the dependency on fossil-fuels and feedstock can be harvested locally.
Score: 86%	***Site Feasibility:*** *A conventional pellet boiler unit may be a practical heating system for the building. This requires procurement of pellets, storing pellets, periodic filling the pellet hopper during the heating season, and emptying the ash. A feasibility study is recommended if this is a consideration.*
Ground-Mounted Solar Photovoltaic Systems	System Description: A ground-mounted PV system is composed of the same solar collector panels used for a roof-mount system. The collectors are mounted on a frame support system on the ground verses a roof structure. This is advantageous when roof framing cannot accommodate the increased load of the collector panel and the ease of installation and access for maintenance and repair.
Score: 82%	***Site Feasibility:*** *There is an ample amount of grounds open at the Transfer Station where a medium-sized (10kW-30kW) system could be installed. However, future use of the open space based on increased need would be restricted. This would require a design and permitting process with the local utility for a grid-tie connection. Current utility incentives and renewable energy grants would help offset the capital cost for the system.*
Roof-Mounted Solar Photovoltaic Systems	System Description: Photovoltaic (PV) systems are composed of solar energy collector panels that are electrically connected to DC/AC inverter(s). The inverter(s) then distributes the AC current to the building electrical distribution system. Surplus energy is sent into the utility grid via net metering and reimbursed by the utility at a discounted rate. The capital investment cost for PV systems is high but the technology is becoming increasingly more efficient thereby lowering initial costs.
Score: 74%	***Site Feasibility:*** *Roof space is limited and could accommodate a small-sized (5kW-10kW) system. This would require a design and permitting process with the local utility for a grid-tie connection. Current utility incentives and renewable energy grants would help offset the capital cost for the system. A structural evaluation of the roof framing system would be required to ensure that it could accommodate the increased loading. The existing electrical systems may require upgrade especially if the PV system is interconnected to the grid.*
Wind Turbine Generator	System Description: Wind turbine generators (WTGs) simply convert wind energy into electrical energy via a turbine unit. WTGs may be pole mounted or rooftop mounted however system efficiency improves with increased elevation. Due to cost and site related constraints, WTG technology in New England is only practical for select sites. Constraints include local geographical and manmade features that alter wind direction, turbulence, or velocity. Other technology constraints include local variability of wind patterns and velocity. Additionally, WTGs require permitting (local, state, FAA) and local zoning that may restrict systems due to height limitations, and/or, visual detraction of the local landscape. Presently, WTG technology is not widely used in New England based on the relatively high capital cost compared to the energy savings.
Score: 72%	***Site Feasibility:*** *There is adequate site space to install a small (<5kW) to medium-sized (10kW) pole-mounted wind turbine. However, considering the relatively low mean wind speeds in the region, a WTG unit may not be a cost practical consideration.*
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: 69%	*Site Feasibility:* *Based on the moderate 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.*
Geothermal Heating & Cooling	System Description: Geothermal heating systems utilize solar energy residing in the upper crust of the earth. Cooling is provided by transferring heat from the building to the ground. There are a variety of heating/cooling transfer systems but the most common consists of a deep well and piping loop network. All systems include a compressor and pumps which require electrical energy. Geothermal systems are a proven and accepted technology in the New England region. Site constraints and building HVAC characteristics determine the practicality.
Score: 65%	*Site Feasibility:* *Although there are no existing hydronic systems, an air sourced geothermal system could be installed. There appears to be ample land available for the system to be installed. The heating demand for the building is moderate but a large incentive would be to switch to a renewable energy. Based on the low occupancy and small size of the building it may not be a practical consideration.*
Combined Heat & Power (CHP)	System Description: Combined heat and power (CHP) systems are reliant on non-renewable energies. Systems are composed of a fossil-fuel powered combustion engine and electrical generator. Electrical current is distributed to the building distribution system to reduce reliance on grid supplied electricity. Byproduct thermal energy derived from the combustion engine is recovered and used to heat the building (this is generally considered to be renewable energy). Another benefit of CHP systems is that they provide electrical energy during power outages in buildings that do not have emergency power backup. Larger CHP units require a substantially large fuel supply and if natural gas is not available then a LPG tank must be sited.
Score: 63%	*Site Feasibility:* *Considering the low electric and heating demand for the Transfer Station, a smaller CHP may be practical. However there is no natural gas within the Town and costs associated with the infrastructure development for a large propane tank would be high. CHP systems also require intensive maintenance and have a low expected service life.*
Solar Thermal Systems	System Description: Similar to a roof-mounted solar PV system, solar thermal systems are most commonly installed on rooftops. These systems utilize solar energy for heating of outdoor air. The most common application is for pre-heating of outdoor air used for air exchanges systems in buildings. This reduces the heating fuel required to maintain setpoint temperatures in interior spaces.
Score: 61%	*Site Feasibility:* *The building currently has an adequate amount of space for a PV system to be installed however there is no air handling unit which could be utilized. This may not be a practical consideration.*

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.

New Hampshire Public Utilities Commission

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 SmartSTART program is limited to PSNH's municipal customers only and includes schools. The program is available on a first-come, first served basis to projects which have been pre-qualified by PSNH. The cost of the improvements is fronted by PSNH which is then repaid over time by the municipality or school using the savings generated by the products themselves. This program is for lighting and lighting controls, air sealing, insulation and other verifiable energy savings measures which have sufficient kilowatt-hour savings. For more information on this program visit: http://www.psnh.com/SaveEnergyMoney/For-BusinesslMunicipal-Smart-Start-Program.aspx

