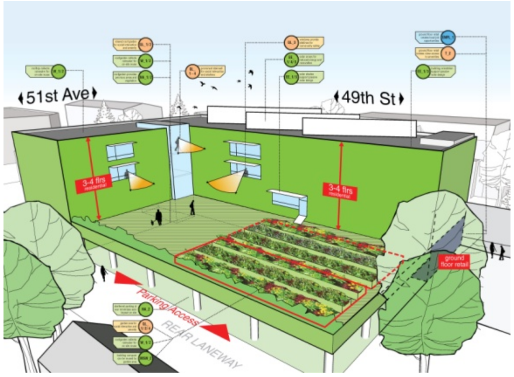
APPENDIX 1

ENERGY MODEL SUMMARY

- RETAIL SPACE ENERGY ANALYSIS
- CBIP SCREENING TOOL BASELINE
- ENERGY USE BENCHMARK



DR. TED KESIK, P.ENG.
BUILDING SCIENCE ENGINEERING . BUILDING SYSTEMS INTEGRATION

January 11, 2013

Mr. Jon Neuert
Baird Sampson Neuert Architects
317 Adelaide Street West
Suite 1004
Toronto ON M5V 1P9

Re: Design Development Stage Energy Modelling Final Report

Dear Jon:

I have completed and attached the results of energy modelling for the Yellowknife Eco-Housing Project. The methodology employed in conducting the energy simulations is as follows:

1. Individual HOT2000 models were created for each of the 24 suites and common areas.
2. A separate eQuest model was developed for the retail space.
3. The results were summarized on a spreadsheet and the annual energy use intensity was calculated for the housing portion alone, then the retail space alone, and finally for the entire development.
4. A solar water heating contribution was assumed to achieve the stated target of 50% reduction over the MNECB 1997.

The results of the analysis indicate that the minimum required solar water heating contribution must be no less than 32,000 kWh to achieve a 50% reduction. A yield of 59,000 kWh was assumed in the analysis for a system that meets nearly all of the domestic water energy demand over the spring, summer and fall months.

A sensitivity analysis was performed to see if there are any additional, cost effective measures than can be employed and nothing significant was identified. Increasing the thermal efficiency of the envelope has marginal benefits due to the high overall effective R-value of the entire building. Air source heat pumps do not sustain a competitive COP in the Yellowknife climate and improvements in HRV efficiency within the range of available units does not deliver appreciable benefits. One area for improvement is LED lighting in exterior areas where the heat is not useful for space heating, such as the parkade area, but this is not a significant energy saving measure.

This energy modelling work and sensitivity analysis indicates that almost any additional measures represent diminishing returns with the one exception being occupant behaviour - something that is difficult to energy model but has been measured as having the potential to reduce energy by up to 30%. It should be noted I am reporting entirely positive results because a 50% reduction in energy demand in the Yellowknife climate is a very significant accomplishment.

Kindly review the attached data and retail space energy modelling report and let me know if you have any questions or comments.

Sincerely,

TKesik

Dr. Ted Kesik, P.Eng.

Yellowknife Eco Housing
Energy Modelling Summary

T. Kesik 04-Dec-13

Reference Building MNECB

Based on combined residential and retail occupancies.

Annual Energy Use Intensity	***183.5***	kWh.m2
Annual Energy Use Target	91.75	kWh.m2

Unit Analysis Assumptions

Building envelope effective thermal resistance values based on design development drawings.

Window R-values vary based on the proportion of frame to glazing area and type of window (fixed vs operator).

Refer to Option 3 window characteristics, Dec. 17/12 window cost benefit analysis.

Base loads assume all Energy Star appliances, compact fluorescent lighting and hot water demand as per water conservation targets.

