Center Harbor

Municipal Buildings

A Comprehensive Energy Plan for the Future

Prepared by: The Jordan Institute as part of its *GSE2 Program*

November 18, 2009

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The Jordan Institute

Building Climate Change Solutions

Center Harbor Municipal Buildings
Energy Assessment Report
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Disclaimer: This report is delivered without any warranties, expressed or implied. This report contains information about the Center Harbor Municipal Buildings only and is based upon our observations and upon information which we received from Town officials. No estimation of utility and/or government incentive programs is included in this report; these should be researched and sought during design of the implementation phase. The Jordan Institute has used care, its best professional judgment, and the services of qualified vendors and sub-contractors to research and prepare this report, and we believe we are presenting an accurate and complete assessment of your buildings and the opportunities they present for energy improvements. But The Jordan Institute shall not be liable for any inaccuracies in this report, for any damages that may result from the implementation of measures recommended in this report, or discrepancies between the avoided energy cost estimates listed in this report and those which the school actually realizes from the implementation of the outlined plan.

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Executive Summary

The Jordan Institute (TJI) has been contracted to analyze the opportunities for energy conservation and efficiency improvements at three Center Harbor Municipal Buildings. Over the past few months, a team of consultants, contractors, and TJI personnel has developed a comprehensive energy plan for the Town to follow in order to cost-effectively reduce the energy consumption and carbon footprint of these buildings.

In doing so, many **Energy Efficiency Measures (EEMs)** have been studied. Our evaluation has produced a list, starting with no-cost measures, moving to those with a favorable return on investment which we feel should be pursued – both urgently and over the longer term – and finally those EEMs not recommended. This report is a presentation of our findings.

TJI evaluated many viable measures and, with this report, is recommending that certain solution steps be implemented in order to reduce the energy consumption and improve the energy efficiency at the three Center Harbor Municipal Buildings.

The list of the EEMs is below, and a more detailed description of these measures is included in the body of this report. The projected capital cost and savings appear in the breakdown following the complete descriptions of the EEMs. A full financial model with paybacks is included as Appendix A. All predicted costs and savings listed here are estimations to be used as a guide for planning and for moving toward the implementation process, where the numbers will be refined and become more specific as a result of actual bids, etc.

IMMEDIATE NO/LOW COST INITIATIVES

- Institute a computer scheduling protocol that requires monitor and CPU shutdown.
- Encourage the use of task lighting to enable overhead lighting reductions.
- Shut and lock windows during the heating season.
- Reduce thermostat settings by 3 degrees during heating season.
- Add low-flow aeration devices to all faucets.
- Move vending machine.

RECOMMENDED EEMs

- Air Sealing / Additional Shell Insulation
- Glazing & Door Improvements
- Lighting & Lighting Control Upgrades
- Appliance Upgrades

- Heating System Upgrades
- Mechanical Control Upgrades
- Renewable Energy Systems

MEASURES NOT CURRENTLY BEING RECOMMENDED

- Biomass
- Highway Department Insulation
- Ground Source Heat Pumps
- Propane Fired Combined Heat and Power Unit

ENERGY USE REDUCTION AND COST AVOIDANCE

The results of our analysis indicate that by following this energy plan, the energy use reductions and energy cost avoidance listed below can be achieved:

RECOMMENDED EEMS	MUNICIPAL BUILDING	LIBRARY	HIGHWAY DEPT.
% ENERGY USE REDUCTION	**49.0%**	**9.2%**	**13.6%**
% ENERGY COST AVOIDANCE	**67.6%**	**7.8%**	**16.0%**
CAPITAL INVESTMENT	**$271,690**	**$48,315**	**$25,810**

The capital investment will become more precise in the course of a bidding process, during the implementation phase. This figure also depends upon timely implementation.

Please see our financial modeling and analysis (Appendix A) for a complete presentation of costs and benefits related to this project.

TJI recognizes the Town of Center Harbor's desire to be a leader in energy efficiency and green, environmentally sound, practices. Those aims align perfectly with the TJI mission and we are fully prepared to help you achieve your goals. This report outlines our recommendations to get you there.

Introduction

The Jordan Institute (TJI) is a New Hampshire non-profit organization with principal offices at 49 N. Main Street, Concord, NH 03301. We work to implement significant climate change solutions by reducing energy use in buildings. According to the US-EPA, investing in measures that will reduce energy use is the fastest, most cost-effective strategy to reduce greenhouse gas emissions. And greenhouse gas emissions from buildings account for well over half of all such emissions in this country – 59% in the rural state of New Hampshire. Energy Efficiency Measures (EEMs) for buildings are available immediately, at reasonable cost, and yield tremendous gains in building performance. Furthermore, and more important to your bottom line, they help control the operational costs of your buildings.

TJI is an independent, mission-driven organization, governed by a Board of Directors. We represent no product lines. We sell nothing but our energy conservation and efficiency services. We seek to fill an "honest broker," third-party role, serving much like an energy department for our clients, aiming for high value, long-term results in energy demand reduction and energy supply alternatives that will contribute to the mitigation of global climate change while improving the comfort, productivity, and cost-effectiveness of buildings.

TJI was founded in 1995 with a bequest from a Seacoast New Hampshire area couple eager to see an organization working to enhance the quality of life through strategic activities at the intersection of the economy, the environment, and public health. Over the years, TJI has moved in a natural progression from award-winning work in environmental planning and the importance of thoughtful, low-impact land development to our current focus on forcefully addressing global climate change by significantly reducing fossil fuel use and the consequent greenhouse gas emissions from buildings.

To address the reduction of greenhouse gasses through available EEMs, TJI has established the **Granite State Energy Efficiency Program (GSE2).** GSE2 is a comprehensive program to plan, implement, and evaluate energy performance improvements in all major building sectors and to expand funding options to achieve energy savings. GSE2 tackles major barriers to improved energy performance of buildings: lack of know-how, lack of organizational focus, lack of up-front capital,

and inability to aggregate projects to produce energy-saving action on a large scale. The GSE2 Program Manager is Gary O'Connell.

For the Center Harbor Municipal Buildings the TJI in-house team of building professionals has partnered with contractors and vendors who specialize in the wide variety of strategies available to make buildings more energy efficient. That collaboration has resulted in this comprehensive analysis of your buildings' needs and opportunities.

The findings and recommendations from our team of experts have been reviewed by the TJI project team and the most promising suggested upgrades have been entered into our energy modeling calculator, with their estimated costs going into our financial modeling software. This report summarizes the results of that process. Not all evaluated measures/costs are recommended.

Facilities

Building Descriptions

The Municipal Building, housing Town Offices and the Police and Fire Departments, was built in 1969. It also serves as a small meeting space for town-related business. It is a 7,077 square foot masonry building on an uninsulated concrete slab, with low-pitched roof angles, large glass roll-up doors for the fire equipment, and a history of an inadequate thermal barrier between the inside and the outside.

The Library was built in 1910 using quarried stone, masonry, and wood framing, and it is now on the National Register of Historic Places. It is a 2,010 square foot single-level neo-classical construction with a dome. There is a basement with an uninsulated foundation that is used regularly for storage which also includes a small staff break room. The roof is slate, and there are two fireplaces which are exposed but no longer in use. The building has had a full window upgrade consistent with historic guidelines, but the windows are now fixed in place and cannot be opened.

The Highway Department building was built in 1987. It is a pre-engineered structure on an uninsulated slab, with a metal roof. It was built by the Trapper Brown Corporation on a site some distance from the main part of Town. The building is divided into three use areas: One, about 3,000 square feet, provides conditioned space for parking and servicing of large Town trucks and other equipment; another, about 1,200 square feet, serves as a conditioned bay for parking and maintaining one of the Town's fire trucks; and the last, about 3,000 square feet, is an unconditioned warehouse area for storing seasonal and other equipment. The total square footage of the building is about 7,200 square feet, with about 4,200 of that being conditioned space. There are a total of six large roll-up overhead doors in the building.

Existing Heating, Ventilation and Air Conditioning (HVAC) equipment

Heat for the Municipal Building is provided by two oil-fired boilers which run in series. Heat is distributed by hot water piping to coils in ceiling mounted fan units. The fire station has 5 such heaters (Modine-style fan and coil units) near the ceiling and the office spaces get forced hot air

through duct work in both the floor and ceiling. Air conditioning is supplied to the Town Offices by a compressor outside in the back, and a window unit is employed for the Police Department office. There is also a window AC unit in the Fire Chief's office but it is located in a window that opens to the interior of the rest of the building and is said never to be used. Domestic hot water for the building comes off the heating system and does not run in the summer time to save fuel.

Heat for the Library is supplied by a new Dunkirk oil-fired steam boiler, installed in 2007. Supplemental heat, when needed on the coldest winter days, comes from a Mr. Slim electric "split" system installed over the front door. This equipment also provides cooling in the summer. Domestic hot water requirements in the Library are minimal, supplied by a small electric tank in the basement. There is no mechanical ventilation in the building and the windows cannot – by design – be opened; fresh air enters the building only when doors are opened.

The Highway Department building is heated by two original equipment propane-fired Dayton heaters, each running at about 80% efficiency. The larger unit serves the municipal garage space from a mezzanine above the work floor. And the fire department bay has a smaller similar unit which operates independently. This equipment is controlled manually, including a night set-back option. The building also contains three small electric resistance baseboard strip heaters with knob-style thermostats. There is one in both the office space and the bathroom space of the municipal garage, and one in the bathroom of the fire department bay. Domestic hot water for the Highway Department garage building comes from a State Select 19.9 gallon electric water heater, supplying wash rooms in both the garage area and the fire department bay. The entire building is insulated – both the conditioned and the unconditioned spaces – with about two inches of fiberglass batting. The unconditioned space is said to seldom drop below freezing.

Existing Maintenance Issues

In the Library there is a weekly requirement that someone manually drain the steam boiler condensate line of about 2 to 3 cups of water – until it runs clear. This is done to prevent sludge build up in the steam distribution system and to prevent deterioration of the piping. The Library also requires two dehumidifiers in the basement to remove excess humidity in the warmer months.

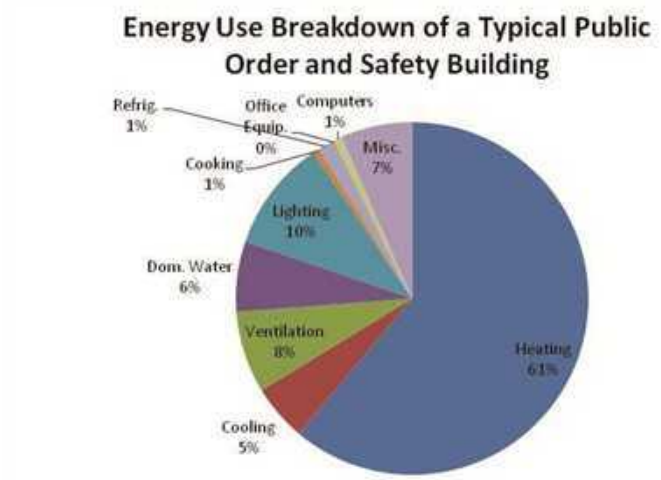
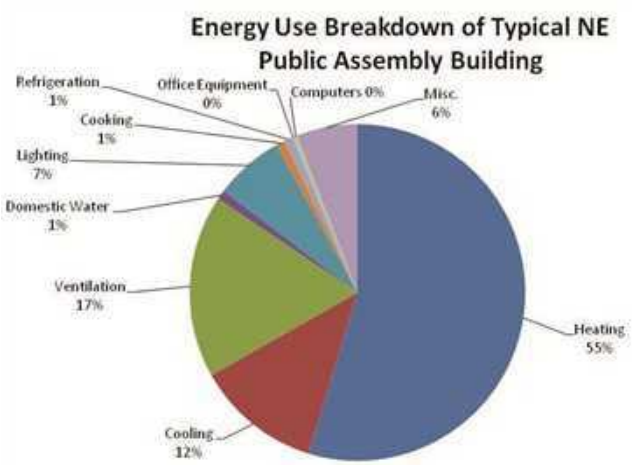
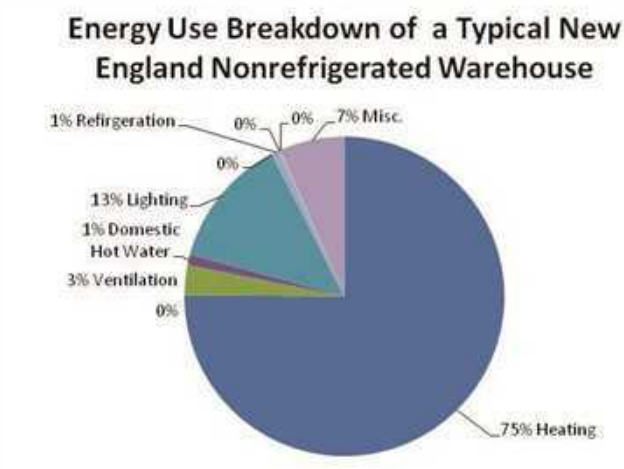
Existing Energy Consumption

The U.S. Department of Energy tracks the breakdown of energy usage in eighteen different building categories via their *Commercial Buildings Energy Consumption Survey* (CBECS). The survey is conducted every four years. This information is available on a regional basis and New England is listed within the data. It should be noted that the CBECS data used to create the graph below is based on 2003 responses to the survey (2007 data is not yet published).

