

## **Energy Audit Report**

***St. Lawrence University Canton, NY  
38 East Main St. - Apartment Building***

**Prepared By:**

***L&S Energy Services, Inc.***  
58 Clifton Country Road  
Suite 101  
Clifton Park, NY 12065

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

**August 2008**

Facility Name: 38 East Main St. - Apartment Building  
Facility Location: St. Lawrence University

Facility Address: 38 East Main St.  
Facility City: Canton  
Facility State: NY  
Facility Zip: 13617  
Facility County: St. Lawrence

Contact Name: Louise Gava  
Contact Title: Coordinator of Sustainability Projects  
Contact Phone: 315-229-5825  
Contact Fax:  
Contact Email: lgava@stlawu.edu

Size of Facility: 2,596 Sq. Ft.

Total Annual Energy Costs	\$5,066.93
Electric	\$560.41
Natural Gas	\$4,506.52
Water and Sewer	\$769.36

Type of Facility (included in Abstract):  
Apartment Building

## 38 East Main St. - Apartment Building

### 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 July 8, 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 \$30,115. The annual cost savings is estimated to be \$2,361 . The recommended measures are projected to save 42.9% of the buildings current energy use. The energy improvement measures have a combined SIR of 1.32. Annual emissions savings are listed in Table 1.

If all the recommended water saving measures are implemented the total cost of water savings measures is estimated at \$1,600. The annual water cost savings is estimated to be \$260 . The water saving measures have a combined SIR of 2.8. The water savings measures are projected to save 25,216 gallons per year.

# **38 East Main St. - Apartment Building**

## **Description of Existing Building Systems**

### **1.1 BUILDING ENVELOPE**

38 East Main St. is a four unit apartment building. It is a two story building and a full basement, and reportedly was built around 1940. The building contains four separate apartment residences for faculty/staff. It appears to be occupied primarily when school is in session. Occupancy appears to be reduced in the summer and during school breaks. The building contains four separate kitchen facilities and one common laundry facility, which is in the basement. The apartments divide the house footprint into four quadrants, creating four 2-story apartment units.

The interior of this building consists of four separate apartments with four separate exterior entrances. Common space consists of only the laundry facility in the basement. There are no adjoining rooms, hallways, foyers, or doorways between the apartments. The basement is entered from the outdoors.

Exterior walls are 2 x 4 wood framed with drywall, and appear to contain no insulation except a small amount of rockwool that may have fallen down into some of the walls from the attic. The basement is unheated and uninsulated.

Windows are primarily older single glazed with exterior storm windows. The four exterior doors are metal, two of which have a storm door. The basement also has an exterior door, which is uninsulated wood.

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

The attic over the second floor of the structure has approximately 2-3 inches of rockwool insulation. The attic is a shallow space under a flat roof. The entrance to the attic is a small hatch composed of solid wood approximately an inch thick.

A blower door test was deemed impractical, due to the fact that the building consists of five unconnected sections (the four apartments and the basement. Infiltration in this building is assumed to be moderate.

### **1.2 HEATING AND COOLING SYSTEMS**

The heat for this building is supplied by a Weil McLain 300,000 Btu natural gas boiler with natural draft. The boiler is not original to the building. Annual efficiency is assumed to be 80% based on combustion efficiency tests performed on the units, manufacturer's specifications and the historical energy usage of the building. The cast iron hydronic distribution system in the basement is not insulated. The boiler has a pilot light that was firing at the time of the site visit.

The heat is in four zones for the four apartments, each controlled by a non-programmable thermostat. Winter temperature setting is assumed to be approximately 68F.

### **1.3 LIGHTING SYSTEMS**

Lighting for this building appears to be provided almost entirely by fluorescent fixtures. These are mostly circline round fluorescents, compact fluorescents, and T-12 linear fluorescents with magnetic ballasts. A small number of incandescent bulbs are also present.

#### **1.4 WATER HEATING SYSTEMS**

Domestic hot water is provided by a natural gas AO Smith 74.5 gallon hot water heater with natural draft. The hot water temperature was measured at 140F. Domestic hot water piping in the unconditioned basement is uninsulated.

#### **1.5 WATER USAGE**

Water flow rates were measured at 1 gallon per minute at all sinks. The toilets were all measured at approximately 5 to 6.5 gallons per flush. The four kitchens contain no dishwashers. The shared laundry area in the basement contains a newer Kenmore washer.