Clean Air - Cool Planet

Community Energy Efficiency

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

APPENDIX A

Photographs

TRANSFER STATION GROUNDS

TRANSFER STATION GROUNDS

TRANSFER STATION SIGN


TRANSFER STATION GROUNDS

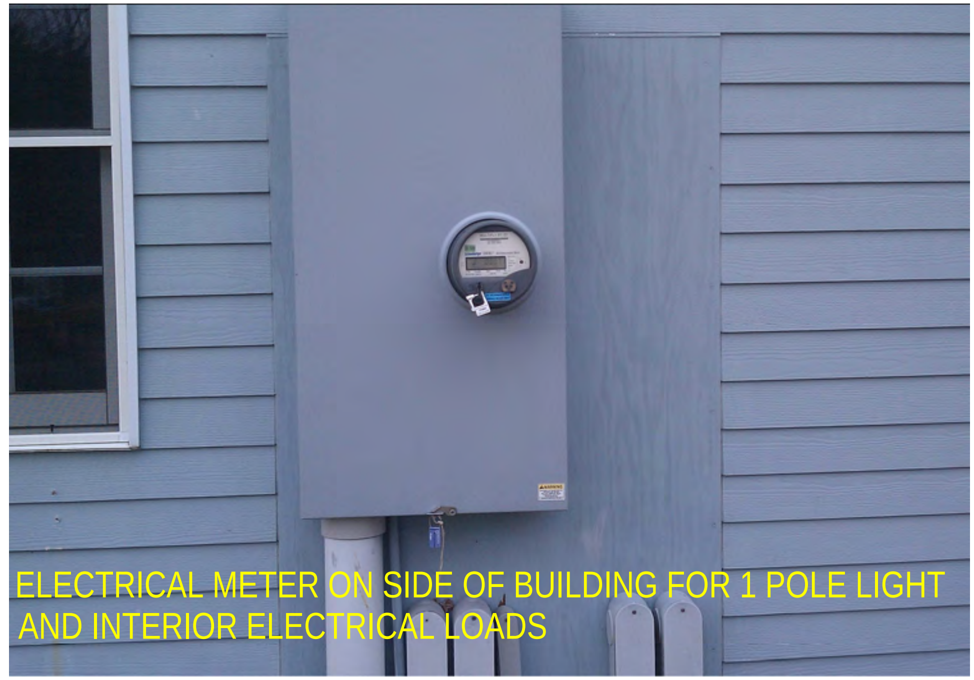
TRANSFER STATION SIGN

TRANSFER STATION RECYCLING


TRANSFER STATION GROUNDS


TRANSFER STATION GROUNDS

TRANSFER STATION RECYCLING

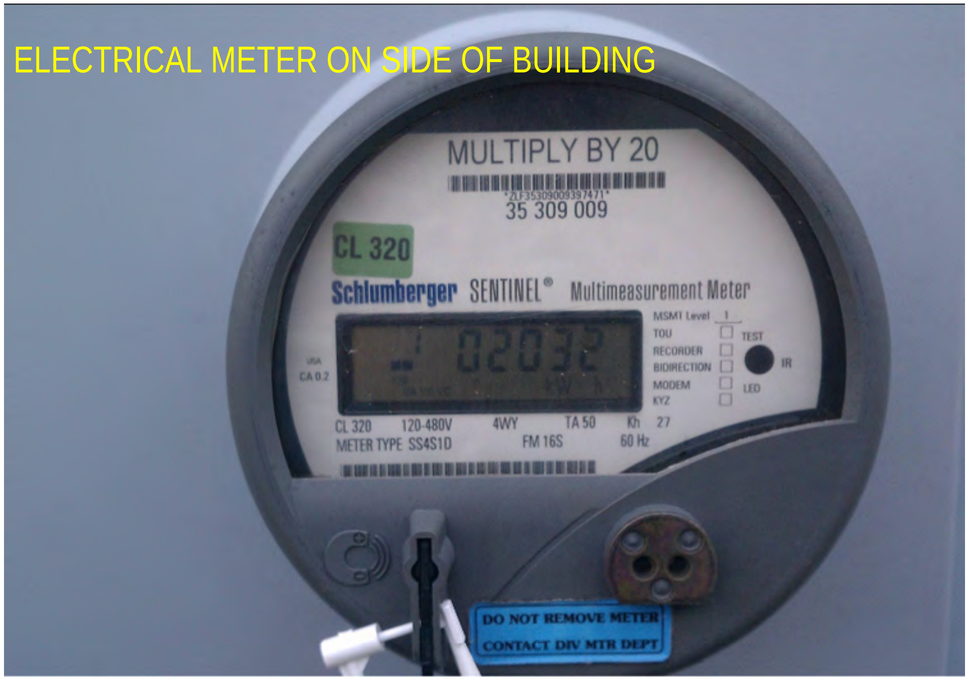

ELECTRICAL METER ON SIDE OF BUILDING FOR 1 POLE LIGHT AND INTERIOR ELECTRICAL LOADS

TRANSFER STATION RECYCLING

TRANSFER STATION STORAGE SHED

STORAGE SHED

ELECTRICAL LINES AND POLE LIGHT



ELECTRICAL METER ON SIDE OF BUILDING

SIDE OF BUILDING WITH VENTS AND EXHAUST PIPE

EMERGENCY SHUTOFF SWITCH FOR COMPACTOR


3 OF 4 ROLLOFF COMPACTORS

