Energy Audit Report

Town of North Hampton Facilities

May 2009

North Hampton Energy Committee

North Hampton Town Facilities
Energy Audit

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INTRODUCTION

The implementation of a comprehensive energy management program not only preserves the environment by reducing emissions of climate-altering greenhouse gases but it also saves our taxpayers money. Managing energy costs and maximizing savings throughout our local governments' buildings and facilities is a prudent practice and can ultimately gain public support for future energy efficiency projects.

The North Hampton Energy Committee (NHEC) prepared the following energy audit report based on visual inspections of the Police/Fire/Town Offices Complex's, Tax Collectors Office and Old Town Hall. NHEC members Robert Copp, Dietrich Ebert, and Peter Philbrook conducted the on-site assessments starting in December 2008 and continuing through April 2009.

The purpose of these audits was to identify energy related opportunities that show immediate potential for improvements within each of the town's operating facilities. The findings in this report will provide the select board and town officials with a starting point to address known energy deficiencies. Performing corrective action(s) on the NHEC recommendations will realize immediate energy savings that will reduce operating costs and help the town operate in a more environmentally sound manner.

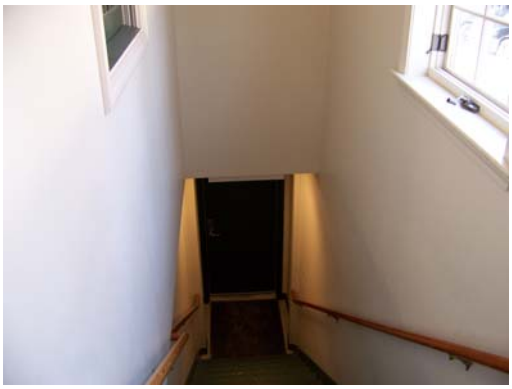
It is important to note that the NHEC members that performed the on-site assessments are not Professional Engineers (PE). Many professional engineering companies and energy audit assessors do offer comprehensive energy audit services for a fee.

POLICE/FIRE/TOWN OFFICES COMPLEX

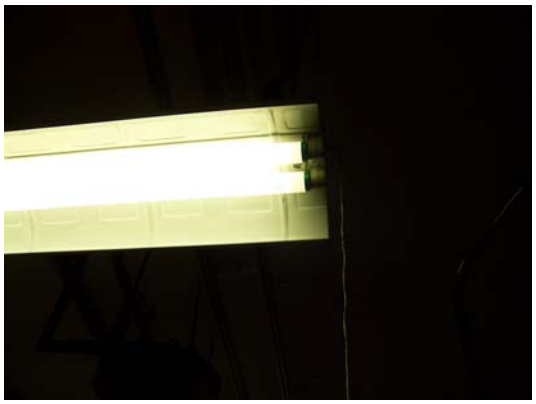
LIGHTING

Interior Lighting

During the daylight inspection we found that the lights were left on in the North (employee only) staircase which employees use to enter and exit the 2nd floor town offices. These lights should be shut off when not in use. We would recommend installing occupancy sensors in this stairwell area. Unoccupied areas should also have all lights turned off.



Fluorescent Lights - Retrofitting T12 overhead fluorescent lamps with modern T8 lamps and electronic ballasts can reduce lighting energy consumption by 35%. Adding specular reflectors, new lenses, and occupancy sensors or timers can double the savings. Paybacks of one to three years are common. This retrofit or replacement would be highly recommended for the overhead lighting in the Fire Department truck bays.



There are a number of incandescent light fixtures throughout the tax collectors building that should be replaced with more efficient CFL's.

Exterior Lighting

A.) Single incandescent floodlight which illuminates the flag in the front of the building was on during daylight hours, this should be on a timer or photovoltaic operated switch.

B.) Lights along the east side of the building appear to be on a timer system.

C.) Single light above the stairway of the employee's entrance, was on during daytime hours. This light apparently is on constantly and should be on a timer or photovoltaic operated switch.

D.) Double (pair) incandescent floodlights above the rear entrance of the fire department were on during daytime hours, and should be on a timer or photovoltaic operated switch.

E.) Incandescent floodlights should be replaced with CFL bulbs.

WINDOWS

The town office windows are vinyl-coated wood-frame double hung windows and have double glazed thermopane glass. We performed thermal measurements and these units were found to be very air tight and efficient; however some of the windows were cracked open or not locked tight. These should be kept latched in cold weather.

