Energy Audit Report

St. Lawrence University Canton, NY

1 Lincoln St. - The (new) Hub

Prepared By:

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Community Energy Services, Inc.
101 Main Street
Canton, NY 13617

July 2008

Facility Name:	1 Lincoln St. - The (new) Hub
Facility Location:	St. Lawrence University

Facility Address:	1 Lincoln St.
Facility City:	Canton
Facility State:	NY
Facility Zip:	13617
Facility County:	St. Lawrence

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Size of Facility:	6,424 Sq. Ft.

Total Annual Energy Costs	$6,669.73
Electric	$2,171.78
Natural Gas	$4,497.95
Water and Sewer	$961.01

Type of Facility (included in Abstract):

College Dormitory - Theme House

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ABSTRACT

The purpose of this study was to investigate and report on the effects of installing various energy and water conservation measures for this building. An on-site visit was conducted by an experienced energy auditor from Community Energy Services, Inc. familiar with this type of facility. During a site survey conducted on June 10, 2008 data was gathered through visual inspections of the building shell and its equipment and through the use of diagnostic testing where appropriate. Data was used to produce a computer model of the facility using TREAT modeling software to predict potential energy savings from recommended improvements. Provided utility bills were reviewed to correlate the building model with actual usage. Results were compiled by L & S Energy Services, Inc. to produce this report.

SUMMARY

A summary of the recommended energy improvement measures is shown at the end of the report titled Improvement Packages. Projected savings are expressed in terms of simple payback and SIR (Savings to Investment ratio). Simple payback is calculated by dividing the estimated cost by the annual estimated savings. Simple payback is the estimated number of years it takes for energy saving to pay back your investment in the cost of improvements if interest and inflation rates are zero. SIR is a calculation that compares the return of investing capital in an interest bearing account versus in the improvements. An SIR greater than 1 means an investment in the projected measures has a better than projected return than an interest bearing account.

The estimate may include items that do not produce enough energy cost savings to justify implementation. However these measures can save significant energy in the building and/or improve the comfort and/or safety of the residence. The estimate may also include items that produce no savings but can improve the comfort and/or safety of the residence. These items have a negative impact on the payback and the SIR of the overall package.

If all the recommended energy improvement measures are implemented the total cost of the project is estimated at $26,105. The annual cost savings is estimated to be $1,933 . The recommended measures are projected to save 31.4% of the buildings current energy use. The energy improvement measures have a combined SIRof 1.37. Annual emissions savings are listed in Table 1.

No water saving measures were identified for this building.

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Description of Existing Building Systems

1.1 BUILDING ENVELOPE

1 Lincoln Street, now known as the Hub and formerly known as Phi Kapp, is a two story building with a partial basement reportedly built around 1930. The building is used as a student residence. It is occupied primarily during school sessions. Occupancy is reduced in the summer and during school breaks. The building contains a common kitchen facility and a common laundry facility.

The first floor of the building contains the common kitchen and laundry facilities. The basement is entered from the first floor near the kitchen.

Exterior walls are 2 x 4 wood framed with drywall. Walls appear to be insulated with 3.5 inches of fiberglass. The basement contains radiators from the boiler and is uninsulated. A south facing crawlspace is older and has uninsulated walls and a dirt floor. The East facing crawlspace is newer and has insulated walls and a concrete slab floor. The rim joists in this newer crawlspace are uninsulated.

Windows are entirely double glazed with vinyl frames. Exterior doors are insulated steel. The north door and the second floor south door to the fire escape have poor weatherstripping.

The heated basement is used for mechanical systems and the walls are uninsulated masonry. The floor of the basement is concrete slab.

The attic over the second floor of the structure has cellulose insulation varying between 2 and 6 inches in depth. Much of the attic has a wood floor and could be used for storage, although very little is stored there now.

A blower door test performed on the building found moderate air leakage. Leakage was particularly noticeable from the first floor north door, second floor south door, and a basement door that needs a bottom sweep. Also notable was a leaky bathroom window on the second floor, and some holes in the floor in the north laundry room.

1.2 HEATING AND COOLING SYSTEMS

The heat for this building is supplied by a 310,000 Btuh Weil Mclain Ultra 310 natural gas boiler. The boiler is not original to the building. The boiler is a sealed combustion unit. Annual efficiency is assumed to be 85% based on combustion efficiency tests performed on the units, manufacturer's specifications and the historical energy usage of the building. Heating hot water piping is partially insulated. The boiler has an outdoor reset.

Winter temperature setting is assumed to be approximately 68F to 70F.