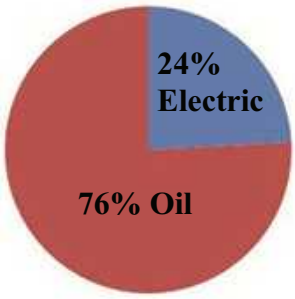
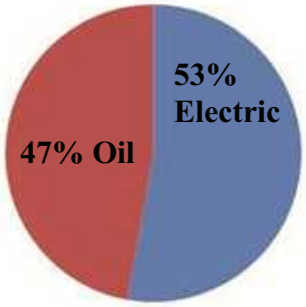
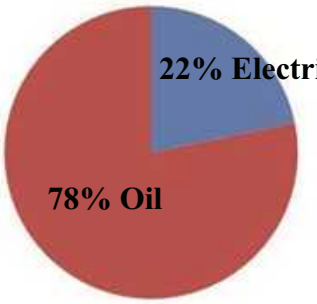
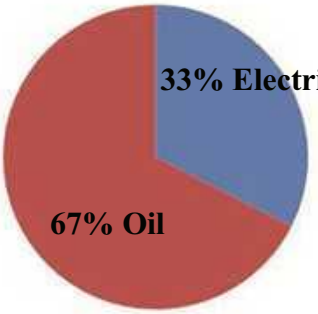
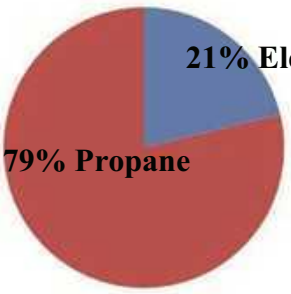
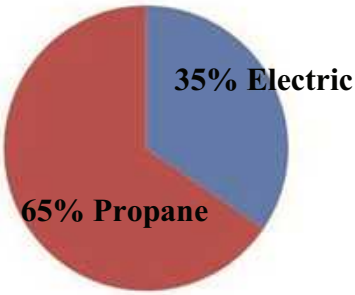
To review this data you can visit the following site and view File 17:
www.eia.doe.gov/emeu/cbecs/cbecs2003/public use 2003/cbecspudata2003.html

Within the New England region, the typical public order and safety and public assembly facilities consume energy in the manner displayed in Figure 1, which also shows actual energy consumption of Center Harbor Municipal Buildings for comparison. TJI personnel created Figure 1 using the CBECS data found in File 17.

Figure 1: Energy Use Breakdown Comparisons

Municipal Offices		**Center Harbor:** 68% Heating 7.65% Hot Water 7.2% Lighting 5.8% Ventilation 3.6% Cooling .7% Computers .7% Refrigeration .2% Office .7% Cooking 5.1% Misc.
Library		**Center Harbor:** 77% Heating 1.4% Hot Water 3.4% Lighting 8.4% Ventilation 5.9% Cooling .2% Computers .4% Refrigeration .1% Office .4% Cooking 3% Misc.
Highway Dept		**Center Harbor:** 78% Heating 1.04% Hot Water 11.5% Lighting 2.6% Ventilation 0% Cooling 0% Computers .9% Refrigeration 0% Office 0% Cooking 6.2% Misc.

The above usage profile (adjusted slightly and allocated to your building's energy history) has produced *Figure 2* below:

Figure 2:	Energy Use Breakdown by Type Usage	Energy Use Breakdown by Cost
Municipal		
Library		
Highway Dept		

Building Benchmarking

A building's energy use is displayed as annual **Energy Use Intensity (EUI)**, the sum of all energy consumption using British Thermal Units per square foot (BTU/SF) per year. Because the numbers get so large, EUI is often expressed as thousands of BTU/SF, or kBTU/SF, an industry-wide recognized unit. There are two types of EUI, *source* and *site*. Source EUI refers to all energy consumed at the facility being analyzed *plus* the energy required to provide generation and transmission. Site EUI refers solely to the energy consumed at the facility. For the purpose of comparison across buildings, we have chosen source EUI because that is the unit of measurement adopted by the Department of Energy's CBECS reporting.

The second pertinent value is **Cost Use Intensity (CUI)**, the sum of all energy costs expressed in dollars per square foot ($/SF) annually. This is also an industry-wide recognized value.

Here are the benchmark numbers for the three Center Harbor municipal buildings using 2008/2009 energy use and cost data provided by Town officials:

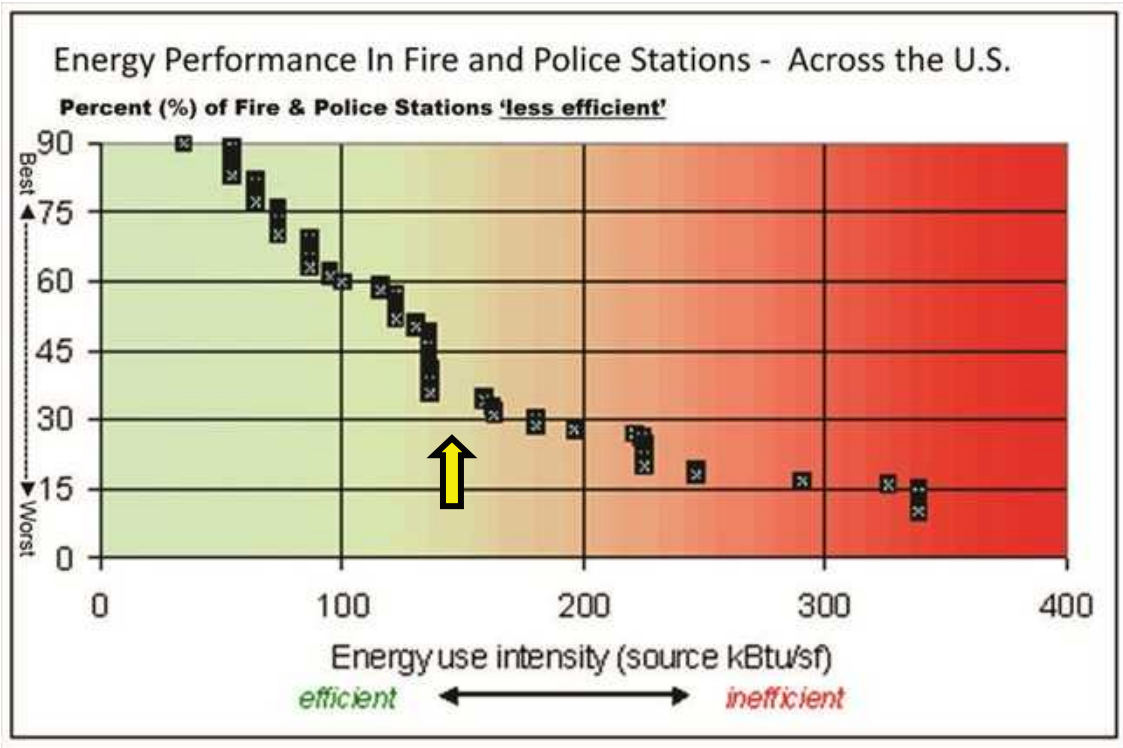
Municipal Building	**Library**	**Highway Department**
EUI = 142.1kBTU/SF	EUI= 145.2kBTU/SF	EUI= 130.0kBTU/SF
CUI= $2.42/SF	CUI= $3.50/SF	CUI= $2.93/SF
SF= 7,077	SF= 2,010	SF= 4,200

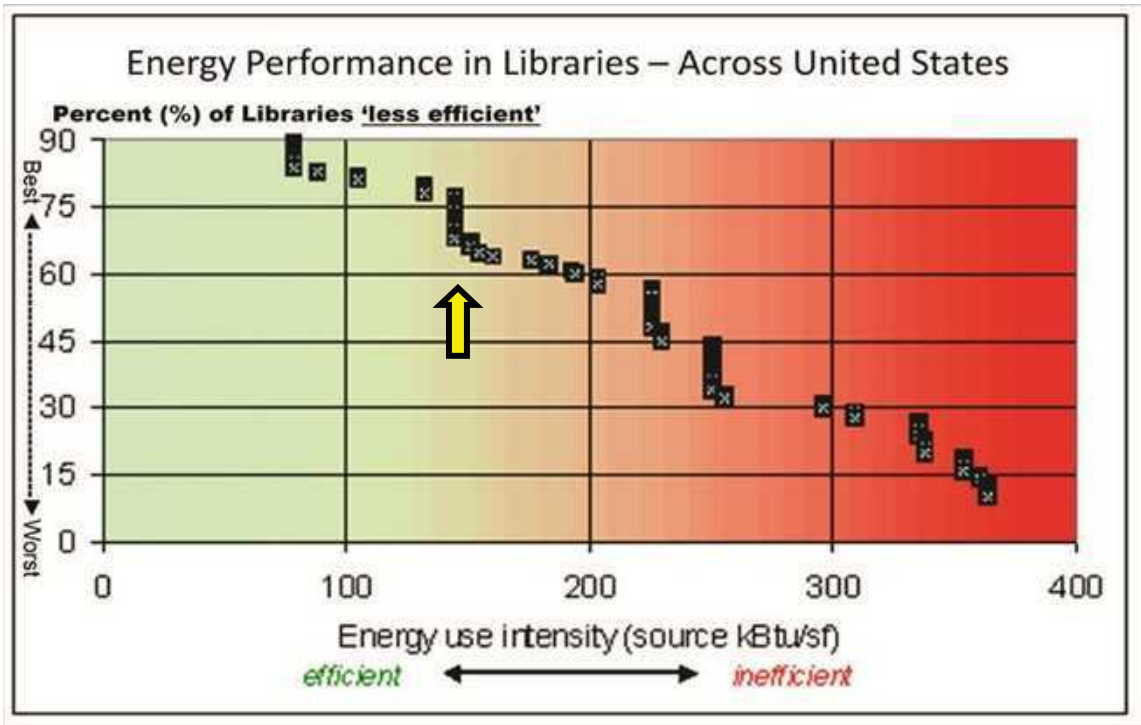
Although many factors driving a building's CUI are linked to current unit prices and market conditions, the building's EUI is a value which The Jordan Institute's experienced staff can significantly help to reduce. The numbers above provide the "benchmark" against which to measure those reductions.