The south facing circular window located upstairs in the document storage room is cracked and needs to be replaced.

The five windows in the fire department truck bay on the west side of the facility and the two windows in the front are old inefficient single pane windows with outer storms. The windows in the truck bay were covered inside with clear plastic shrink film insulation. Thermal readings from our infrared thermometer showed that the plastic covering does help, however we recommend replacing these with high energy efficient windows. The rating or U-Factor (rate of heat loss) for windows in New Hampshire is listed as $U \leq 0.35$. An argon gas filled vinyl/wood frame double glazing Low-E replacement would meet this requirement and save significant energy. A fact sheet "Selecting Energy Efficient Windows in New Hampshire" is included at the end of the report.

The hose tower window located at the top of the tower is also a single pane window without a storm and should be replaced with the above rated window.

HVAC

The police department area is heated by a single Heil Model LP forced hot air heater. The three zone system appears to be in good operating condition. All thermostats in the police department were set at 68^0 F and the space felt comfortable.

The town offices are heated by a York HX-75V Magic Aire LP forced hot air unit. This system appeared to be in good condition. The office areas are tempered using a single thermostat located inside the office area. The thermostat is mounted on a wall across from the office entrance door behind the receptionist. The temperature setting was 69 F at the time of our visit. The fan switch was left in the constant on mode which is not necessary and is inefficient. On subsequent visits it was noticed that this fan is on during office hours. Signage should be posted near the thermostat to make employees aware of proper usage and list energy saving settings.

The fire department is heated by an old inefficient oil burning furnace. We found this as one of the main opportunities for savings. This older unit is way past the end of its service life and upgrading to modern equipment in the 90-95% efficiency range would significantly reduce fuel oil consumption.

Another big energy concern in the fire department was the hose tower. The structure is used solely for the purpose of drying and storage of fire hoses. The tower is made of brick and cinder blocks, has a single pane window at the top, is a very large heated area, and is not insulated. Shutting the heat off in this area during winter would be a significant opportunity for saving energy. This area could be fully utilized during the warmer months when heating is not necessary.

Investigating an optional, more energy efficient, method of drying the fire hoses during the winter months would be well worth the effort. At a minimum heat should only be turned on in this area when the fire hoses are actively drying after a response. The hoses could then be removed and stored without the need of heating this area throughout the winter.

The Tax Collectors Office has an older oil burning forced hot air (FHA) furnace in the basement. Although the system appeared to be in good condition a more efficient modern system would certainly realize energy savings. The biggest low cost opportunity for energy savings in this building would be insulating the FHA ducting and basement ceiling or floor joists.

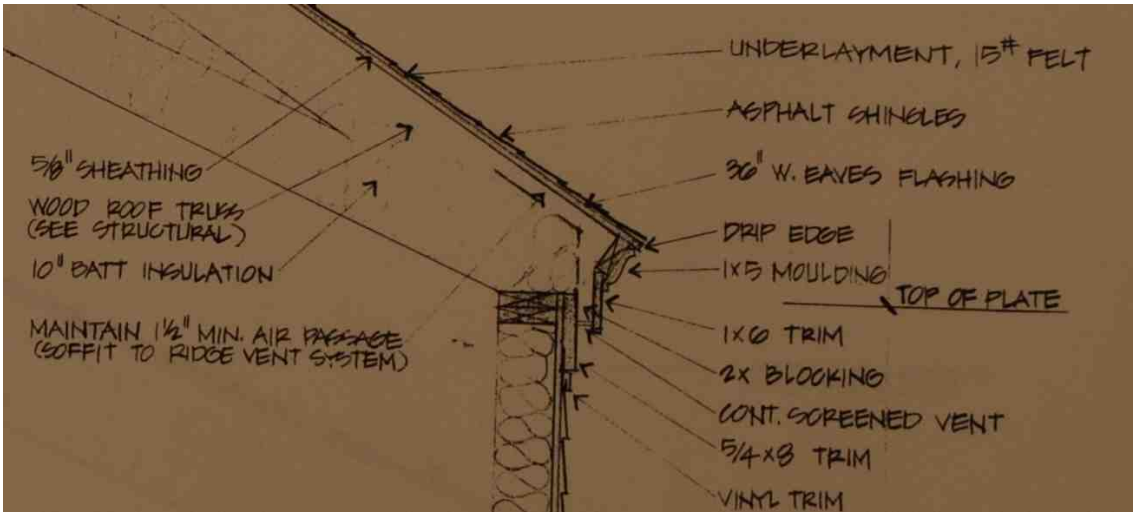
Tax Collectors Office Basement - Needs Insulation (Ceiling and FHA Ducts)

HVAC Summary

All HVAC systems should be on a maintenance program; a service technician should inspect each system annually and lubricate all moving parts, check and inspect condensate drain, check refrigerant levels, clean and adjust blower components. Check all oil (or gas) connections, gas pressure, burner combustion and heat exchanger. The facility manager should be replacing air filters monthly.