RECYCLING FLUORESCENT BULBS

POWER SWITCH FOR COMPACTOR

ROLLOFF COMPACTORS FOR RECYCLING


LARGE TRAILER COMPACTOR FOR TRASH

ROLLOFF COMPACTOR TAG INFORMATION


1 ROLLOFF COMPACTOR AND 1 NORMAL TRASH BIN

TRAILER COMPACTOR MOTOR

PRESSURE GUAGES FOR 3 OF 4 COMPACTORS

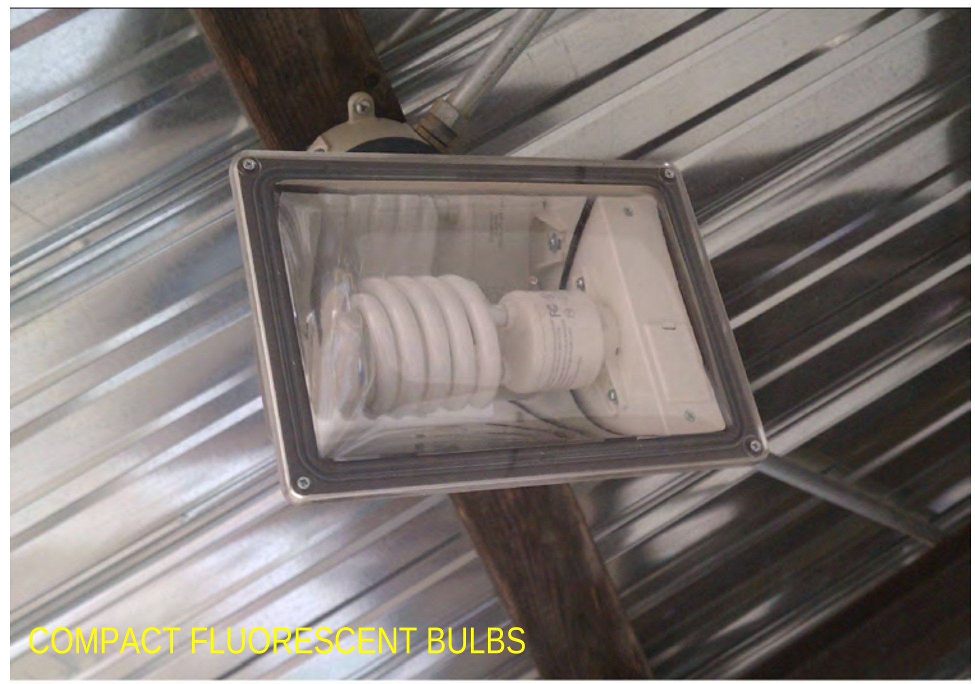
TRAILER COMPACTOR MOTOR

2 OF 3 TRAILER COMPACTORS

3 OF 4 ROLLOFF COMPACTORS AND DISPOSAL CHUTES

RECYCLING AREA

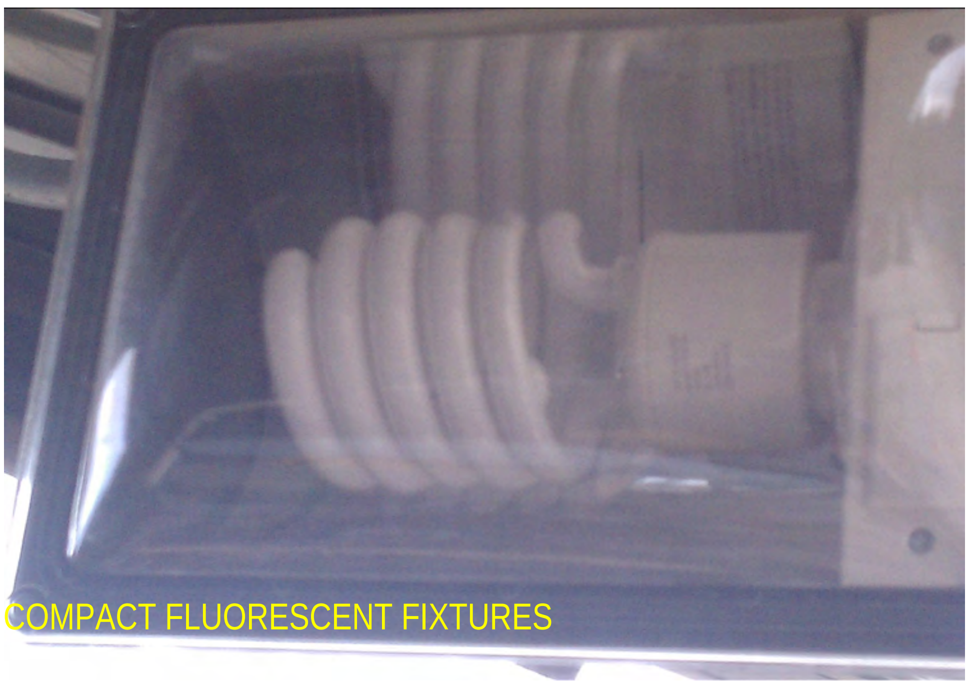
PRESSURE GUAGES FOR ROLLOFF COMPACTORS



COMPACT FLUORESCENT BULBS

COMMUNITY POSTING BOARD

ELECTRIC METER FOR TRAILERS AND YARD LIGHTING


COMPACT FLUORESCENT FIXTURES

ELECTRICAL BOXES FOR TRAILERS AND YARD LIGHTING

CARDBOARD RECYCLING TO TRAILER COMPACTOR


EMPLOYEE CENTER WITH OLD REFRIGERATOR

RECYCLING ENCOURAGEMENT SIGN

