

## Energy Audit Report

*St. Lawrence University Canton, NY*  
*1 University Ave. - Artists Guild*

Prepared By:

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Facility Name: 1 University Ave. - Artists Guild  
Facility Location: St. Lawrence University

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

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Size of Facility: 2,607 Sq. Ft.

Total Annual Energy Costs	\$3,930.62
Electric	\$690.21
Natural Gas	\$3,240.41
Water and Sewer	\$1,949.15

Type of Facility (included in Abstract):  
College Dormitory - Theme House

# 1 University Avenue - Artists Guild

## 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 May 23, 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 \$23,435. The annual cost savings is estimated to be \$1,861. The recommended measures are projected to save 40.3% of the buildings current energy use. The energy improvement measures have a combined SIR of 1.22. 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 \$1,200. The annual water cost savings is estimated to be \$100. The water saving measures have a combined SIR of 1.5. The water savings measures are projected to save 9,773 gallons per year.

# 1 University Avenue - Artists Guild

## Description of Existing Building Systems

### 1.1 BUILDING ENVELOPE

1 University Avenue, also known as the Artist's Guild, is a two story building with a full basement connected to a one story section over a crawlspace. It was reportedly built around 1930. The building is used as a student dormitory. It is occupied primarily during school sessions. Occupancy is reduced in the summer and during school breaks. The building contains common kitchen and laundry facilities.

The first floor contains common kitchen, laundry, living room, and bath, as well as some dormitory space. The second floor contains more dormitory rooms and another bath. The basement is entered from the first floor.

Exterior walls are 2 x 4 wood framed with drywall. Walls of the older section appear to be primarily uninsulated and walls in the one story section appear to be insulated based on fuel usage and age of the building sections. The basement is unheated and uninsulated. The rim joists are closed-off and also uninsulated. The crawlspace walls are uninsulated, but the floor over the crawlspace is insulated.

Windows are primarily single glazed with wood frames and storm windows. Exterior doors are wood panel. The doors are leaky. The second floor contains a door to a walk-up attic.

The unconditioned basement is used for mechanical systems and the walls are uninsulated masonry. The floor of the basement is concrete slab. The floor of the attached crawlspace is dirt.

The attic over the second floor of the structure has 2 to 3 inches of fiberglass insulation in poor condition. Much of the attic has a wood floor and is used for storage.

A blower door test performed on the building found significant air leakage. Major sources of infiltration are: the crawlspace, the old windows, the back door, the furnace cold air returns, an interior stairway wall 4 ft in from the north side of the building, and the door to the back-room that leads to the walk-up attic.

### 1.2 HEATING AND COOLING SYSTEMS

The heat for this building is supplied by a Conquest 90 natural gas induced draft furnace. The furnace is not original to the building. Annual efficiency is assumed to be 95% based on combustion efficiency tests performed on the units, manufacturer's specifications and the historical energy usage of the building. The ductwork is mostly uninsulated. The furnace filter was in very poor condition and was replaced at the time of the site visit.

There is a non-programmable thermostat that appears to be controlling the heat. Winter temperature setting is assumed to be approximately 68F.

### 1.3 LIGHTING SYSTEMS

Lighting for the common spaces for this building is provided primarily by a combination of T-12 linear fluorescent and circline fluorescent fixtures, with a few incandescent bulbs. Common bathrooms have incandescent bulbs. Common bathrooms do not contain occupancy sensors. Students fixtures are assumed to use incandescent lamps.

### 1.4 WATER HEATING SYSTEMS

Domestic hot water is provided by two water heaters that appear to serve two separate sections of the building. One is a 36,000 Btu natural gas Rheem 30 gallon natural draft unit. The other is an 75,000 Btu AO Smith 80 gallon natural draft unit. The hot water temperature was measured at 140F in the first floor bathroom. Domestic hot water piping in the unconditioned basement is uninsulated.

### 1.5 WATER USAGE

Water flow rates were measured at between 1 and 1.5 gallons per minute at all locations. Water usage of three toilets was measured, and found to range from 2.7 to 3.1 gallons per flush.

## **1.6 APPLIANCES**

The first floor common kitchen contains an older inefficient auto-defrost top freezer refrigerator and an electric range with a range hood that does not vent to the outside and has no grease screen. The first floor laundry contains a high-efficiency front load washer and an electric dryer. The vent duct to the dryer is metal but air flow is restricted which can lead to inefficient drying.