1.3 LIGHTING SYSTEMS

Lighting for the common spaces for this building is provided by a combination of hard wired compact fluorescent (cfl) fixtures, T-12 and T-8 linear fluorescent fixtures, circline fluorescent fixtures, and also several incandescent bulbs. Common bathrooms have a combination of fluorescent lamps and incandescent bulbs. Common bathrooms do not contain occupancy sensors. It is assumed students provided fixtures use incandescent lamps.

1.4 WATER HEATING SYSTEMS

Domestic hot water is provided by a 75,000 Btuh natural gas A.O. Smith 74.5 gallon hot water heater. The hot water temperature was measured at 138F. The water heater is old and very corroded. Domestic hot water piping in the heated basement is uninsulated.

1.5 WATER USAGE

Water flow rates were measured at 2 gallons per minute (GPM) maximum at sinks, except the kitchen sink which may have been flowing at up to 6 GPM. Water usage of two toilets was measured at 1.9 gallons each per flush. The other two toilets contained Sloan Flushmate high efficiency inserts and are therefore low flush volume units.

1.6 APPLIANCES

This building has common kitchen and laundry facilities. The kitchen contains a Hotpoint CTX18DB top freeze refrigerator and a Frigidaire electric range. The laundry facility contains two Maytag commercial washers, and two Maytag commercial electric dryers.

1.7 VENTILATION

Three of the four bathrooms contain working bath fans. The bath fan in the 1st floor north bathroom does not appear to work. The bath fans appear to vent to the exterior. Installing humidistats or automatic fan controls can help to reduce humidity and improve indoor air quality. Any attic work should include verification that the bath vents exit to the exterior and do not vent into the attic.

1.8 OTHER OBSERVATIONS

1) One natural gas leak was found and reported.
2) Knob and tube wiring was observed.
3) The basement is very damp and mold was observed.
4) Dirt floor crawlspaces allow moisture to enter the building. Covering the dirt will help to reduce humidity and associated mold and mildew.

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Description of Improvements

2.1 Increase Attic Insulation

Existing Conditions:
The attic over the second floor of the structure has cellulose insulation varying between 2 and 6 inches in depth. Much of the attic has a wood floor and could be used for storage, although very little is stored there now.

Improvement Specifications:
Increase attic insulation to a minimum of 16 inches by adding blown in cellulose above the existing insulation where possible. If the attic is needed for storage an insulated floor area can be installed consisting of 4 inches of foam board over the existing floor with a plywood surface. Install a sealable attic hatch into the attic. Insulate the attic hatch to a minimum of R20. Box the hatchway to prevent cellulose from falling into the hatchway as necessary. Weatherstrip the hatch to prevent infiltration. Conduct air sealing prior to insulating. Correct any electrical wiring issues prior to insulating.

2.2 Upgrade Heating System

Existing Conditions:
The heat for this building is supplied by a 310,000 Btu Weil Mclain Ultra 310 natural gas boiler. The boiler is not original to the building. The boiler is a sealed combustion unit. Annual efficiency is assumed to be 85% based on combustion efficiency tests performed on the units, manufacturer's specifications and the historical energy usage of the building. Heating hot water piping is partially insulated. The boiler has an outdoor reset.

Improvement Specifications:
Based on the natural gas usage at the building and the apparent boiler control strategy it appears the boiler is not run at its optimum efficiency. The existing boiler is a condensing boiler that has been installed into a preexisting distribution system. There does not appear to have been any upgrade of the distribution system in conjunction with the new boiler. The existing high efficiency boiler will only achieve its high efficiency if the exiting flue gases are allowed to condense thereby recapturing the heat in the flue gases. For this to happen the supply and return temperatures of the distribution water should be 110F and 90F respectively according to manufacturer's specifications. In order for this to be accomplished the distribution system must be sized to provide adequate heat at the lower supply temperature. Adding additional radiation may be necessary in the building to accomplish this. The cost of this measure is not justified by the dollar savings but the energy saved and the potential for increased comfort and system control may justify the improvement so it is included in the package.

2.3 Install an Indirect Hot Water Heater off The Boiler

Existing Conditions:
Domestic hot water is provided by a 75,000 Btu natural gas A.O. Smith 74.5 gallon hot water heater. The hot water temperature was measured at 138F. The water heater is old and very corroded. Domestic hot water piping in the heated basement is uninsulated.

Improvement Specifications:
The existing hot water heater is nearing the end of its useful life. Installing an indirect hot water heater off the existing boiler will greatly improve the overall efficiency. Reduce water temperature to 125F maximum. The savings are based on the efficiency of the existing boiler prior to upgrade recommended in 2.2.

2.4 Insulate Basement Walls

Existing Conditions:
The heated basement is used for mechanical systems and the walls are uninsulated masonry. The floor of the basement is concrete slab.