#### **1.6 APPLIANCES**

This building contains four modest kitchens and one shared laundry facility. Each kitchen contains an older White Westinghouse top freezer auto defrost refrigerator. There is also an electric range in each apartment. The basement laundry area contains a newer Kenmore washer and an older Roper electric clothes dryer.

#### **1.7 VENTILATION**

At least two of the apartments appear to contain a working bath fans. 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) The basement contains a considerable amount of mold, particularly on sheetrock walls.
- 2) Some rotted roof rafters are visible in the attic.
- 3) Knob and tube wiring is visible in the attic and appears to be in use.

# 38 East Main St. - Apartment Building

## Description of Improvements

### 2.1 Increase Attic Insulation

#### Existing Conditions:

The attic over the second floor of the structure has approximately 2-3 inches of rockwool insulation. The attic is a shallow space under a flat roof. The entrance to the attic is a small hatch composed of solid wood approximately an inch thick.

#### Improvement Specifications:

Increase attic insulation to a minimum of 16 inches by adding blown in cellulose above the existing insulation where possible. Install a sealable attic hatch over the existing stairwell. 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 Install Programmable Thermostat

#### Existing Conditions:

The heat is in four zones for the four apartments, each controlled by a non-programmable thermostat. Winter temperature setting is assumed to be approximately 68F.

#### Improvement Specifications:

Install one programmable thermostat per zone. Savings is based on a three degree set back per for 8 hours per day.

### 2.3 Insulate Walls

#### Existing Conditions:

Exterior walls are 2 x 4 wood framed with drywall, and appear to contain no insulation except a small amount of rockwool that may have fallen down into some of the walls from the attic. The basement is unheated and uninsulated.

#### Improvement Specifications:

Insulate Exterior walls with cellulose insulation blown in at dense pack conditions. Repair or replace wiring prior to insulation.

### 2.4 Insulate Domestic Hot Water Piping

#### Existing Conditions:

Domestic hot water piping in the unconditioned basement is uninsulated.

#### Improvement Specifications:

Insulate the Domestic Hot Water Piping to an average R-value of 5.0 using rigid foam or fiberglass wrap insulation.

## **2.5 Replace Boiler and Insulate Heating Distribution Piping**

### **Existing Conditions:**

The heat for this building is supplied by a Weil McLain 300,000 Btu natural gas boiler with natural draft. The boiler is not original to the building. Annual efficiency is assumed to be 80% based on combustion efficiency tests performed on the units, manufacturer's specifications and the historical energy usage of the building. The cast iron hydronic distribution system in the basement is not insulated. The boiler has a pilot light that was firing at the time of the site visit.

### **Improvement Specifications:**

Replace the boiler with a high efficiency condensing boiler. Adjust distribution system as necessary to accommodate lower distribution temperatures. Insulate the heating hot water piping to an average R-value of 5.0 using rigid foam or fiberglass wrap insulation.

## **2.6 Install Indirect Hot Water Heater off of Boiler**

### **Existing Conditions:**

Domestic hot water is provided by a natural gas AO Smith 74.5 gallon hot water heater with natural draft. The hot water temperature was measured at 140F. Domestic hot water piping in the unconditioned basement is uninsulated.

### **Improvement Specifications:**

Replace the existing hot water heater with an indirect high efficiency hot water heater fired off the new condensing boiler. Adjust water temperature to 125F.

## **2.7 Reduce Infiltration**

### **Existing Conditions:**

A blower door test was deemed impractical, due to the fact that the building consists of five unconnected sections (the four apartments and the basement). Infiltration in this building is assumed to be moderate.

### **Improvement Specifications:**

Install weatherstripping on doors as needed. Conduct comprehensive airsealing in conjunction with a blower door in individual apartments to identify areas for sealing. Close off the attic hatch with an insulated removable cover.

## **2.8 Replace Incandescent Lighting with Compact Fluorescent Lamps**

### **Existing Conditions:**

Lighting for this building appears to be provided almost entirely by fluorescent fixtures. These are mostly circline round fluorescents, compact fluorescents, and T-12 linear fluorescents with magnetic ballasts. A small number of incandescent bulbs are also present.

