

Downtown Hotel

Dawson City, Yukon

Energy + Building Systems Analysis Energy Upgrading Options 2001

April 2002



Prepared by:

Energy Analysis + Design 

Energy Efficiency, Sustainability and Innovation in Building Design

a joint venture between Kobayashi + Zedda Design Group, Dorward Engineering and Northern Climate Engineering

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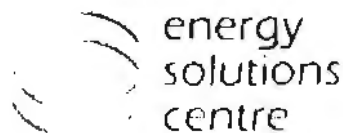


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1.0 INTRODUCTION

The Downtown Hotel (main building) in Dawson City was constructed in 1982. Supported on wood cribbing, the 'L' shaped wood frame building is two stories high. The hotel contains a lobby and reception area, administration area, meeting rooms, guest rooms, hotel laundry, a lounge, mechanical room and storage areas. The total floor area is **1,815** sq. metres.

The "Annex" building was reviewed and found not to require an energy audit. The focus of this energy audit therefore concentrates, in its review, on only the main hotel building.

The wood frame structure was built using construction methods typical of standards available in the early 1980's. The 2x6 exterior walls are not entirely filled with batt insulation, perhaps due to the expected seasonal use of the building when designed. The roof and lower floor is insulated with RSI 2.5 (R20) batt insulation. A crawlspace is located under a portion of the main floor, to allow for servicing of the plumbing system and to avoid potential freezing problems.

The building is heated with five Hydrotherm oil-fired low-pressure boilers in conjunction with baseboard radiant convectors and unit heaters. Ventilation air is indirectly provided by individual guest room exhaust fans, a lounge exhaust fan, a kitchen exhaust hood and laundry dryers. There is no current provision for mechanical make-up air which results in negative interior air pressure. An oil-fired water heater provides domestic hot water. This unit is coupled with a storage tank equipped with an indirect heating coil from the boiler bank.

The boilers system control consists of aquastats with high/low set points for each boiler. The aquastat control set points are manually set to stage and designate the boilers firing order in their preferred sequence.

2.0 HISTORICAL ENERGY USE

The following tables outline the electricity, fuel oil and propane use at the building for a recent one-year period.

Electricity Use:

Date	Days	Meas. Demand (kW)	Billed Demand (kW)	Consump. (kWh)	Ave. Daily Consump. (kWh/day)	Cost
00.12.13	28			24,000	857	\$3695.79
01.01.11	29			13,320	459	\$2226.50
01.02.13	33			20,400	618	\$3195.54
01.03.14	29			27,240	939	\$4161.72
01.04.12	29			19,920	687	\$3205.14
01.05.14	32			19,680	615	\$3167.29
01.06.14	31			24,000	774	\$3748.60
01.07.16	32			25,560	799	\$3962.11
01.08.15	30			25,560	852	\$3962.11
01.09.14	30			24,360	812	\$3797.86
01.10.15	31			21,120	681	\$3324.07
01.11.15	31			24,640	794	\$3406.20
Total	365			269,800	735	\$41,852.93

Propane Use:

Date	Consumption (litres)	Cost
01.01.15	Assumed full	Market Average
01.02.01	1244.7	\$721.93
01.02.22	1954.5	\$1,133.61
01.03.13	1289.0	\$747.62
01.04.05	1438.6	\$834.39
01.04.24	1295.7	\$751.51
01.05.18	1190.1	\$690.26
01.06.07	1694.3	\$982.69
01.06.22	1369.4	\$794.25
01.07.04	1150.2	\$667.12
01.07.20	1591.7	\$923.19
01.07.31	1193.6	\$692.29
01.08.17	1503.1	\$871.80
01.08.31	620.6	\$359.95
01.09.14	1955.0	\$1,133.90
01.09.28	1043.9	\$605.46
01.10.13	1040.0	\$603.20
01.11.01	1270.5	\$736.89
01.11.22	1250.2	\$725.12
01.12.14	1467.9	\$851.38
02.01.05	383.3	\$222.31
02.01.15	829.8	\$481.28
Total	26776.1	\$15,530.14

Fuel Oil Consumption

Date From – To	Consumption (Litres)	Cost per fill-up
00.08.07	3013	
00.09.11	4257	\$2345.83
00.10.06	2914	\$1636.94
00.11.29	6546	\$3887.34
01.01.05	7069	\$4424.78
01.02.13	6567	\$4110.62
01.03.14	5503	\$3444.42
01.04.26	3640	\$2403.65
01.06.04	6379	\$3924.69
01.08.07	4621	\$2635.90
Total	47,496	\$28,832.17

The interior electricity consumption totals 239,322 kWh per year or 129.6 kWh per square metre per annum; exterior electricity consumption totals 30,478 kWh per annum. The most recent cost averages are \$0.155 per kWh.

The propane use of 26,776.1 litres per year is equivalent to 188,273 kWh or 102 kWh per square meter per annum. While the cost of propane fluctuates throughout the year, a cost per litre of \$0.58 has been used for calculations in this report. This equates to an annual cost of **\$15,530.14**.

The fuel oil use of 47,496 litres per year is equivalent to 485,320 kWh or 262.9 kWh per square meter per annum. While the cost of fuel oil also fluctuates throughout the year, a cost per litre of \$0.609 has been used for calculations in this report. This equates to an annual cost of **\$28,832.17**.

The total energy consumption at the building is consequently 912,915 kWh or 494.5 kWh per square metre per annum. Total annual heating cost is **\$86,215.24** or \$47.50 per sq. meter of floor area. All heating unit prices are GST inclusive.

3.0 BREAKDOWN OF EXISTING ENERGY USE

The table below indicates the breakdown of the existing total electricity, fuel oil, and propane use by component, based on computer simulation and industry standard formulae for the building heating requirements and industry standard formulae for domestic hot water use.

Breakdown of Existing Energy Use, By Component:

Annual Energy Input:

Electricity (Interior Usage)	239,322 kWh
Electricity (Exterior Usage)	30,478 kWh
Propane	188,273 kWh
Fuel Oil	485,320 kWh
Total	943,393 kWh

Annual Energy Consumption:

Roof	39,230.9 kWh	4.4%
Main Floor Walls	87,640.8 kWh	9.7%
Foundation/Floor	46,590.1 kWh	5.2%
Windows	55,307.6 kWh	6.2%
Doors	2,058 kWh	0.2%
Infiltration	166,814 kWh	18.5%
Domestic Hot Water	130,969 kWh	14.5%
Summer Electrical Use	120,960 kWh	13.5%
Exterior Electrical Use	30,478 kWh	3.4%
Summer Propane Use	74,758 kWh	8.3%
Chimney Losses	145,596 kWh	16.1%
Total	900,402 kWh	100%

Note: The calculated energy consumption is 95.4% of the actual use, which is an acceptable margin of inaccuracy.

4.0 ENERGY CONSERVATION MEASURES & CONCLUSIONS

The energy conservation measures which follow are recommended for implementation at this building. The measures are presented in ascending order of simple payback period. It should be noted that each measure that is implemented would affect the economics of any subsequent measures. For example, if the heating system efficiency is upgraded, subsequent measures that are designed to save fuel oil will be diminished. If the lighting is upgraded, resulting in additional fuel oil consumption due to reduced internal heat gain from lights, then the effectiveness of measures designed to reduce heating energy consumption will improve.

4.1 Architectural:

Architectural options focus on the upgrade of the existing building envelope. These include the addition of insulation to the roof, replacement of windows and infiltration control measures. The insulation levels in this building though adequate in the walls are not up to current standards in roof areas. The most economic option is to increase the levels of insulation in the roof area. Another option that has been considered is the replacement of the existing windows with double glazed, low-e units. The insulation values plus the air leakage at the operating window were researched and compared to new double-glazed low-E units (typically the most cost-effective replacement unit).

Option 1: Building Envelope Repairs

Infiltration is the single largest energy loss component in this building. The building has no mechanical make-up air provisions in place other than uncontrolled infiltration. The infiltration will occur when the structure is depressurized with exhaust systems, when differential pressure results from prevailing winds and through stack effect when warm air rises and escapes from the second floor and is replaced with outdoor air at the lower floor. A review of the building shell indicates that there are many areas where infiltration can occur. However, should the shell be tightly sealed, the exhaust systems will be starved for air. It is recommended to provide make-up air systems for the building. One would be sized to match the kitchen exhaust hood airflow, and interlocked with this fan for simultaneous operation. Another system would be used to pressurize the hallways, eventually relieving through the dryer exhaust. The saving given below, while difficult to quantify, gives some idea of the magnitude of savings available through a general sealing program. The calculated saving is based on the current infiltration load, however takes into account the make-up air required 16 hrs/day.

<i>Estimated Cost:</i>	\$1,500
<i>Calculated saving:</i>	\$1,000 (1650 litres of fuel oil)
<i>Simple payback period:</i>	1.5 years

Option 2: Upgrade Attic Insulation from RSI 3.5 (R20) to RSI 7.0 (R40)

The insulation levels in this building, while adequate, are not up to current standards. While the cost of upgrading the exterior wall insulation is not justifiable from energy savings alone, adding more insulation to the attic areas is not cost prohibitive. The figures below are based on adding 150 mm of blown-in insulation. It is important to note that the second floor rooms may be cooler, and therefore more comfortable, during the summer

months as a result of the insulation work. The attic heat will have less effect on the rooms below.

Estimated Cost: **\$9,100**
Calculated Saving: **\$1,440** (2364 litres of fuel oil)
Simple Payback Period: **6.3** years

The following measures were investigated during the audit process. While the measures are not considered feasible due to the long payback periods, they are presented for information purposes only.

Option 3: Upgrade Existing Windows

The energy savings associated with replacing the windows with argon filled double-glazed low-e units was also researched. The cost for supplying and installing the new windows is approximately \$36,000. There is a slight cost premium due to the requirements of heritage conformance. The annual fuel oil saving of 3,675 litres, or \$2,220, would result in a simple payback period of 16 years.

Estimated Cost: **\$36,000**
Calculated Saving: **\$2,220** (3,675 litres of fuel oil)
Simple Payback Period: **16** years

Architectural Options List Summary:

Measure	Estimated Cost of Measure	Fuel Savings	Calculated Savings	Simple Payback Period
Building Envelope Repairs	\$1,500.00	1,650 litres	\$1,000	1.5 years
Upgrade Attic Insulation	\$9,100.00	2,364 litres	\$1,440	6.3 years
Replace Windows with Double Glazed Low-e (or equal)	\$36,000.00	3,675 litres	\$2,220	16 years

4.2 Mechanical Measures:

Option 1: Mop Sink Faucet Leak

The mop sink hot water faucet leaks at a rate of 0.8 litres per minute, which equates to \$0.24/hr. for domestic hot water at 60C supply temperature. While this doesn't appear significant, if allowed to leak over a one-year period, the wasted hot water would consume \$2102.40 worth of fuel oil.

<i>Estimated Cost:</i>	\$50.00
<i>Calculated savings:</i>	\$2,100 (3450 litres of fuel oil)
<i>Simple payback period:</i>	9 days

Option 2: Installation of thermostats at entrance unit heaters

It is understood that the entrance unit heaters operate under manual control only. Staff has indicated that the current controls are a manual off/low/high switch. Hotel staff have indicated that the cabinet heaters are turned off when the doors are locked, turned on low when temperatures are approximately -20C or warmer, and turned on high when approximately -20C or colder outside.

The installation of thermostats at the entrance areas, in conjunction with the present on/off switches, would provide the option of cycling the units as the space temperature requires heat and manually deenergizing when heating is not required. The thermostatically controlled heaters would save approximately 2.25 litres of fuel oil per hour of operation per unit heater based on 14.5 kW heater capacities. The saving below is based on reducing the operation of the two unit heaters by 20% of the winter daytime operating time.

<i>Estimated Cost:</i>	\$500.00 (\$250 each)
<i>Calculated savings:</i>	\$1,800 (2956 litres of fuel oil)
<i>Simple payback period:</i>	100 days

Option 3: Reconditioning or Replacement of Existing Boilers

Efficiency tests on four of the five boilers indicated efficiency ranges from 65% to 86%, with an average of 74%. Seasonal efficiency would be approximately 5% lower due to cycling. In this report, an estimated seasonal efficiency of 70 percent was used.

It is recommended to initiate general boiler cleaning and maintenance, repairs of items such as flue dampers, adjustment/replacement of burners, and controls replacement where necessary and settings for maximum efficiencies. An efficiency increase of approximately 10% would be expected with the boilers operating at their maximum efficiency. Given the age of the boilers, with proper care in reconditioning and preventative maintenance in the future, they are likely to provide another 10 years of operation.

<i>Estimated Cost:</i>	\$10,000
<i>Calculated Saving:</i>	\$1,850 (3038 litres of fuel oil)
<i>Simple Payback Period:</i>	5.4 years

These boilers could be replaced with new condensing oil fired boilers, resulting in a seasonal efficiency of approximately 80 percent or better. The new system would consist of a new modular high efficiency multi-boiler system with primary and back-up boiler designations plus a conventional primary/secondary loop using a heat exchanger. The current domestic hot water (DHW) is heated by an oil-fired heater. It is paralleled with a storage tank equipped with an indirect heating coil. It is recommended that this DHW piping system layout remain as it is. The advantages in the general re-piping of the Mechanical Room is the incorporation of a conventional primary/secondary loop offering a reduction of heat loss in the mechanical room boiler piping system. Presently all the hot water in the heating system passes through boilers not in operation, thus creating standby losses by dispersing heat before reaching its required destination. The existing piping arrangement is not a desired concept as it requires all boiler circulators to operate in order to provide the full flow rate necessary to supply hot water throughout the buildings heating system. The cost of the renovation will depend on the number and size of the boilers and pumps installed, and can only be accurately determined following detailed design, however a class "E" estimate will be in the order of magnitude given below.

<i>Estimated Cost:</i>	\$50,000
<i>Calculated Saving:</i>	\$2,049 (3,376 litres of fuel oil)
<i>Simple Payback Period:</i>	24.5 years

Option 4: Install Solar Domestic Hot Water Heating System

The "RETScreen" computer energy modeling was used for analysis of solar collector heat recovery to contribute to the domestic hot water energy load. Three types of collectors were analyzed; Evaluated, Unglazed and Glazed. Included in the analysis was a 40% incentive grant towards all capital expenditures.

Several modeling attempts were made including various combinations, types and numbers of solar panels, annual energy requirements and alterations of any variables key in the selection of a RETScreen modeling system that would provide economic viability with a quick payback period. The model offering the earliest payback period was the unglazed panel type (least expensive) with a total project equity of **\$61,483** for 25.15 MWh of energy. The simple payback period was **23 years**. This solar water heating project model thus proves non-feasible.