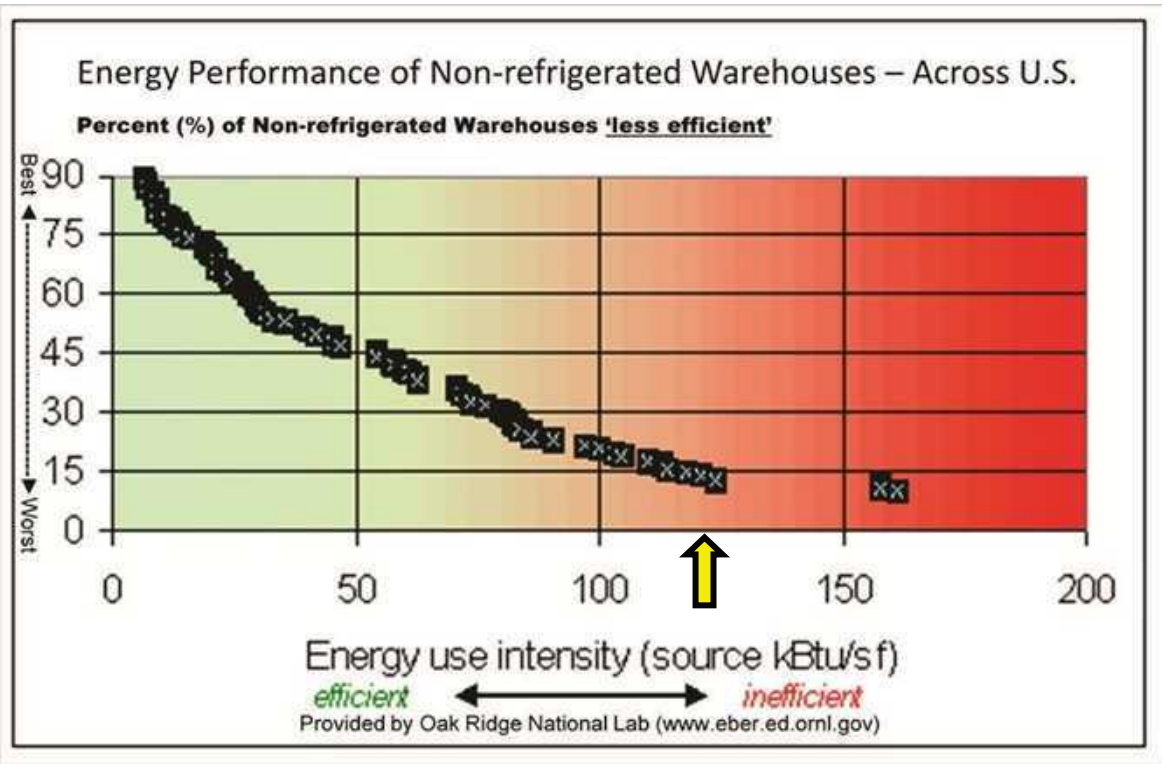
For building benchmarking and to help us compare building performance against other similar buildings, TJI uses a statistically representative building model, also created from the CBECS responses. In New England, CBECS covered 252,000 buildings. Using the responses from the survey, the graph below was created by the Department of Energy's Oak Ridge National Laboratory for making building energy performance comparisons. For a more in-depth explanation of building benchmarking go to: http://eber.ed.ornl.gov/benchmark/bldgtype.htm

The three graphs below were created by Oak Ridge National Laboratory using CBECS data. We

have added the yellow arrow in each case to locate the Center Harbor buildings along the range of buildings to which they are being compared:







No-Cost / Low-Cost Initiatives

There are a few Energy Efficiency Initiatives that will cost the Town of Center Harbor little to no money to implement. It is important to encourage staff and occupants of these buildings to change their behavior slightly – which is not easy – but such efforts will produce energy savings without any other investment. For this reason, The Jordan Institute feels compelled to list these initiatives as part of this analysis. By training the building's occupants to alter a few simple routines, energy can be saved regardless of equipment upgrades. These No-Cost /Low-Cost Initiatives are:

❶ **Computer Settings:** An easy way to reduce plug load and thus electricity use is to turn off all computers at night and when not in use for extended periods of time.

Since computers are in use more hours per day than they used to be, power management is important to saving energy. ENERGY STAR® power management features place computers (CPU, hard drive, etc.) into a low-power 'sleep mode' after a designated period of inactivity. Low-power modes for computers reduce the spinning of the hard disk, which decreases power consumption. Simply hitting a key on the keyboard or moving the mouse awakens the computer in a matter of seconds. For information on power management or procurement specs, visit these two good web resources: www.energystar.gov/index.cfm?c=power_mgt.pr_power_management & www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CO

❷ **Task Lighting:** To reduce electric demands from lighting, task lighting should be encouraged, where appropriate. A task lighting initiative would encourage building occupants to shut-off the ceiling mounted lighting and to depend on task lighting (portable desk lamps, workstation under-shelf lighting, etc.) to provide the illumination they may need whenever possible. Providing task lighting devices for spaces appropriate to their use may entail a small expense if task lights do not presently exist.

A related item is the need, noted in both the Municipal Building and the Library, to replace existing incandescent light bulbs with appropriate compact fluorescent bulbs.

❸ **Reduce Drafts:** For ventilation systems to work effectively, and to prevent air infiltration, shut and lock the windows. This practice is successful during both the heating and cooling seasons. All window manufacturers list infiltration values based upon locked sash conditions, not just shut. A shut but not locked condition allows unwanted air infiltration, especially if the sash is left ajar for extended periods. Again, regardless of the quality of the window units, this practice saves energy.

❹ **Thermostat Setback (3°F+/-):** To reduce demands from the heating source, thermostat settings can be cut back by 3°F when outside temperature allows. Studies have shown that when the average outside temperature is above 38°F, a slight adjustment down on interior temperature settings does not influence comfort. Over an eight-hour workday this practice can produce a noticeable energy use reduction. It is suggested that the staff perform a test to see if comfort level is greatly affected. www.energystar.gov/index.cfm?c=power_mgt.pr_power_management & www.energystar.gov/index.cfm?fuseaction=find a product.showProductGroup&pgw code=CO

❺ **Low Flow Plumbing Devices:** We recommend adding flow-restricting aeration devices to all faucets. This will reduce both the amount of water which must be purchased for the building and the sewer charges to take it away.

❻ **Vending Machine:** We recommend moving the vending machine in front of the Municipal Building to the rear of the building. This will reduce the cooling load of the vending machine, as it will be out of direct sunlight.

❼ **Controls:** Thermostat to control ceiling fans in the Highway Department Garage**:** We recommend that a thermostat be installed at the ceiling to turn the ceiling fans on when the temperature reaches a pre-set level and would provide a benefit below if circulated. This

thermostat could be over-ridden in the summertime.

The Library is also equipped with an antiquated thermostat and the installation of a digital programmable unit with night setback capabilities is recommended.

❽ LED Exit Signs: All exit signs in town buildings should be upgraded to LED technologies.

Measures for Future Consideration

❶ **Point of use domestic hot water heaters for the Highway Department and Municipal Building.**

Domestic hot water (DHW) in the Municipal Building is currently derived with a heat exchanger from the hot water produced to heat the building. In the months when the heating system is not operating, there is no DHW in the building. There is very little hot water required in the Municipal Building – hand washing and a small amount of dish washing accounting for most of it – so we recognize the hesitation to provide year-round DHW. However, code requirements for a public building like this may mean that the situation should be addressed. And certainly the convenience and well-being of fire and police personnel returning to the building after a job argues for year-round hot water. We recommend the installation of a small point of use electric hot water heating system to provide year-round hot water to the bathrooms. This could most easily be accomplished during the work anticipated in the heating system upgrade of the building, but may understandably be postponed until maintenance of the plumbing system can include it.

DHW in the Highway Garage is currently provided by a small electrically heated storage tank. It seems to be working, is used relatively little, and does not meet the cost/benefit test for replacement. But we suggest when replacement time comes that consideration be given to using a small point of use electric (or propane, since there is a propane supply already at the building) water heating system that would supply the bathrooms.

❷ **Appliances:** When it is time for replacement of new appliances for any of the buildings, Energy Star models should be selected, as they are more efficient that traditional models.

Measures Not Recommended At This Time

❶ **Biomass-fired district heating plant for the Municipal Building and the Town Library.** Our evaluation of a pellet boiler solution was not viable due to the small load of the Municipal building alone. We considered tying the Library into the system however, distribution renovations did not help to make this measure economically feasible. This option should be revisited if the plans to create a third building on the site materialize.

❷ **Additional insulation in the Highway Department Garage.** We considered the addition of rigid foam board insulation to the inside of both the wall and ceiling areas of the conditioned spaces in the Highway Department Garage, but the expense was larger than could be justified by the savings to be gained. Energy use in the garage is relatively small already and payback time for measures to improve thermal performance will only be shortened by the rising of fuel prices. At some point in the future, adding more insulation to this building will make economic sense, but not yet.

❸ **Ground Source Heat Pumps.** We found this measure to be an expensive retro fit requiring new piping in the Library and Fire Station section of the Municipal building. As well as the currently low air conditioning demand and lack of hot water demand year round.

❹ **Combine Heat and Power.** We looked into a propane system as natural gas is not available in the area. Similar to Ground Source Heat Pumps, distribution retrofit combined with low air conditioning and domestic hot water demands, this measure was not feasible.

Recommended Energy Efficiency Measures (EEMs)

The following EEM descriptions, projected costs, and resulting energy savings are the result of TJI's work with qualified consultants and contractors who have studied your building. At implementation, these prequalified contractors will provide the most competent installation of their unique scope of work. The costs and savings shown in the following tables are approximations and are expected to be refined and sharpened during the implementation phase.

A breakdown of the energy savings and investment costs generated by these measures can be found following each of the EEM descriptions. Please note that the specific tables following each

EEM description display energy savings in kBTUs. The descriptions of the suggested EEMs are presented below in detail.

A note about air sealing and insulation:
Critical to any successful building envelope upgrade is an analysis to determine the effectiveness of existing barriers to air leakage. This process of identifying and measuring air leakage in a building is done using two very distinct but complementary procedures: blower door testing and infrared imaging – or, when the temperature differential between inside and outside is low, the use of theatrical fog – to make the location of unwanted air infiltration visible.
The first step in blower door testing is to create a pressure difference between the interior of the building and the outside so that unwanted air movement through the leaks can be detected. This pressure difference is created using large depressurization fans properly installed, calibrated, and sealed into various entrances throughout the building.

Using appropriate metering techniques, blower-door testing will uncover *how much* infiltration is occurring in a building. The test result is presented in cubic feet per minute per square foot of building shell area at 50 Pascals of pressure. Most buildings in the United States are tested at the same level of pressure (50 Pascals) as a means of comparison.

To reduce the amount of air leakage and to improve the thermal effectiveness of a building's shell, we regularly propose the strategic use of air sealing and additional insulation in the building, based on the findings of the blower door and related tests. Air sealing is the process of creating a continuous seal at the building perimeter in order to eliminate infiltration of unwanted air. This is a process which has a major impact on both the heating and cooling load of a building.

Air sealing is not insulating, however. Air sealing is strictly intended to stop the air flow through the building's shell. Air sealing addresses heat loss due to infiltration and *convection*, whereas adding insulation addresses heat loss due to *conduction*. Sometimes the application of a spray foam material can provide an air seal *and* appropriate additional insulation, as well as a moisture barrier in certain installations.

The Recommendations

After considerable analysis, comparison, and consultation with vendors and contractors familiar with a number of possible energy efficiency technologies, TJI is proposing the EEMs summarized in Table C, below, for the Center Harbor buildings:

TABLE 1 – Energy Efficiency Measure by Location

EEMs	Description	Muni Bldg	Library	Highway Garage
EEM 1	Air Sealing / Additional Shell Insulation	x	x	
EEM 2	Glazing & Door Improvements	x	x	x
EEM 3	Lighting & Lighting Controls Upgrade	x		x
EEM 4	Heating and Ventilating System Upgrades	x	x	x
EEM 5	Mechanical Control Upgrades	x		
EEM 6	Upgrades to Renewable Energy Systems	x		

MUNICIPAL BUILDING (Police and Fire Departments, Town Offices)

❶ Air Sealing and Insulation in the Municipal Building

Current Shell Conditions at the Municipal Building

1) In the Fire Station, the header area above the overhead doors and the vertical I-beams between the overhead doors are both uninsulated and conducting considerable heat to the outside on cold days.
2) The gable ends (east and west) of the Fire Station are large uninsulated wall areas constructed of concrete block with a brick exterior facing. Each gable end has a narrow mezzanine area which extends into the Fire Station space at a second floor level. Each of these mezzanine areas is now used for storage, but access up a vertical ladder attached to the wall makes use difficult and infrequent.
3) The north and east walls of the Meeting room at the Town Office – or east – end of the Municipal Building are also relatively large uninsulated wall areas and, like the gable end walls in the Fire Station, they too are constructed of concrete block with a brick exterior facing. These walls are losing heat to the outside via conduction, radiation, and direct gaps in the construction at the roof line. The length of recessed fluorescent lighting at the wall-to–roof transition on the north wall of the Mead meeting room is not providing sufficient functional lighting to warrant its continued use.

4) The entire north-facing roof section of the building, from the sheathing out, contains very little insulation and has apparently not been upgraded during the life of the building.
5) The blower door test and the infrared camera images reveal that the Municipal Building has air leakage and heat loss problems at most of the structural transitions: wall corners, wall-to-roof junctions, etc.