Ceiling	R-80	HRV/ERV	67%	Req'd Min. Seasonal Efficiency
Walls & Exposed Floors	R-60	DWHR	30%	Req'd Min. Drainwater Heat Recovery Efficiency
Windows	R-6 (nominal)			

				Base Loads			
	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit A1	4			2	5	1	120
Area	75.9	m2	303.6				
Design Heat Loss	2.5	kW					
Space Heating	1,609.6	kWh					
DHW	1,971.0	kWh					
Lighting & Appliances	2,920.0	kWh					
Total	6,500.6	kWh	26,002.4				
Annual Energy Use Intensity	***85.6***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit A2	1			2	5	1	120
Area	75.9	m2	75.9				
Design Heat Loss	2.5	kW					
Space Heating	1,930.7	kWh					
DHW	1,971.0	kWh					
Lighting & Appliances	2,920.0	kWh					
Total	6,821.7	kWh	6,821.7				
Annual Energy Use Intensity	***89.9***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit B1	1			2	5	1	80
Area	67.0	m2	67.0				
Design Heat Loss	2.0	kW					
Space Heating	1,734.6	kWh					
DHW	1,314.0	kWh					
Lighting & Appliances	2,920.0	kWh					
Total	5,968.6	kWh	5,968.6				
Annual Energy Use Intensity	***89.1***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit B2	1			2	5	1	80
Area	67.0	m2	67.0				
Design Heat Loss	2.0	kW					
Space Heating	1,184.9	kWh					
DHW	1,314.0	kWh					
Lighting & Appliances	2,920.0	kWh					
Total	5,418.9	kWh	5,418.9				
Annual Energy Use Intensity	***80.9***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit C1	1			2	5	1	80
Area	44.9	m2	44.9				
Design Heat Loss	2.0	kW					
Space Heating	1,014.4	kWh					
DHW	1,314.0	kWh					
Lighting & Appliances	2,920.0	kWh					
Total	5,248.4	kWh	5,248.4				
Annual Energy Use Intensity	***116.9***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit C2	1			2	5	1	80
Area	44.9	m2	44.9				
Design Heat Loss	2.0	kW					
Space Heating	1,014.4	kWh					
DHW	1,314.0	kWh					
Lighting & Appliances	2,920.0	kWh					
Total	5,248.4	kWh	5,248.4				
Annual Energy Use Intensity	***116.9***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit D	1			2	5	1	80
Area	47.2	m2	47.2				
Design Heat Loss	2.5	kW					
Space Heating	1,638.0	kWh					
DHW	1,314.0	kWh					
Lighting & Appliances	2,920.0	kWh					
Total	5,872.0	kWh	5,872.0				
Annual Energy Use Intensity	***124.4***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit E-1	3			2	8	1	157.5
Area	78.5	m2	235.4				
Design Heat Loss	3.0	kW					
Space Heating	2,136.5	kWh					
DHW	2,587.0	kWh					
Lighting & Appliances	4,015.0	kWh					
Total	8,738.5	kWh	26,215.4				
Annual Energy Use Intensity	***111.4***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit E-2	4			2	8	1	157.5
Area	78.5	m2	313.8				
Design Heat Loss	3.0	kW					
Space Heating	1,704.7	kWh					
DHW	2,587.0	kWh					
Lighting & Appliances	4,015.0	kWh					
Total	8,306.6	kWh	33,226.5				
Annual Energy Use Intensity	***105.9***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit E-3	1			2	8	1	157.5
Area	78.5	m2	78.5				
Design Heat Loss	3.5	kW					
Space Heating	2,511.9	kWh					
DHW	2,587.0	kWh					
Lighting & Appliances	4,015.0	kWh					