Option 5: Solar Wall to Preheat Ventilation Air

The Solar Wall uses air heated by solar energy from within a perforated panel cavity adjacent to a south wall. The air path is through the perforations, into the cavity, then into the intake duct to an air-handling unit. Heat is captured in the warm cavity, and generally distributed in the building through ductwork. Though this concept sounds simple or basic, the equity cost versus capital recovery makes it non-feasible. The capital cost for this project is **\$61,800** for 51.4 MWh of energy with a simple payback period of **24 years**.

4.3 Electrical Measures:

Electrical energy consumption is comprised of:

- lighting
- kitchen equipment
- general purpose outlets

Because the loading of the general outlets is not a fixed load, this report will focus on the buildings lighting loads.

The lighting load consists of approximately:

- 20 T-bar fixtures
- 26 four-foot surface mounted T12 fluorescent fixtures.
- 238 incandescent lamps

For purposes of calculation, it is assumed that:

- hallway lamps are on 100% of the time
- room lights are on 15 % of the time

Option 1: Upgrade Incandescent Lighting

The existing incandescent lamps should be replaced with more energy efficient compact fluorescent lamps. Compact fluorescent lamps consume less energy and output approximately the same level of light, when the correct replacement is used. Care should be given in choosing replacement lamps for existing incandescent fixtures. Common sense is required of the installer to determine which lamps to replace and which to leave. For example, rooms having pot lights which are rarely used, would not be good candidates. Currently compact fluorescent lamps are not readily available with dimmable ballasts. Therefore re-lamping should not be done on any fixture controlled by a dimmer switch. As dimmable fluorescent lamps become more readily available future replacement for such fixtures may become a viable option.

The cost and saving below assumes the replacement of all 238 lamps, with average savings of 70 percent. The number of lamps actually installed will affect the capital cost but not the payback period. It should also be noted that compact fluorescent lamps have a longer lamp life then incandescent lamps, savings due to the longer lamp life was not taken into consideration for this report. We have used an installation cost of \$15 per lamp. A lower installation cost will significantly reduce the payback period.

<i>Estimated Cost:</i>	\$8,806
<i>Calculated Saving:</i>	\$2,900
<i>Simple Payback Period:</i>	3.04 years

Option 2: Upgrade Existing T12 Fixtures

The hotel currently uses 34W T12 fluorescent fixtures, each 34 W lamp consumes approximately 40W due to its' ballast. New T8 lamps with electronic ballasts consume approximately 30W each (60W per 2 lamp fixture). It is recommended to replace all existing T12 fluorescent fixtures with new electronic ballast T8 surface mounted or recessed fixtures as applicable.

<i>Estimated Cost:</i>	\$5,686
<i>Calculated Saving:</i>	\$623
<i>Simple Payback Period:</i>	9.13 years

Option 3: Install Occupancy Sensors in Washrooms for Lighting Control

It was observed that the lights in the main floor washrooms were on 24 hours a day. The installation of multi-technology occupancy sensors would prevent the lights from being on unnecessarily. It is therefore recommended to install occupancy sensors to control the lighting in the 2 main floor washrooms.

<i>Estimated Cost:</i>	\$920
<i>Calculated Saving:</i>	\$265
<i>Simple Payback Period:</i>	3.48 years

Option 4: Upgrade Existing Exit Signs

The existing exit lights in the hotel have two incandescent bulbs each, it is recommended to replace the existing incandescent lamps with LED lamps. LED lamps consume approximately 90% less energy, have a longer life and will give off a more even light output than the current incandescent lamps. It is important to choose a lamp designed to retrofit the existing fixtures.

<i>Estimated Cost:</i>	\$396
<i>Calculated Saving:</i>	\$344
<i>Simple Payback Period:</i>	1.24 years

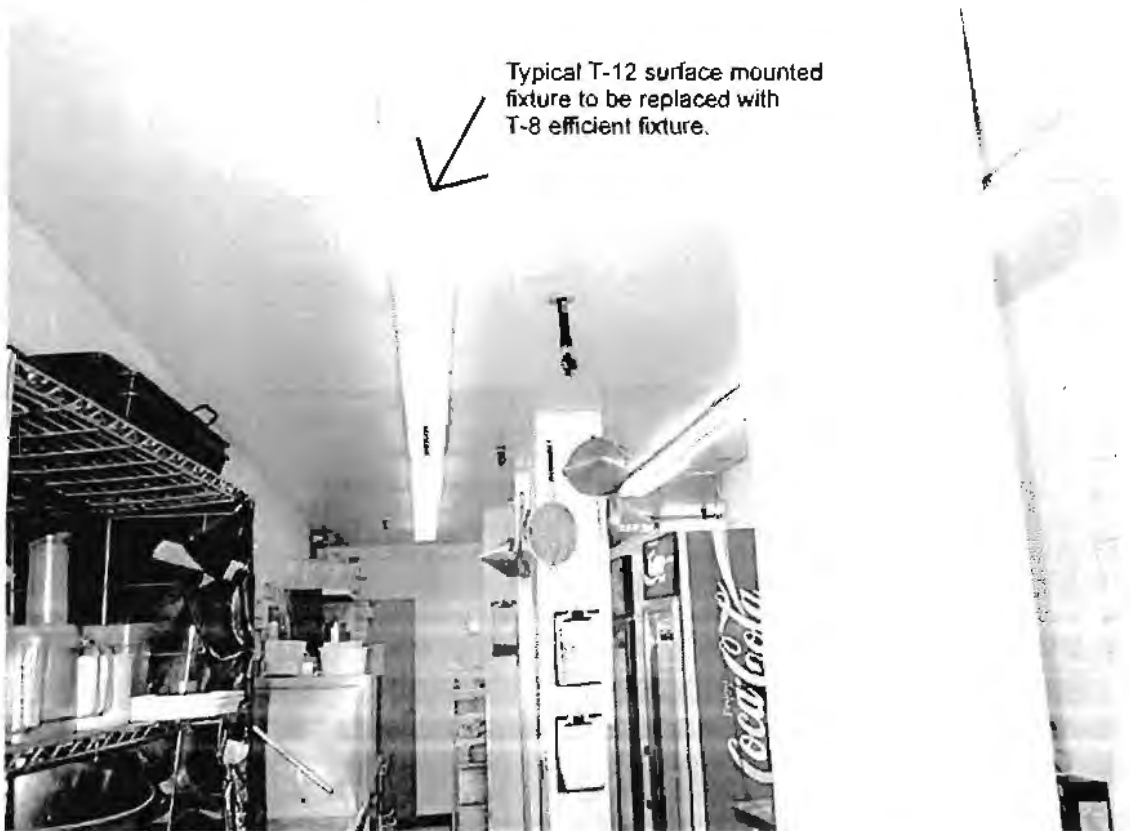
5.0 APPENDICES

APPENDIX A: Photo Documentation



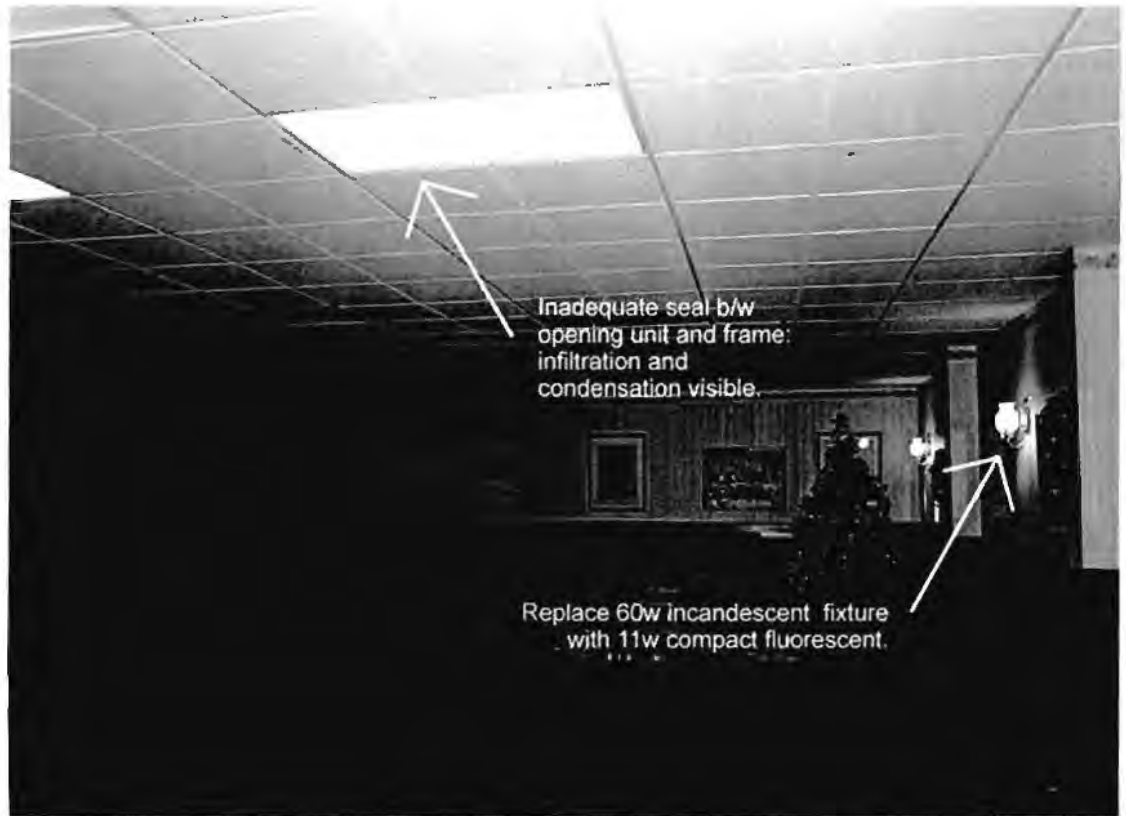
Photograph One

Typical Service Corridor T-12 Fluorescent to be replaced with T-8 lamps and electronic ballasts.

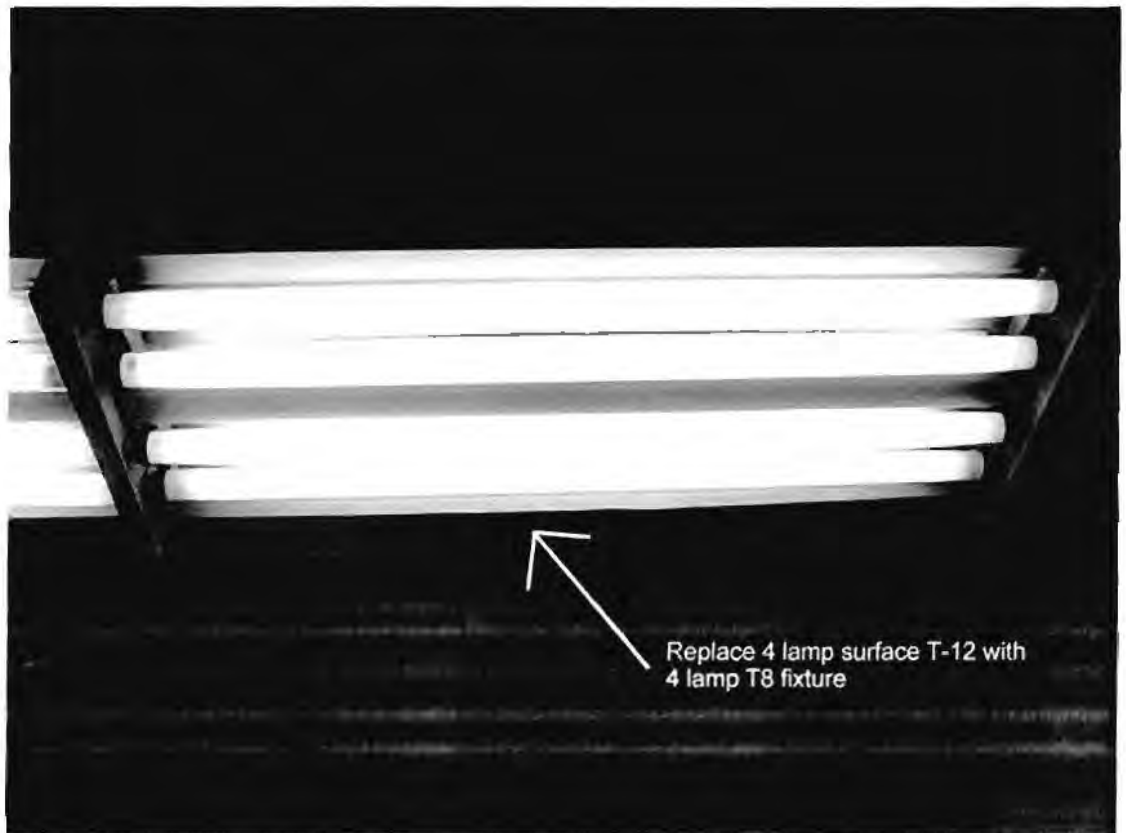


Photograph Two

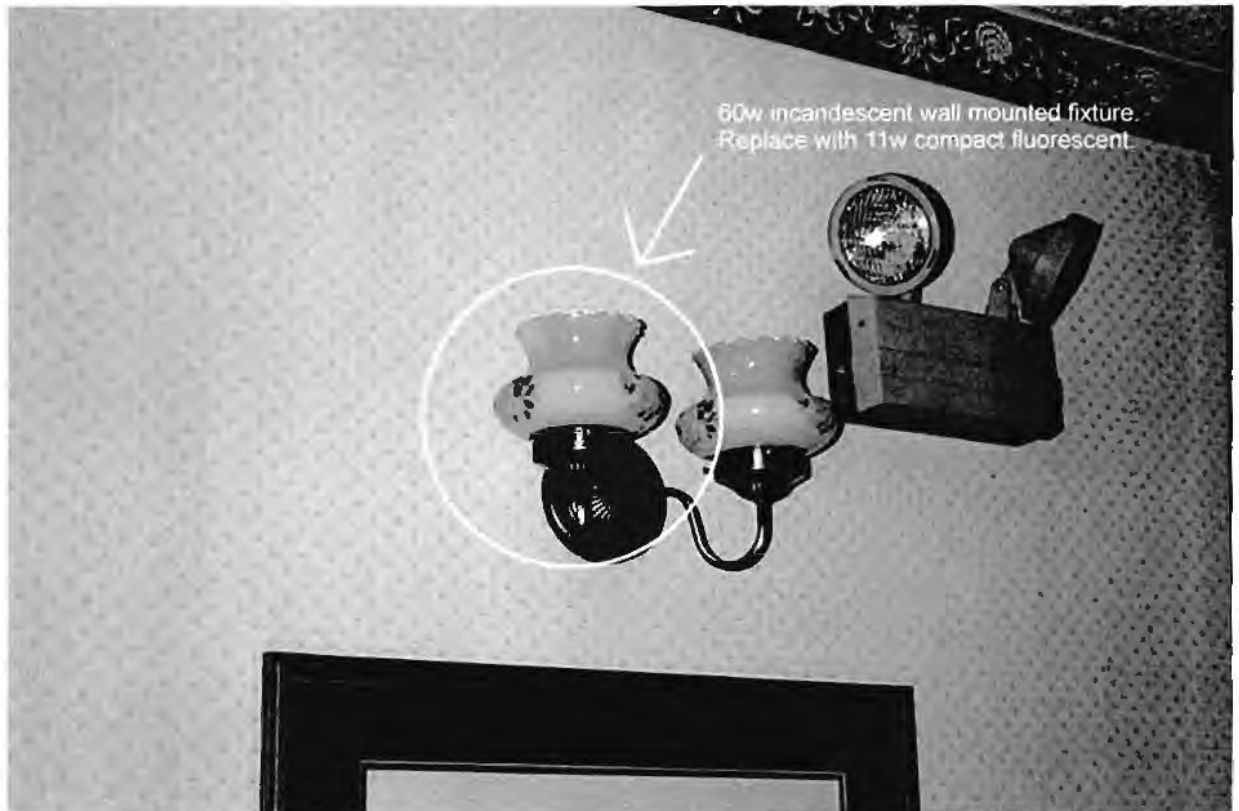
Kitchen area T-12 fluorescent fixture to be replaced with T8 electronic ballast fluorescent fixtures.