Proposed Shell Solutions for the Municipal Building

1) Both the header area over the roll-up doors and the I-beams between the roll-up doors should be covered with closed-cell spray foam on the inside, to insulate them and reduce heat loss due to conduction to the outside.
2) The mezzanine areas at the gable ends of the Fire Station should be thoroughly air sealed and insulated to minimize heat loss out of the building that is now occurring via conduction, radiation, and direct gaps to the outside at the seams. The cavities in the concrete block should be filled with spray foam. The seams at the wall to roof transition should be caulked and sealed. And the interior face of the concrete block in these mezzanine areas should be completely covered with a 2 inch layer of rigid foam insulating board, thoroughly sealed at the seams between boards, and followed by strapping and a fire-rated gypsum board finishing layer over the whole wall.
3) In the Cary Mead meeting room at the east end of the Municipal Building, the north and east walls should be treated much the same as the gable end walls in #2 above. The cavities in the concrete block should be filled with spray foam. The seams at the wall to roof transition should be caulked and sealed. And the interior face of the concrete block should be completely covered with a 2 inch layer of rigid foam insulating board, thoroughly sealed at the seams between boards, and followed by strapping and a fire-rated gypsum board finishing layer over the entirety of each wall area. As part of this upgrade to the insulation and air sealing of the space, the recessed lighting at the wall-to-roof transition on the north wall of the room needs to be removed.
4) Improvements to the north-facing roof section of the Municipal Building should include: removal of the current roofing material down to the sheathing, the addition of 2 inches of rigid foam insulating board with an insulating value of about R-10, the placement of a new layer of sheathing on top of the insulating board, the placement of a layer of bituthene on the new sheathing, and completed with a layer of asphalt shingles.
5) We propose that exterior transitions from brick to clapboard be sealed, as well as all wall-to-roof transitions around the building.

A summary of the predicted savings and capital investment of implementing EEM 1 – Air Sealing & Insulation Upgrades is as follows:

EEM 1 – Air Sealing & Added Insulation

Energy Related Investment	$26,485	Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	45,291	905	2.00%
Annual Electricity Cost	$$ / Yr	$9,035	$181	
Annual Fuel Oil Usage	gallons / Yr	3,498	525	15.00%
Annual Fuel Oil Cost	$$ / Yr	$8,065	$1,210	
TOTAL ENERGY USAGE (kBTU/Year)		644,253	76,539	11.88%
TOTAL ENERGY COST ($$/Year)		$17,100	$1,390	8.13%
		IRR	7.81%	
		NPV	$ 11,910	
		INFLATION ADJUSTED PAYBACK	13.7 years	

❷ Glazing and Door Upgrades at the Municipal Building

Current Glazing and Door Conditions at the Municipal Building

1) All exterior doors, hinged and overhead, would benefit from careful weather-stripping to restrict unwanted heat loss.
2) The overhead door on the north side of the Municipal Building is old, ill-fitting, the source of considerable heat loss from the building, and in need of replacement.

Proposed Solutions for Glazing and Door Opportunities at the Municipal Building

1) We propose that all exterior doors, both the hinged and the overhead types, be carefully weather-stripped and tightened up to reduce unwanted heat loss and cold air infiltration.
2) We propose to have the one overhead door on the north, or back, side of the Municipal Building replaced with a modern insulated and well-sealed overhead door. This replacement, while no longer presenting a glass appearance, will provide better energy performance and will not detract from the uniform glass appearance of the front of the building.

A summary of the predicted savings and capital investment of implementing EEM 2 – Glazing & Door Upgrades is as follows:

EEM 2 – GLAZING & DOOR IMPROVEMENTS

Energy Related Investment	$3,265	Adj. Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	45,291	453	1.00%
Annual Electricity Cost	$$ / Yr	$8,854	$90	
Annual Fuel Oil Usage	gallons / Yr	2,973	179	6.00%
Annual Fuel Oil Cost	$$ / Yr	$6,855	$412	
ADJUSTED ENERGY USAGE (kBTU/Year)		567,714	26,536	4.67%
ADJUSTED ENERGY COST ($$/Year)		$15,710	$502	3.19%
		IRR	20.06%	
		NPV	$ 10,598	
		INFLATION ADJUSTED PAYBACK	5.8 years	

❸ Lighting and Lighting Controls in the Municipal Building

Current Lighting Conditions in the Municipal Building

1) The Municipal Building has undergone a lighting upgrade recently, but it did not include the Fire Station. The high bay lighting in the Fire Station is still old and inefficient T-12 technology.

Proposed Lighting Solutions for the Municipal Building

1) The old T-12 lighting in the Fire Station should be replaced with high efficiency T-5 fixtures and lamps. These fixtures should be lowered so that the lights hang about 15 feet above the floor, allowing clearance for the overhead roll-up doors to open unobstructed. And thought should be given to the on-off switching for these fixtures. T-5 lamps are more efficient than T-12s and will save energy simply in the substitution of the latter for the former – but additional savings can be gained by wiring and switching the fixtures so that different combinations of bulbs are energized depending on the lighting requirements of the task taking place in the space. And we recommend the addition of a daylight harvesting sensor to automatically turn the overhead lights on and off depending on the lumens being received through the overhead doors and other glazed openings.

A summary of the predicted savings and capital investment of implementing EEM 3 – Lighting & Lighting Controls Upgrades is as follows:

EEM 3 – LIGHTING & LIGHTING CONTROLS

Energy Related Investment	$11,500	Adj. Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	45,291	4,530	10.00%
Annual Electricity Cost	$$ / Yr	$8,764	$904	
Annual Fuel Oil Usage	gallons / Yr	2,795	-28	-1.00%
Annual Fuel Oil Cost	$$ / Yr	$6,444	($64)	
ADJUSTED ENERGY USAGE (kBTU/Year)		541,178	11,541	2.13%
ADJUSTED ENERGY COST ($$/Year)		$15,208	$839	5.52%
		IRR	10.74%	
		NPV	$ 11,678	
		INFLATION ADJUSTED PAYBACK	10.7 years	

❹ Heating and Ventilating System Upgrades at the Municipal Building

Current Heating and Ventilating System Conditions at the Municipal Building

1) The Municipal Building is currently heated using two oil-fired Utica boilers, each rated at an output of 231,000 BTUs/hr. They produce hot water which circulates to fan coils where the warmed air is blown into the conditioned space. The two boilers are redundant, operating alternately so that the accumulated hours on each boiler are always about the same. They may, if necessary, operate at the same time on very cold days, but each is large enough on its own to provide the needed heat for the space under most weather conditions. The boilers are, however, about 13 years old and operating at an efficiency level of between 81 and 83% - not high enough to meet current industry standards and far below the value associated with high performance buildings.

Proposed Heating and Ventilating System Solutions for the Municipal Building

1) We recommend that the two current oil-fired boilers in the Municipal Building be replaced with two high efficiency modulating and condensing oil-fired boilers placed in the same location. This state of the art equipment, in combination with the shell upgrades recommended earlier in this report, will provide much more efficient use of the fuel purchased by the Town and will add reliability and ease of maintenance for the personnel responsible for its operation.

A summary of the predicted savings and capital investment of implementing EEM 4 - Heating & Ventilation System Upgrades is as follows:

EEM 4 – HEATING & VENTILATION SYSTEM UPGRADES

Energy Related Investment	$40,875	Adj. Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	45,291	0	0.00%
Annual Electricity Cost	$$ / Yr	$7,816	$0	
Annual Fuel Oil Usage	kWh / Yr	2,823	452	16.00%
Annual Fuel Oil Cost	$$ / Yr	$6,508	$1,041	
ADJUSTED ENERGY USAGE (kBTU/Year)		528,869	63,228	11.96%
ADJUSTED ENERGY COST ($$/Year)		$14,324	$1,041	7.27%
		IRR	2.69%	
		NPV	$ (12,116)	
		INFLATION ADJUSTED PAYBACK	22.3 years	

❺ Mechanical Control System Upgrades at the Municipal Building

Current Condition of Mechanical Controls at the Municipal Building

1) The heating systems in the Municipal Building are currently managed using a Tekmar Controls system. It is a basic system which provides some automation but is dated and in need of upgrading.

Proposed Solutions for Mechanical Controls in the Municipal Building

1) We recommend upgrading the current Tekmar Controls to include more automation in the areas of night use set-back, outdoor temperature reset, and optimal start/stop features. In order to optimize the controls investment, we also recommend that consideration be given to tying the Library in to this mechanical control system, so that both buildings may be monitored and managed from a single location

A summary of the predicted savings and capital investment of implementing EEM 5 – Mechanical Control Upgrades is as follows:

EEM 5 – MECHANICAL CONTROLS UPGRADES

Energy Related Investment	$1,970	Adj. Baseline Data	1st Year Savings	Percent Savings
Electricity Usage	kWh / Yr	45,291	225	2.00%
Annual Electricity Cost	$$ / Yr	$7,816	$45	
Annual Fuel Oil Usage	kWh / Yr	2,371	47	2.00%
Annual Fuel Oil Cost	$$ / Yr	$5,467	$109	
ADJUSTED ENERGY USAGE (kBTU/Year)		465,641	7,411	1.59%
ADJUSTED ENERGY COST ($$/Year)		$13,283	$154	1.16%
		IRR	11.44%	
		NPV	$ 2,291	
		INFLATION ADJUSTED PAYBACK	10.1 years	

❻ Upgrades to Renewable Energy Systems at the Municipal Building

Current Use of Renewable Energy Systems at the Municipal Building

1) The Municipal Building is oriented on its site so that its front faces in a southerly direction, allowing for utilization of passive solar heating. The building designers did take some advantage of this by placing large glazed areas on this face of the building. The overhead doors in the Fire Department section, for instance, are largely made of glass and do allow a good deal of sunshine to penetrate into the inside of the building, warming the floor and other objects, which then release that heat after the sun has moved on.

Proposed Renewable Energy Technology Solution at the Municipal Building

1) We explored a number of renewable energy strategies for the Center Harbor buildings and after economic analysis we have concluded that the best option is to install an array of photovoltaic (PV) cells on the south-facing roof of the Municipal Building. We recommend a grid-tied 39 KW PV system. This system would be flush-mounted, with the array divided into subsections to allow room for service walkways. The system would consist of 170 solar electric panels, each rated at 230 watts. The panels would cover 2,855 square feet of available roof space. The 39 KW system size is large enough to produce power in excess of that required by the Municipal Building and the Library together, which means that Center Harbor will be sending some power back to the grid and reducing its electric bill by that amount each month.

A summary of the predicted savings and capital investment of implementing EEM 6 – Renewable Energy Technologies is as follows:

EEM 6 – RENEWABLE ENERGY TECHNOLOGIES

Energy Related Investment	$188,040	Adj. Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	45,291	38,045	84.00%
Annual Electricity Cost	$$ / Yr	$7,771	$7,590	
ADJUSTED ENERGY USAGE (kBTU/Year)		458,230	129,810	28.33%
ADJUSTED ENERGY COST ($$/Year)		$13,128	$7,590	57.81%
		IRR	5.78%	
		NPV	$ 21,575	
		INFLATION ADJUSTED PAYBACK	16.5 years	

LIBRARY

❶ Air Sealing and Insulation in the Library

Current Shell Conditions at the Library

1) The roof system has been insulated at the ceiling level loosely with fiberglass insulation.
2) Most of the windows in the Library have been upgraded to reduce heat loss in the building, but that upgrade has made those windows inoperable – they do not open. That means that the counter weights hanging in cavities on either side of those windows are no longer needed and have probably been removed, leaving the empty cavities. Air sealing and insulating of the band joist in the basement, 2' from the exterior wall of the entire basement.
3) Both of the fireplaces are no longer in use and have been closed.
4) There are two attic access hatches located in storage closets.
5) Considerable air passage from the basement to the first floor which was evident during the blower door test.

Proposed Shell Solutions at the Library

1) Upgrade the cold roof, pull back the fiberglass insulation and add 1" of foam insulation at the ceiling, cover with existing fiberglass insulation.
2) Foam the weight cavity of the fixed windows.
3) Insulate around both of the fireplaces at the ceiling level in the attic space.
4) It is proposed to insulation and air seal both of the hatches by adding 2" of rigid board to the interior walls of the hatch area and create an insulated hatch door with an air sealed hatch door and closing mechanism.
5) In the storage closet it was noticed that there were holes in the sheetrock creating an opening to the basement. Patch and seal holes in the sheetrock allowing air to infiltrate from the basement to the main level. In addition to patching the small holes, it is recommended to air seal and insulate the band joists in the basement area/floor of the main level with foam insulation. The area to be insulated will be around the perimeter of the building extending 2' into the basement ceiling/main level floor.

A summary of the predicted savings and capital investment of implementing EEM 1 – Air Sealing & Insulation Upgrades is as follows:

EEM 1 – AIR SEALING & ADDED INSULATION

Energy Related Investment	$13,800	Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	12,215	122	1.00%
Annual Electricity Cost	$$ / Yr	$2,285	$23	
Annual Fuel Oil Usage	gallons / Yr	1,082	76	7.00%
Annual Fuel Oil Cost	$$ / Yr	$4,743	$332	
TOTAL ENERGY USAGE (kBTU/Year)		193,158	11,022	5.71%
TOTAL ENERGY COST ($$/Year)		$7,028	$355	5.05%
		IRR	2.74%	
		NPV	$ (3,999)	
		INFLATION ADJUSTED PAYBACK	22.1	years

❷ Glazing and Door Upgrades at the Library

Current Glazing and Door Conditions at the Library

1) The Library's exterior doors, as well as the door from the Librarian's office to the basement and the rear exit, exhibit a lack of air sealing, allowing significant exchange of air with the outside.
2) Originally the windows operated by a rope system with weights and pulleys. No longer in use there is a dead air space allowing for infiltration.