BUILDING SHELL & INTERIOR MODIFICATIONS

Indoor thermal readings of the ceiling/wall interface in the town offices indicated heat loss. Outdoor scans, using a more sophisticated thermal imaging infrared camera, of the soffit area confirmed this finding. We pulled some of the office ceiling tiles away and discovered that the insulation along the roof line was pushed up allowing air direct access to the indoor office area. It appeared that the insulation had either been pulled away for electrical work or had been installed incorrectly in the first place. Regardless, this deficiency should be a top priority for corrective action as this breach affects the efficiency of both the heating and air conditioning systems. A blow up of the building plans below shows the problem area. The 10" Batt insulation is lifted away from the top plate, this "lifting" may also be blocking the soffit to ridge vent air passage system.

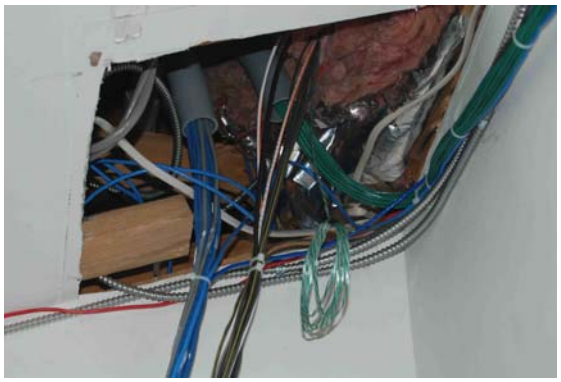


Ceiling / Wall Interface

Pushed Up Insulation

The computer server room which is located in a small space off of the storage room in the southwest side of the top floor has a separate cooling system plugged into a wall socket and directly vented to the outdoors through the wall. This unit was set to 55F. It is understood that the computer room needs to be maintained at a certain temperature, and that the room is prone to overheating. The room has a ~24" square opening in the ceiling where cable modifications were made. There is a fan hole in the shared storage wall, and the window in this room is unfinished and has no internal shades for sun protection. The room appears to have been hastily fabricated with no thought as to energy efficiency. There should be documentation from the computer manufacturer as to optimal operating temperatures of the computer server that resides in this space. The room temperature should be maintained as much as possible using the house HVAC system as the primary system and the secondary AC unit that is in the room should supplement cool air only when needed.

Computer Server Room Window



Server Room Ceiling

During our visit in December the air conditioning unit was on full with the temperature setting of 55^0 F on the AC unit. In the winter months simply leaving the door open and using a floor fan to circulate air would most likely keep this room within correct operating temperature. The current configuration has the main HVAC heating the facility and the supplemental AC in the server room system cooling. These two systems are fighting each other and it is a very inefficient set-up. The holes in the ceiling should be repaired, the window should be finished, and a solar shade should be hung in the window which can be drawn during the summer months (south facing window).

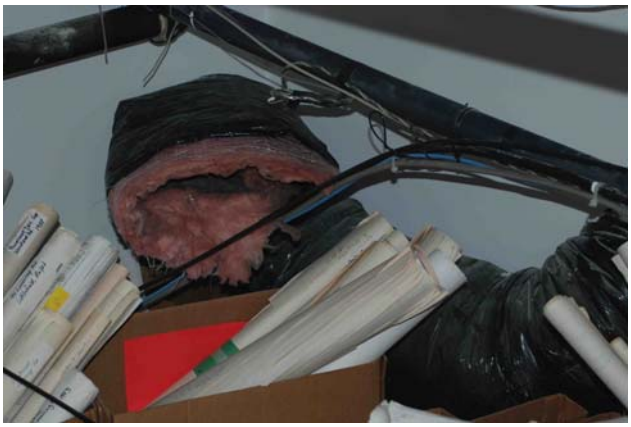
Building Shell Intrusions

There were a number of openings in the town offices building where cold air intrusion was apparent. The majority of these openings were in the two furnace rooms located off the storage area. There is a ~6" intake hole directly below the smaller current air intake for the furnace that supplies the town offices.