Photograph Three
Ground floor meeting Room light fixture upgrades



Photograph Four
Kitchen area surface mounted T-12 fluorescent fixture in need of replacement



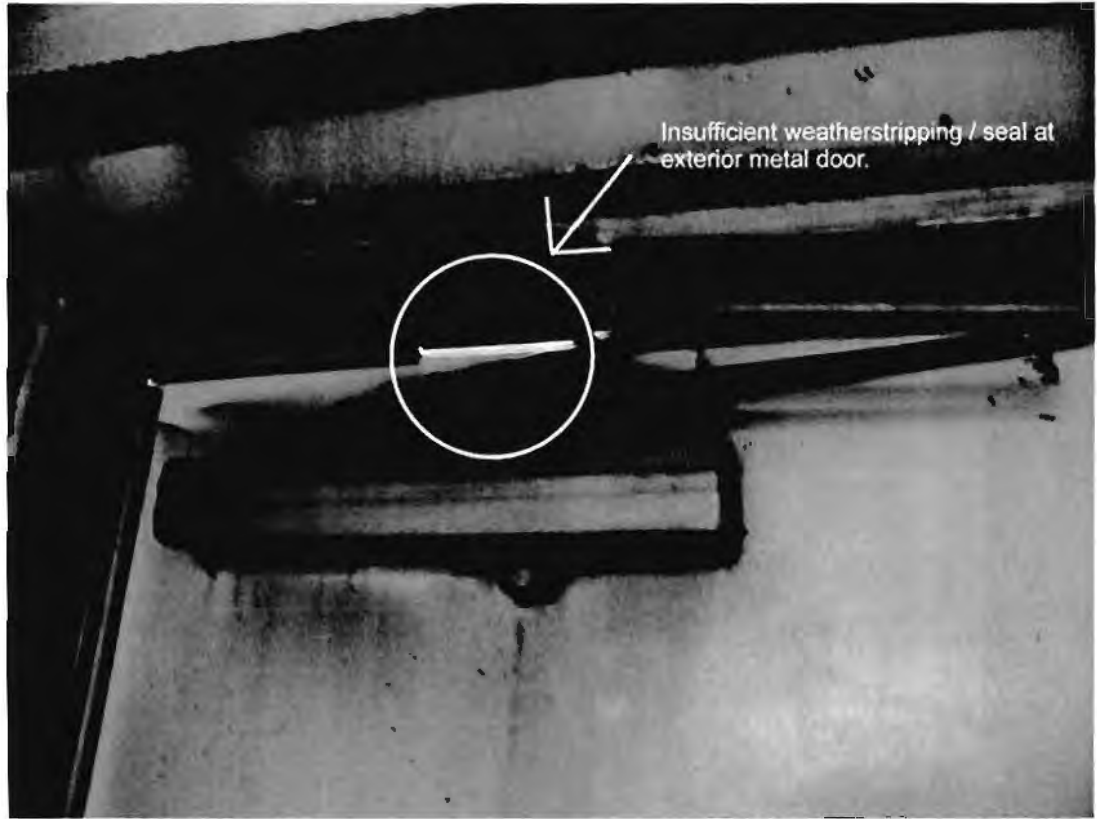
Photograph Five

Restaurant - view of existing wall mounted incandescent fixture to be replaced with 11w compact fluorescent



Photograph Six

Licensed lounge area - view of existing wall mounted incandescent fixture to be replaced with 11w compact fluorescent



Insufficient weatherstripping / seal at exterior metal door.

Photograph Seven
view of exterior metal door at closer

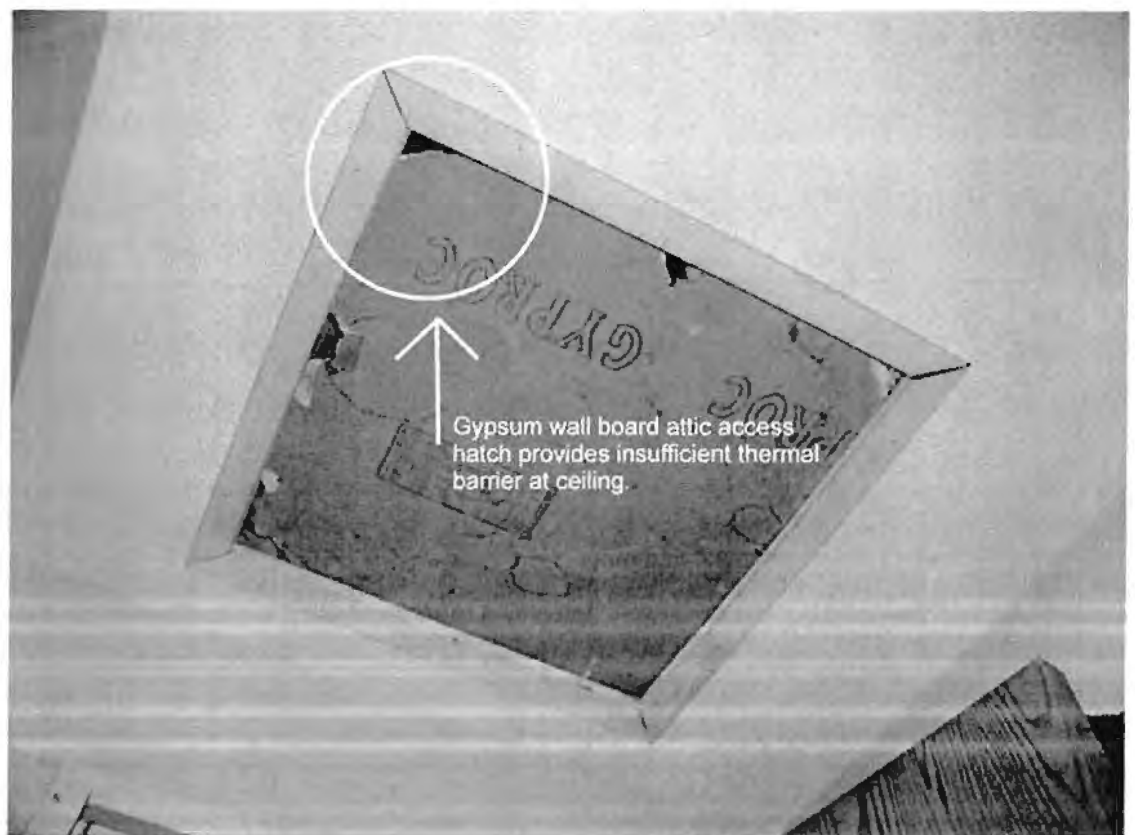


Insufficient weatherstripping / seal at damaged exterior metal door sill.

Photograph Eight
View of exterior metal door at sill



Photograph Nine
Roof attic - Insufficient levels of glass fibre batt insulation.

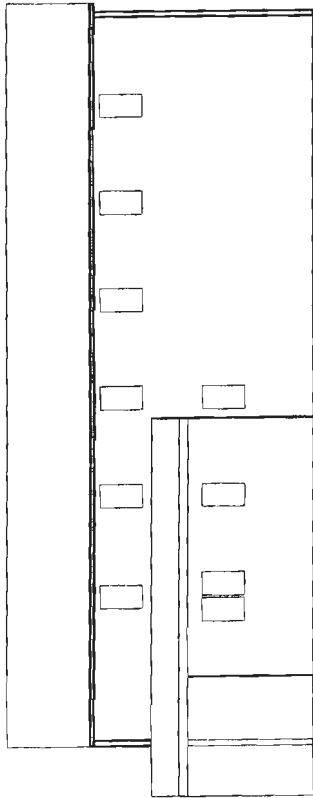


Photograph Ten
View of attic access hatch

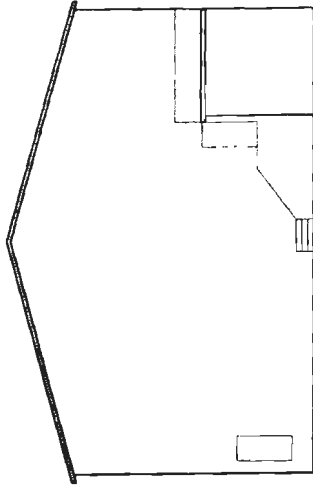


Photograph Eleven
Hot water losses due to leaking tap at janitor mop sink

APPENDIX B: Architectural Building Elevations – Glazing & Wall Areas



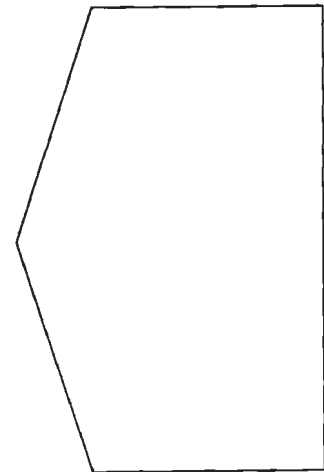
Total 2127 sq. ft.
 glazing 138 sq. ft.
 2 x 6 wood frame
 R12 insulation



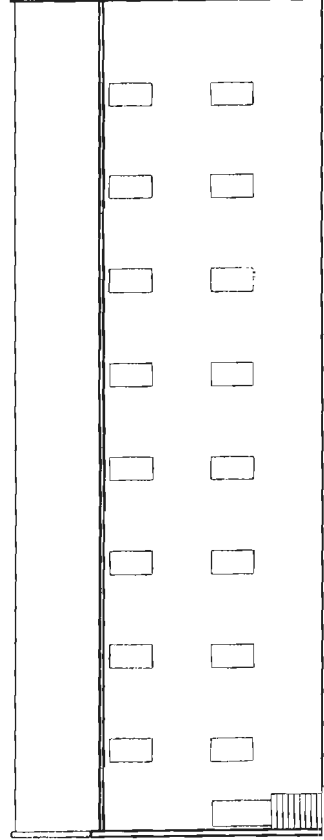
Total 1766 sq. ft.
 glazing 39 sq. ft.
 2 x 6 wood frame
 R12 insulation



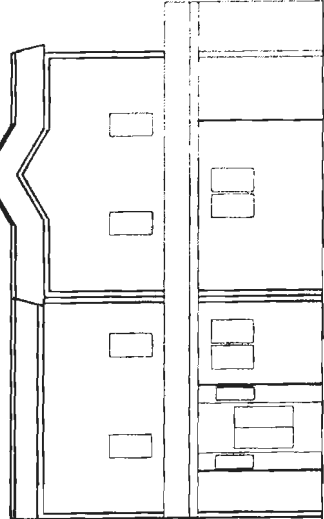
Total 65 sq. ft.
 glazing 19 sq. ft.
 2 x 6 wood frame
 R12 insulation



Total 1717 sq. ft.
 glazing 0 sq. ft.
 2 x 6 wood frame
 R12 insulation



Total 4288 sq. ft.
 glazing 379 sq. ft.
 2 x 6 wood frame
 R12 insulation



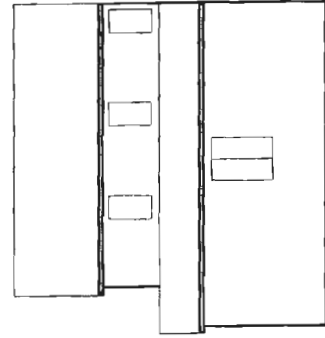
Total 1720 sq. ft.
 glazing 35 sq. ft.
 2 x 6 wood frame
 R12 insulation



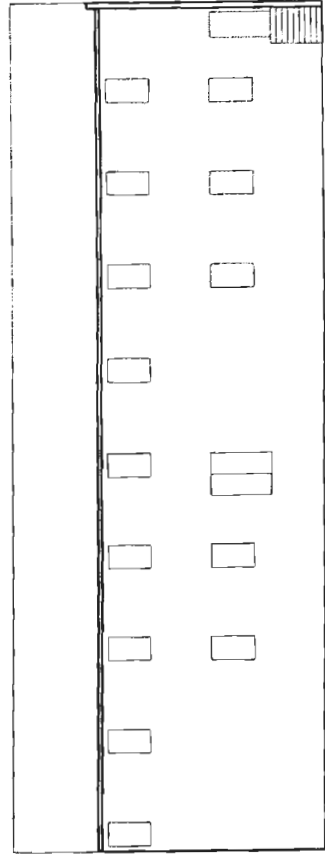
Typical notes:

Ceiling insulation = R20 batt
Floor Ceiling = R20 batt
Window Units = Double Glazed (no low-e)

Annex building not included.



total 285 sq. ft.
glazing 76 sq. ft.
2 x 6 wood frame
R12 insulation



total 2558 sq. ft.
glazing 249 sq. ft.
2 x 6 wood frame
R12 insulation

APPENDIX C: Mechanical Report Data

RETScreen® Energy Model - Solar Air Heating Project

Site Conditions		Estimate	Notes/Range
Project name		Downtown Hotel	
Project location		Dawson City, Yukon	
Nearest location for weather data		Dawson City	<i>Complete SR sheet</i>
Annual solar radiation (tilted surface)	MWh/m ²	1.10	
Annual average temperature	°C	-10.7	
Annual average wind speed	m/s	2.9	