EXTERIOR OF EMPLOYEE CENTER

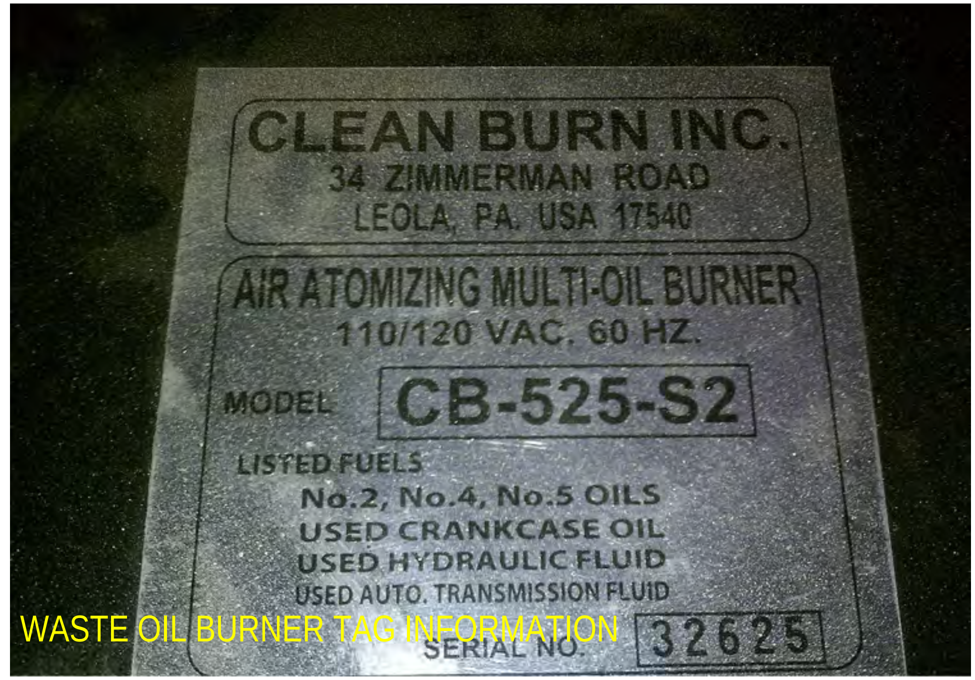

INTERIOR OF EMPLOYEE CENTER


ACCESS DOOR BETWEEN GARAGE AND EMPLOYEE CENTER

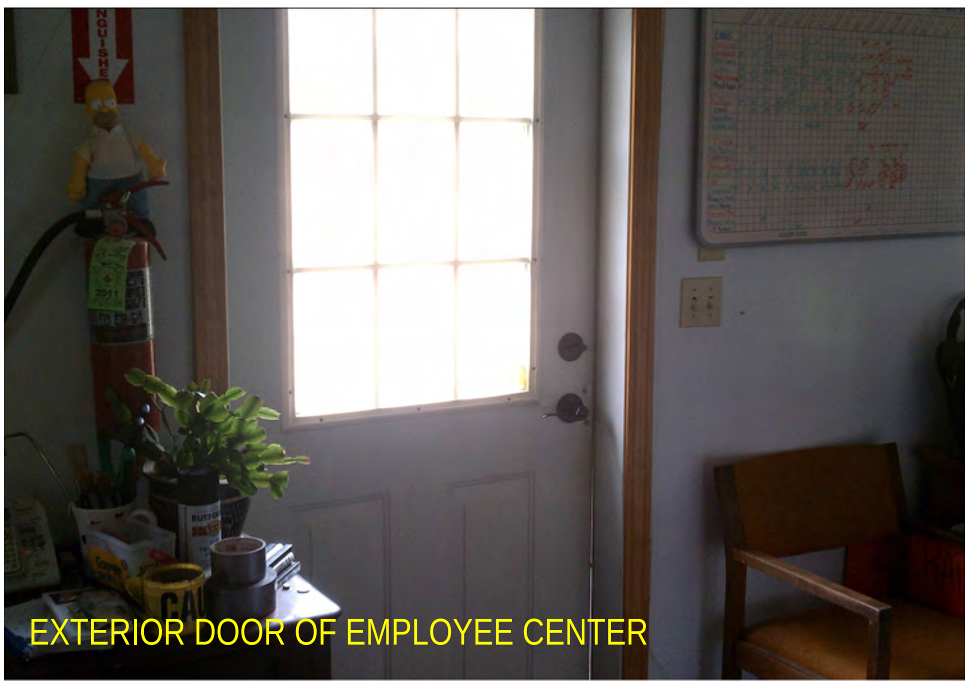

T8 FIXTURES IN EMPLOYEE CENTER


WINDOW UNIT IN EMPLOYEE CENTER

GARAGE EQUIPMENT

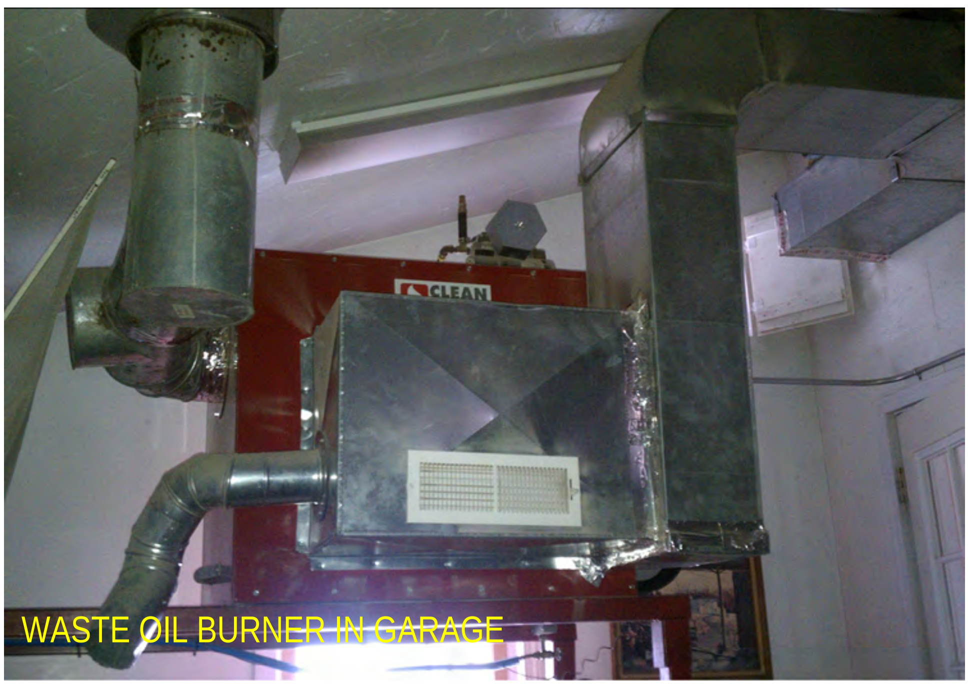


WASTE OIL BURNER TAG INFORMATION


EXTERIOR DOOR OF EMPLOYEE CENTER

WASTE OIL BURNER TAG INFORMATION

VENT FOR WASTE OIL BURNER



WASTE OIL BURNER IN GARAGE

VENT ON SIDE OF GARAGE

APPENDIX B

Indoor Metering Data

INDOOR AIR QUALITY DATA

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

Location /Use Description	Time	Occupied	Air Quality			Lighting Density	Notes
			Temp (°F)	RH (%)	CO2 (ppm)	Vert (FC)	
Main office	1645	Y	62	31	450	42	Don't use overhead lights