It was unclear if this hole was required for make up air to the existing system or if it was simply a hole that was made mistakenly during installation of the existing furnace. This should be investigated with a furnace technician, to determine if it us necessary.

The exhaust ducting associated with the Police Dept furnace needs insulation around the openings to eliminate heat loss and cold air infiltration.

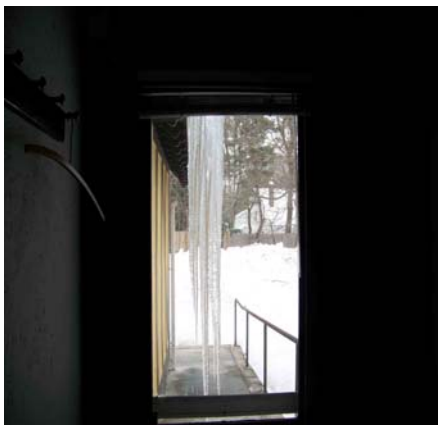
In the same room of the building there were two other areas of concern along the south wall. The first was an old insulated duct that should be removed and plugged, the other is an area where the insulation has been pulled away from some piping, perhaps to eliminate pipes from freezing. This should be investigated as well to determine whether appropriate insulation has been installed.



There were other instances of openings in the building associated with maintenance or fixing problems. The public entry to the tax collectors office had a ceiling panel removed apparently to check on a roof leak. The panel was never replaced, exposing this heated area to an uninsulated area above the ceiling. Another opening was found in the truck bay of the fire station. It should be a standard operating procedure that if a repair is initiated the affected area needs to be resealed as soon as possible after repair in order to conserve as much energy as possible.

Exterior Doors

Both back doors to the fire department need to be replaced with energy efficient models. They are poorly weatherized, leaky, old, rusted, and damaged.



The back door of the tax collectors office needs a storm window insert, it has a storm door but the screens were still placed in the door.

OLD TOWN HALL

The Old Town Hall is a model of inefficiency. Simply said this building should not be open during the winter months. Although the thermostat was set at a reasonable 61^0F the large single pane windows, poorly insulated walls, and uninsulated floors all add up to wasted energy and giant fuel costs. The oil furnace looked to be in fairly good condition however it is old and should be replaced with a more efficient model.

The 2003 model GE electric hot water heater located in the basement looked to be new; we tested the temperature of the hot water and found it to be 130^0F which is on the high side. We would recommend reducing the temperature to 110^0 - 120^0 F. The R value on this heater is 14.5, optimal R value should be 24 for electric water heaters. Adding an insulating blanket to it can reduce standby heat losses by 25%–45%. This will save the town around 4%–9% in water heating costs for this building. This unit would also be a prime candidate for a timer that would shut the system off at night. This would save an additional 5%-12% in energy costs.

The refrigerator should be unplugged and removed as soon as possible. The unit is ancient and is very inefficient. There is evidence that the doors do not have a tight fit which wastes even more energy. We would highly recommend replacing this refrigerator with an Energy Star rated model.

Since this building is not used on a routine basis shutting things off and turning things down when leaving should be made a priority. We found a Peavey amplifier that was left powered up, we also noticed a microwave oven in the kitchen plugged in.

All incandescent light fixtures should be converted to CFLs.

We were not able to inspect the upper floor and the insulation in the attic area as the door was locked.

We understand that a town committee has been established to investigate the future of the Old Town Hall. Plans for renovations or construction on this building should include energy saving designs. We hope the Old Town Hall committee will seek our input on current and future energy conserving aspects of this building.

Other Energy Saving Opportunities

The refrigerated beverage vending (Coke) machine in the front of the fire department should be removed or, if deemed necessary, should be replaced with an energy efficient (Energy Star) rated model. Refrigerated vending machines consume five times more electricity than a typical home refrigerator. With an energy consumption rating of 7-16 kWh/day this machine alone costs the town over $250/year for electricity.

Office area refrigerated water dispensers (Poland Springs) should be eliminated; these systems are in constant cooling mode consuming electricity even when the office is closed. It would be more efficient and economical to have employees fill their own re-useable water bottles with our high quality town water. Individual bottles of water could also be stored in the office refrigerator for meetings and personal use.