### **Improvement Specifications:**

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

## **2.9 Install Energy Star Refrigerators**

### **Existing Conditions:**

This building contains four modest kitchens and one shared laundry facility. Each kitchen contains an older White Westinghouse top freezer auto defrost refrigerator.

### **Improvement Specifications:**

Replace the existing refrigerators with Energy Star models of similar style and similar or smaller size. Style and size have significant impact on the energy usage of the unit. Downsizing the unit should be considered to reduce long term energy use.

## **2.10 Install Natural Gas Dryers**

### **Existing Conditions:**

This building contains four modest kitchens and one shared laundry facility. The basement laundry area contains a newer Kenmore washer and an older Roper electric clothes dryer.

### **Improvement Specifications:**

Replace existing electric dryer with a natural gas unit. Install a solid metal flue to exhaust gases and humidity.

## **2.11 Install Low Flush Toilet**

### **Existing Conditions:**

Water flow rates were measured at 1 gallon per minute at all sinks. The toilets were all measured at approximately 5 to 6.5 gallons per flush.

### **Improvement Specifications:**

Replace the existing high flush toilets with low flush units with a maximum flush rate of 1.6 gallons per flush. For increased potential savings dual flush toilets are now available that can reduce water usage per flush as low as 1.0 gallon per flush.

## IMPROVEMENT PACKAGES

38 E Main

For: SLU

By: Scott Shipley

Date: 8/6/2008

### Evaluated Packages:

Package Name	Cost \$	Annual Savings, MMBtu	Annual Savings, \$	Payback years	Cashflow \$/year	SIR
Improvement Package 1	30,115	165.68	2,361	12.75	-290	1.32

### Package Description:

#### 1. Improvement Package 1

Improvement Name	Cost (\$)	Annual Savings MMBtu	Annual Savings (\$)	Payback (years)	Cashflow (\$/year)	Improve- ment Life (Years)	SIR in Package
Insulate Domestic Hot Water Piping	750	2.42	30	24.8	-36	20	0.6
Replace Boiler and insulate Distribution	13,000	53.50	669	19.4	-476	20	0.77
Insulate Attic	2,400	11.56	144	16.6	-67	40	1.41
Install Energy Star Refrigerators	2,800	3.52	226	12.4	-20	15	0.97
Install Natural Gas Dryer	850	-2.51	70	12.2	-5	15	0.98
Replace Water Heater with Indirect off of the Boil	1,500	10.52	131	11.4	-1	15	1.05
Reduce Infiltration	2,000	14.77	185	10.8	9	20	1.38
Insulate Walls	6,500	61.86	773	8.4	201	20	1.78
Install Programmable Thermostats	300	10.00	125	2.4	99	15	5.01

Replace Incandescents	15	0.05	8	2.0	6	7	3.18
<b>Total for Package</b>	30,115	165.68	2,361	12.75	-290	N/A	1.32

**Table 1**  
**Annual Emissions Savings**

Fuel Type	NOx (LBS)	SO2 (LBS)	CO2 (LBS)
Electricity	4	8	2,387
Natural Gas	16	0	18,311
Oil	0	0	0
Propane	0	0	0
Other: Other Fuel Type Name	0	0	0
<b>Total</b>	<b>19</b>	<b>8</b>	<b>20,697</b>