Proposed Glazing and Door Solutions for the Library

1) All of the doors named above should be carefully weather-stripped to minimize leakage of air around them.
2) Foam the weigh cavities of the windows.

A summary of the predicted savings and capital investment of implementing EEM 2 – Glazing & Door Upgrades is as follows:

EEM 2 – GLAZING & DOOR IMPROVEMENTS

Energy Related Investment	$390	Adj. Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	12,215	122	1.00%
Annual Electricity Cost	$$ / Yr	$2,262	$23	
Annual Fuel Oil Usage	gallons / Yr	1,006	40	4.00%
Annual Fuel Oil Cost	$$ / Yr	$4,411	$177	
ADJUSTED ENERGY USAGE (kBTU/Year)		182,136	6,056	3.33%
ADJUSTED ENERGY COST ($$/Year)		$6,673	$199	2.99%

IRR	56.13%
NPV	$ 5,117
INFLATION ADJUSTED PAYBACK	1.9 years

❹ Heating and Ventilating System Upgrades at the Library

Current Condition of the Heating and Ventilating System at the Library

1) The heating system in the Library is an oil-fired steam boiler, installed less than 2 years ago. It does not require attention at this time UNLESS the Town chooses to create a central, district heating system to serve the Library and the Municipal Building as well as the anticipated police station nearby. In that case, substantial changes to the Library's steam heating system would be required to make it compatible with the hydronic technology likely to be utilized by the district plant.
2) Air quality is currently compromised by excess humidity in the basement, a lack of mechanical ventilation, and the inability to open most of the windows in the building.

Proposed Solutions for the Heating and Ventilating System in the Library

1) There are no solution scenarios for the Library heating system unless the Town chooses to build a district heating system to supply all of the municipal buildings, in which case the Library's current steam system would need alteration to utilize hot water from the central system.

2) To address the air quality issues in the Library, we recommend the installation of a properly sized energy recovery ventilator (ERV) in the basement, with vent and return ducts serving both the basement and the first floor. ERVs address dehumidification and provision of fresh air. In the Center Harbor Library, an ERV would make the current dehumidifiers unnecessary in the basement, while providing controlled and pre-heated fresh air to the first floor.

An analysis of the added energy consumption (shown as a negative savings) from EEM 4 – Heating & Ventilating Upgrades is as follows:

EEM 4 – HEATING & VENTILATION SYSTEM UPGRADES

Energy Related Investment	$32,175	Adj. Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	12,215	-488	-4.00%
Annual Electricity Cost	$$ / Yr	$2,239	-$91	
Annual Fuel Oil Usage	kWh / Yr	966	0	0.00%
Annual Fuel Oil Cost	$$ / Yr	$4,234	$0	
ADJUSTED ENERGY USAGE (kBTU/Year)		176,080	-1,665	-0.95%
ADJUSTED ENERGY COST ($$/Year)		$6,474	-$91	-1.41%
		IRR	n/a	
		NPV	$ (34,696)	
		INFLATION ADJUSTED PAYBACK	0.0 years	

HIGHWAY DEPARTMENT GARAGE

❷ Glazing and Door Upgrades for the Highway Department Garage

Current Glazing and Door Conditions at the Highway Department Garage

1) There are four existing overhead doors which open into the conditioned space of the Highway Department Garage, three into the Highway Department portion, and one into the Fire Department portion. These four doors could all be improved by the installation of proper weather-stripping to address unwanted air infiltration and heat loss. The hinged access doors are also in need of weather-stripping and sealing.

Proposed Glazing and Door Upgrades at the Highway Department Garage

1) We recommend that all doors, both overhead and hinged, which open into a conditioned portion of the Highway Department Garage, including the Fire Department's portion, should be properly weather-stripped and sealed to minimize unwanted air infiltration and heat loss.

A summary of the predicted savings and capital investment of implementing EEM 2 – Glazing & Door Upgrades is as follows:

EEM 2 – GLAZING & DOOR IMPROVEMENTS

Energy Related Investment	$16,600	Adj. Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	23,543	4,708	20.00%
Annual Electricity Cost	$$ / Yr	$4,544	$909	
Annual Propane Usage	gallons / Yr	3,261	-65	-2.00%
Annual Propane Cost	$$ / Yr	$8,606	-$172	
ADJUSTED ENERGY USAGE (kBTU/Year)		380,341	10,077	2.65%
ADJUSTED ENERGY COST ($$/Year)		$13,150	$736	5.60%
		IRR	6.48%	
		NPV	$ 3,737	
		INFLATION ADJUSTED PAYBACK	15.5 years	

❸ Lighting and Lighting Control Upgrades at the Highway Department Garage

Current Lighting and Lighting Control Conditions at the Highway Department Garage

1) Lighting inside the two conditioned spaces in this building is currently entirely by artificial means. When the overhead doors are down, daylight cannot enter the building. As a result, electricity must be used to light the space, even mid-day on a sunny but cold day.
2) The current night lighting for the building is provided by two exterior "street" style lights which are located indoors and which are left on all the time to overcome the darkness upon entering the building day or night.
3) The interior lighting is now provided by high pressure sodium lamps, also an outdated and inefficient technology for the uses to which it is being put in this building.
4) The unconditioned storage and warehouse space to the rear of the Highway Garage gets only episodic use. One person can now enter, turn on the overhead lights, and then leave without turning those lights off and they may remain energized for many hours before the next person comes along and remembers to turn them off.

Proposed Lighting and Lighting Control Solutions for the Highway Department Garage

1) To provide some daylight to the Highway Garage space (the Fire Department does not have the occupancy time to justify its inclusion here), and to reduce the need for artificial lighting use during daytime occupancy, we recommend the installation of 4 Day Star skylights evenly spaced around the roof of this section of the building.
2) We recommend replacing the current indoor "street" lights with two compact fluorescent spot lights wired to a motion sensor placed just inside the main entry door.
3) We recommend that the current high pressure sodium lamps which are lighting the interior of the Highway Department's conditioned space be removed and replaced with high efficiency T-5 fluorescent fixtures and lamps. The fixtures should be suspended from the ceiling at a height which places them just above the overhead doors when they are in the "up" position, and, for the ones toward the front of the space, in a location between the overhead doors so that their light is not blocked when the doors are up.
4) In the unconditioned warehouse space, we recommend that a motion sensor be added that would turn the existing lighting on and off with use. The sensor could, of course, be over-ridden with a standard switch if necessary.

A summary of the predicted savings and capital investment of implementing EEM 3 – Lighting & Lighting Controls is as follows:

EEM 3 – LIGHTING & LIGHTING CONTROLS

Energy Related Investment	$6,350	Adj. Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	23,543	1,648	7.00%
Annual Electricity Cost	$$ / Yr	$3,635	$318	
Annual Propane Usage	gallons / Yr	0	0	0.00%
Annual Propane Cost	$$ / Yr	$0	$0	
ADJUSTED ENERGY USAGE (kBTU/Year)		370,264	5,630	1.52%
ADJUSTED ENERGY COST ($$/Year)		$12,414	$318	2.56%
		IRR	7.43%	
		NPV	$ 2,433	
		INFLATION ADJUSTED PAYBACK	14.2 years	

4 Heating and Ventilating System Upgrades for the Highway Department Garage

Current Heating and Ventilating System Conditions at the Highway Department Garage

1) The conditioned garage space for the Highway Department is currently heated by a propane-fired 1986 Dayton space heating unit rated at 250,000 BTUs/hr and located on a ceiling deck over the office area to the rear of the garage working space. This heating unit is original equipment in the building and has reached the end of its useful, cost-effective life. It is currently operating at about 80% efficiency, well below the current industry standard.
2) The high bay nature of the building lends itself to heat stratification, leaving a lot of usable heat too high in the space to contribute to comfortable conditions on the floor.

Proposed Heating and Ventilating Solutions for the Highway Department Garage

1) We recommend replacing the current propane-fired Dayton heater with a new, energy efficient unit sized to meet the demands of the space after implementation of the insulation upgrade proposed in EEM 1, above.
2) We recommend that the heat stratification problem in the garage space be addressed with the installation of thermostats to control the existing ceiling fans. The fans would be set to come on when the temperature of the air near the ceiling reached a level which would benefit occupants on the floor, and would provide an air mixing function, to keep the building's internal temperatures approximately equalized.

A summary of the predicted savings and capital investment of implementing EEM 4 – Heating & Ventilation Upgrades is as follows:

EEM 4 – HEATING & VENTILATION SYSTEM UPGRADES

Energy Related Investment	$2,860	Adj. Baseline Data	1st Year Savings	Percent Savings
Annual Electricity Usage	kWh / Yr	23,543	0	0.00%
Annual Electricity Cost	$$ / Yr	$3,317	$0	
Annual Propane Usage	kWh / Yr	2,927	452	12.00%
Annual Propane Cost	$$ / Yr	$8,671	$1,041	
ADJUSTED ENERGY USAGE (kBTU/Year)		364,634	63,228	17.34%
ADJUSTED ENERGY COST ($$/Year)		$12,096	$1,041	8.61%
		IRR	41.40%	
		NPV	$ 25,899	
		INFLATION ADJUSTED PAYBACK	2.6 years	

Recap of Energy Use Reduction & Energy Cost Avoidance

The energy use reduction produced by the energy efficiency measures listed within this report were presented independently; however they are now presented as a package with savings displayed in actual energy units (not BTUs) annually. The tables below analyze each measures affect on the current electrical load (kWh), fuel oil (gallons) and propane (gallons).

Municipal Building Results:

EEM	MEASURE DESCRIPTION	Electricity (kWh)	Fuel Oil (gallons)
Baseline Annual Energy Usage		45,291	3,498
EEM1	Air Sealing & Insulation	905	525
EEM2	Glazing & Door Upgrades	453	179
EEM3	Lighting & Lighting Control Upgr	4,530	-28
EEM4	Appliance Upgrades	225	0
EEM7	Renewable Energy Upgrades	0	452
Total Project Predicted Energy Reduction		6,113	1,127

EEM	MEASURE DESCRIPTION	Electricity ($$)	Fuel Oil ($$)
Baseline Annual Energy Cost		$9,035	$8,065
EEM1	Air Sealing & Insulation	$181	$1,210
EEM2	Glazing & Door Upgrades	$90	$412
EEM3	Lighting & Lighting Control Upgr	$904	-$64
EEM4	Appliance Upgrades	$45	$0
EEM7	Renewable Energy Upgrades	$0	$1,041
Total Project Predicted Energy Cost		$1,219	$2,598

Library Results:

EEM	MEASURE DESCRIPTION	Electricity (kWh)	Fuel Oil (gallons)
Baseline Annual Energy Usage		12,215	1,082
EEM1	Air Sealing & Insulation	122	76
EEM2	Glazing & Door Upgrades	122	40
EEM5	Heating System & Ventilation Upgrades	-488	0
EEM6	Mechanical Controls	122	15
Total Project Predicted Energy Reduction		**-123**	**131**

EEM	MEASURE DESCRIPTION	Electricity ($$)	Fuel Oil ($$)
Baseline Annual Energy Cost		$2,285	$4,743
EEM1	Air Sealing & Insulation	$23	$332
EEM2	Glazing & Door Upgrades	$23	$177
EEM5	Heating System & Ventilation Upgrades	-$91	$0
EEM6	Mechanical Controls	$23	$0
Total Project Predicted Energy Cost Avoidance		**-$23**	**$509**

Highway Department Results

EEM	MEASURE DESCRIPTION	Electricity (kWh)	Propane (gallons)
Baseline Annual Energy Usage		23,543	3,261
EEM1	Air Sealing & Insulation	0	0
EEM2	Glazing & Door Upgrades	4,708	-65
EEM3	Lighting & Lighting Control Upgr	1,648	0
Total Project Predicted Energy Reduction		**6,356**	**-65**

EEM	MEASURE DESCRIPTION	Electricity ($$)	Propane ($$)
Baseline Annual Energy Cost		$4,544	$8,606
EEM1	Air Sealing & Insulation	$0	0
EEM2	Glazing & Door Upgrades	$909	-172
EEM3	Lighting & Lighting Control Upgr	$318	0
Total Project Predicted Energy Cost		**$1,227**	**-$172**

Summary of Financial Analysis

Municipal Building:

Gross Capital Investment	**$339,250**
Avoided End-of-Life / Maintenance Investment	**$67,560**
Net Energy Eficiency Capital Investment	**$271,690**
Energy Rate Inflation	**5.0%**
Cost of Capital	**5.0%**
Expected Equipment Lifespan (years)	**30**
Inflation Adjusted Payback (years)	**7**
Net Present Value	**$423,481**
Expected Internal Rate of Return	**15.6%**

Library:

Gross Capital Investment	**$48,315**
Avoided End-of-Life / Maintenance Investment	**$0**
Net Energy Eficiency Capital Investment	**$48,315**
Energy Rate Inflation	**5.0%**
Cost of Capital	**5.0%**
Expected Equipment Lifespan (years)	**30**
Inflation Adjusted Payback (years)	**24**
Net Present Value	**-$18,495**
Expected Internal Rate of Return	**2.0%**

Highway Department:

Gross Capital Investment	**$27,010**
Avoided End-of-Life / Maintenance Investment	**$1,200**
Net Energy Eficiency Capital Investment	**$25,810**
Energy Rate Inflation	**5.0%**
Cost of Capital	**5.0%**
Expected Equipment Lifespan (years)	**30**
Inflation Adjusted Payback (years)	**5**
Net Present Value	**$88,616**
Expected Internal Rate of Return	**21.1%**

Funding and Financing Options for Project Implementation

Implementing the energy efficiency and renewable energy measures recommended in this report can save the Town of Center Harbor and its taxpayers significant sums in avoided energy costs over time, and can yield operating cost savings and productivity improvements as well. While some utility, state, and other programs can defray the Town's share of capital costs, the Town will likely need to pay some part of those costs and recoup its investment from future energy cost savings. It should be possible to finance the Town's share of costs in a manner that will yield positive cash flow.