Metrics

When considering the efficiency of any operation a baseline exam of energy consumption is required. The data used in this assessment is known in the world of energy benchmarking as metrics. Once baseline metrics have been determined then the implementation of energy related projects are easily tracked and their impact on energy savings can be quantified. Metrics is one of the most important first steps towards initiating a town energy policy.

Members of the NHEC have been trying to compile energy data for each building and entering the data into the US Environmental Protection Agency's Portfolio Manager

Database. Portfolio Manager is an interactive energy management tool that allows you to track and assess energy and water consumption across your entire portfolio of buildings in a secure online environment (http://www.energystar.gov). Entering complete energy consumption and cost data into this program would allow us to benchmark each town owned and operated building. We would also be able to rate each buildings energy performance relative to similar buildings nationwide.

We are entering electricity, fuel oil, propane, and water information into the system for each of the town's buildings including the North Hampton School. Data for the North Hampton School is complete and we have an excellent profile for that building. The school data has been readily available from the annual budget reports and can also be accessed on line at SAU21.org. Energy data for the other town buildings is incomplete, unorganized, and is very difficult to breakdown.

We highly recommend that the town implement a system similar to that of SAU21 in organizing the town's energy data. Energy should be entered and compiled in an electronic spreadsheet format allowing easy access. The complete data sets should be organized on a building by building basis and should include electric, fuel oil, propane, and water consumption data as well as the costs associated with each. A copy of the school electricity data available from SAU21 is included as a reference.

Month	2006		2007		2008		2009
July	19,979.000 KWH	48.82%	29,733.000 KWH	-5.11%	28,213.000 KWH	-4.82%	26,853.000 KWH
August	28,228.000 KWH	-16.40%	23,600.000 KWH	4.32%	24,619.000 KWH	-6.50%	23,019.000 KWH
September	34,636.000 KWH	-14.77%	29,520.000 KWH	-0.27%	29,440.000 KWH	2.40%	30,148.000 KWH
October	35,919.000 KWH	-0.67%	35,680.000 KWH	-4.26%	34,160.000 KWH	-2.59%	33,276.000 KWH
November	40,168.000 KWH	2.17%	41,040.000 KWH	-6.24%	38,479.000 KWH	-14.97%	32,719.000 KWH
December	33,848.000 KWH	10.85%	37,520.000 KWH	-7.89%	34,560.000 KWH	-3.45%	33,368.000 KWH
January	40,474.000 KWH	-11.25%	35,920.000 KWH	-5.10%	34,088.000 KWH	-14.08%	29,289.000 KWH
February	33,990.000 KWH	27.78%	43,434.000 KWH	-11.96%	38,240.000 KWH	-3.57%	36,874.000 KWH
March	42,702.000 KWH	-20.03%	34,150.000 KWH	-5.86%	32,150.000 KWH	-3.98%	30,870.000 KWH
April	38,293.000 KWH	-1.86%	37,582.000 KWH	8.94%	40,942.000 KWH	-100.00%	0.000 KWH
May	37,971.000 KWH	-8.77%	34,640.000 KWH	-11.16%	30,773.000 KWH	-100.00%	0.000 KWH
June	29,733.000 KWH	23.67%	36,771.000 KWH	-8.48%	33,651.000 KWH	-100.00%	0.000 KWH
Total	**415,941.000 KWH**	**0.88%**	**419,590.000 KWH**	**-4.83%**	**399,315.000 KWH**	**-30.78%**	**276,416.000 KWH**

Month	2006		2007		2008		2009
July	$3,043.00	35.98%	$4,137.88	-1.78%	$4,064.30	1.56%	$4,127.50
August	$4,221.00	-25.18%	$3,158.11	5.23%	$3,323.23	0.16%	$3,328.42
September	$4,921.00	-16.75%	$4,096.65	0.80%	$4,129.40	8.43%	$4,477.42
October	$5,055.00	-4.48%	$4,828.45	-3.52%	$4,658.35	4.73%	$4,878.68
November	$5,578.00	-3.29%	$5,394.73	-5.15%	$5,117.07	-5.29%	$4,846.40
December	$4,940.00	1.55%	$5,016.64	-5.61%	$4,735.06	4.97%	$4,970.48
January	$6,391.00	-23.34%	$4,899.06	-1.28%	$4,836.44	-4.26%	$4,630.53
February	$5,527.00	3.15%	$5,701.23	-8.71%	$5,204.58	7.27%	$5,583.10
March	$6,706.00	-30.57%	$4,656.11	-2.41%	$4,543.90	6.70%	$4,848.47
April	$6,112.00	-16.90%	$5,079.34	7.70%	$5,470.63	-100.00%	$0.00
May	$6,071.00	-22.37%	$4,713.20	-6.06%	$4,427.62	-100.00%	$0.00
June	$4,138.00	19.43%	$4,941.90	-6.80%	$4,605.70	-100.00%	$0.00
Total	**$62,703.00**	**-9.70%**	**$56,623.30**	**-2.66%**	**$55,116.28**	**-24.36%**	**$41,691.00**