## **ENERGY BILLS**

## 38 East Main St. - Apartment Building

Electric Bills					
Utility:		National Grid/ Constellation Energy			
Rate Class:		SC1			
Account Number:		Unknown			
Start Billing Date	End Billing Date	Days in Period	Usage (kWh)	Cost	Cost per kWh
07/03/06	8/1/06	29	229	\$19.90	\$0.09
08/01/06	9/1/06	31	509	\$39.22	\$0.08
09/01/06	9/29/06	28	565	\$52.29	\$0.09
09/29/06	10/31/06	32	684	\$58.47	\$0.09
10/31/06	12/1/06	31	635	\$47.81	\$0.08
12/01/06	12/29/06	28	589	\$50.82	\$0.09
12/29/06	1/31/07	33	631	\$58.09	\$0.09
01/31/07	3/1/07	29	626	\$46.16	\$0.07
03/01/07	4/2/07	32	570	\$45.81	\$0.08
04/02/07	5/1/07	29	530	\$49.89	\$0.09
05/01/07	6/1/07	31	452	\$40.21	\$0.09
06/01/07	7/2/07	31	395	\$32.36	\$0.08
<b>Totals 2006-2007</b>			<b>6,415</b>	<b>\$541.03</b>	<b>\$0.08</b>
07/02/07	8/1/07	30	276	\$24.56	\$0.09
08/01/07	8/30/07	29	500	\$36.88	\$0.07
08/30/07	9/28/07	29	790	\$60.29	\$0.08
09/28/07	10/29/07	31	1,001	\$73.73	\$0.07
10/29/07	11/30/07	32	940	\$72.22	\$0.08
11/30/07	1/2/08	33	979	\$56.98	\$0.06
01/02/08	1/31/08	29	642	\$38.90	\$0.06
01/31/08	2/29/08	29	838	\$49.22	\$0.06
02/29/08	3/31/08	31	814	\$49.25	\$0.06
03/31/08	4/30/08	30	745	\$45.13	\$0.06
04/30/08	5/30/08	30	662	\$46.61	\$0.07
05/30/08	6/30/08	31	289	\$6.64	\$0.02
<b>Totals 2007-2008</b>			<b>8,476</b>	<b>\$560.41</b>	
Average Cost Per kWh				\$0.066	

## 38 East Main St. - Apartment Building

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	12/21/05	30	604	\$775.61	\$1.28
12/21/05	1/23/06	33	503	\$649.62	\$1.29
1/23/06	2/21/06	29	574	\$683.98	\$1.19
2/21/06	3/22/06	29	573	\$677.79	\$1.18
3/22/06	4/20/06	29	321	\$338.98	\$1.06
4/20/06	5/22/06	32	210	\$214.12	\$1.02
5/22/06	6/21/06	30	125	\$131.40	\$1.05
6/21/06	7/24/06	33	0	\$0.00	\$0.00
7/24/06	8/22/06	29	20	\$22.76	\$1.14
8/22/06	9/21/06	30	171	\$188.68	\$0.00
9/21/06	10/23/06	32	294	\$245.20	\$0.83
10/23/06	11/21/06	29	462	\$479.10	\$1.04
<b>Totals for 2006</b>			<b>3,857</b>	<b>\$4,407.24</b>	
11/21/06	12/21/06	30	457	\$520.02	\$1.14
12/21/06	1/23/07	33	601	\$707.82	\$1.18
1/23/07	2/21/07	29	771	\$921.25	\$1.19
2/21/07	3/22/07	29	521	\$636.94	\$1.22
3/22/07	4/20/07	29	402	\$484.50	\$1.21
4/20/07	5/22/07	32	127	\$165.50	\$1.30
5/22/07	6/21/07	30	108	\$147.84	\$1.37
6/21/07	7/23/07	32	16	\$25.19	\$1.57
7/23/07	8/22/07	30	98	\$112.88	\$1.15
8/22/07	9/20/07	29	52	\$59.13	\$1.14
9/20/07	10/22/07	32	184	\$193.61	\$1.05
10/22/07	11/21/07	30	429	\$531.84	\$1.24
<b>Totals for 2007</b>			<b>3,766</b>	<b>\$4,506.52</b>	
<b>Average Cost Per Therm</b>				<b>\$1.20</b>	

## 38 East Main St. - Apartment Building

### Water and Sewer Cost

Begin	End	Gallons	Water \$	Sewer \$	Total	\$Water/ 1000 gal	\$Sewer/ 1000 gal
Jul-08	Sep-08	7,000	\$31.43	\$38.85	\$70.28	\$4.49	\$5.55
Oct-06	Dec-06	18,000	\$80.82	\$99.90	\$180.72	\$4.49	\$5.55
Jan-07	Mar-07	14,000	\$62.86	\$77.70	\$140.56	\$4.49	\$5.55
Apr-07	Jun-07	12,000	\$56.04	\$69.72	\$125.76	\$4.67	\$5.81
Jul-07	Sep-08	12,000	\$56.04	\$69.72	\$125.76	\$4.67	\$5.81
Oct-08	Dec-08	36,000	\$168.12	\$209.16	\$377.28	\$4.67	\$5.81
<b>Total</b>		<b>74,000</b>	<b>\$343.06</b>	<b>\$426.30</b>	<b>\$769.36</b>	<b>\$4.64</b>	<b>\$5.76</b>