APPENDIX C

Lighting Fixture Inventory

LIGHTING FIXTURE INVENTORY

Facility:		Location:				Date:	
Hollis Transfer Station		Hollis, NH				01/03/2012	
Location /Use Description	**Fixture**	**Watts/fixture**	**Qty**	**Controls**	**Total watts**	**Est. Hr/Wk**	**Est. KWH Consumption/Yr**
Exterior	Cfl	42	12		504	10	262
Exterior	T8	28	4		112	10	58
Exterior	Hps	70	1		70	10	36
Main office	Cfl	17	1		17	10	9
Main office	T8	56	7		392	0.5	10
Bathroom	T8	56	1		56	1	3
Total			26		1,151		379

APPENDIX D

Mechanical Equipment Inventory

MECHANICAL EQUIPMENT INVENTORY

Facility:		Location:	Date:				
Hollis Transfer Station		Hollis, NH	01/03/2012				
Location /Use Description	**Qty**	**Affiliated System**	**MBH**	**HP**	**V**	**Phase**	**Est kWh/yr**
Garage / Waste Oil Burner	1	Heat	180	1/6	115	1	90
Hot water Heater	1	DHW	50	NA	240	1	400
Small compactor	4	Garbage	-	15	480	3	3,824
Trailer compactor	3	Garbage	-	30	480	3	3,481
Total							7,795

APPENDIX E

Plug Load Inventory

PLUG LOAD INVENTORY

Facility:		Location:		Date:			
Hollis Transfer Station		Hollis, NH		01/03/2012			
Location /Use Description	Unit	Watts/fixture	Qty	Total watts	Est. Hr/Wk	Est. kWh/Yr	Notes
Main office	Desktop	80	1	80	1	4	No Internet, 1 time used per month
Main office	Old monitor	85	1	85	1	4	
Main office	Tube tv	90	1	90	1	5	
Main office	Microwave	1,000	1	1,000	0.5	26	
Main office	Refrigerator	800	1	800	31	1,270	
Main office	Window AC	900	1	900	3.5	47	Summertime use
Main office	Desk jet	35	2	70	0.1	0	
Main office	Hepa vacuum	1,200	1	1,200	0.1	6	
Main office	Lamp	17	1	17	10	9	
Total				4,242		1,372	

APPENDIX F

ENERGY STAR® Statement of Energy Performance

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Transfer Station Office

Building ID: 1714786
For 12-month Period Ending: November 30, 2011[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 28, 2012

Facility
Transfer Station Office
10 Rocky Pond Road
Hollis, NH 03049

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

Primary Contact for this Facility
N/A

Year Built: 2006
Gross Floor Area (ft^2): 3,690

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	35,262
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	35,262

Energy Intensity[4]	
Site (kBtu/ft^2/yr)	10
Source (kBtu/ft^2/yr)	32

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	4

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

National Median Comparison	
National Median Site EUI	70
National Median Source EUI	127
% Difference from National Median Source EUI	-75%
Building Type	Other

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.

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	Transfer Station Office	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Other	Is this an accurate description of the space in question?		☐
Location	10 Rocky Pond Road, Hollis, NH 03049	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of a hospital, k-12 school, hotel and senior care facility) nor can they be submitted as representing only a portion of a building.		☐

Transfer Station Office (Office)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	575 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.		☐
Weekly operating hours	40 Hours	Is this the total number of hours per week that the Office space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	2	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100. The normal worker density ranges between 0.3 and 5.3 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	0	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐

Transfer Station Outdoor Covered Grounds (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑

Gross Floor Area	3,115 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	N/A(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	40Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	N/A(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

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

Fuel Type: Electricity

Meter: 56-854351012 PSNH (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
10/27/2011	11/26/2011	220.00
10/01/2011	10/26/2011	160.00
09/01/2011	09/30/2011	180.00
08/01/2011	08/31/2011	280.00
07/01/2011	07/31/2011	280.00
06/01/2011	06/30/2011	260.00
05/01/2011	05/31/2011	280.00
04/01/2011	04/30/2011	420.00
03/01/2011	03/31/2011	400.00
02/01/2011	02/28/2011	440.00
01/01/2011	01/31/2011	420.00
12/01/2010	12/31/2010	360.00
56-854351012 PSNH Consumption (kWh (thousand Watt-hours))		**3,700.00**
56-854351012 PSNH Consumption (kBtu (thousand Btu))		**12,624.40**

Meter: 56-213041072 PSNH Grounds (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
10/27/2011	11/26/2011	540.00
10/01/2011	10/26/2011	440.00
09/01/2011	09/30/2011	380.00
08/01/2011	08/31/2011	400.00
07/01/2011	07/31/2011	420.00
06/01/2011	06/30/2011	380.00
05/01/2011	05/31/2011	440.00
04/01/2011	04/30/2011	540.00
03/01/2011	03/31/2011	600.00
02/01/2011	02/28/2011	860.00
01/01/2011	01/31/2011	880.00
12/01/2010	12/31/2010	640.00
56-213041072 PSNH Grounds Consumption (kWh (thousand Watt-hours))		**6,520.00**