The following discussion first covers funding and financing opportunities for implementing energy efficiency measures and then addresses opportunities for renewable energy and combined heat and power measures.

Energy Efficiency Measures

Funding (Cost-Sharing) Sources

The New Hampshire Electric Cooperative CORE efficiency programs, as enhanced this year by an award of Greenhouse Gas Emissions Reduction Fund (Regional Greenhouse Gas Initiative, or RGGI) monies from the NH Public Utilities Commission, help pay for lighting and other efficiency measures in customer buildings. NHEC offers both "prescriptive" or formula-based incentives for lighting and "custom" incentives for some HVAC and other measures. Competitive funding programs discussed below will likely expect the Town to have taken advantage of "off-the-shelf" utility program funding. The Town's first step therefore should be to determine through discussion with the utility the scope and level of incentives NHEC will pay. As discussed below, NHEC may also invest in renewable energy measures.

The other major sources of funding for energy efficiency measures are two upcoming competitive grant programs, both of which will likely announce funding rounds in early 2010. The first is a competitive Energy Efficiency and Conservation Block Grant program that will be administered by the state Office of Energy and Planning through a yet-to-be-named program manager. The program will provide approximately $9 million in grants to municipalities for building retrofits and other eligible activities. The maximum grant will be $400,000. No announcement has been made yet, so further details are unavailable. Because the US Department of Energy requires these funds to be provided to municipalities by March 13, 2010, the Town should be prepared to submit an application on short notice by January.

Another potential source of funding for efficiency measures is the Greenhouse Gas Emissions Reduction Fund administered by Public Utilities Commission with Regional Greenhouse Gas Initiative auction proceeds. The PUC has indicated it will next solicit proposals under this program at the beginning of next year. Although the timing of this solicitation is somewhat less certain, the program provides another reason to set priorities and develop information likely to be required in a grant application by early January.

Financing Options

To finance its share of project costs, the Town has as many as five options. First, the NHEC SmartStart Program provides zero-interest financing. Due to its low cost, the related need to apply for incentives from NHEC, and potential applicability to a broad range of the energy efficiency

measures discussed in this report, the scope and level of available SmartStart financing should be investigated first.

Second, the Town could use a municipal lease finance agreement with a bank or other financial institution. Lease finance agreements resemble the SmartStart finance agreements used by New Hampshire utilities. They are a standard source of financing for energy service company (ESCO) performance contract projects but are available for energy efficiency projects undertaken by other contractors as well. Municipal lease finance agreements generally have somewhat higher rates than bonds, but significantly lower transaction costs. Thus, for small- to medium-size projects, their overall cost can be lower than that of bonds. A lease finance agreement itself would require approval of the Board of Selectmen but not Town Meeting; appropriation of payments under the agreement would then require annual approval by Town Meeting as part of the budget process.

Third, the Community Development Finance Authority will be administering a municipal loan program with Greenhouse Gas Emissions Reduction Funds. CDFA has not yet announced a schedule, application process, or terms, but will likely do so in the near future.

Fourth, the Town could use tax-exempt municipal bond proceeds. The Town could take part in a New Hampshire Municipal Bond Bank bond issue or, conceivably, issue its own bond. Either would require Town Meeting approval unless the Town happens to have outstanding unutilized authorization. The cost of a stand-alone Town bond issue for the amount the Town will likely need to finance could make this an inferior option.

Finally, the Town may be able to access allocations of federally authorized Qualified Energy Conservation Bonds. Because the federal government pays 70 percent of the interest on those so-called tax credit bonds, the cost to a municipality is lower than that of a conventional tax-exempt municipal bond even though the overall rate for QECBs is higher than the rate for municipal bonds. QECBs were first authorized by the Troubled Asset Relief Program legislation in 2008 and American Reinvestment and Recovery Act in 2009. The first and current New Hampshire QECB allocation is $13.7 million, which has been apportioned to various parts of the state.

Renewable Energy and Combined Heat and Power Measures

Funding (Cost-Sharing) Sources

Various external sources of funding support are available for renewable energy and combined heat and power measures. Tax credits represent a major form of support for these measures but are available only to private entities. In the case of solar photovoltaic installations, the commonly used way for a municipality or non-profit entity to capture those tax credits is through an arrangement in which a private third party leases the space where the PVs are installed and enters into a power purchase agreement with the host building owner. Because the federal tax credit for PVs and other qualifying renewable energy measures is in an amount equal to 30 percent of the capital cost and is accompanied by depreciation and potentially other tax benefits, third-party owner-operator arrangements can have significantly superior economics. They enable a municipality to avoid up-front capital costs and lock in long-term electricity rates at levels in the range of current rates with escalation factors that tend to be lower than likely future inflation in utility rates.

The federal tax credit for combined heat and power is set at a lower level. Although third-party

CHP owner-operator arrangements are less widely available in the market, they still warrant investigation. At least one New England CHP firm enters into these arrangements with hosts who are not taxpayers. Under the American Recovery and Reinvestment Act, third-party owner-operators are currently able to receive grants in lieu of the tax credits. The size of the solar PV installation discussed in this report is such that fewer third-party owner-operator offerings will be available than would be the case if the installation were larger.

An alternative to a lease and power purchase agreement with a private owner-operator may be partial or full investment by NHEC in the PV array or CHP installation. Under state legislation enacted in 2008 (SB 451), electric utilities are authorized to invest in forms of small-scale distributed generation that include both solar PVs and CHP. Utilities are now developing and seeking PUC approval for proposals to use this authority for the first time.

If the Town partnered with either a private third-party owner-operator or NHEC, external sources of support for renewable energy would be accessed by the other party. The primary current form of support would come through sales of renewable energy credits. Current REC prices are not a reliable indication of future prices: a major change in the Massachusetts Renewable Portfolio Standard, involving the creation of a solar RPS quota and a new solar renewable energy credit or "S-REC", is currently underway and will significantly affect regional market prices for RECs in the coming year. A potential future form of support for PV installations of less than 100 kW in size is the state PUC-administered Renewable Energy Portfolio standard program. (The program is currently limited to small residential installations.)

To the extent the Town does not partner with a third party, it will need to assemble a funding package that, in the case of solar PVs, would include REC sales and NHEC rebates. In addition, some competitive grant sources will be available for solar PV, geothermal and/or CHP measures. Such measures may be eligible under the competitive Energy Efficiency and Conservation Block Grant program that will be launched by the state Office of Energy and Planning at the beginning of 2010, mentioned above. OEP has indicated that it also intends to fund an expanded Renewable Energy Program through the PUC with $581 K in State Energy Program funds, supplementing the amount available under the state RPS fund mentioned above.

Financing Options

Financing options for renewable energy measures include some of those discussed above as options for energy efficiency measures. They include lease finance agreements, Municipal Bond Bank or Town bond issues, and federal tax-credit bonds – in the case of renewable energy measures, Clean Renewable Energy Bonds. (The existing federal loan guarantee program, administered by the US Department of Energy, is not a form of support that it would be feasible to access for installations of the comparatively small size under consideration by the Town.) The CDFA municipal loan program mentioned above may include CHP within the scope of eligible projects. Financing possibilities involving NHEC warrant investigation in discussions with the utility concerning possible investment under SB 451 or rebates.

Environmental Impact

The reduced energy consumption figures to be realized as a result of this project have been re-entered into the Portfolio Manager software available on the EPA Energy Star website. The following breakdown of the impact is as follows:

Environmental Impact Municipal Building

Greenhouse Gas Emissions

	Direct GHG Emissions (on site)	Indirect GHG Emissions (off site)	TOTAL
Currently	35.68 mTon CO_2	19.20 mTon CO_2	54.88 mTon CO_2
Projected	23.71 mTon CO_2	.39 mTon CO_2	24.10 mTon CO_2
Reduction	**33.5%**	**98%**	**56%**

Environmental Impact Library

Greenhouse Gas Emissions

	Direct GHG Emissions (on site)	Indirect GHG Emissions (off site)	TOTAL
Currently	11.05 mTon CO_2	5.22 mTon CO_2	16.26 mTon CO_2
Projected	9.70 mTon CO_2	5.23 mTon CO_2	14.93 mTon CO_2
Reduction	**12%**	**-.19%**	**8%**

Environmental Impact Highway Department

Greenhouse Gas Emissions

	Direct GHG Emissions (on site)	Indirect GHG Emissions (off site)	TOTAL
Currently	17.39 mTon CO_2	10.02 mTon CO_2	27.41 mTon CO_2
Projected	17.03 mTon CO_2	7.29 mTon CO_2	24.32 mTon CO_2
Reduction	**2%**	**27%**	**11%**

The EEMs that address reducing thermal demands in the building produce the most significant decrease in CO_2 emissions from the building. Indirect emissions refer to greenhouse gas emissions that occur off site, not at your facility. This refers to electric generation and transmission related

emissions. During generation and transmission of the electricity that is consumed at your facility, greenhouse gases are emitted.

Next Steps

With the completion of this detailed energy analysis of three Center Harbor buildings, the Town of Center Harbor must now consider how to move forward and begin to take advantage of energy saving opportunities presented in this report.

It is our judgment that in order to achieve the energy savings outlined in the final report, it is essential that careful professional attention be paid to proper design and installation of the selected Energy Efficiency Measures (EEMs). The Jordan Institute is prepared to provide professional oversight and commissioning services during the implementation phase of your projects and have included a standard contract to do so in Appendix C.

As a non-profit firm dedicated to improving energy use in the built environment, The Jordan Institute is committed to representing the owner's best interests and to ensuring that the most cost-effective approaches to achieving energy efficiency are utilized. The buildings owned by the Town of Center Harbor are among its most important physical assets, with significant implications for the annual budget, for long-term planning, and for the well-being and productivity of Town employees and citizens. We believe it is time to move ahead in a planned but aggressive way to reduce the use of fossil fuels in, and the emission of green house gases from, your buildings, and to set an example for your business and residential constituents.

Some thoughts on weighing renovation and upgrades on the current Municipal Building against the option of constructing a new municipal police, fire, and office complex nearby

The Jordan Institute has spent considerable time reviewing the information we collected in order to prepare this report. Our results are fully reported in this document. While savings of both energy and money are possible in the Center Harbor buildings we investigated, those savings are at the low end of the range we have seen as compared to other similar buildings around the state. We believe that a thorough analysis of the cost to "start fresh" with a new high-performance municipal services building should be carefully compared to the costs associated with renovating and upgrading the current Municipal Building.

Of course this observation is in reference to the Municipal Building only. However, certain synergies may be incorporated such as a 'campus' district heating plant for the three buildings. We do not know how this comparison might come out, or how it would be affected by the overlay of other Town projects and concerns. But we suggest that such an analysis be done before dollars are committed to renovation and upgrade projects which may not provide the most value for the amount of the investment.

Appendix A: GSE2 Financial Modeling Report

FINANCIAL MODELING RESULTS

Project Title: *Center Harbor Municipal Building*

Assumptions:

	Electricity	Fuel Oil	Total Energy
Baseline Energy Usage:	45,291 kWh	3,498 Gallons	644,252.9 kBTU
Baseline Annual Energy Cost:	$9,035	$8,065	$17,100
Baseline Unit Cost:	$0.1995 ($/kWh)	$2.31 ($/gal.)	