Summary

The NHEC recommends that the Town of North Hampton implement an energy policy that requires all thermostats be turned down at the close of business every day and that all computers, printers, copiers etc. be powered off.

Turning Things Off

Turn off lights when they are not in use. Occupancy sensors and timers can help, but a less expensive alternative would be to educate and motivate employees to turn lights off at the end of the day.

During work hours make sure the energy saving mode is enabled on all office equipment. Power off all computers and monitors at the end of the day and then toggle the surge protectors to "off". Reduce phantom loads such as TVs, VCR/DVD Players, Cable Boxes (DVRs), chargers, stereos, microwave ovens, water coolers and surge protectors.

Turning Things Down

During closed hours, turn temperature settings down in warming season and up in cooling seasons. Typical office buildings are occupied only 24% of the time (40 hours per week), 76% of the time these areas are unoccupied which make them a prime target for energy saving measures.

Summary of Findings with Recommended Corrective Actions

Finding	Building	Location	Recommended Action
Outdoor light above doorway is constantly on	TO	North stairwell/employees entrance	Wire so that it is on a timer or photovoltaic sensor.
Indoor light in stairwell left on	TO	North stairwell/employees entrance	Install occupancy sensor
HVAC house fan left on	TO	Town office HVAC system	Post energy saving instructions on wall near thermostat. Use localized personal fans to move air.
T12 fluorescent lights	FD	Main truck bay ceiling above fire trucks	Replace or retrofit with energy efficient T8
Floodlights on during day	FD	Above back door	Photovoltaic sensor & replace incandescent bulbs with CFL flood lights
Floodlight on during day	FD	Flag Illumination	Photovoltaic sensor & replace incandescent bulbs with CFL flood lights
Cracked window	TO	South facing circular window	Replace window with energy efficient model
Fire Dept. widows	FD	All 7 single pane widows, 5 on west side 2 in front	Replace with high efficiency models
Fire Dept hose tower	FD	Single pane window	Replace with high efficiency models
Fire Dept hose tower	FD	Interior of hose tower	Shut heat off when not in use – find alternative method to drying hoses in winter
Fire Dept furnace	FD	Furnace Room	Replace with energy efficient model
Basement insulation	TC	Basement ceiling/floor joists	Insulate FHA ducting and between floor joists.
Insulation adjustment	TO	10” Batt insulation, top plate entire perimeter of town office	Inspect insulation installation and adjust where necessary
Computer server room inefficiency	TO	Server room off of TO storage	Re-think this area (see report specifics)

Building shell intrusions	TO	Police furnace room / TO furnace room	Close up and insulate problem areas
Building maintenance and repairs	ALL	Should be standard operating practice	Replace, repair, reseal any and all holes opened up for maintenance
Exterior doors	FD	Back doors	Replace both doors
Storm window on back door	TC	Back Door	Install storm window on back storm door, currently has a screen only.
Water heater to hot	OTH	Basement of Old Town Hall	Turn heat down to 110
Water heater insulation	OTH	Basement of Old Town Hall	Insulating blanket / timer
Old inefficient refrigerator	OTH	Kitchen	Remove as soon as possible
Incandescent lights	OTH	Throughout the building	Replace with CFLs
Refrigerated Vending Machine	FD	Front of Fire/Police Department	Remove (recommended)or Replace with energy star model.
Office area refrigerated water dispensers	ALL		Remove, use town water and existing office refrigerators for water needs.

- Building Codes: OTH = Old Town Hall, TO = Town Offices, FD = Fire Department, PD = Police Department, TC = Tax Collectors Office

Approved by the North Hampton Energy Committee

11 June 2009

NHEC Members:

Name	Signature
Name	Signature
Name	Signature
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