Total	9,113.9	kWh	9,113.9
Annual Energy Use Intensity	***116.2***	kWh.m2	

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit E-4	1			2	8	1	157.5
Area	78.5	m2	78.5				
Design Heat Loss	3.5	kW					
Space Heating	2,564.7	kWh					
DHW	2,587.0	kWh					
Lighting & Appliances	4,015.0	kWh					
Total	9,166.6	kWh	9,166.6				
Annual Energy Use Intensity	***116.8***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit E-5	1			2	8	1	157.5
Area	78.5	m2	78.5				
Design Heat Loss	3.0	kW					
Space Heating	2,150.1	kWh					
DHW	2,587.0	kWh					
Lighting & Appliances	4,015.0	kWh					
Total	8,752.0	kWh	8,752.0				
Annual Energy Use Intensity	***111.5***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit F-1	1			2	8	1	157.5
Area	130.1	m2	130.1				
Design Heat Loss	4.5	kW					
Space Heating	4,923.8	kWh					
DHW	2,587.0	kWh					
Lighting & Appliances	4,015.0	kWh					
Total	11,525.8	kWh	11,525.8				
Annual Energy Use Intensity	***88.6***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit F-2	1			2	8	1	157.5
Area	130.1	m2	130.1				
Design Heat Loss	4.5	kW					
Space Heating	4,002.0	kWh					
DHW	2,587.0	kWh					
Lighting & Appliances	4,015.0	kWh					
Total	10,604.0	kWh	10,604.0				
Annual Energy Use Intensity	***81.5***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit G	1			2	8	1	157.5
Area	139.7	m2	139.7				
Design Heat Loss	4.0	kW					
Space Heating	3,621.7	kWh					
DHW	2,587.0	kWh					
Lighting & Appliances	4,015.0	kWh					
Total	10,223.6	kWh	10,223.6				
Annual Energy Use Intensity	***73.2***	kWh.m2					

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Unit H	1			2	8	1	157.5
Area	155.7	m2	155.7				
Design Heat Loss	5.5	kW					
Space Heating	5,032.8	kWh					

DHW	2,587.0	kWh	
Lighting & Appliances	4,015.0	kWh	
Total	11,634.8	kWh	11,634.8
Annual Energy Use Intensity	***74.7***	kWh.m2	

	# of Units		Totals	Electric Lighting kWh	Appliances kWh	Exterior Lights kWh	DWH Litres/Day
Commons	1			7	0	0	0
Area	284.3	m2	284.3				
Design Heat Loss	9.5	kW					
Space Heating	17,631.7	kWh					
DHW	0.0	kWh					
Lighting	2,555.0	kWh					
Total	20,186.7	kWh	20,186.7				
Annual Energy Use Intensity	***71.0***	kWh.m2					

Annual Energy Demand Summary - 24 Units + Common Areas

Total Heated Area	2,275.0	m2	
Total Design Heat Loss	82.0	kW	
Total Space Heating	70,621.9	kWh	
Total DHW	52,642.8	kWh	
Total Lighting	87,965.0	kWh	
Total Energy	211,229.7	kWh	
Annual Energy Use Intensity	***92.9***	kWh.m2	Unadjusted.
Solar Water Heating Credit	30,826.1	kWh	Minimum Req'd SWH Credit 30,000 kWh/yr
Adjusted Total Energy	180,403.6	kWh	
Annual Energy Use Intensity	***79.3***	kWh.m2	Adjusted for solar water heating contribution.
% Reduction Over MNECB*	***56.78%***		* Combined overall energy use intensity of 183.5 kWh/m2.year.

Annual Energy Demand Summary - Retail Space

Total Heated Area	480.1	m2	
Space Heating	30,600.0	kWh	
Lights	22,730.0	kWh	
Equipment (Plug Loads)	4,138.0	kWh	
Auxiliary (Fans)	11,000.0	kWh	
Total Energy Use	68,468.0	kWh	
Annual Energy Use Intensity	**142.6**	kWh/m2	
% Reduction Over MNECB*	***22.28%***		* Combined overall energy use intensity of 183.5 kWh/m2.year.