## **1.7 VENTILATION**

Bathrooms contain bath fans. 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. Air purifiers are used on the first floor to improve indoor air quality.

The kitchen range hood is a venting model but does not appear to be vented to the exterior.

## **1.8 OTHER OBSERVATIONS**

- 1) During the site visit, natural gas leaks were found on the main line and reported.
- 2) This building contains old wiring, which should be examined for possible upgrade before insulating.

# 1 University Avenue - Artists Guild

## Description of Improvements

### 2.1 Increase Attic Insulation

#### Existing Conditions:

The attic over the second floor of the structure has 2 to 3 inches of fiberglass insulation in poor condition. Much of the attic has a wood floor and is used for storage.

#### 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 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 Insulate Exterior Walls

#### Existing Conditions:

Exterior walls are 2 x 4 wood framed with drywall. Walls of the older section appear to be primarily uninsulated and walls in the one story section appear to be insulated based on fuel usage and age of the building sections.

#### Improvement Specifications:

Increase wall insulation in the uninsulated wall sections to R12 minimum by installing dense pack blown cellulose in wall cavities or its equivalent. Prior to installing insulation confirm the depth of the wall cavity. Installing insulation can reduce infiltration into the building if installed properly. Particular attention should be paid to rim and band joists to insure insulation of these areas is accomplished by the insulation technique. Rim and Band joists can be significant sources of infiltration.

### 2.3 Reduce Hot Water Temperature

#### Existing Conditions:

Domestic hot water is provided by two water heaters that appear to serve two separate sections of the building. One is a 36,000 Btu natural gas Rheem 30 gallon natural draft unit. The other is an 75,000 Btu AO Smith 80 gallon natural draft unit. The hot water temperature was measured at 140F in the first floor bathroom. Domestic hot water piping in the unconditioned basement is uninsulated.

#### Improvement Specifications:

Reduce Hot Water Temperature to 125F.

### 2.4 Insulate Domestic Hot Water Piping

#### Existing Conditions:

Domestic Hot Water piping in the mechanical room is uninsulated. Heat is lost to the mechanical room and basement unnecessarily.

#### 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 Install Programmable Thermostat**

### **Existing Conditions:**

There is a non-programmable thermostat that appears to be controlling the heat. Winter temperature setting is assumed to be approximately 68F.

### **Improvement Specifications:**

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

## **2.6 Reduce Infiltration**

### **Existing Conditions:**

A blower door test performed on the building found significant air leakage. Major sources of infiltration are: the crawlspace, the old windows, the back door, the furnace cold air returns, an interior stairway wall 4 ft in from the north side of the building, and the door to the back-room that leads to the walk-up attic.

### **Improvement Specifications:**

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

## **2.7 Replace Refrigerator**

### **Existing Conditions:**

The first floor common kitchen contains an older inefficient auto-defrost top freezer refrigerator

### **Improvement Specifications:**

Replace with an Energy Star unit of similar or smaller volume.

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

### **Existing Conditions:**

Lighting for the common spaces for this building is provided primarily by a combination of T-12 linear fluorescent and circline fluorescent fixtures, with a few incandescent bulbs. Common bathrooms have incandescent bulbs. Common bathrooms do not contain occupancy sensors. Students fixtures are assumed to use incandescent lamps.

### **Improvement Specifications:**

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

## **2.9 Replace Windows**

### **Existing Conditions:**

Windows are primarily single glazed with wood frames and storm windows.

### **Improvement Specifications:**

Replace windows with Energy Star units with a maximum Uvalue of 0.32. Specify windows with a thermal break. Window frames must be properly air sealed around frames during installation to maximize energy savings and comfort. Flashing around windows must be installed correctly to prevent water damage to building. Window replacement by itself will not save enough energy to justify replacement. But replacement will save some energy, especially if proper air sealing is conducted during replacement and can improve the comfort of residents.

## **2.10 Install Energy Star Fans on Automatic Controls**

### **Existing Conditions:**

Bathrooms contain bath fans. The bath fans appear to vent to the exterior.

### **Improvement Specifications:**

Install Energy Star bath fans on humidistats or automatic timer controls to improve ventilation in the bathrooms and reduce humidity in the space. Bath fans on automatic controls can be used to provide ventilation throughout the building by insuring fresh air enters the building at a controlled rate. Alternatively installing a central heat recovery system will allow for improved air quality with a minimal energy cost to the building.