EEM Num.	Proposed Improvements	ENERGY EFFICIENCY MEASURES				Electricity					Fuel Oil					OVERALL RESULTS				
		Estimated Capital Investment	Estim. Rebates / Grants	Energy Investment Cost	KBTU Savings	Pre-EEM Usage (kWh)	Post-EEM Usage (kWh)	Savings (kWh)	Savings (%)	Elec $$ Savings	Pre-EEM Usage (gallons)	Post-EEM Usage (gallons)	Savings (Gallons)	Savings (%)	Fuel Oil $$ Savings	Energy Cost Savings	O & M Savings	Total Savings	Simple Pay Back	INTERNAL RATE OF RETURN
1	Air Sealing & Insulation	$26,485	$0	$26,485	76,539	45,291	44,386	905	2.00%	$181	3,498	2,973	525	15.00%	$1,210	$1,390	$0	$1,390	19.1	7.81%
2	Glazing & Door Upgrades	$3,265	$0	$3,265	26,536	45,291	44,838	453	1.00%	$90	2,973	2,795	179	6.00%	$412	$502	$0	$502	6.5	20.06%
3	Lighting & Lighting Control Upgrades	$18,615	$7,560	$11,055	11,541	45,291	40,761	4,530	10.00%	$904	2,795	2,823	(28)	-1.00%	$(64)	$839	$0	$839	13.2	11.12%
4	Heating System & Ventilation Upgrades	$40,875	$0	$40,875	63,228	45,291	45,291	-	0.00%	$-	2,823	2,371	452	16.00%	$1,041	$1,041	$0	$1,041	39.3	2.69%
5	Mechanical Controls	$1,970	$0	$1,970	7,411	45,291	45,066	225	0.50%	$45	2,371	2,324	47	2.00%	$109	$154	$0	$154	12.8	11.44%
6	Renewable Energy Upgrades	$248,040	$60,000	$188,040	129,810	45,291	7,246	38,045	84.00%	$7,590	2,324	2,324	-	0.00%	$-	$7,590	$0	$7,590	24.8	5.78%
	Total Project	$339,250	$67,560	$271,690	315,832	317,037	272,654	44,383	98%	$8,854	19,607	18,432	1,174	34%	$2,707	$11,561	$0	$11,561	23.5	15.6%

ENERGY USE IMPACT		ENERGY COSTIMPACT				Total	
All Current Energy Types (kBTU)		Electricity		Fuel Oil			
Current	644,253	Current	$9,035	Current	$8,065	Current	$17,100
New	328,421	New	$181	New	$5,358	New	$5,539
Savings	315,832	Savings	$8,854	Savings	$2,707	Savings	$11,561
Total Avoided Usage	**49.0%**	Total Avoided Cost	**98.0%**	Total Avoided Cost	**33.6%**	Total Avoided Cost	**67.6%**

Project Title: *Center Harbor Library*

Assumptions:

Baseline Energy Usage: 12,215 kWh
Baseline Annual Energy Cost: $2,285
Baseline Unit Cost: $0.1871 ($/kWh)

Fuel Oil: 1,082 Gallons; $4,743; $4.38 ($/gal.)

Total Energy: 193,157.6 kBTU; $7,028

EEM Num.	Proposed Improvements	ENERGY EFFICIENCY MEASURES: Estimated Capital Investment	Estim. Rebates / Grants	Energy Investment Cost	KBTU Savings	Electricity: Pre-EEM Usage (kWh)	Post-EEM Usage (kWh)	Savings (kWh)	Savings (%)	Elec $$ Savings	Fuel Oil: Pre-EEM Usage (gallons)	Post-EEM Usage (gallons)	Savings (Gallons)	Savings (%)	Fuel Oil $$ Savings	OVERALL RESULTS: Energy Cost Savings	O & M Savings	Total Savings	Simple Pay Back	INTERNAL RATE OF RETURN
1	Air Sealing & Insulation	$13,800	$0	$13,800	11,022	12,215	12,093	122	1.00%	$23	1,082	1,006	76	7.00%	$332	$355	$0	$355	38.9	2.74%
2	Glazing & Door Upgrades	$390	$0	$390	6,056	12,215	12,093	122	1.00%	$23	1,006	966	40	4.00%	$177	$199	$0	$199	2.0	56.13%
5	Heating System & Ventilation Upgrades	$32,175	$0	$32,175	(1,665)	12,215	12,703	(488)	-4.00%	$(91)	966	966	-	0.00%	$-	-$91	$0	$(91)	-352.5	n/a
7	Renewable Energy Efforts	$0	$0	$0	-	12,215	12,215	-	0.00%	$-	951	951	-	0.00%	$-	$0	$0	$-	0.0	n/a
	Total Project	$48,315	$0	$48,315	17,858	85,505	85,628	-123	-1%	-$23	6,903	6,773	131	12%	$572	$549	$0	$549	88.0	2.0%

ENERGY USE IMPACT: All Current Energy Types (kBTU)		ENERGY COSTIMPACT: Electricity		Fuel Oil		Total	
Current	193,158	Current	$2,285	Current	$4,743	Current	$7,028
New	175,299	New	$2,308	New	$4,171	New	$6,479
Savings	17,858	Savings	$(23)	Savings	$572	Savings	$549
Total Avoided Usage	**9.2%**	Total Avoided Cost	**-1.0%**	Total Avoided Cost	**12.1%**	Total Avoided Cost	**7.8%**

Project Title: *Center Harbor Highway Dept. Building*

Assumptions:

	Electricity	Propane	Total Energy
Baseline Energy Usage:	23,543 kWh	3,261 Gallons	380,340.7 kBTU
Baseline Annual Energy Cost:	$4,544	$8,606	$13,150
Baseline Unit Cost:	$0.1930 ($/kWh)	$2.64 ($/gal.)	

EEM Num.	Proposed Improvements	ENERGY EFFICIENCY MEASURES: Estimated Capital Investment	Estim. Rebates / Grants	Energy Investment Cost	KBTU Savings	Electricity: Pre-EEM Usage (kWh)	Post-EEM Usage (kWh)	Savings (kWh)	Savings (%)	Elec $$ Savings	Propane: Pre-EEM Usage (gallons)	Post-EEM Usage (gallons)	Savings (Gallons)	Savings (%)	Propane $$ Savings	OVERALL RESULTS: Energy Cost Savings	O & M Savings	Total Savings	Simple Pay Back	INTERNAL RATE OF RETURN
2	Glazing & Door Upgrades	$16,600	$0	$16,600	10,077	23,543	18,835	4,708	20.00%	$909	3,261	3,326	(65)	-2.00%	$(172)	$736	$0	$736	22.5	6.48%
3	Lighting & Lighting Control Upgrades	$7,550	$1,200	$6,350	5,630	23,543	21,895	1,648	7.00%	$318	3,326	3,326	-	0.00%	$-	$318	$0	$318	20.0	7.43%
5	Heating System & Ventilation Upgrades	$2,860	$0	$2,860	36,064	23,543	23,543	-	0.00%	$-	3,326	2,927	399	12.00%	$1,053	$1,053	$0	$1,053	2.7	n/a
	Total Project	$27,010	$1,200	$25,810	51,771	23,543	17,187	6,356	27%	$1,227	$22,355	$22,021	$334	10%	$881	$2,108	$0	$2,108	12.2	21.1%

ENERGY USE IMPACT (All Current Energy Types (kBTU))		ENERGY COSTIMPACT: Electricity		Propane		Total	
Current	380,341	Current	$4,544	Current	$8,606	Current	$13,150
New	328,570	New	$3,317	New	$7,725	New	$11,042
Savings	51,771	Savings	$1,227	Savings	$881	Savings	$2,108
Total Avoided Usage	**13.6%**	Total Avoided Cost	**27.0%**	Total Avoided Cost	**10.2%**	Total Avoided Cost	**16.0%**

Appendix B: EEM Budget Estimates

Municipal Budget Estimates

The Jordan Institute

49 North Main Street, Concord, NH 03301
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	1 of 6

DESCRIPTION

Insulate:
The headers at overhead doors,
Vertical columns between the overhead doors
The block walls in the Fire Station (East and West walls) and Meeting Room (North and East wall)
Back roof with 2" of rigid insulation, finish with new sheathing, Ice and Water Shield, and asphalt shingles

Air Sealing at roof to wall connections and wood to brick connections

	BUDGET PRICING		TOTAL
Air Sealing and Added Insulation			
1	**Air Sealing and Insulation**	**$**	**23,998.00**
Additional Items			
	M & V Prep Work	$	161.00
Contingency			
		$	2,326.00
	TOTAL	**$**	**26,485.00**
Add Alternate			
1	Installation of a new Viessmann Single Boiler Plant as described above	$	52,700.00

This is a non binding estimate. Actual building conditions will determine the final customer quote.

The Jordan Institute

49 North Main Street, Concord, NH 03301
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	2 of 6

DESCRIPTION

Weather-stripping on all overhead doors (3) and exterior door back doors

New insulated overhead door at rear of building

BUDGET PRICING	TOTAL
Glazing and Door Upgrades	
	$ 2,924.00
Additional Items	
M & V Prep Work	$ 22.00
Contingency	
	$ 319.00
TOTAL	**$ 3,265.00**

This is a non binding estimate. Actual building conditions will determine the final customer quote.

The Jordan Institute
49 North Main Street, Concord, NH 03304
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	3 of 6

DESCRIPTION
Install T-5 fixtures over the Fire Station bays and daylight harvesting controls

BUDGET PRICING		TOTAL
Lighting and Lighting Controls		
	$	16,867.00
Additional Items		
M & V Prep Work	$	113.00
Contingency		
	$	1,635.00
TOTAL	$	18,615.00

This is a non binding estimate. Actual building conditions will determine the final customer quote.

The Jordan Institute
49 North Main Street, Concord, NH 03304
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	4 of 6

DESCRIPTION

Demo and remove two existing boilers

Install two high efficiency condensing boilers (oil fired)

BUDGET PRICING	TOTAL
Heating System Upgrade	
	$ 37,036.00
Additional Items	
M & V Prep Work	$ 249.00
Contingency	
	$ 3,590.00
TOTAL	**$ 40,875.00**

This is a non binding estimate. Actual building conditions will determine the final customer quote.

The Jordan Institute
49 North Main Street, Concord, NH 03304
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	5 of 6

DESCRIPTION

Upgrade TekMar Controls to include additional controls for night setback and outdoor reset

BUDGET PRICING	TOTAL
Mechanical Controls	
	$ 1,785.00
Additional Items	
M & V Prep Work	$ 12.00
Contingency	
	$ 173.00
TOTAL	**$ 1,970.00**

This is a non binding estimate. Actual building conditions will determine the final customer quote.

The Jordan Institute
49 North Main Street, Concord, NH 03304
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	6 of 6

DESCRIPTION
Install new 39kW Solar Photovoltaic on Fire Station front roof

BUDGET PRICING	TOTAL
Renewable Energy Source	
	$ 224,743.00
Additional Items	
M & V Prep Work	$ 1,511.00
Contingency	
	$ 21,786.00
TOTAL	**$ 248,040.00**

This is a non binding estimate. Actual building conditions will determine the final customer quote.

Library Budget Estimates

The Jordan Institute

49 North Main Street, Concord, NH 03301
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	1 of 3

DESCRIPTION

Air Seal ceiling plane in the attic space with closed cell foam, replace existing iberglass batt insulation

Air Seal and Insulate the band joists in the basement, extending 2' from exterior walls into the basement ceiling

Insulate the weight cavities of the windows

Insulate attic hatches and access areas

	BUDGET PRICING	TOTAL
Air Sealing and Added Insulation		
		$ 12,517.00
Additional Items		
	M & V Prep Work	$ 133.00
Contingency		
		$ 1,150.00
	TOTAL	**$ 13,800.00**
Add Alternate		
1	Installation of a new Viessmann Single Boiler Plant as described above	$ 52,700.00

This is a non binding estimate. Actual building conditions will determine the final customer quote.

The Jordan Institute

49 North Main Street, Concord, NH 03301
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	2 of 3

DESCRIPTION
Weather-stripping exterior door (including door to basement)

BUDGET PRICING	TOTAL
Glazing and Door Upgrades	
	$ 356.00
Additional Items	
M & V Prep Work	$ 2.00
Contingency	
	$ 32.00
TOTAL	**$ 390.00**

This is a non binding estimate. Actual building conditions will determine the final customer quote.