System Characteristics		Estimate	Notes/Range
Heating application type	-	Ventilation air	
Base Case Heating System			
Heating fuel type	-	Diesel (#2 oil)	
Heating system seasonal efficiency	%	70%	0% to 350%
Building			
Building type	-	Commercial	
Maximum delivered air temperature	°C	20.0	10.0 to 60.0
RSI-value of building wall	m ² - °C/W	2.1	0.1 to 10.0
Airflow Requirements			
Design airflow rate	m ³ /h	5,097	50 to 1,000,000
Operating days per week	d/w	7.0	1.0 to 7.0
Operating hours per day	h/d	16.0	5.0 to 24.0
Solar Collector			
Design objective	-	High temperature rise	
Collector colour	-	Black	<i>See Product Database</i>
Solar absorptivity	-	0.95	0.20 to 0.99
Suggested solar collector area	m ²	71	
Solar collector area	m ²	61	
Percent shading during season of use	%	0%	0% to 50%
SAH fan flow rate	m ³ /h/m ²	84	
Average air temperature rise	°C	7.7	
Incremental fan power	W/m ²	37.0	0.0 to 7.0

Annual Energy Production (12.0 months analysed)		Estimate	Notes/Range
Incremental fan energy	MWh	13.2	
Specific yield	kWh/m ²	843	
Collector efficiency	%	69%	
Solar availability while operating	%	100%	
Renewable energy collected	MWh	46.2	
Building heat loss recaptured	MWh	5.2	
Renewable energy delivered	MWh	51.4	
	GJ	185.1	

Complete Cost Analysis sheet

RETScreen® Solar Resource - Solar Air Heating Project

Site Latitude and Collector Orientation		Estimate	Notes/Range
Nearest location for weather data		Dawson City	See Weather Database
Latitude of project location	°N	64.2	-90.0 to 90.0
Slope of solar collector	°	90.0	0.0 to 90.0
Azimuth of solar collector	°	0.0	0.0 to 180.0

Monthly Inputs					
Month	Fraction of month used (0 - 1)	Monthly average daily radiation on horizontal surface (kWh/m ² /d)	Monthly average temperature (°C)	Monthly average wind speed (m/s)	Monthly average daily radiation in plane of solar collector (kWh/m ² /d)
January	1.00	0.12	-28.3	3.2	0.79
February	1.00	0.84	-25.9	3.0	3.35
March	1.00	2.50	-21.6	2.8	5.48
April	1.00	4.29	-12.0	2.7	5.46
May	1.00	4.79	-4.0	2.6	4.26
June	1.00	5.51	8.8	2.9	3.35
July	1.00	4.71	14.1	2.7	3.01
August	1.00	3.48	10.0	2.8	2.77
September	1.00	2.16	-0.9	2.7	2.76
October	1.00	1.10	-16.4	2.8	3.30
November	1.00	0.22	-24.3	3.1	1.17
December	1.00	0.05	-27.8	3.2	0.59
			Annual	Season of use	
Solar radiation (horizontal)		MWh/m ²	0.91	0.91	
Solar radiation (tilted surface)		MWh/m ²	1.10	1.10	
Average temperature		°C	-10.7	-10.7	
Average wind speed		m/s	2.9	2.9	

[Return to Energy Model sheet](#)

RETScreen[®] Cost Analysis - Solar Air Heating Project

Type of project

Currency

Cost references

Initial Costs (Credits)		Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
Feasibility Study								
Other	Cost		0	\$ -	\$ -			
Sub-total					\$ -	0.0%		
Development								
Other	Cost		0	\$ -	\$ -			
Sub-total					\$ -	0.0%		
Engineering								
Other	Cost		1	\$ 5,000	\$ 5,000			
Sub-total					\$ 5,000	8.1%		
Renewable Energy (RE) Equipment								
Solar collector materials	m ²		61	\$ 170	\$ 10,370			
Equipment installation	m ²		61	\$ 75	\$ 4,575			
Cladding material credit	m ²		-61	\$ -	\$ -			
Cladding labour credit	m ²		-61	\$ -	\$ -			
Incremental transportation	project		0	\$ 3,000	\$ -			
Other	Cost		0	\$ -	\$ -			
Sub-total					\$ 14,945	24.2%		
Balance of Equipment								
Fans and ducting materials	Lts		1,416	\$ -	\$ -			
Fans and ducting labour	Lts		1,416	\$ -	\$ -			
Fan and duct mat'l credit	Lts		-1,416	\$ -	\$ -			
Fan and duct labour credit	Lts		-1,416	\$ -	\$ -			
Incremental transportation	project		0	\$ -	\$ -			
Other	Cost		1	\$ 30,000	\$ 30,000			
Sub-total					\$ 30,000	48.5%		
Miscellaneous								
Overhead	%		15%	\$ 44,945	\$ 6,742			
Training	p-h		2	\$ 60	\$ 120			
Contingencies	%		10%	\$ 49,945	\$ 4,995			
Sub-total					\$ 11,856	19.3%		
Initial Costs - Total					\$ 61,801	100.0%		

Annual Costs (Credits)		Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
O&M								
Property taxes Insurance	project		1	\$ -	\$ -			
O&M labour	project		4	\$ 60	\$ 240			
Travel and accommodation	p-trip		1	\$ -	\$ -			
Other	Cost		0	\$ -	\$ -			
Contingencies	%		0%	\$ 44,945	\$ -			
Sub-total					\$ 240	10.4%		
Fuel Electricity	kWh		13,181	\$ 0.1570	\$ 2,069	89.6%		
Annual Costs - Total					\$ 2,309	100.0%		

Periodic Costs (Credits)		Period	Unit Cost	Amount	Interval Range	Unit Cost Range
Dampers & motors	Cost	15 yr	\$ 1,000	\$ 1,000		
			\$ -	\$ -		
			\$ -	\$ -		
End of project life			\$ -	\$ -		

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RETScreen Financial Summary - Solar Air Heating Project

Annual Energy Balance					
Project name	Downtown Hotel	Electricity required	MWh	13.2	
Project location	Dawson City, Yukon				
Renewable energy delivered	MWh	51.4	GHG analysis sheet used?	yes/no	No
Heating fuel displaced	Diesel (#2 oil)				

Financial Parameters					
Avoided cost of heating energy	\$/L	0.607	Debt ratio	%	0.0%
			Income tax analysis?	yes/no	No
Retail price of electricity	\$/kWh	0.157			
Energy cost escalation rate	%	3.0%			
Inflation	%	2.0%			
Discount rate	%	0.0%			
Project life	yr	25			

Project Costs and Savings					
Initial Costs			Annual Costs and Debt		
Feasibility study	0.0%	\$ -	O&M	\$	240
Development	0.0%	\$ -	Fuel/Electricity	\$	2,069
Engineering	8.1%	\$ 5,000			
RE equipment	24.2%	\$ 14,945	Annual Costs - Total	\$	2,309
Balance of equipment	48.5%	\$ 30,000	Annual Savings or Income		
Miscellaneous	19.2%	\$ 11,856	Heating energy savings/income	\$	4,152
Initial Costs - Total	100.0%	\$ 61,801	Annual Savings - Total	\$	4,152
Incentives/Grants		\$ 17,978	Schedule yr # 15		
Periodic Costs (Credits)					
dampers & motors		\$ 1,000			
		\$ -			
		\$ -			
End of project life -		\$ -			

Financial Feasibility					
Pre-tax IRR and ROI	%	3.4%	Project equity	\$	61,801
After-tax IRR and ROI	%	3.4%			
Simple Payback	yr	23.8			
Year-to-positive cash flow	yr	18.1			
Net Present Value - NPV	\$	25,206			
Annual Life Cycle Savings	\$	1,008			
Profitability Index - PI	-	0.41			

Yearly Cash Flows			
Year	Pre-tax	After-tax	Cumulative
#	\$	\$	\$
0	(43,823)	(43,823)	(43,823)
1	1,901	1,901	(41,923)
2	1,960	1,960	(39,963)
3	2,021	2,021	(37,942)
4	2,084	2,084	(35,857)
5	2,150	2,150	(33,707)
6	2,217	2,217	(31,491)
7	2,286	2,286	(29,205)
8	2,357	2,357	(26,848)
9	2,431	2,431	(24,417)
10	2,507	2,507	(21,910)
11	2,585	2,585	(19,326)
12	2,665	2,665	(16,660)
13	2,748	2,748	(13,912)
14	2,834	2,834	(11,078)
15	1,576	1,576	(9,502)
16	3,013	3,013	(6,489)
17	3,107	3,107	(3,383)
18	3,203	3,203	(180)
19	3,303	3,303	3,123
20	3,405	3,405	6,528
21	3,511	3,511	10,039
22	3,620	3,620	13,659
23	3,732	3,732	17,391
24	3,848	3,848	21,239
25	3,967	3,967	25,206

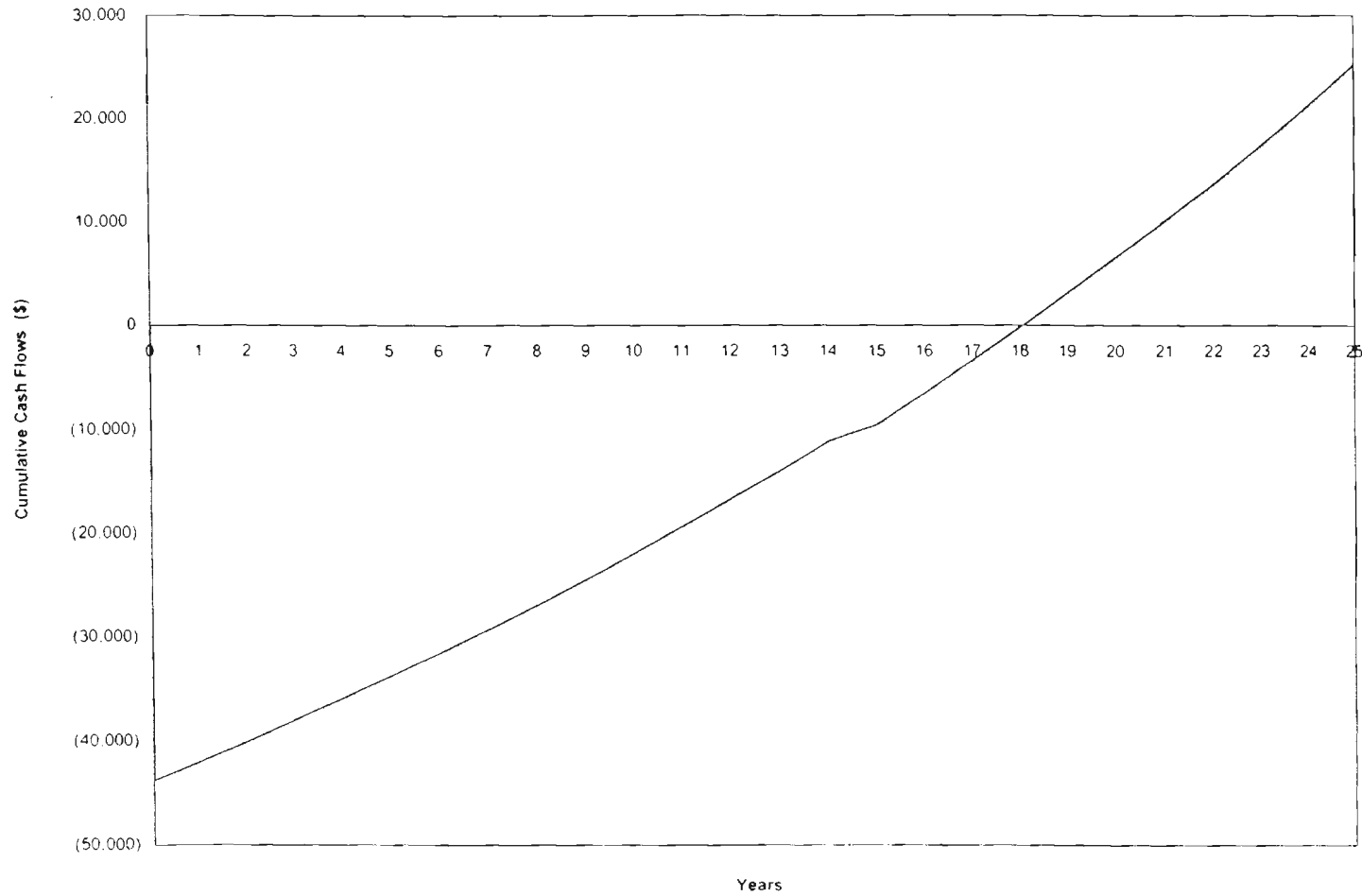
Cumulative Cash Flows Graph

SAH Project Cumulative Cash Flows Downtown Hotel, Dawson City, Yukon

Year-to-positive cash flow 18.1 yr

IRR and ROI 3.4%

Net Present Value \$ 25,206



NASA Surface meteorology and Solar Energy Data Set

RETScreen Data

Latitude 64.17 / Longitude 139.5 was chosen.

RETScreen Model(s) chosen:

Solar Air Heating

Average Daily Radiation on Horizontal Surface (kWh/m²/day)

Lat 64.17 Lon 139.5	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10 Year Average	0.12	0.84	2.50	4.29	4.79	5.51	4.71	3.48	2.16	1.10	0.22	0.05

Average Temperature (° C)

Lat 64.17 Lon 139.5	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
10 Year Average	-28.3	-25.9	-21.6	-12.0	-3.98	8.82	14.1	9.96	-0.87	-16.4	-24.3	-27.8	-10.7
El Nino Year (1987)	-29.9	-27.0	-22.2	-14.1	-5.96	8.15	15.0	10.7	-2.24	-18.3	-23.9	-32.7	-11.8
La Nina Year (1988)	-29.1	-26.3	-21.3	-11.7	-3.19	10.3	17.3	7.48	1.41	-14.4	-22.0	-24.2	-9.64

Average Wind Speed (m/s)

Lat 64.17 Lon 139.5	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
10 Year Average	3.21	3.01	2.78	2.69	2.63	2.93	2.73	2.78	2.65	2.79	3.08	3.18	2.87
El Nino Year (1987)	3.28	3.13	2.72	2.54	2.60	3.00	2.18	2.45	2.85	2.59	3.19	3.29	2.81
La Nina Year (1988)	3.22	2.97	2.75	2.91	2.46	2.50	2.68	3.14	2.49	2.98	3.00	3.17	2.85

It is recommended that users of these wind data view the Methodology Section of this web site. The user may wish to correct for bias as well as local effects within the grid region.