Total Project Energy Performance

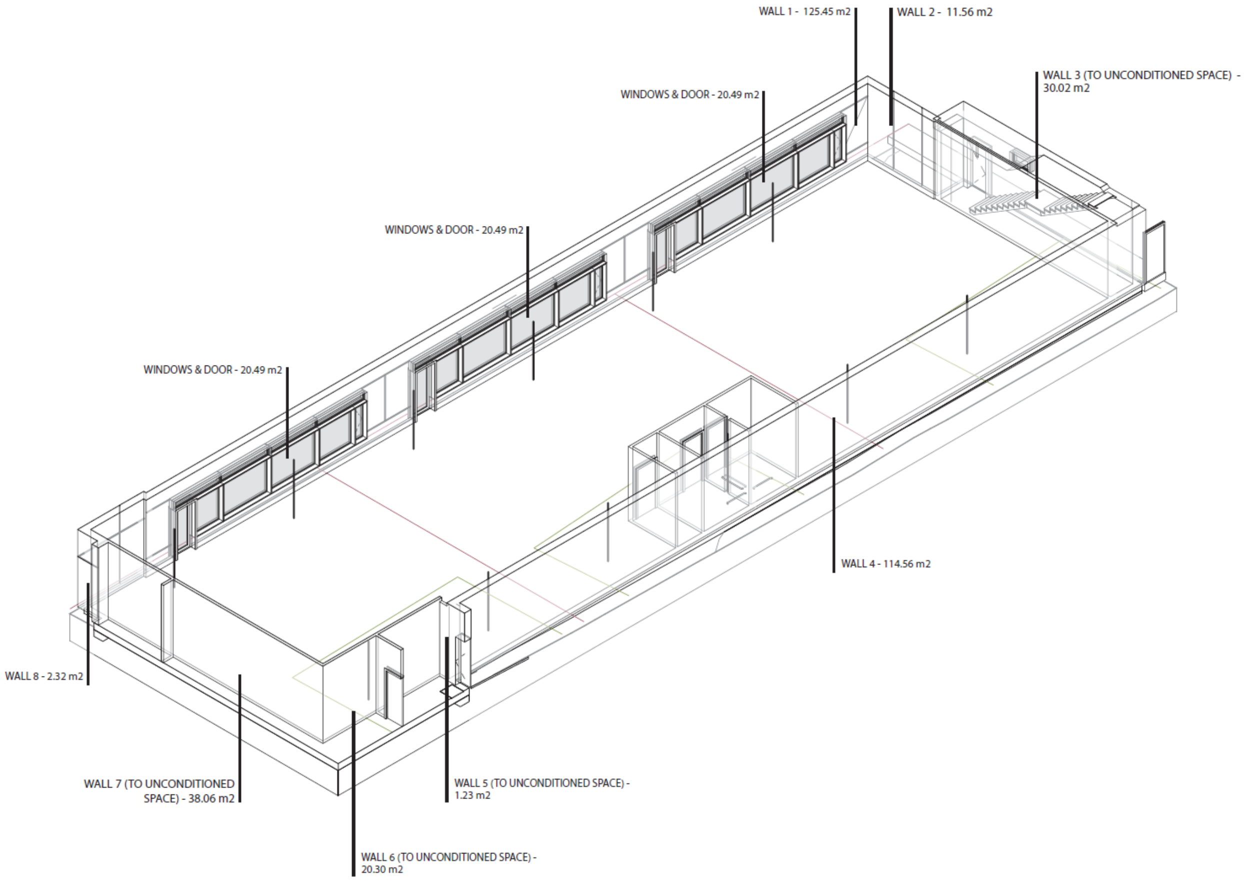
Total Project Heated Area	2,755.1	m2	
Total Project Energy	248,871.6	kWh	
Annual Energy Use Intensity	90.3	kWh/m2	
Annual Energy Use Target	91.75	kWh.m2	
% Reduction Over MNECB*	***50.8%***		* Combined overall energy use intensity of 183.5 kWh/m2.year.

NOTE: In order to meet the stipulated energy target for the entire development, solar water heating that contributes a minimim of 32,000 kWh annually must be installed. Refer to the retail space energy modelling report for the measures that must be observed by tenant improvements.

Yellowknife Eco Housing Retail Space Energy Analysis

Objective: Determine strategies that reduce the energy use intensity (EUI) of the retail space by 50% relative to the MNECB 1997 reference model (estimated at 345 kWh/m^2/year using Screening Tool for New Building Design).

Building geometry: The major dimensions of the space were modelled as 39.435 by 12.175 meters, with the long walls facing northeast and southwest. The exterior wall with glazing is northeast and has an opening to wall area ratio of 46%, based on a floor-to-ceiling height of 3.4 meters.