## **2.11 Install Low Flush Toilet**

### **Existing Conditions:**

Water flow rates were measured at 1 gallon per minute maximum (GPM) at all locations, except the kitchen sink which was 2 GPM.

### **Improvement Specifications:**

Replace the existing high flush toilets with a low flush unit 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.

## **2.12 Replace Electric Clothes Dryer with Natural Gas fired Unit**

### **Existing Conditions:**

The first floor laundry contains a high-efficiency front load washer and an electric dryer. The vent duct to the dryer is metal but air flow is restricted which can lead to inefficient drying.

### **Improvement Specifications:**

Replace the existing electric dryer with natural gas fired dryer. Combustion gases should be vented to the exterior of the building through solid metal duct flue pipe.

## IMPROVEMENT PACKAGES

1 University Artist's Guild

For: Louise Gava

By: Scott Shipley

Date: 7/1/2008

### Evaluated Packages:

Package Name	Cost \$	Annual Savings, MMBtu	Annual Savings, \$	Payback years	Cashflow \$/year	SIR
Improvement Package 1	23,435	128.59	1,861	12.59	-203	1.22

### 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
Replace Windows	10,800	15.08	190	56.8	-761	20	0.26
Attic Insulation	1,700	10.10	127	13.4	-22	40	1.76
Replace Refrigerator	650	0.80	56	11.6	-1	15	1.03
Install Natural Gas Dryer	750	-3.41	93	8.0	27	15	1.5
Insulate Hot Water Piping	250	3.05	38	6.5	16	20	2.31
Insulate uninsulated walls	4,000	55.88	704	5.7	352	20	2.64
Reduce Infiltration	2,500	35.99	454	5.5	233	20	2.72
Reduce Water Temperature	25	0.76	10	2.6	7	10	3.28
Replace Incandescents	110	0.60	66	1.7	56	10	5.14

Install Programmable Thermostat	150	10.12	127	1.2	114	15	10.21
Install HRV	2,500	-0.39	-5	N/A	-225	20	N/C
<b>Total for Package</b>	<b>23,435</b>	<b>128.59</b>	<b>1,861</b>	<b>12.59</b>	<b>-203</b>	<b>N/A</b>	<b>1.22</b>

**Non-Energy Benefits:**

1. Replace Windows: Improve comfort (reduce drafts), increase value of building.
2. Attic Insulation: Improve comfort, increase value of building.
3. Replace Refrigerator: Increase value of building, reduce environmental risk due to old ozone-depleting refrigerants.
4. Install Natural Gas Dryer: Increase value of building, reduce environmental risk due to old ozone-depleting refrigerants.
5. Insulate Hot Water Piping: Reduce risk of scalding, reduce flow noise, protect piping from damage.
6. Insulate uninsulated walls: Improve comfort, increase value of building.
7. Reduce Infiltration: Reduce drafts.
8. Reduce Water Temperature: Reduce risk of scalding.
9. Replace Incandescents: Reduce maintenance, reduce replacement cost (fluorescent bulbs last 10,000 hours whereas incandescent bulbs typically last less than 1,000 hours).
10. Install Programmable Thermostat: Improve comfort, improve convenience.
11. Install HRV: Improve indoor air quality, increase value of building.

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

Fuel Type	NOx (LBS)	SO2 (LBS)	CO2 (LBS)
Electricity	4	8	2,439
Natural Gas	12	0	13,935
Oil	0	0	0
Propane	0	0	0
Other: Other Fuel Type Name	0	0	0
<b>Total</b>	<b>16</b>	<b>8</b>	<b>16,373</b>