RETScreen® Energy Model - Solar Water Heating Project

Site Conditions		Estimate	Notes/Range
Project name		Downtown Hotel	
Project location		Dawson City, Yukon	
Nearest location for weather data		Dawson City	Complete SR&HLC sheet
Annual solar radiation (tilted surface)	MWh/m ²	1.13	
Annual average temperature	°C	-10.7	
Annual average wind speed	m/s	2.9	
Desired load temperature	°C	60	
Hot water use	L/d	8,400	
Number of months analysed	month	4.0	
Energy demand for months analysed	MWh	70.54	

System Characteristics		Estimate	Notes/Range
Application type		Service hot water (with storage)	
Base Case Water Heating System			
Heating fuel type	-	Diesel (#2 oil)	
Heating system seasonal efficiency	%	70%	60% to 300%
Solar Collector			
Collector type	-	Unglazed	See Technical Note 1
Solar water heating collector manufacturer		Falco	See Product Database
Solar water heating collector model		SunSaver-1	
Area per collector	m ²	2.94	1.00 to 5.00
Fr (tau alpha) coefficient	-	0.88	0.50 to 0.90
Wind correction for Fr (tau alpha)	s/m	0.029	0.030 to 0.050
Fr UL coefficient	(W/m ²)/°C	9.96	10.00 to 15.00
Wind correction for Fr UL	(J/m ³)/°C	4.56	3.00 to 15.00
Suggested number of collectors		61	
Number of collectors		80	
Total collector area	m ²	235.2	
Storage			
Ratio of storage capacity to coll. area	L/m ²	37.5	37.5 to 100.0
Storage capacity	L	8,820	
Balance of System			
Heat exchanger/antifreeze protection	yes/no	No	
Suggested pipe diameter	mm	N/A	8 to 25 or PVC 30 to 38
Pipe diameter	mm	25	8 to 25 or PVC 30 to 38
Pumping power per collector area	W/m ²	2	3 to 22, or 0
Piping and solar tank losses	%	3%	1% to 10%
Losses due to snow and/or dirt	%	5%	2% to 10%
Horz. dist. from mech. room to collector	m	27	5 to 20
# of floors from mech. room to collector	-	2	0 to 20

Annual Energy Production (4.00 months analysed)		Estimate	Notes/Range
Pumping energy (electricity)	MWh	0.19	
Specific yield	kWh/m ²	107	
System efficiency	%	21%	
Solar fraction for months analysed	%	36%	
Renewable energy delivered	MWh	25.15	
	GJ	90.54	

Complete Cost Analysis sheet

PETScreen® Solar Resource and Heating Load Calculation - Solar Water Heating Project

Site Latitude and Collector Orientation		Estimate	Notes/Range
Nearest location for weather data		Dawson City	See Weather Database
Latitude of project location	°N	64.2	-90.0 to 90.0
Slope of solar collector	°	25.0	0.0 to 90.0
Azimuth of solar collector	°	0.0	0.0 to 180.0

Monthly Inputs

(Note: 1. Cells in grey are not used for energy calculations. 2. Revisit this table to check that all required inputs are filled if you change system type or solar collector type or pool type or method for calculating cold water temperature.)

Month	Fraction of month used (0 - 1)	Monthly average daily radiation on horizontal surface (kWh/m ² /d)	Monthly average temperature (°C)	Monthly average relative humidity (%)	Monthly average wind speed (m/s)	Monthly average daily radiation in plane of solar collector (kWh/m ² /d)
January	0.00	0.12	-28.3	65.0	3.2	0.42
February	0.00	0.84	-25.9	73.0	3.0	2.02
March	0.00	2.50	-21.6	84.0	2.8	4.16
April	0.00	4.29	-12.0	87.0	2.7	5.39
May	0.00	4.79	-4.0	85.0	2.6	5.11
June	1.00	5.51	8.8	67.0	2.9	5.50
July	1.00	4.71	14.1	55.0	2.7	4.79
August	1.00	3.48	10.0	56.0	2.8	3.84
September	1.00	2.16	-0.9	71.0	2.7	2.64
October	0.00	1.10	-16.4	88.0	2.8	2.19
November	0.00	0.22	-24.3	80.0	3.1	0.64
December	0.00	0.05	-27.8	69.0	3.2	0.28

		Annual	Season of Use
Solar radiation (horizontal)	MWh/m ²	0.91	0.48
Solar radiation (tilted surface)	MWh/m ²	1.13	0.52
Average temperature	°C	-10.7	8.0
Average wind speed	m/s	2.9	2.8

Water Heating Load Calculation

		Estimate	Notes/Range
Application type	-	Service hot water	
System configuration	-	With storage	
Building or load type	-	Hotel/Motel	
Number of units	Room	35	
Rate of occupancy	%	100%	50 to 100
Estim. hot water use (at ≈60 °C)	L/d	2,355	
Hot water use	L/d	8,400	
Desired water temperature	°C	60	
Days per week system is used	d	7	1 to 7
Cold water temperature	-	Auto	
Minimum	°C	10	10 to 15.0
Maximum	°C	10	5 to 15.0
Months SWH in use	month	4.0	
Ener. demand for months analysed	MWh	70.54	
	GJ	253.94	

Return to Energy Advisor, sheet 1

RETScreen Cost Analysis - Solar Water Heating Project

Type of project

Currency

Cost references

Initial Costs (Credits)	Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
Feasibility Study							
Other	Cost	0	\$ -	\$ -	0.0%		
Sub-total				\$ -	0.0%		
Development							
Other	Cost	0	\$ -	\$ -	0.0%		
Sub-total				\$ -	0.0%		
Engineering							
Other	Cost	1	\$ 4,000	\$ 4,000	6.5%		
Sub-total				\$ 4,000	6.5%		
Renewable Energy (RE) Equipment							
Solar collector	m ²	235.2	\$ 90	\$ 21,168			
Solar storage tank	L	8,820	\$ -	\$ -			
Solar loop piping materials	m	79	\$ 6.93	\$ 547			
Insulating pumps	W	353	\$ 1.73	\$ 610			
Heat exchanger	kW	0.0	\$ -	\$ -			
Transportation	project	1	\$ 1,500	\$ 1,500			
Other	Cost	0	\$ -	\$ -			
Sub-total				\$ 23,497	38.2%		
Balance of System							
Collector support structure	m ²	235.2	\$ 40	\$ 9,408			
Plumbing and control	project	1	\$ 1,500	\$ 1,500			
Collector installation	m ²	235.2	\$ 50	\$ 11,760			
Solar loop installation	m	79	\$ 15.00	\$ 1,192			
Auxiliary equipment installation	project	1	\$ 500	\$ 500			
Transportation	project	1	\$ 3,600	\$ 3,600			
Other	Cost	0	\$ -	\$ -			
Sub-total				\$ 27,960	45.5%		
Miscellaneous							
Training	p-h	4	\$ 60	\$ 480			
Contingencies	%	10%	\$ 55,457	\$ 5,546			
Sub-total				\$ 6,026	9.8%		
Initial Costs - Total				\$ 61,483	100.0%		

Annual Costs (Credits)	Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
24hr							
Property taxes/insurance	project	0	\$ -	\$ -			
24hr labour	project	4	\$ 60	\$ 240			
Other	Cost	0	\$ -	\$ -			
Contingencies	%	10%	\$ 240	\$ 24			
Sub-total				\$ 264	89.9%		
Fuel/Electricity	kWh	188	\$ 0.1570	\$ 30	10.1%		
Annual Costs - Total				\$ 294	100.0%		

Periodic Costs (Credits)	Period	Unit Cost	Amount	Interval Range	Unit Cost Range
Valves and fittings	Cost 10 yr	\$ 250	\$ 250		
Pool heat pump compressor	Credit 10 yr	\$ -	\$ -		
Control panel (1/yr)			\$ -		

RETScreen® Financial Summary - Solar Water Heating Project

Annual Energy Balance					
Project name	Downtown Hotel	Electricity required	MWh	0.2	
Project location	Dawson City, Yukon				
Renewable energy delivered	MWh	25.15	GHG analysis sheet used?	yes/no	No
Heating fuel displaced	Diesel (#2 oil)				

Financial Parameters					
Avoided cost of heating energy	\$/L	0.607	Debt ratio	%	0.0%
			Income tax analysis?	yes/no	No
Retail price of electricity	\$/kWh	0.157			
Energy cost escalation rate	%	3.0%			
Inflation	%	2.0%			
Discount rate	%	0.0%			
Project life	yr	25			

Project Costs and Savings					
Initial Costs			Annual Costs and Debt		
Feasibility study	0.0%	\$ -	O&M	\$	264
Development	0.0%	\$ -	Fuel/Electricity	\$	30
Engineering	6.5%	\$ 4,000			
RE equipment	38.2%	\$ 23,497	Annual Costs - Total	\$	294
Balance of system	45.5%	\$ 27,960	Annual Savings or Income		
Miscellaneous	9.8%	\$ 6,026	Heating energy savings/income	\$	2,031
Initial Costs - Total	100.0%	\$ 61,483	Annual Savings - Total	\$	2,031
Incentives/Grants		\$ 20,583	Schedule yr #	10.20	
Periodic Costs (Credits)					
Valves and fittings	\$	250			
Pool heat pump compressor	\$.			
	\$.			
End of project life	\$.			

Financial Feasibility					
Pre-tax IRR and ROI	%	3.5%	Project equity	\$	61,483
After-tax IRR and ROI	%	3.5%			
Simple Payback	yr	23.5			
Year-to-positive cash flow	yr	17.6			
Net Present Value - NPV	\$	24,949			
Annual Life Cycle Savings	\$	998			
Profitability Index - PI		0.41			

Yearly Cash Flows			
Year	Pre-tax	After-tax	Cumulative
#	\$	\$	\$
0	(40,900)	(40,900)	(40,900)
1	1,792	1,792	(39,108)
2	1,848	1,848	(37,259)
3	1,907	1,907	(35,353)
4	1,967	1,967	(33,386)
5	2,028	2,028	(31,358)
6	2,092	2,092	(29,266)
7	2,158	2,158	(27,108)
8	2,226	2,226	(24,882)
9	2,296	2,296	(22,586)
10	2,063	2,063	(20,524)
11	2,442	2,442	(18,082)
12	2,518	2,518	(15,563)
13	2,597	2,597	(12,966)
14	2,679	2,679	(10,287)
15	2,762	2,762	(7,525)
16	2,849	2,849	(4,676)
17	2,938	2,938	(1,738)
18	3,030	3,030	1,292
19	3,124	3,124	4,416
20	2,851	2,851	7,267
21	3,323	3,323	10,589
22	3,426	3,426	14,016
23	3,533	3,533	17,549
24	3,643	3,643	21,192
25	3,757	3,757	24,949

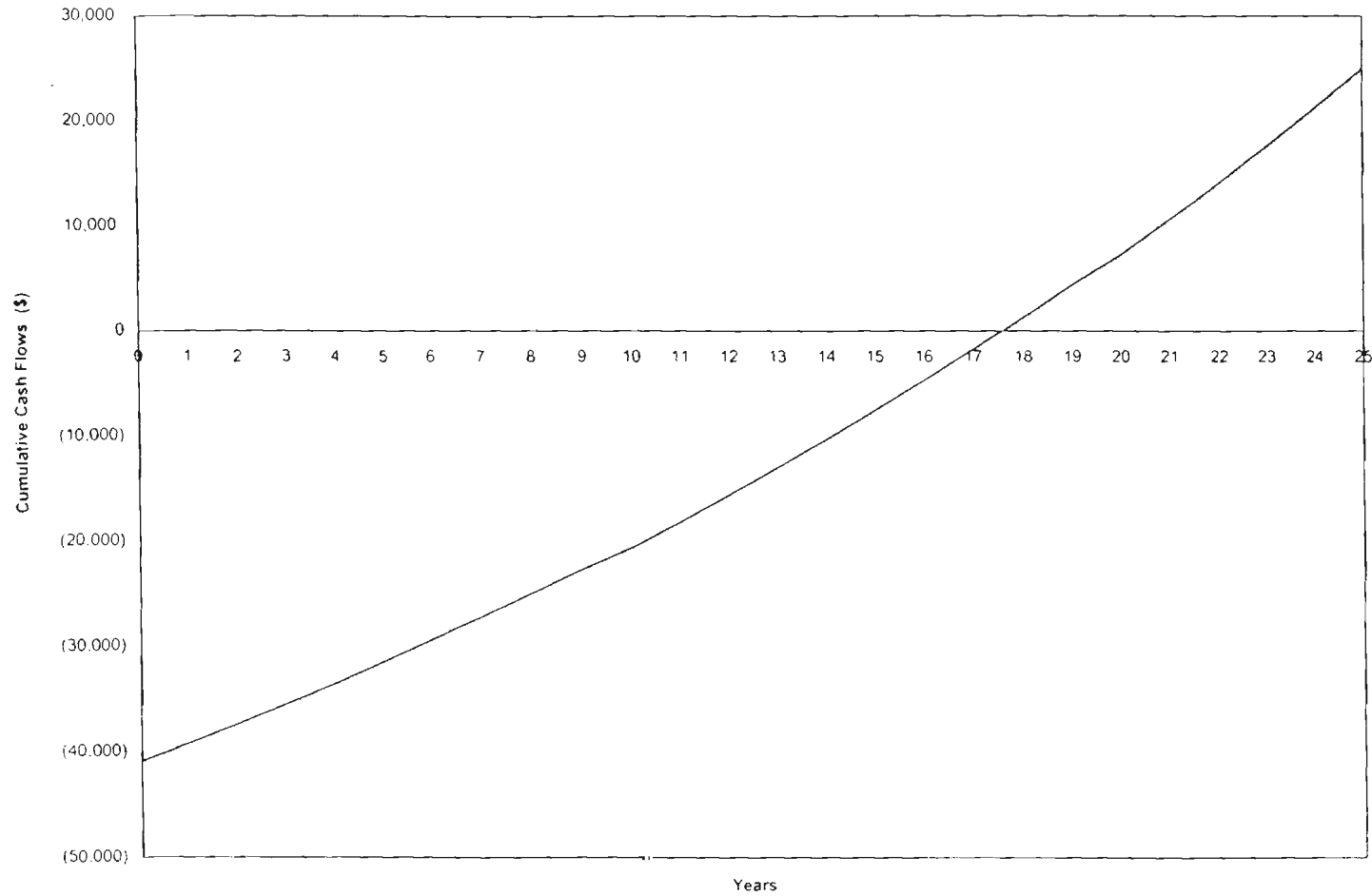
Cumulative Cash Flows Graph

SWH Project Cumulative Cash Flows Downtown Hotel, Dawson City, Yukon

Year-to-positive cash flow 17.6 yr

IRR and ROI 3.5%

Net Present Value \$ 24,949



RETScreen[®] Energy Model - Solar Water Heating Project

Site Conditions		Estimate	Notes/Range
Project name		Downtown Hotel	
Project location		Dawson City, Yukon	
Nearest location for weather data		Dawson City	Complete SR&HLC sheet
Annual solar radiation (tilted surface)	MWh/m ²	1.13	
Annual average temperature	°C	-10.7	
Annual average wind speed	m/s	2.9	
Desired load temperature	°C	60	
Hot water use	L/d	8,400	
Number of months analysed	month	7.5	
Energy demand for months analysed	MWh	130.93	