Modelling assumptions

- No heat is lost through walls that are adjacent to other spaces (as shown in the drawing above)
- No shading occurs from neighbouring buildings/vegetation (a reasonable assumption since glazing is northeast facing and receives little direct solar radiation anyway)
- Domestic hot water demands for the space are considered to be negligible
- The space is occupied from 9am to 9pm at varying rates (relative to full capacity at 30 m^2/person) depending on the day of the week and holidays, that are typical of a retail space.
- No mechanical cooling
- Heating is electric

Effective exterior wall R-value	R-60
Floor R-value	R-40
Effective window U-value (quad-glazed, low-e, argon)	0.68 (W/m^{2}K) R-value = 8.33)
Equipment plug load (W/m^2)	2.5

Reference case energy use

The base energy use and energy use intensity based on a retail space of the same geometry is summarized in the table below. These results indicate that the greatest opportunities for energy savings are heating and lighting.

	kWh	**kWh/m^2**
Heating	84,209	175.4
Lights	49,473	103.1
Equipment (plug)	4,138	8.6
Auxiliary (fans)	22,633	47.2
Totals	165,698	345.2

Beyond the base case, eQUEST V3.64 was used for all modelling. Because the building envelope is already very well-insulated and many of the walls are not exposed to the exterior, there is little further opportunity to reduce heating with a better envelope. The main remaining source of heat loss is outdoor air for ventilation. Use of heat recovery ventilation with a 80% effectiveness reduces the heating energy by about 60%, though at the cost of approximately a 20 kWh/m^2/year of additional fan energy.

Next, demand-controlled ventilation (DCV) can further reduce heating energy because of the highly-variable expected occupancy during occupied hours. The model suggests that DCV yields 20% energy savings over an equivalent scheduled ventilation system.

An air-source heat pump is not recommended because they do not function well below temperatures of -5°C. At this point, their coefficient performance approaches 1 – the equivalent of electric baseboard heaters.

Lighting power density in the MNECB 1997 reference case is 26.7 W/m^2. A recent guide[1] on energy efficient retail space design by the National Renewable Energy Laboratory suggested that 12 W/m^2 is feasible using high-efficiency fluorescent tube luminaires. It is important to note that this 55% reduction in lighting power density yields 55% savings in annual lighting energy use only. However, this actually causes heating energy to increase because of the reduced heat output of the luminaires. The efficient lighting is still a worthwhile upgrade because the luminaire heat output is not useful in the non-heating season and may not be useful during unoccupied hours. Use of LED luminaires is not recommended for the current state of technology, as it does not yield a significant improvement over fluorescent tube lighting with regards to lighting power density[2]. This is particularly true because this heating-dominated climate does not benefit from lighting energy reductions as much as in cooling-dominated climates, where heat must be mechanically removed from the space.

The potential for daylighting to replace electric lighting is modest because of low-solar altitudes, the orientation of the glazing, and the fact that the space is relatively deep compared to window height (~4 times). However, it is recommended that the lights near the front façade be controlled separately with manual switches to enable some exploitation of daylight.

The combined effect of heat recovery, demand controlled ventilation, and efficient lighting yields predicted energy savings of 58% relative to the MNECB 1997 reference case.

	Reference		**Design**	
	kWh	**kWh/m^2**	**kWh**	**kWh/m^2**
Heating	84,209	175.4	30600	63.8
Lights	49,473	103.1	22730	47.4
Equipment (plug)	4,138	8.6	4138	8.6
Auxilliary (fans)	22,633	47.2	11000	22.9
Totals	**165,698**	**345.2**	**68468**	**142.6**

The analysis above is based on typical operating conditions in a retail space. Specific performance is dependent on space use, commissioning, and typical year-to-year weather variations.

Prepared by Liam O'Brien, PhD
Reviewed by Dr. Ted Kesik, P.Eng.
January 7, 2013

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[1] www.nrel.gov/docs/fy08osti/42828.pdf

[2] http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led-t8-flourescent-replacement.pdf

Screening Tool For New Building Design

Screening Tool Summary

Facility Description for Yellowknife EcoHousing

Your Facility Description:

Yellowknife EcoHousing
Reference Building 1997 MNECB
Annual EUI 183.5 kWh/m2

Configuration

1. Multi-Unit Residential, Electricity - 82.2%
2. Retail, Strip Mall, Electric Resistance - 17.8%

Total Floor Area: 3,110 m²

Location: Yellowknife (B), Northwest Territories

Utility Rates

Your marginal utility rates (including any taxes and fees):