56-213041072 PSNH Grounds Consumption (kBtu (thousand Btu))	**22,246.24**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))	**34,870.64**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity 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
Transfer Station Office
10 Rocky Pond Road
Hollis, NH 03049

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

Primary Contact for this Facility
N/A

General Information

Transfer Station Office	
Gross Floor Area Excluding Parking: (ft^2)	3,690
Year Built	2006
For 12-month Evaluation Period Ending Date:	November 30, 2011

Facility Space Use Summary

Transfer Station Office	
Space Type	Office
Gross Floor Area (ft^2)	575
Weekly operating hours	40
Workers on Main Shift	2
Number of PCs	0
Percent Cooled	50% or more
Percent Heated	50% or more

Transfer Station Outdoor Covered Grounds	
Space Type	Other - Other
Gross Floor Area (ft^2)	3,115
Number of PCs o	N/A
Weekly operating hours o	40
Workers on Main Shift o	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 11/30/2011)	**Baseline** (Ending Date 12/31/2008)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft²)	10	9	9	N/A	70
Source (kBtu/ft²)	32	31	29	N/A	127
Energy Cost					
$/year	$ 3,791.68	$ 3,133.48	$ 3,482.32	N/A	$ 27,763.35
$/ft²/year	$ 1.03	$ 0.85	$ 0.95	N/A	$ 7.54
Greenhouse Gas Emissions					
$MtCO_2e$/year	4	4	4	N/A	29
$kgCO_2e/ft^2$/year	1	1	1	N/A	7

More than 50% of your building is defined as Other. This building is currently ineligible for a rating. Please note the National Median column represents the CBECS national median data for Other. This building uses 75% less energy per square foot than the CBECS national median for Other.

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

APPENDIX G

Renewable Energies Screening Worksheets

RENEWABLE ENERGY SCREENING SUMMARY

Building/Facility:	Hollis Transfer Station	Location:	Hollis, NH
Gross Area (sf):	3,609	Date:	3/29/2012
Use Category:	Other	EUI (kBtu/sf/yr):	32
Heating Fuel(s):	Waste Oil	PM Grade:	NA
Heating System(s):	Forced Hot Air	Cooling System(s):	NA

RE Technology	Score (out of 70 pts.)	Grade	Notes/Comments
Biomass Heating	60.0	86%	Pellet feed system recommended.
Ground Photovoltaic	57.5	82%	Small to medium system 10kw-30kw.
Roof Photovoltaic	51.5	74%	Small system 5kw-10kw.
Wind Turbine Generator	50.5	72%	Permit requirements are height dependent.
Solar DHW	48.0	69%	DHW demand should be confirmed.
Geothermal Heating/Cooling	45.5	65%	Closed-loop GSHP system.
Combined Heat & Power	44.0	63%	Smaller system.
Solar Thermal	42.5	61%	Medium-temperature collector.

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Transfer Station	Location:	Hollis, NH
Gross Area (sf):	3,609	Date:	3/29/2012
Use Category:	Other	EUI (kBtu/sf/yr):	32
Heating Fuel(s):	Waste Oil	PM Grade:	NA
Heating System(s):	Forced Hot Air	Cooling System(s):	NA

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

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	4.5	Well demonstrated technology. Some woodchip and pellet feed units are newer technology.
2	Expected service life/durability	4	Expected service life is 20 yrs.
3	Geographical considerations	3.5	Limited fuel in Southern NH
4	Energy demand	2.5	Heating energy is relatively low in the building.
5	Facility/systems conditions	5	Woodchips/pellets could be stored outside.
6	Facility/systems compatibility	5	Woodchips/pellets could be stored outside.
7	Permitting constraints	5	No special permits required.
8	Abutter concerns	5	Systems are located inside building. Wood or chip feedstock located outside would not be a concern.
9	Capital investment	4.5	Low capital cost.
10	O&M requirements	4.5	Wood and woodchip units require constant attending and feedstock must be sourced. Pellet systems with hoppers are less intensive and feedstock is commercially available.
11	Financial incentives	2.5	Limited incentives.
12	Owner initiatives	4.5	Owner is open to renewable options.
13	CO_2e emissions	4.5	Biomass does emit CO_2 but the net reduction from the oil system will be significant.
14	Public awareness/education	5	High public use. Information could be displayed in the building so users are aware of biomass heating system. Applicable for residential uses.
	Total Score:	**60**	
	Total Possible Score:	**70**	
	Grade:	**86%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Transfer Station	Location:	Hollis, NH
Gross Area (sf):	3,609	Date:	3/29/2012
Use Category:	Other	EUI (kBtu/sf/yr):	32
Heating Fuel(s):	Waste Oil	PM Grade:	NA
Heating System(s):	Forced Hot Air	Cooling System(s):	NA

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	5	High electrical demand.
5	Facility/systems conditions	5	Newer facilities and systems.
6	Facility/systems compatibility	5	Ample land space could be made available.
7	Permitting constraints	2.5	Utility grid connection permit is long-lead and may require a designed/engineered system.
8	Abutter concerns	5	No abutting properties can view the area.
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	5	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	Highly used public facility.
	Total Score:	**57.5**	
	Total Possible Score:	**70**	
	Grade:	**82%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Transfer Station	Location:	Hollis, NH
Gross Area (sf):	3,609	Date:	3/29/2012
Use Category:	Other	EUI (kBtu/sf/yr):	32
Heating Fuel(s):	Waste Oil	PM Grade:	NA
Heating System(s):	Forced Hot Air	Cooling System(s):	NA