Improvement Specifications:
Insulate the basement walls with a minimum of one inch rigid foam. Cover the foam with an non degradable surface that will not mold and mildew. An alternative to this improvement is to control the heat in the basement if the basement is not used to reduce or eliminate heating of the basement.

2.5 Reduce Infiltration

Existing Conditions:
A blower door test performed on the building found moderate air leakage. Leakage was particularly noticeable from the first floor north door, second floor south door, and a basement door that needs a bottom sweep. Also notable was a leaky bathroom window on the second floor, and some holes in the floor in the north laundry room.

Improvement Specifications:
Install weatherstripping on doors as needed. Conduct comprehensive air sealing in conjunction with a blower door to identify areas for sealing.

2.6 Replace Incandescent Lighting with Compact Fluorescent Lamps

Existing Conditions:
Lighting for the common spaces for this building is provided by a combination of hardwired compact fluorescent (cfl) fixtures, T-12 and T-8 linear fluorescent fixtures, circline fluorescent fixtures, and also several incandescent bulbs. Common bathrooms have a combination of fluorescent lamps and incandescent bulbs. Common bathrooms do not contain occupancy sensors. It is assumed students provided fixtures use incandescent lamps.

Improvement Specifications:
Replace all incandescent lighting with compact fluorescent lamps that provide equivalent light.

2.7 Replace Older T12 Fluorescent linear bulbs and ballasts with T8 Fluorescent linear bulbs and ballasts

Existing Conditions:
Lighting for the common spaces for this building is provided by a combination of hardwired compact fluorescent (cfl) overhead fixtures, T-12 linear fluorescent fixtures with magnetic ballasts, compact fluorescent lamps and incandescent bulbs. Common bathrooms have a combination of fluorescent lamps and incandescent bulbs. Common bathrooms do not contain occupancy sensors.

Improvement Specifications:
Replace all T12 linear fluorescent bulbs and magnetic ballasts with T8 linear fluorescent bulbs and electronic ballasts that provide equivalent light. The existing fixtures may be reusable depending on condition.

IMPROVEMENT PACKAGES

1 Lincoln Old Phi Kapp New HUB

For: St. Lawrence University

By: Scott Shipley

Date: 7/1/2008

Evaluated Packages:

Package Name	Cost $	Annual Savings, MMBtu	Annual Savings, $	Payback years	Cashflow $/year	SIR
Improvement Package	26,105	149.36	1,933	13.5	-365	1.37

Package Description:

1. Improvement Package

Improvement Name	Cost ($)	Annual Savings MMBtu	Annual Savings ($)	Payback (years)	Cashflow ($/year)	Improve-ment Life (Years)	SIR in Package
Replace Radiators	7,500	25.34	317	23.7	-344	20	0.63
Upgrade T12 to T8	450	0.43	20	22.8	-20	10	0.38
Install Attic Insulation	5,000	21.14	264	18.9	-176	40	1.24
Insulate Basement Walls	8,500	36.37	455	18.7	-294	40	1.25
Reduce Infiltration	2,500	33.46	418	6.0	198	20	2.51
Install Indirect Hot Water Heater off of Boiler	2,000	31.08	389	5.1	212	15	2.33
Replace Incandescent Lamps	155	1.55	71	2.2	58	8	3.24
Total for Package	26,105	149.36	1,933	13.5	-365	N/A	1.37

Non-Energy Benefits:

1. Replace Radiators: Increased equity.
2. Upgrade T12 to T8: Reduce maintenance, reduce replacement cost (fluorescent bulbs last

10,000 hours whereas incandescent bulbs typically last less than 1,000 hours).

3. Install Attic Insulation: Improve comfort, increase value of building.
4. Insulate Basement Walls: Improve comfort, increase value of building.
5. Reduce Infiltration: Reduce drafts.
6. Install Indirect Hot Water Heater off of Boiler: Increase value of building.
7. Replace Incandescent Lamps: Reduce maintenance, reduce replacement cost (fluorescent bulbs last 10,000 hours whereas incandescent bulbs typically last less than 1,000 hours).

Table 1
Annual Emissions Savings

Fuel Type	NOx (LBS)	SO2 (LBS)	CO2 (LBS)
Electricity	2	3	1,019
Natural Gas	15	0	17,024
Oil	0	0	0
Propane	0	0	0
Other: Other Fuel Type Name	0	0	0
Total	**16**	**3**	**18,042**