System Characteristics		Estimate	Notes/Range
Application type		Service hot water (with storage)	
Base Case Water Heating System			
Heating fuel type	-	Diesel (#2 oil)	
Heating system seasonal efficiency	%	70%	60% to 300%
Solar Collector			
Collector type	-	Glazed	See Technical Note 1
Solar water heating collector manufacturer		Thermo Dynamics	See Product Database
Solar water heating collector model		G32	
Area per collector	m ²	3.00	1.00 to 5.00
Fr (tau alpha) coefficient	-	0.74	0.50 to 0.90
Fr UL coefficient	(W/m ²)/°C	5.25	3.50 to 6.00
Suggested number of collectors		62	
Number of collectors		69	
Total collector area	m ²	207.0	
Storage			
Ratio of storage capacity to coll. area	L/m ²	37.5	37.5 to 100.0
Storage capacity	L	7,763	
Balance of System			
Heat exchanger/antifreeze protection	yes/no	Yes	
Heat exchanger effectiveness	%	85%	50% to 85%
Suggested pipe diameter	mm	N/A	8 to 25 or PVC 30 to 38
Pipe diameter	mm	25	8 to 25 or PVC 30 to 38
Pumping power per collector area	W/m ²	4	3 to 22, or 0
Piping and solar tank losses	%	10%	1% to 10%
Losses due to snow and/or dirt	%	8%	2% to 10%
Horz. dist. from mech. room to collector	m	27	5 to 20
# of floors from mech. room to collector	-	2	0 to 20

Annual Energy Production (7.45 months analysed)		Estimate	Notes/Range
Pumping energy (electricity)	MWh	1.03	
Specific yield	kWh/m ²	249	
System efficiency	%	30%	
Solar fraction for months analysed	%	39%	
Renewable energy delivered	MWh	51.64	
	GJ	185.9	

Complete Cost Analysis sheet

RETScreen® Solar Resource and Heating Load Calculation - Solar Water Heating Project

Site Latitude and Collector Orientation		Estimate	Notes/Range
Nearest location for weather data		Dawson City	See Weather Database
Latitude of project location	°N	64.2	-90.0 to 90.0
Slope of solar collector	°	25.0	0.0 to 90.0
Azimuth of solar collector	°	0.0	0.0 to 180.0

Monthly Inputs

Note: 1. Cells in grey are not used for energy calculations. 2. Revisit this table to check that all required inputs are filled if you change system type or solar collector type or pool type or method for calculating cold water temperature.

Month	Fraction of month used (0 - 1)	Monthly average daily radiation on horizontal surface (kWh/m ² /d)	Monthly average temperature (°C)	Monthly average relative humidity (%)	Monthly average wind speed (m/s)	Monthly average daily radiation in plane of solar collector (kWh/m ² /d)
January	0.25	0.12	-28.3	65.0	3.2	0.42
February	0.60	0.84	-25.9	73.0	3.0	2.02
March	0.30	2.50	-21.6	84.0	2.8	4.16
April	0.30	4.29	-12.0	87.0	2.7	5.39
May	0.85	4.79	-4.0	85.0	2.6	5.11
June	1.00	5.51	8.8	67.0	2.9	5.50
July	1.00	4.71	14.1	55.0	2.7	4.79
August	1.00	3.48	10.0	56.0	2.8	2.94
September	1.00	2.16	-0.9	71.0	2.7	2.64
October	0.50	1.10	-16.4	88.0	2.8	2.19
November	0.40	0.22	-24.3	80.0	3.1	0.64
December	0.25	0.05	-27.8	69.0	3.2	0.28

		Annual	Season of Use
Solar radiation (horizontal)	MWh/m ²	0.91	0.71
Solar radiation (tilted surface)	MWh/m ²	1.13	0.82
Average temperature	°C	-10.7	-3.9
Average wind speed	m/s	2.9	2.8

Water Heating Load Calculation		Estimate	Notes/Range
Application type	-	Service hot water	
System configuration	-	With storage	
Building or load type	-	Hotel/Motel	
Number of units	Room	35	
Rate of occupancy	%	100%	50 to 100
Estim. hot water use (at ≈60 °C)	L/d	2,355	
Hot water use	L/d	8,400	
Desired water temperature	°C	60	
Days per week system is used	d	7	1 to 7
Cold water temperature	-	Auto	
Minimum	°C	10	10 to 16.0
Maximum	°C	10	5.0 to 15.0
Months SWH in use	month	7.5	
Energy demand for months analysed	MWh	130.93	
	GJ	471.36	

[Return to Energy Model sheet](#)

RETScreen® Financial Summary - Solar Water Heating Project

Annual Energy Balance				
Project name	Downtown Hotel	Electricity required	MWh	1.0
Project location	Dawson City, Yukon			
Renewable energy delivered	MWh 51.64	GHG analysis sheet used?	yes/no	No
Heating fuel displaced	- Diesel (#2 oil)			

Financial Parameters				
Avoided cost of heating energy	\$/L	<input type="text" value="0.607"/>	Debt ratio	% <input type="text" value="0.0%"/>
			Income tax analysis?	yes/no <input type="text" value="No"/>
Retail price of electricity	\$/kWh	0.157		
Energy cost escalation rate	%	<input type="text" value="3.0%"/>		
Inflation	%	<input type="text" value="2.0%"/>		
Discount rate	%	<input type="text" value="0.0%"/>		
Project life	yr	<input type="text" value="25"/>		

Project Costs and Savings						
Initial Costs		Annual Costs and Debt				
Feasibility study	0.0%	\$	-	O&M	\$	264
Development	0.0%	\$	-	Fuel/Electricity	\$	162
Engineering	2.9%	\$	4,000			
RE equipment	53.2%	\$	74,582	Annual Costs - Total	\$	426
Balance of system	34.5%	\$	48,397			
Miscellaneous	9.4%	\$	13,178	Annual Savings or Income		
Initial Costs - Total	100.0%	\$	140,156	Heating energy savings/income	\$	4,169
Incentives/Grants		\$	<input type="text" value="49,192"/>			
				Annual Savings - Total	\$	4,169
Periodic Costs (Credits)		Schedule yr # 10,20				
Valves and fittings		\$	250			
Pool heat pump compressor		\$	-			
		\$	-			
End of project life -		\$	-			

Financial Feasibility				
Pre-tax IRR and ROI	%	3.3%		
After-tax IRR and ROI	%	3.3%		
Simple Payback	yr	24.3	Project equity	\$ 140,156
Year-to-positive cash flow	yr	18.1		
Net Present Value - NPV	\$	50,224		
Annual Life Cycle Savings	\$	2,009		
Profitability Index - PI	-	0.36		

Yearly Cash Flows			
Year #	Pre-tax \$	After-tax \$	Cumulative \$
0	(90,964)	(90,964)	(90,964)
1	3,858	3,858	(87,106)
2	3,977	3,977	(83,129)
3	4,099	4,099	(79,030)
4	4,225	4,225	(74,806)
5	4,354	4,354	(70,452)
6	4,488	4,488	(65,964)
7	4,625	4,625	(61,339)
8	4,767	4,767	(56,571)
9	4,913	4,913	(51,658)
10	4,759	4,759	(46,899)
11	5,219	5,219	(41,680)
12	5,379	5,379	(36,301)
13	5,543	5,543	(30,758)
14	5,713	5,713	(25,045)
15	5,888	5,888	(19,157)
16	6,068	6,068	(13,088)
17	6,254	6,254	(6,834)
18	6,445	6,445	(389)
19	6,642	6,642	6,253
20	6,474	6,474	12,727
21	7,055	7,055	19,782
22	7,270	7,270	27,053
23	7,493	7,493	34,545
24	7,722	7,722	42,267
25	7,957	7,957	50,224

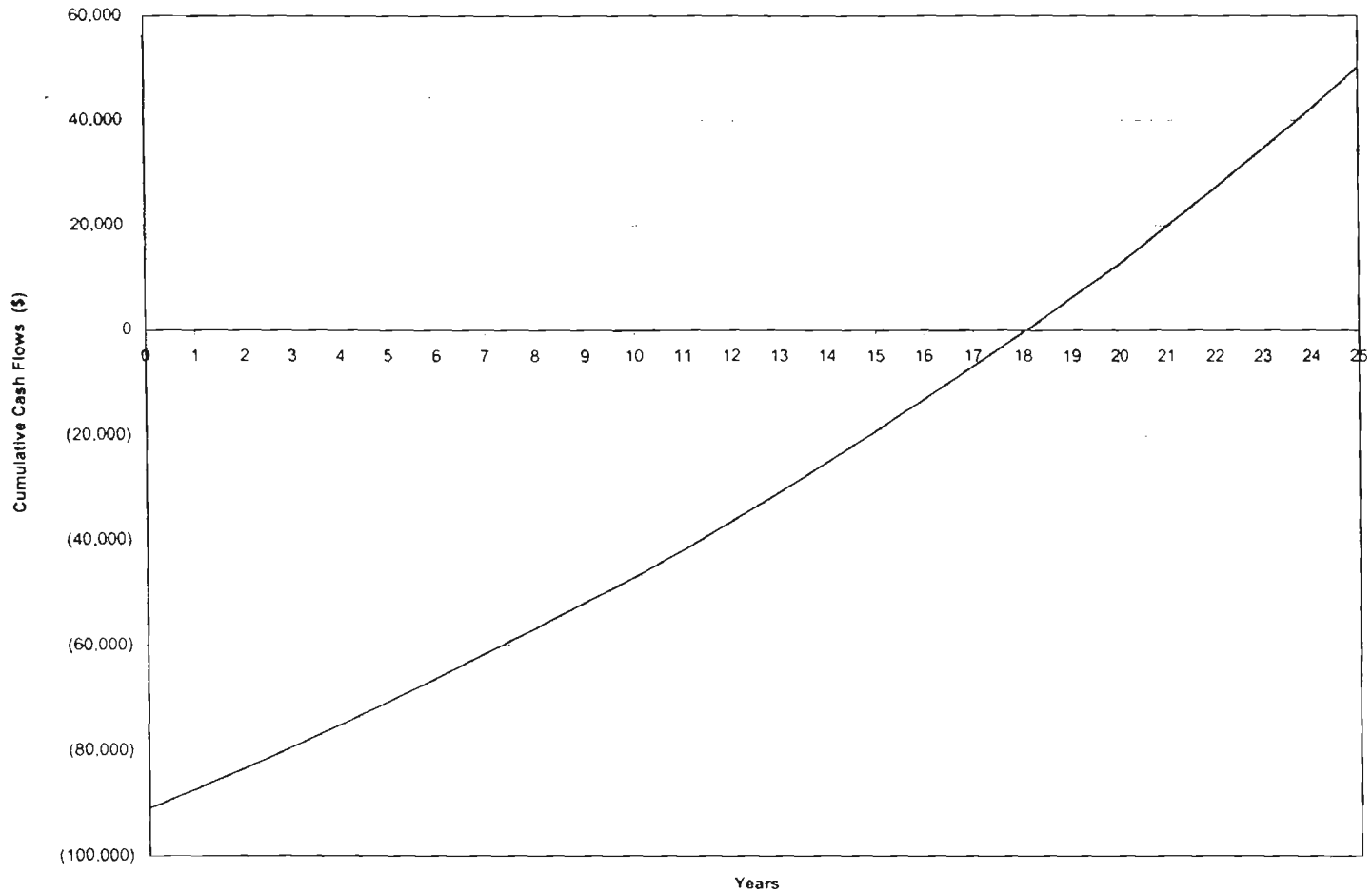
Cumulative Cash Flows Graph

SWH Project Cumulative Cash Flows Downtown Hotel, Dawson City, Yukon

Year-to-positive cash flow 18.1 yr

IRR and ROI 3.3%

Net Present Value \$ 50,224



NASA Surface meteorology and Solar Energy Data Set

RETScreen Data

Latitude 64.17 / Longitude 139.5 was chosen.

RETScreen Model(s) chosen:
Solar Water Heating

Average Daily Radiation on Horizontal Surface (kWh/m²/day)

Lat 64.17 Lon 139.5	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10 Year Average	0.12	0.84	2.50	4.29	4.79	5.51	4.71	3.48	2.16	1.10	0.22	0.05

Average Temperature (°C)

Lat 64.17 Lon 139.5	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
10 Year Average	-28.3	-25.9	-21.6	-12.0	-3.98	8.82	14.1	9.96	-0.87	-16.4	-24.3	-27.8	-10.7
El Nino Year (1987)	-29.9	-27.0	-22.2	-14.1	-5.96	8.15	15.0	10.7	-2.24	-18.3	-23.9	-32.7	-11.8
La Nina Year (1988)	-29.1	-26.3	-21.3	-11.7	-3.19	10.3	17.3	7.48	1.41	-14.4	-22.0	-24.2	-9.64

Average Relative Humidity (%)

Lat 64.17 Lon 139.5	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
10 Year Average	65	73	84	87	85	67	55	56	71	88	80	69	73

Average Wind Speed (m/s)

Lat 64.17 Lon 139.5	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
10 Year Average	3.21	3.01	2.78	2.69	2.63	2.93	2.73	2.78	2.65	2.79	3.08	3.18	2.87
El Nino Year (1987)	3.28	3.13	2.72	2.54	2.60	3.00	2.18	2.45	2.85	2.59	3.19	3.29	2.81
La Nina Year (1988)	3.22	2.97	2.75	2.91	2.46	2.50	2.68	3.14	2.49	2.98	3.00	3.17	2.85

It is recommended that users of these wind data view the Methodology Section of this web site. The user may wish to correct for bias as well as local effects within the grid region.