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	5	High electrical demand.
5	Facility/systems conditions	1	Limited roof space.
6	Facility/systems compatibility	5	Facilities and equipment are newer.
7	Permitting constraints	2.5	Utility grid connection permit is long-lead and may require a designed/engineered system.
8	Abutter concerns	5	No abutting properties with view of facility.
9	Capital investment	2.5	High capital cost.
10	O&M requirements	3	Increased roof maintenance and panel replacement.
11	Financial incentives	2.5	Limited incentives in NH.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	4.5	Electrical source energy is NH has lower than average CO2 emissions.
14	Public awareness/education	5	Highly used public facility.
	Total Score:	**51.5**	
	Total Possible Score:	**70**	
	Grade:	**74%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Transfer Station	Location:	Hollis, NH
Gross Area (sf):	3,609	Date:	3/29/2012
Use Category:	Other	EUI (kBtu/sf/yr):	32
Heating Fuel(s):	Waste Oil	PM Grade:	NA
Heating System(s):	Forced Hot Air	Cooling System(s):	NA

Technology: **Wind Turbine Generator**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	3.5	A well demonstrated technology but proper site selection is critical.
2	Expected service life/durability	3.5	Some turbine units have proven unreliable (design flaws). Selection of a reputable manufacturer is critical.
3	Geographical considerations	2.5	Limited wind energy but a feasibility study is required.
4	Energy demand	5	Electric energy consumption is high.
5	Facility/systems conditions	3.5	Newer systems. Wind energy study required to determine feasiblity.
6	Facility/systems compatibility	5	Newer systems.
7	Permitting constraints	2	Special permits are required depending on the height of the pole-mounted turbine. Roof-mounted turbines may be practical however they provide less energy.
8	Abutter concerns	4	Pole-mounted turbines have a large visual impact. No abutting properties have direct view.
9	Capital investment	3	Moderate capital cost.
10	O&M requirements	3	Routine maintenance required. Units are subject to damage from elements.
11	Financial incentives	2.5	Limited incentives in NH.
12	Owner initiatives	4	Owner open to renewable options.
13	CO2e emissions	4	Electrical source energy is NH has lower than average CO2 emissions.
14	Public awareness/education	5	Highly visibility.
	Total Score:	**50.5**	
	Total Possible Score:	**70**	
	Grade:	**72%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Transfer Station	Location:	Hollis, NH
Gross Area (sf):	3,609	Date:	3/29/2012
Use Category:	Other	EUI (kBtu/sf/yr):	32
Heating Fuel(s):	Waste Oil	PM Grade:	NA
Heating System(s):	Forced Hot Air	Cooling System(s):	NA

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	Expected DHW demand is low.
5	Facility/systems conditions	1	No current systems to utilize.
6	Facility/systems compatibility	1	No current systems to utilize.
7	Permitting constraints	5	No special permitting required.
8	Abutter concerns	5	Low visibility/impact.
9	Capital investment	2.5	High capital cost.
10	O&M requirements	4	Panel replacement and normal DHW system maintenance.
11	Financial incentives	2.5	Limited incentives in NH.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	3.5	Low reduction of oil use based on DHW demand.
14	Public awareness/education	5	Highly used public facility.
	Total Score:	**48**	
	Total Possible Score:	**70**	
	Grade:	**69%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Transfer Station	Location:	Hollis, NH
Gross Area (sf):	3,609	Date:	3/29/2012
Use Category:	Other	EUI (kBtu/sf/yr):	32
Heating Fuel(s):	Waste Oil	PM Grade:	NA
Heating System(s):	Forced Hot Air	Cooling System(s):	NA

Technology: **Geothermal Heating & Cooling**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	4	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	4	Abundant geothermal energy reserves.
4	Energy demand	1	Heating and cooling energy consumption is low.
5	Facility/systems conditions	1	Occupancy is low and the building size is small resulting in a high cost per area.
6	Facility/systems compatibility	2	Building system is newer and ample space to install. Small building makes it less practical.
7	Permitting constraints	5	No special permitting required for a closed-loop system (open-loop would require state permit and is not recommended).
8	Abutter concerns	5	Abutters with water supply wells can be sensitive to geothermal wells but a closed-loop system will have no impact.
9	Capital investment	2	High capital cost.
10	O&M requirements	4	Very low O&M except routine equipment maintenance.
11	Financial incentives	2	Limited incentives in NH.
12	Owner initiatives	3	Owner is open to renewable options.
13	CO_2 emissions	3.5	The building currently uses waste oil which emitts a high amount of CO_2.
14	Public awareness/education	4	High public use. Information could be displayed in the building so users are aware of geothermal system.
	Total Score:	**45.5**	
	Total Possible Score:	**70**	
	Grade:	**65%**	

RENEWABLE ENERGY SCREENING WORKSHEET

Building/Facility:	Hollis Transfer Station	Location:	Hollis, NH
Gross Area (sf):	3,609	Date:	3/29/2012
Use Category:	Other	EUI (kBtu/sf/yr):	32
Heating Fuel(s):	Waste Oil	PM Grade:	NA
Heating System(s):	Forced Hot Air	Cooling System(s):	NA

Technology: **Combined Heat & Power System**

No.	Criteria	Score (1-5 pts.)	Notes/Comments
1	Demonstrated technology	3	Smaller CHP units are relatively new technology. Larger units (+75kW) are more reliable.
2	Expected service life/durability	1.5	Expected service life for a small CHP unit is 10 yrs. Large CHPs have a 20 yr. service life.
3	Geographical considerations	4	NH has a low electrical energy cost.
4	Energy demand	5	Electric energy consumption is high.
5	Facility/systems conditions	5	Newer systems and facility.
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	1.5	Frequent maintenance required. Large system manufacturers require that they complete maintenance for warranty validation.
11	Financial incentives	2	Limited incentives.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	1	CHPs consume a large amount of fuel and emissions relative to the re-used energy.
14	Public awareness/education	4	High 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