ENERGY BILLS

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Electric Bills						
Utility:			National Grid/ Constellation Energy			
Rate Class:			SC2D			
Account Number:			Unknown			
Start Billing Date	End Billing Date	Days in Period	Usage (kWh)	Demand (kW)	Cost	Cost per kWh
10/31/06	12/1/06	31	3,892	13.2	$222.46	$0.06
12/01/06	1/2/07	32	3,563	13.1	$254.88	$0.07
01/02/07	1/31/07	29	1,021	3.9	$77.71	$0.08
01/31/07	3/1/07	29	1,141	2.8	$52.07	$0.05
03/01/07	4/2/07	32	1,153	3.2	$62.30	$0.05
04/02/07	5/1/07	29	1,270	4.7	$94.44	$0.07
05/01/07	6/1/07	31	985	2.8	$60.40	$0.06
Totals 2006			**13,025**		**$824.26**	**$0.06**
06/01/07	7/2/07	31	1,085	2.8	$56.36	$0.05
07/02/07	8/1/07	30	1,099	3.8	$68.13	$0.06
08/01/07	8/30/07	29	1,115	7.4	$97.90	$0.09
08/30/07	9/28/07	29	3,766	11.1	$210.78	$0.06
09/28/07	10/30/07	32	4,161	11.1	$210.04	$0.05
10/30/07	11/30/07	31	3,587	15.3	$249.76	$0.07
11/30/07	1/2/08	33	3,794	16.5	$208.24	$0.05
01/02/08	1/31/08	29	2,364	16.4	$198.91	$0.08
01/31/08	2/29/08	29	4,092	16.4	$225.23	$0.06
02/29/08	3/31/08	31	3,764	16.5	$228.02	$0.06
03/31/08	4/29/08	29	3,778	15.9	$220.25	$0.06
04/29/08	5/29/08	30	2,269	15.0	$198.16	$0.09
Totals 2007-2008			**34,874**		**$2,171.78**	
Average Cost Per kWh					$0.06	

1 Lincoln is charged for demand. Though this is a significant part of the cost of electricity given the resident population and the unusual usage patterns it is difficult to assess what devices are leading to the demand charges. Consequently only the price per kWh for electricity is used and potential demand savings is ignored.

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Natural Gas Bills					
			St. Lawrence Gas		
Account Number:			Unknown		
Start Billing Date	End Billing Date	Days in Period	Usage (Therms)	Cost	Cost per Therm
11/21/05	12/20/05	29	947	$1,214.57	$1.28
12/21/05	1/21/06	31	1008	$1,301.71	$1.29
1/23/06	2/22/06	30	899	$1,071.78	$1.19
2/21/06	3/26/06	33	907	$1,071.55	$1.18
3/22/06	4/20/06	29	584	$615.54	$1.05
4/20/06	5/19/06	29	516	$524.25	$1.02
5/22/06	6/20/06	29	117	$122.96	$1.05
6/21/06	7/23/06	32	0	$0.00	$0.00
7/24/06	8/23/06	30	0	$0.00	$0.00
8/22/06	11/22/06	92	6	$6.22	$1.04
9/21/06	10/23/06	32	404	$336.78	$0.83
10/23/06	11/21/06	29	413	$428.81	$1.04
Totals for 2006			**5,801**	**$6,694.17**	
11/21/06	12/21/06	30	692	$782.38	$1.13
12/21/06	1/23/07	33	242	$290.53	$1.20
1/23/07	2/21/07	29	1240	$1,474.89	$1.19
2/21/07	3/22/07	29	151	$190.55	$1.26
3/22/07	4/20/07	29	601	$718.74	$1.20
4/20/07	5/22/07	32	11	$18.56	$1.69
5/22/07	6/21/07	30	71	$99.76	$1.41
6/21/07	7/23/07	32	51	$84.87	$1.66
7/23/07	8/22/07	30	60	$72.12	$1.20
8/22/07	9/20/07	29	21	$26.87	$1.28
9/20/07	10/22/07	32	156	$166.04	$1.06
10/22/07	11/21/07	30	462	$572.64	$1.24
Totals for 2007			**3,758**	**$4,497.95**	
Average Cost Per Therm				**$1.20**	

6/21/2005

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Water and Sewer Cost

Begin	End	Gallons	Water $	Sewer $	Total	$Water/ 1000 gal
Jul-08	Sep-08	53,000	$238.42	$295.68	$534.10	$4.50
Oct-06	Dec-06	71,000	$321.94	$404.76	$726.70	$4.53
Jan-07	Mar-07	15,000	$67.35	$83.25	$150.60	$4.49
Apr-07	Jun-07	2,000	$23.35	$29.05	$52.40	$11.68
Jul-07	Sep-08	17,000	$79.39	$98.77	$178.16	$4.67
Oct-08	Dec-08	55,000	$257.65	$322.20	$579.85	$4.68
Total		**89,000**	**$988.10**	**$1,233.71**	**$961.01**	**$11.10**

$Sewer/ 1000 gal
$5.58
$5.70
$5.55
$14.53
$5.81
$5.86
$13.86