## **ENERGY BILLS**

# 1 University Avenue - Artists Guild

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
10/02/06	11/1/06	30	1,203	\$149.24	\$0.12
11/01/06	12/4/06	33	1,323	\$163.82	\$0.12
12/04/06	1/2/07	29	1,024	\$126.11	\$0.12
01/02/07	2/1/07	30	849	\$113.46	\$0.13
02/01/07	3/2/07	29	1,542	\$210.32	\$0.14
03/02/07	4/3/07	32	1,354	\$175.61	\$0.13
04/03/07	5/2/07	29	1,233	\$168.01	\$0.14
<b>Totals 2006 - 2007</b>			<b>8,528</b>	<b>\$1,106.57</b>	<b>\$0.13</b>
05/02/07	6/4/07	33	803	\$108.81	\$0.14
06/04/07	7/3/07	29	203	\$27.39	\$0.13
07/03/07	8/2/07	30	478	\$64.26	\$0.13
08/02/07	8/31/07	29	518	\$67.97	\$0.13
08/31/07	10/1/07	31	1,504	\$70.32	\$0.05
10/01/07	10/30/07	29	1,423	\$61.57	\$0.04
10/30/07	12/3/07	34	1,689	\$73.41	\$0.04
12/03/07	1/3/08	31	1,482	\$38.45	\$0.03
01/03/08	2/1/08	29	1,036	\$35.80	\$0.03
02/01/08	3/3/08	31	1,823	\$55.84	\$0.03
03/03/08	4/2/08	30	1,228	\$39.71	\$0.03
04/02/08	5/1/08	29	1,325	\$46.68	\$0.04
<b>Totals 2007- 2008</b>			<b>13,512</b>	<b>\$690.21</b>	
<b>Average Cost Per kWh</b>				<b>\$0.05</b>	

Constellation Energy began supplying electricity in September of 2007. No cost data for purchases was provided. This accounts for the lower than expected \$/kWh in the last eight months above.

# 1 University Avenue - Artists Guild

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	449	\$576.84	\$1.28
12/21/05	1/23/06	33	394	\$509.24	\$1.29
1/23/06	2/21/06	29	427	\$510.15	\$1.19
2/21/06	3/22/06	29	401	\$474.31	\$1.18
3/22/06	4/20/06	29	197	\$208.67	\$1.06
4/20/06	5/22/06	32	157	\$160.72	\$1.02
5/22/06	6/21/06	30	52	\$55.40	\$1.07
6/21/06	7/24/06	33	0	\$0.00	\$0.00
7/24/06	8/22/06	29	21	\$23.97	\$1.14
8/22/06	9/21/06	30	36	\$40.03	\$1.11
9/21/06	10/23/06	32	189	\$158.67	\$0.84
10/23/06	11/21/06	29	267	\$278.03	\$1.04
<b>Totals for 2006</b>			<b>2,590</b>	<b>\$2,996.03</b>	
11/21/06	12/21/06	30	327	\$374.13	\$1.14
12/21/06	1/23/07	33	380	\$450.85	\$1.19
1/23/07	2/21/07	29	590	\$707.17	\$1.20
2/21/07	3/22/07	29	482	\$590.58	\$1.23
3/22/07	4/20/07	29	284	\$344.67	\$1.21
4/20/07	5/22/07	32	146	\$189.31	\$1.30
5/22/07	6/21/07	30	38	\$57.92	\$1.52
6/21/07	7/23/07	32	8	\$14.21	\$1.78
7/23/07	8/22/07	30	31	\$40.81	\$1.32
8/22/07	9/20/07	29	44	\$51.23	\$1.16
9/20/07	10/22/07	32	104	\$113.97	\$1.10
10/22/07	11/21/07	30	243	\$305.56	\$1.26
<b>Totals for 2007</b>			<b>2,677</b>	<b>\$3,240.41</b>	
<b>Average Cost Per Therm</b>				<b>\$1.21</b>	

6/21/2005

# 1 University Avenue - Artists Guild

## Water and Sewer Cost

Begin	End	Gallons	Water \$	Sewer \$	Total	\$Water/ 1000 gal	\$Sewer/ 1000 gal
Jul-08	Sep-08	14,000	\$62.86	\$77.70	\$140.56	\$4.49	\$5.55
Oct-06	Dec-06	58,000	\$261.62	\$325.98	\$587.60	\$4.51	\$5.62
Jan-07	Mar-07	51,000	\$229.14	\$283.56	\$512.70	\$4.49	\$5.56
Apr-07	Jun-07	51,000	\$238.33	\$296.84	\$535.17	\$4.67	\$5.82
Jul-07	Sep-08	45,000	\$210.15	\$261.45	\$471.60	\$4.67	\$5.81
Oct-08	Dec-08	41,000	\$191.47	\$238.21	\$429.68	\$4.67	\$5.81
Total		260,000	\$1,193.57	\$1,483.74	\$1,949.15	\$4.59	\$5.71