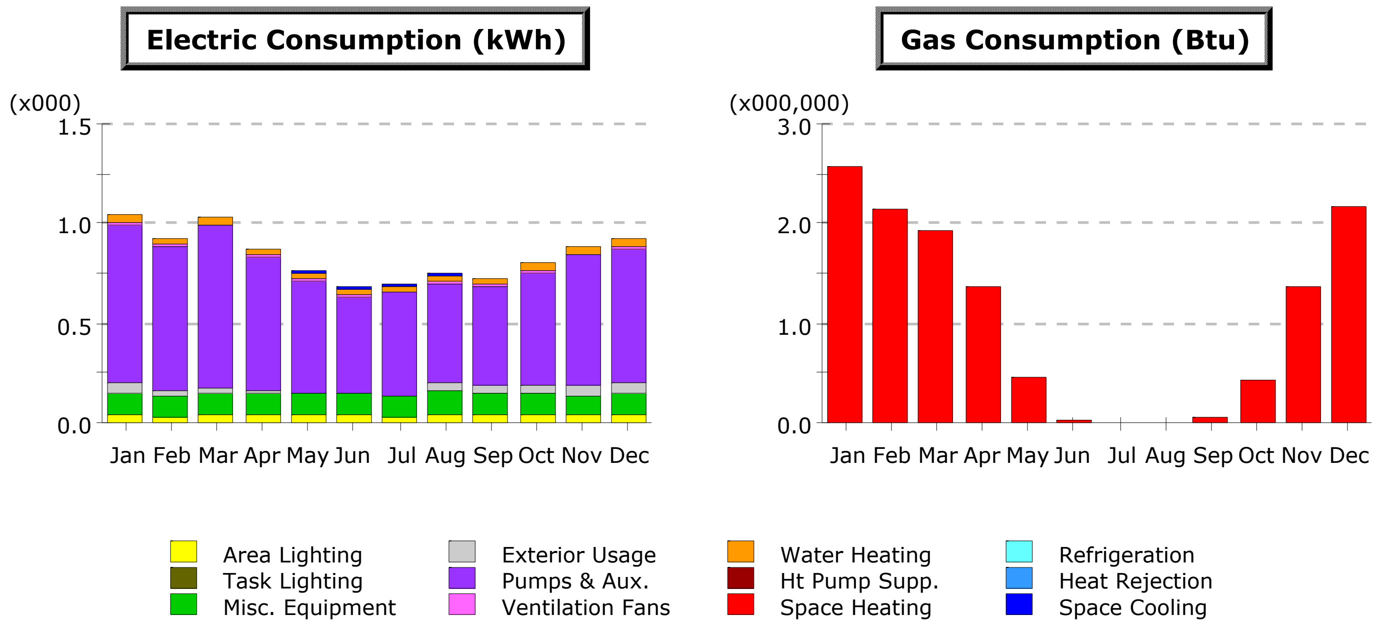
Building/Facility:	Hollis Transfer Station	Location:	Hollis, NH
Gross Area (sf):	3,609	Date:	3/29/2012
Use Category:	Other	EUI (kBtu/sf/yr):	32
Heating Fuel(s):	Waste Oil	PM Grade:	NA
Heating System(s):	Forced Hot Air	Cooling System(s):	NA

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	2	Heating and cooling is low.
5	Facility/systems conditions	1	No air handling equipment currently installed.
6	Facility/systems compatibility	1	Considerable space required. Plumbing complex to protect against freezing. No mechanical equipment currently installed.
7	Permitting constraints	2.5	Utility grid connection permit is long-lead and may require a designed/engineered system.
8	Abutter concerns	5	No abutting properites would be affected.
9	Capital investment	2	High capital cost.
10	O&M requirements	3	Vegetative cutting for ground mount, roof maintenance for roof mount, panel replacement.
11	Financial incentives	2.5	Limited incentives in NH.
12	Owner initiatives	4	Owner is open to renewable options.
13	CO2e emissions	4	Electrical source energy in NH has lower than average CO2 emissions.
14	Public awareness/education	5	Highly used public facility.
	Total Score:	**42.5**	
	Total Possible Score:	**70**	
	Grade:	**61%**	

APPENDIX H

eQUEST® Energy Efficiency Measure Modeling



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	0.00	0.01	0.02	0.02	0.01	-	-	-	0.05
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.04	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.40
Vent. Fans	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.09
Pumps & Aux.	0.79	0.73	0.82	0.67	0.57	0.49	0.52	0.50	0.50	0.57	0.65	0.68	7.48
Ext. Usage	0.05	0.02	0.02	0.02	-	-	-	0.04	0.04	0.04	0.05	0.05	0.34
Misc. Equip.	0.11	0.10	0.11	0.11	0.11	0.11	0.11	0.12	0.11	0.11	0.11	0.11	1.32
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.04	0.03	0.04	0.03	0.04	0.04	0.03	0.04	0.03	0.04	0.03	0.03	0.43
Total	1.04	0.93	1.04	0.87	0.76	0.68	0.70	0.75	0.72	0.80	0.88	0.92	10.09

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	2.58	2.14	1.92	1.36	0.46	0.04	0.00	0.00	0.04	0.43	1.36	2.17	12.49
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	2.58	2.14	1.92	1.36	0.46	0.04	0.00	0.00	0.04	0.43	1.36	2.17	12.49

APPENDIX I

Cost Estimates

BUDGETARY COST ESTIMATE

Facility: **Hollis Transfer Station**
Date: **3/30/2012**

EEM	Design + Engineering	Installed Cost				Construction Management	Contingency (15%)	Total Investment
		Pricing Unit	Price	Qty	Subtotal			
Replace exterior metal halide light fixtures with LED units (12).	$ 1,000	EA	$ 1,116	12	**$ 13,392**	$ 1,339	$ 2,360	**$ 18,091**
Replace waste oil furnace with a pellet-fired furnace with 7-day programmable thermostat.	$ 300	EA	$ 1,800	1	**$ 1,800**	$ 180	$ 342	**$ 2,622**
Replace existing trash compactor with super energy efficient unit.	$ 500	EA	$ 25,000	1	**$ 25,000**	$ 2,500	$ 4,200	**$ 32,200**