The Jordan Institute
49 North Main Street, Concord, NH 03304
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	3 of 3

DESCRIPTION

Distribution system recommissioning - Steam trap survey and clean

Energy Recovery Ventilator with dehumidification

BUDGET PRICING	TOTAL
Heating and Ventilation	
	$ 29,308.00
Additional Items	
M & V Prep Work	$ 186.00
Contingency	
	$ 2,681.00
TOTAL	**$ 32,175.00**

This is a non binding estimate. Actual building conditions will determine the final customer quote.

Highway Department Budget Estimates

The Jordan Institute

49 North Main Street, Concord, NH 03301
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	1 of 3

DESCRIPTION

Weather-strip overhead doors

Install 4 DayStar skylights over Highway Department conditioned bays

BUDGET PRICING	TOTAL
Glazing and Door Upgrades	
	$ 15,420.00
Additional Items	
M & V Prep Work	$ 77.00
Contingency	
	$ 1,103.00
TOTAL	**$ 16,600.00**

This is a non binding estimate. Actual building conditions will determine the final customer quote.

The Jordan Institute

49 North Main Street, Concord, NH 03301
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	2 of 3

DESCRIPTION

Replace sodium fixtures with T-5 lighting fixtures and install daylight sensor controls

Replace indoor street lights (night lights) with CFL spots and occupancy sensors

Install occupancy sensors in unconditioned Highway Department space

BUDGET PRICING	TOTAL
Lighting and Lighting Controls	
	$ 6,877.00
Additional Items	
M & V Prep Work	$ 44.00
Contingency	
	$ 629.00
TOTAL	**$ 7,550.00**

This is a non binding estimate. Actual building conditions will determine the final customer quote.

The Jordan Institute
49 North Main Street, Concord, NH 03304
Tel: 603-226-1009 Fax: 603-226-0042
www.jordaninstitute.org

CUSTOMER/ADDRESS	DATE	ESTIMATE #
Town of Center Harbor 36 Main Street Center Harbor, NH 03226	November 18, 2009	3 of 3

DESCRIPTION
Replace boiler with newer model in the conditioned Highway Department space

BUDGET PRICING	TOTAL
Heating	
	$ 2,605.00
Additional Items	
M & V Prep Work	$ 17.00
Contingency	
	$ 238.00
TOTAL	**$ 2,860.00**

This is a non binding estimate. Actual building conditions will determine the final customer quote.

Appendix C: Oversight Contract

ASSESSMENT AGREEMENT

Between

The Jordan Institute, Inc. and Town of Center Harbor

For

A DETAILED ASSESSMENT AND FEASIBILITY STUDY ANALYZING
ENERGY EFFICIENCY AND CLEAN ENERGY IMPROVEMENTS ("The Project")

THIS AGREEMENT ("Agreement") is entered into as of the _____ day of _____, 2009, by and between THE JORDAN INSTITUTE, INC., a New Hampshire not-for-profit corporation with its principal office and place of business at 49 North Main St. Concord, New Hampshire 03301 ("Jordan"), and Town of Center Harbor, located at 36 Main Street Center Harbor, NH 03226. The parties hereto hereby agree as follows:

1. Description of Services. Jordan shall perform for Town of Center Harbor the services described in Schedule A attached hereto and made a part hereof (the "Services" or the "Work"). Jordan will perform the Services with data provided by Town of Center Harbor. If the Project is for multiple buildings and energy history is not specific to each building, Town of Center Harbor will need to provide an estimation of energy usage.

2. Fee. Town of Center Harbor shall pay Jordan for the Services the fee described in Schedule A attached hereto (the "Fee" or "Fees"). Payment of any income or other taxes which may be due upon Jordan's compensation from Town of Center Harbor shall be Jordan's responsibility, and Town of Center Harbor shall not withhold any amounts from Jordan's compensation for this purpose. Jordan will bill Town of Center Harbor monthly for Work completed.

3. Expenses. Town of Center Harbor shall pay Jordan for Expenses as described in Schedule A attached hereto. Upon execution of this Agreement, Jordan will submit a Project/invoicing schedule which will become part of this Agreement.

4. Term. This Agreement is effective as of the date hereof and shall continue for the period described in Schedule A attached hereto unless earlier terminated pursuant to Section 12

hereof. Upon delivery of the Final Assessment Report, prepared by Jordan, the Town of Center Harbor will have 10 days to review Jordan's findings and request clarifications. Jordan will have 10 days to respond to requested clarifications. At this time, the balance of the Fee will be invoiced.

5. Force Majeure. If either party is prevented from complying, either totally or in part, with any of the terms or provisions of this Agreement by reason of fire, flood, storm, strike, lockout or other labor trouble, riot, war, rebellion, accident, terrorist acts or other acts of God, then upon written notice to the other party, the requirements of this Agreement, or the affected provisions hereof to the extent affected, shall be suspended during the period of such disability. During such period, the party not prevented from complying as aforesaid may seek to have its needs (which would otherwise be met hereunder) met by or through third parties without liability hereunder. The party prevented from complying shall make all reasonable efforts to remove such disability within 30 days of giving such notice.

6. Limitation on Liability. IN NO EVENT SHALL JORDAN BE LIABLE TO Town of Center Harbor OR ANY OTHER PERSON FOR ANY INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR PUNITIVE DAMAGES INCLUDING, WITHOUT LIMITATION , LOSS OF PROFIT OR GOODWILL, FOR ANY MATTER ARISING OUT OF OR RELATING TO THIS AGREEMENT AND / OR ITS SUBJECT MATTER, WHETHER SUCH LIABILITY IS ASSERTED ON THE BASIS OF CONTRACT, TORT OR OTHERWISE. Town of Center Harbor UNDERSTANDS AND AGREES THAT ANY LIABILITY OF JORDAN REGARDING THE SERVICES SHALL BE LIMITED TO THE AGGREGATE AMOUNT OF THE FEES ACTUALLY RECEIVED BY JORDAN IN CONNECTION WITH THE SERVICES.

7. Jordan's Warranties; Disclaimer. Jordan represents and warrants to, and agrees that Jordan has and will have full power and authority to enter into, and fully to perform, this Agreement and that no agreement or understanding with any other person, firm, or corporation exists or will exist which would interfere with Jordan's obligations hereunder. Jordan further represents and warrants that the disclosure to Town of Center Harbor of any information by Jordan in connection with the Services does not contravene any confidentiality obligation Jordan may have to any third party.

EXCEPT AS EXPRESSLY STATED HEREIN ABOVE, JORDAN MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED INCLUDING, WITHOUT LIMITATION, ANY

IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE, CONCERNING THE SUBJECT MATTER OF THIS AGREEMENT OR ANY OTHER WARRANTY WITH RESPECT TO THE QUALITY OR ACCURACY OF THE SERVICES.

8. Notices. Any notice given hereunder shall be in writing and delivered in person or mailed by certified or registered mail, postage prepaid, addressed to the appropriate party as set forth in the preamble hereof. Either party may change its address to receive notice by giving written notice of such change to the other party.

9. Changes in the Work. Changes in the Work may be accomplished after execution of this Agreement, and without invalidating this Agreement, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations set forth in this Section 9 and elsewhere in the Agreement Documents. A Change Order shall be based upon agreement among the Owner, Construction Manager, Architect, Contractor, and Jordan; a Construction Change Directive requires agreement by the Owner, Construction Manager and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone. Changes in the Work shall be performed under applicable provisions of the Contract Documents, and Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work. If unit prices are stated in the Agreement Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

10. Independent Contractor. This Agreement shall not give rise to a partnership, agency or other relationship between the parties, except as otherwise provided herein. All activities by Jordan under the terms of this Agreement shall be carried on by Jordan as an independent contractor and not as an agent for or employee of Town of Center Harbor.

11. Assignment. Jordan acknowledges that the Services to be provided to Town of Center Harbor are unique and personal. Accordingly, Jordan may not assign any of its rights or delegate any of its duties or obligations under this Agreement to another party without the prior consent of Town of Center Harbor. This Agreement shall inure to the benefit of their respective successors, assigns and affiliates.

12. Termination.

(a) Either party may immediately terminate this Agreement if a Default (as defined below) by the other party has occurred and is continuing by giving written notice thereof to the defaulting party. Except as otherwise specifically provided herein, the termination of this Agreement shall not relieve the parties of any obligation accruing with respect to this Agreement prior to such termination. The term "Default" shall mean any of the following events:

(1) failure by a party to comply with or to perform in all material respects any provision of this Agreement and continuance of such failure for ten (10) days after notice thereof to such party; or

(2) any warranty or representation made by a party in this Agreement is breached or is false or misleading in any material respect.

(b) Town of Center Harbor may terminate this Agreement with sixty (60) days written notice to Jordan should the Services no longer be required as a result of Town of Center Harbor canceling the Project due to not being able to raise sufficient funds to complete the project. Should such termination occur, Jordan shall provide Town of Center Harbor with a final invoice for any incurred Fees up to the value of the total Agreement as defined in Schedule A attached hereto.

13. Merger; Amendment. This Agreement, together with Schedule A attached hereto, constitutes the entire agreement and understanding between the parties regarding the subject matter hereof, and merges all prior discussions, proposals, and agreements between them relating thereto. No waiver, modification or amendment to this Agreement shall be valid unless in writing and signed by the parties hereto.

14. No Waiver. No failure or delay on the part of either party in the exercise of any right, power or remedy under this Agreement shall operate as a waiver thereof; nor shall any single or partial exercise of any right, power or remedy preclude other or further exercise thereof, or the exercise of any other right, power or remedy.

15. Indemnification. Jordan shall indemnify Town of Center Harbor from and against any damages, claims, or expenses arising out of Jordan's breach of this Agreement or from Jordan's negligent acts or omissions outside the scope of this Agreement. Town of Center Harbor shall indemnify Jordan from and against any damages, claims or expenses arising out of

Town of Center Harbor breach of this Agreement or arising out of claims or actions by third parties against Jordan by virtue of its performance of this Agreement.

16. Publicity. Subject to the prior approval of the other party, which approval shall not be unreasonably withheld, either party may make the terms of this Agreement and the relationship of the parties hereunder public via press releases, seminars, case studies, web sites, or through other media.

17. Headings. Section headings in this Agreement are for convenience only and shall not affect the interpretation of any provision of this Agreement.

18. Governing Law; Severability; etc. This Agreement shall be governed by and construed in accordance with the laws of the State of New Hampshire. Whenever possible, each provision of this Agreement shall be interpreted in such manner as to be effective and valid under applicable law, but if any provision of this Agreement shall be prohibited by or invalid under applicable law, such provision shall be ineffective to the extent of such prohibition of invalidity, without invalidating the remainder of such provision or the remaining provisions of this Agreement. This Agreement may be executed in any number of counterparts, each of which shall be an original, but all of which together shall constitute one instrument.

IN WITNESS WHEREOF, the parties hereto have duly executed this Agreement by their respective authorized representatives as of the date first above written.

THE JORDAN INSTITUTE, INC.	Town of Center Harbor
By:	By:
Typed Name: **D. Dickinson Henry, Jr.**	Typed Name: **(Contact)**
Title: **Executive Director**	Title: **(Contacts Title)**
Date:	Date:

Schedule A: Oversight Services

Town of Center Harbor understands and agrees that Jordan will be providing oversight through the design and construction process of the project, acting on behalf of the owners, Town of Center Harbor. Selected consultants/trades peoples, will supply the following services and work in conjunction with Jordan to achieve maximum performance.

The expected deliverables of oversight services are:

Oversight of Design/Development Phase

- Design and specify selected Energy Efficiency Measures (EEM)
- Value engineering
- Life-cycle cost analysis
- Constructability reviews

Oversight of Procurement Phase

- Preparing bid documents
- Review of bids/proposals received
- Coordinate final contracts between Town of Center Harbor and trades peoples

Oversight of Construction Phase

- Coordinate with project team members
- Attendance at Owner/Architect/Contractor meetings, as required
- Make periodic site visits to monitor progress of energy related work
- Monitor quality of energy related work
- Request blower door tests when required
- Monitor adherence to the contract documents
- Monitor commissioning

Oversight of Construction Closeout Phase

- Punch list development of energy related items
- Project closeout support

- Request final blower door test

Fees

Jordan will perform the Services listed above for X% above the cost of implementation in order to ensure that the measures as outlined in Jordan's Facility Assessment Report, dated (XX), achieve their optimum performance, plus reasonable reimbursables.

Jordan will work in regular communication with Town of Center Harbor to be aware of the needs and expectations of Project personnel.

The parties will negotiate separately the scope of Work.

49 North Main Street, 2nd Floor

Concord, NH 03301

603-226-1009

www.jordaninstitute.org