RETScreen® Energy Model - Solar Water Heating Project

Site Conditions		Estimate	Notes/Range
Project name		Downtown Hotel	
Project location		Dawson City, Yukon	
Nearest location for weather data		Dawson City	Complete SR&HL.C sheet
Annual solar radiation (tilted surface)	MWh/m ²	1.13	
Annual average temperature	°C	-10.7	
Annual average wind speed	m/s	2.9	
Desired load temperature	°C	60	
Hot water use	L/d	8,400	
Number of months analysed	month	4.0	
Energy demand for months analysed	MWh	70.54	

System Characteristics		Estimate	Notes/Range
Application type		Service hot water (with storage)	
Base Case Water Heating System			
Heating fuel type		Diesel (#2 oil)	
Heating system seasonal efficiency	%	70%	60% to 300%
Solar Collector			
Collector type		Glazed	See Technical Note 1
Solar water heating collector manufacturer		Thermo Dynamics	See Product Database
Solar water heating collector model		G32	
Area per collector	m ²	3.00	1.00 to 5.00
Fr (tau alpha) coefficient	-	0.74	0.50 to 0.90
Fr UL coefficient	(W/m ²)/°C	5.25	3.50 to 6.00
Suggested number of collectors		54	
Number of collectors		50	
Total collector area	m ²	150.0	
Storage			
Ratio of storage capacity to coll. area	L/m ²	37.5	37.5 to 100.0
Storage capacity	L	5,625	
Balance of System			
Heat exchanger/antifreeze protection	yes/no	No	
Suggested pipe diameter	mm	N/A	8 to 25 or PVC 30 to 38
Pipe diameter	mm	25	8 to 25 or PVC 30 to 38
Pumping power per collector area	W/m ²	3	3 to 22, or 0
Piping and solar tank losses	%	3%	1% to 10%
Losses due to snow and/or dirt	%	5%	2% to 10%
Horz. dist. from mech. room to collector	m	27	5 to 20
# of floors from mech. room to collector	-	2	0 to 20

Annual Energy Production (4.00 months analysed)		Estimate	Notes/Range
Pumping energy (electricity)	MWh	0.37	
Specific yield	kWh/m ²	216	
System efficiency	%	42%	
Solar fraction for months analysed	%	46%	
Renewable energy delivered	MWh	32.33	
	GJ	116.38	

Complete Cost Analysis sheet

RETScreen® Solar Resource and Heating Load Calculation - Solar Water Heating Project

Site Latitude and Collector Orientation		Estimate	Notes/Range
Nearest location for weather data		Oawson City	See Weather Database
Latitude of project location	°N	64.2	-90.0 to 90.0
Slope of solar collector	°	25.0	0.0 to 90.0
Azimuth of solar collector	°	0.0	0.0 to 180.0

Monthly Inputs

(Note: 1. Cells in grey are not used for energy calculations; 2. Revisit this table to check that all required inputs are filled if you change system type or solar collector type or pool type or method for calculating cold water temperature)

Month	Fraction of month used (0 - 1)	Monthly average daily radiation on horizontal surface (kWh/m ² /d)	Monthly average temperature (°C)	Monthly average relative humidity (%)	Monthly average wind speed (m/s)	Monthly average daily radiation in plane of solar collector (kWh/m ² /d)
January	0.00	0.12	-28.3	65.0	3.2	0.42
February	0.00	0.84	-25.9	73.0	3.0	2.02
March	0.00	2.50	-21.6	84.0	2.8	4.16
April	0.00	4.29	-12.0	87.0	2.7	5.39
May	0.00	4.79	-4.0	85.0	2.6	5.11
June	1.00	5.51	8.8	67.0	2.9	5.50
July	1.00	4.71	14.1	55.0	2.7	4.79
August	1.00	3.48	10.0	66.0	2.8	3.84
September	1.00	2.16	-0.9	71.0	2.7	2.84
October	0.00	1.10	-16.4	88.0	2.8	2.19
November	0.00	0.22	-24.3	80.0	3.1	0.64
December	0.00	0.05	-27.8	69.0	3.2	0.28

		Annual	Season of Use
Solar radiation (horizontal)	MWh/m ²	0.91	0.48
Solar radiation (tilted surface)	MWh/m ²	1.13	0.52
Average temperature	°C	-10.7	8.0
Average wind speed	m/s	2.9	2.8

Water Heating Load Calculation

		Estimate	Notes/Range
Application type	-	Service hot water	
System configuration	-	With storage	
Building or load type	-	Hotel/Motel	
Number of units	Room	35	
Rate of occupancy	%	100%	50 to 100
Estim. hot water use (at =60 °C)	L/d	2,355	
Hot water use	L/d	8,400	
Desired water temperature	°C	60	
Days per week system is used	d	7	1 to 7
Cold water temperature	-	Auto	
Minimum	°C	1.0	1.0 to 10.0
Maximum	°C	1.0	5.0 to 15.0
Months SWH in use	month	4.0	
Ener. demand for months analysed	MWh	70.54	
	GJ	253.94	

Return to Energy Model sheet

RETScreen® Cost Analysis - Solar Water Heating Project

Type of project:

Currency:

Cost references:

Initial Costs (Credits)	Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
Feasibility Study							
Other	Cost	0	\$ -	\$ -	-	-	-
Sub-total :				\$ -	0.0%	-	-
Development							
Other	Cost	0	\$ -	\$ -	-	-	-
Sub-total :				\$ -	0.0%	-	-
Engineering							
Other	Cost	1	\$ 4,000	\$ 4,000	-	-	-
Sub-total :				\$ 4,000	4.7%	-	-
Renewable Energy (RE) Equipment							
Solar collector	m ²	150.0	\$ 310	\$ 46,500	-	-	-
Solar storage tank	L	5,625	\$ -	\$ -	-	-	-
Solar loop piping materials	m	79	\$ 6.00	\$ 477	-	-	-
Circulating pump(s)	W	375	\$ 1.00	\$ 375	-	-	-
Heat exchanger	kW	0.0	\$ 30	\$ -	-	-	-
Transportation	project	1	\$ 1,500	\$ 1,500	-	-	-
Other	Cost	0	\$ -	\$ -	-	-	-
Sub-total :				\$ 48,852	57.4%	-	-
Balance of System							
Collector support structure	m ²	150.0	\$ 40	\$ 6,000	-	-	-
Plumbing and control	project	1	\$ 1,500	\$ 1,500	-	-	-
Collector installation	m ²	150.0	\$ 75	\$ 11,250	-	-	-
Solar loop installation	m	79	\$ 15.00	\$ 1,192	-	-	-
Auxiliary equipment installation	project	1	\$ 500	\$ 500	-	-	-
Transportation	project	1	\$ 3,600	\$ 3,600	-	-	-
Other	Cost	0	\$ -	\$ -	-	-	-
Sub-total :				\$ 24,042	28.3%	-	-
Miscellaneous							
Training	p-h	4	\$ 60	\$ 480	-	-	-
Contingencies	%	10%	\$ 76,893	\$ 7,689	-	-	-
Sub-total :				\$ 8,169	9.6%	-	-
Initial Costs - Total				\$ 85,063	100.0%	-	-

Annual Costs (Credits)	Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
O&M							
Property taxes/Insurance	project	0	\$ -	\$ -	-	-	-
O&M labour	project	4	\$ 60	\$ 240	-	-	-
Other	Cost	0	\$ -	\$ -	-	-	-
Contingencies	%	10%	\$ 240	\$ 24	-	-	-
Sub-total :				\$ 264	81.9%	-	-
Fuel/Electricity	kWh	372	\$ 0.1570	\$ 58	18.1%	-	-
Annual Costs - Total				\$ 322	100.0%	-	-

Periodic Costs (Credits)	Cost	Period	Unit Cost	Amount	Interval Range	Unit Cost Range
Valves and fittings	Cost	10 yr	\$ 250	\$ 250	-	-
Pool heat pump compressor	Credit	10 yr	\$ -	\$ -	-	-
End of project life				\$ -		

Go to GHG Analysis sheet

RETScreen® Financial Summary - Solar Water Heating Project

Annual Energy Balance				
Project name	Downtown Hotel	Electricity required	MWh	0.4
Project location	Dawson City, Yukon			
Renewable energy delivered	MWh 32.33	GHG analysis sheet used?	yes/no	No
Heating fuel displaced	- Diesel (#2 oil)			

Financial Parameters				
Avoided cost of heating energy	\$/L	0.607	Debt ratio	% 0.0%
			Income tax analysis?	yes/no No
Retail price of electricity	\$/kWh	0.157		
Energy cost escalation rate	%	3.0%		
Inflation	%	2.0%		
Discount rate	%	0.0%		
Project life	yr	25		

Project Costs and Savings				
Initial Costs			Annual Costs and Debt	
Feasibility study	0.0%	\$ -	O&M	\$ 264
Development	0.0%	\$ -	Fuel/Electricity	\$ 58
Engineering	4.7%	\$ 4,000		
RE equipment	57.4%	\$ 48,852	Annual Costs - Total	\$ 322
Balance of system	28.3%	\$ 24,042		
Miscellaneous	9.6%	\$ 8,169	Annual Savings or Income	
Initial Costs - Total	100.0%	\$ 85,063	Heating energy savings/income	\$ 2,610
Incentives/Grants		\$ 29,158		
			Annual Savings - Total	\$ 2,610
Periodic Costs (Credits)			Schedule yr # 10,20	
Valves and fittings		\$ 250		
Pool heat pump compressor		\$ -		
		\$ -		
End of project life -		\$ -		

Financial Feasibility				
Pre-tax IRR and ROI	%	3.2%		
After-tax IRR and ROI	%	3.2%		
Simple Payback	yr	24.4	Project equity	\$ 85,063
Year-to-positive cash flow	yr	18.1		
Net Present Value - NPV	\$	30,621		
Annual Life Cycle Savings	\$	1,225		
Profitability index - PI	-	0.36		

Yearly Cash Flows			
Year #	Pre-tax \$	After-tax \$	Cumulative \$
0	(55,905)	(55,905)	(55,905)
1	2,359	2,359	(53,546)
2	2,433	2,433	(51,113)
3	2,508	2,508	(48,605)
4	2,586	2,586	(46,018)
5	2,667	2,667	(43,352)
6	2,750	2,750	(40,602)
7	2,835	2,835	(37,767)
8	2,923	2,923	(34,844)
9	3,014	3,014	(31,830)
10	2,803	2,803	(29,027)
11	3,204	3,204	(25,823)
12	3,303	3,303	(22,520)
13	3,406	3,406	(19,114)
14	3,511	3,511	(15,602)
15	3,620	3,620	(11,982)
16	3,732	3,732	(8,250)
17	3,848	3,848	(4,402)
18	3,967	3,967	(434)
19	4,090	4,090	3,656
20	3,845	3,845	7,501
21	4,347	4,347	11,848
22	4,481	4,481	16,329
23	4,620	4,620	20,949
24	4,763	4,763	25,711
25	4,910	4,910	30,621

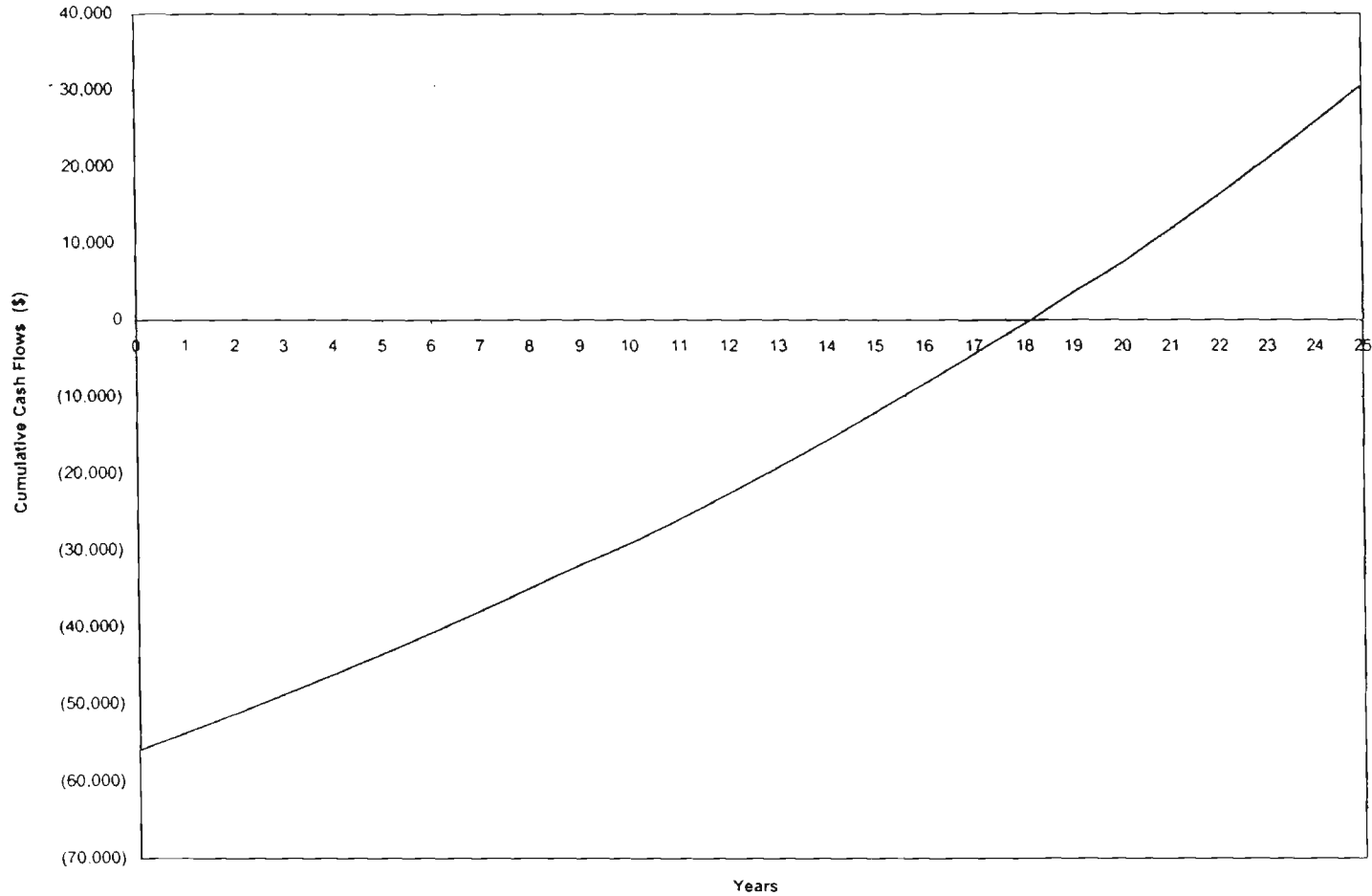
Cumulative Cash Flows Graph

SWH Project Cumulative Cash Flows Downtown Hotel, Dawson City, Yukon

Year-to-positive cash flow 18.1 yr

IRR and ROI 3.2%

Net Present Value \$ 30,621



APPENDIX D: Electrical Report Data

Option 1: Incandescent Lighting

Project Description:

Upgrade interior lighting as follows:

- replace all existing incandescent light lamps with self ballasted compact fluorescent lamps (excluding outdoor)

Cost Breakdown:

Materials:

Replacement for Incandescent lamps (238 @ \$22) \$ 5,236

Subtotal: \$ 5,236

Labour:

Installation: 238 fixtures @ 1/4 hour each and \$60 per hour \$ 3,570

Subtotal: \$ 3,570

Total Cost: \$ 8,806

Propane used to compensate for heat lost due to lower wattage bulbs: \$ 1,586

Total Saving: \$ 2,900

Simple Payback: 3.04 years

Option 2: Fluorescent Lighting

Project Description:

Upgrade interior lighting as follows:

- replace all existing T12 fixtures with new electronic ballast T8 fixtures

Cost Breakdown:

Materials:

T8 surface mounted Fixtures (26 @ \$71 each)	\$ 1,846
T8 8' T-bar Fixtures (20 @ \$100 each)	\$ 2,000
Subtotal:	\$ 3,846

Labour:

Installation: 46 fixtures @ 2/3 hour each and \$60 per hour	\$ 1,840
Subtotal:	\$ 1,840

Total Cost: \$ 5,686

Propane used to compensate for heat lost due to lower wattage bulbs: \$ 440

Total Saving: \$ 623

Simple Payback: . 9.13 years

Option 3 : Washroom Lighting

Project Description:

Upgrade washroom lighting as follows:

- Add two motion sensors to main floor washrooms

Cost Breakdown:

Materials:

2 motion sensors @ 300 each \$ 600

1 power pack @ 80 each \$ 80

Subtotal: \$ 680

Labour:

Installation: 2 sensors @ 2 hour each and \$60 per hour \$ 240

Subtotal: \$ 240

Total Cost: \$ 920

Propane used to compensate for heat lost due to lower wattage bulbs: \$ 208

Total Saving: \$ 265

Simple Payback: 3.48 years

Option 4: Exit Lights

Project Description:

Upgrade exit signs as follows:

- Replace existing incandecent lamps with LED

Cost Breakdown:

Materials:

LED lamps (9 @ \$22 each)

\$ 396

Subtotal:

\$ 396

Labour:

Installation: 9 lamps @ 1/4 hour each and \$60 per hour

\$ 30

Subtotal:

\$ 30

Total Cost:

\$ 426

Total Saving:

\$ 344

Simple Payback:

1.24 years

Detailed Energy Audit Calculations

Downtown Hotel

Downtown Hotel

Lighting -- Electricity Use and Demand for Energy Balance & Savings Calculations

Area	#	kW Before	Total kW Before	kW After	Total kW After	Time Before (Hrs/ Wk)	Time After (Hrs/ Wk)	Time (Wks)	Cost/ kW (\$)	Cost/ kWh (\$)	El. Use Before (kWh)	El. Cost Use & Demand (\$)	El. Use Saving (\$)	El. Use Saving (kWh)	El. Saving (MJ)	El. Saving (kW) (\$)	El. Saving Total (\$)
Restaurant																	
Replace 40W incandescent with 7W compact fluorescent	14	0.040	0.560	0.007	0.098	84	84	52	7.49	0.1482	2,446	413	299	2,018	7,265	42	341
Kitchen																	
Replace 60W incandescent with 11W compact fluorescent	2	0.060	0.120	0.011	0.022	84	84	52	7.49	0.1482	524	88	63	428	1,541	9	72
Replace 4 T-12 tubes with 4 T-8 tube & IS ballast	4	0.160	0.640	0.120	0.480	84	84	52	7.49	0.1482	2,796	472	104	699	2,516	14	118
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	13	0.080	1.040	0.060	0.780	84	84	52	7.49	0.1482	4,543	767	168	1,136	4,088	23	192
Hallway																	
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	5	0.080	0.400	0.060	0.300	168	168	52	7.49	0.1482	3,494	554	129	874	3,145	9	138
Hotel Rooms																	
Replace 60W incandescent with 11W compact fluorescent	170	0.060	10.200	0.011	1.870	28	28	52	7.49	0.1482	14,851	3,118	1,797	12,128	43,663	749	2,546
Mechanical Room																	
Replace 4 T-12 tubes with 4 T-8 tube & IS ballast	2	0.080	0.160	0.060	0.120	168	168	52	7.49	0.1482	1,398	222	52	349	1,258	4	55
Replace 60W incandescent with 11W compact fluorescent	2	0.060	0.120	0.011	0.022	56	56	52	7.49	0.1482	349	63	42	285	1,027	9	51
Bar Area																	
Replace 60W incandescent with 11W compact fluorescent	20	0.060	1.200	0.011	0.220	84	84	52	7.49	0.1482	5,242	885	634	4,281	15,410	88	722
Bar Washrooms																	
Replace 60W incandescent with 11W compact fluorescent	2	0.060	0.120	0.011	0.022	84	84	52	7.49	0.1482	524	88	63	428	1,541	9	72
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	4	0.080	0.320	0.060	0.240	84	84	52	7.49	0.1482	1,398	236	52	349	1,258	7	59
Hallway																	
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	2	0.080	0.160	0.060	0.120	84	84	52	7.49	0.1482	699	118	26	175	629	4	29
Replace 60W incandescent with 11W compact fluorescent	2	0.060	0.120	0.011	0.022	84	84	52	7.49	0.1482	524	88	63	428	1,541	9	72
Washrooms (Main Floor)																	
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	4	0.080	0.320	0.060	0.240	168	56	52	7.49	0.1482	2,796	443	311	2,097	7,548	7	318
Replace 60W incandescent with 11W compact fluorescent	2	0.060	0.120	0.011	0.022	168	56	52	7.49	0.1482	1,048	166	146	984	3,543	9	155
Boardroom																	
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	11	0.080	0.880	0.060	0.660	35	35	52	7.49	0.1482	1,602	316	59	400	1,441	20	79
Replace 60W incandescent with 11W compact fluorescent	6	0.060	0.360	0.011	0.066	35	35	52	7.49	0.1482	655	129	79	535	1,926	26	106
Storage Area																	
Replace 60W incandescent with 11W compact fluorescent	2	0.060	0.120	0.011	0.022	7	7	52	7.49	0.1482	44	17	5	36	128	9	14
Office																	
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	3	0.080	0.240	0.060	0.180	84	84	52	7.49	0.1482	1,048	177	39	262	943	5	44
Replace 60W incandescent with 11W compact fluorescent	6	0.060	0.360	0.011	0.066	14	14	52	7.49	0.1482	262	71	32	214	771	26	58

Main Entrance																	
Replace 25W incandescent with 5W compact fluorescent	10	0.025	0.250	0.005	0.050	168	168	52	7.49	0.1482	2,184	346	259	1,747	6,290	18	277
Laundry Room																	
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	2	0.080	0.160	0.060	0.120	84	84	52	7.49	0.1482	699	118	26	175	629	4	29
Exit Signs																	
Replace Incandescent with LED	9	0.030	0.270	0.002	0.022	168	168	52	7.49	0.1482	2,359	374	322	2,170	7,812	22	344
Totals			18.240		5.764						51,484	9,269	4,772	32,199		1,121	5,893

* Compact fluorescent wattage ratings are nominal. Actual wattage is slightly higher due to ballast and varies with manufacturer.

STANPRO Compact Fluorescent Lamps

STANPRO's CFL-A19 is similar in shape and size to a regular incandescent lamp but consumes 80% less energy and provides 10 times longer life. A soft coated glass cover with a regular lamp base means no change in your existing fixtures. Stanpro CFL-A19 lamps are a brilliant energy efficient alternative where most incandescent lamps are currently used.



CFL-A19

FEATURES

- Soft, glare free light
- Advanced electronic circuit design
- CUL Listed
- End of life circuit protection
- Instant start, flicker-free operation
- 10,000 hour life
- 2700°K, 82+ CRI
- Maximum starting temperature: 120°C
- Minimum starting temperature: -20°C
- Built-in over-current protection and safety fuse

APPLICATIONS

- Table lamps
- Ceiling fixtures
- Residential lighting
- Hotels
- Restaurants
- Anywhere an incandescent lamp is used

SPECIFICATIONS

- Ballast type: Electronic
- Input line voltage: 120VAC
- Input line frequency: 60Hz
- Maximum open circuit voltage: 140V
- Lamp current crest factor: <1.60
- FCC compliance: Part 18

CONVERSIONS & SAVINGS

Incandescent	CFL	Watt Savings	Annual Savings/Lamp
40W	- 7W =	33W	\$ 8.43
50W	- 9W =	41W	\$ 10.48
60W	- 11W =	49W	\$ 12.52

Based on 10 hrs/day for 1 year, totalling 3650 hrs/year at \$0.07/kwh.

PRODUCT INFORMATION

Internal Code	Ordering Code	Watts	Base	Diameter inches	Diameter mm	M.O.L. inches	M.O.L. mm	Initial Lumens	Qty/Case
6660	7W CFL-A19 2700K	7	Medium	1 1/16	40	5 1/2	138	350	12
6661	9W CFL-A19 2700K	9	Medium	1 1/16	40	5 13/16	145	450	12
6662	11W CFL-A19 2700K	11	Medium	1 1/16	40	6 1/16	152	550	12
6662/Y	11W CFL-A19 Buglite	11	Medium	1 1/16	40	6 1/16	152	-	12

BENEFITS

- Consumes 1/5 of the energy of an incandescent lamp
- Lighting expenses reduced by 80%



*Based on max. 8 hrs/day operation

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B.C. Office
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Coquitlam, B.C. V3K 6T2

STANDARD

STANPRO Compact Fluorescent Lamps

STANPRO's CFL-Candle series is an excellent alternative to existing incandescent lamps in chandeliers or decorative light fixtures. Stanpro CFL-Candle lamps do not generate much heat, thereby protecting expensive fixtures.



CFL-Candle

FEATURES

- Soft, glare free light
- Advanced electronic circuit design
- CUL Listed
- End of life circuit protection
- Instant start, flicker-free operation
- 10,000 hour life
- 2700°K, 82+ CRI
- Maximum starting temperature: 120°C
- Minimum starting temperature: -20°C
- Built-in over-current protection and safety fuse

GUILLEVIN INT'L INC.
113 PLATINUM ROAD
WHITEHORSE, YUKON
Y1A 5M3

SPECIFICATIONS

- Ballast type: Electronic
- Input line voltage: 120VAC
- Input line frequency: 60Hz
- Maximum open circuit voltage: 140V
- Lamp current crest factor: <1.60
- FCC compliance: Part 18

PRODUCT INFORMATION

Internal Code	Ordering Code	Watts	Base	Diameter inches	mm	M.O.L. inches	mm	Initial Lumens	Qty/Case
6654	5W CFL-Candle E12 2700K	5	Candelabra	1 11/16	40	5 5/8	140	230	12
6655	5W CFL-Candle E26 2700K	5	Medium	1 11/16	40	5 5/8	140	230	12

APPLICATIONS

- Table lamps
- Ceiling fixtures
- Residential lighting
- Hotels
- Restaurants
- Anywhere an incandescent lamp is used

CONVERSIONS & SAVINGS

Incandescent	CFL	Watt Savings	Annual Savings/Lamp
25W	- 5W	= 20W	\$ 5.11

Based on 10 hrs/day for 1 year, totalling 3650 hrs/year at \$0.07/kwh.

BENEFITS

- Consumes 1/5 of the energy of an incandescent lamp
- Lighting expenses reduced by 80%



*Based on max. 8 hrs/day operation

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B.C. Office
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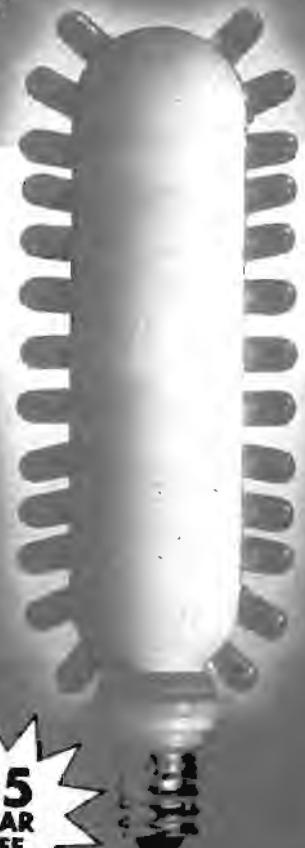
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STANDARD

BRIGHTER THAN EVER

STANPRO
L A M P S

ENS 2000
LED EXIT LAMP



25 YEAR LIFE

FEATURES & BENEFITS :

- 1.2 watt / 120 volts
- UP TO 95% SAVINGS
- OPTIMIZED LIGHT OUTPUT
25 Super Bright LEDs arranged in U shape provide superior light output
- INCREASED CIRCUIT EFFICIENCY
Electronic circuit is designed using current limiting resistors and surge suppressors which protect the LEDs from electrical surges
- FLICKER FREE
Low frequency direct current crest factor
- DURABLE
Made of vandal resistant tempered glass
- LONG LIFE
Quality electronic components ensure long-lasting performance
Lower driving current (20mA) to EEC reduces energy of LED die
- ADJUSTABLE BASE
Ability to align parallel to exit sign/diffuser which provides maximum amount of light
- BASES AVAILABLE
Candelabra, Intermediate and DC Izzyonet bases

SUPER SAVINGS

Existing Lamp	Replacement Lamp	Watts	Life (hrs)	Initial Cost	Annual Savings
15T6CC (145V (125W))	ENS2000-Cand (120V)	1.2	25,000	\$7.77	23%
15T6NC (145V (115W))	ENS2000-Int (120V)	1.2	25,000	\$7.93	24%
25T6 5DC (145V (25W))	ENS2000-DC (120V)	1.2	25,000	\$12.97	65%
25T6 5DC (145V (25W))	ENS2000-DC (120V)	1.2	25,000	\$12.97	25%

*Based on 24 hours/day

Note: Maintenance savings due to longer life not included in savings calculations.

PRODUCT INFORMATION

Ordering	Code	MDL	Unit
Exit - Candelabra	15T6CC	15T6CC	100
Exit - Intermediate	15T6NC	15T6NC	100
Exit - DC	25T6 5DC	25T6 5DC	100



STANPRO ADVANTAGE



Stanpro offers better light distribution than other brands

PRODUITS STANDARD PRODUCTS INC.

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