$ 0.237 per kWh

$ 0.000 per GJ

$ 14.680 per kW

$ 0.000 per litre oil/propane

First Building Block

First Building Block:	Multi-Unit Residential, 2555 m²
Heating System:	Electricity

Building Shell (Multi-Unit Residential)

	Reference Building	Your Design
Average window-to-wall-area ratio:	25.5	25.5 %
Overall window USI-value:	1.2	1.2 W/m²°C
Window shading coefficient:	0.736	0.736
Overall wall RSI-value:	3.704	3.704 m²°C/W
Gross exterior wall area:	1541	1541 m²
Roof type:	All other	All other
Overall roof RSI-value:	5	5
Gross exterior roof area:	657	657 m²

Mechanical System (Multi-Unit Residential)

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	Reference Building	Your Design
Heating efficiency:	100	100 %
Minimum outside air:	0.4	0.4 l/s/m^2
Demand control ventilation (DCV) type:	None	None
Percent of outside air controlled by DCV:	0	0 %
Percent of floor area cooled:	0	0 %
Cooling efficiency:	2.5	2.5 COP
Outdoor air economizer?	No	No
Efficiency of exhaust air heat recovery:	0	0 %
Service water heating fuel type:	Electric	Electric
Service water heating efficiency:	100	100 %
Service water savings:	0	0 %
Mechanical Efficiency Options (only applies to Your Design):		
Variable speed fans:		No

Lighting (Multi-Unit Residential)

	Reference Building	Your Design
Average lighting density:	10	10 W/m^2
Lighting controls (select if applicable and enter floor area):		
None		0 %
None		0 %

Parkade lighting (Multi-Unit Residential)

	Reference Building	Your Design
Parkade floor area:	605	605 m^2
Average lighting density:	3.2	3.2 W/m^2
Percent of lighting load with occupancy sensor control:	0	0 %

Process Loads (Multi-Unit Residential)

	Reference Building	Your Design
Average process load density:	0	0
Percent served by electricity:	0	0 %

Second Building Block

Second Building Block: Retail, Strip Mall, 555 m^2

Heating System: Electric Resistance

Building Shell (Retail, Strip Mall)

	Reference Building	Your Design
Average window-to-wall-area ratio:	28.5	28.5 %
Overall window USI-value:	1.2	1.2 W/m²°C
Window shading coefficient:	0.736	0.736
Overall wall RSI-value:	3.704	3.704 m²°C/W
Gross exterior wall area:	327	327 m²
Roof type:	All other	All other
Overall roof RSI-value:	5	5
Gross exterior roof area:	0	0 m²

Mechanical System (Retail, Strip Mall)

	Reference Building	Your Design
Heating efficiency:	100	100 %
Minimum outside air:	0.9	0.9 l/s/m²
Demand control ventilation (DCV) type:	None	None
Percent of outside air controlled by DCV:	0	0 %
Percent of floor area cooled:	100	100 %
Cooling efficiency:	2.5	2.5 COP
Outdoor air economizer?	No	No
Efficiency of exhaust air heat recovery:	0	0 %
Service water heating fuel type:	Electric	Electric
Service water heating efficiency:	100	100 %
Service water savings:	0	0 %
Mechanical Efficiency Options (only applies to Your Design):		
Variable speed fans:		No

Lighting (Retail, Strip Mall)

	Reference Building	Your Design
Average lighting density:	26.7	26.7 W/m²
Lighting controls (select if applicable and enter floor area):		
None		0 %
None		0 %

Process Loads (Retail, Strip Mall)

	Reference Building	Your Design
Average process load density:	0	0

Percent served by electricity:	0	0 %

Building Performance Results

Based on the information you provided, your building design is not 25% more energy efficient than the reference building that meets the Model National Energy Code for Buildings.

Current Design Performance

Annual Energy Use (GJ)

Reference Building	2,059	
Your Design	2,073	
Energy Savings	**-13**	**-0.6%**

Annual Energy Cost Savings **$-973.05**

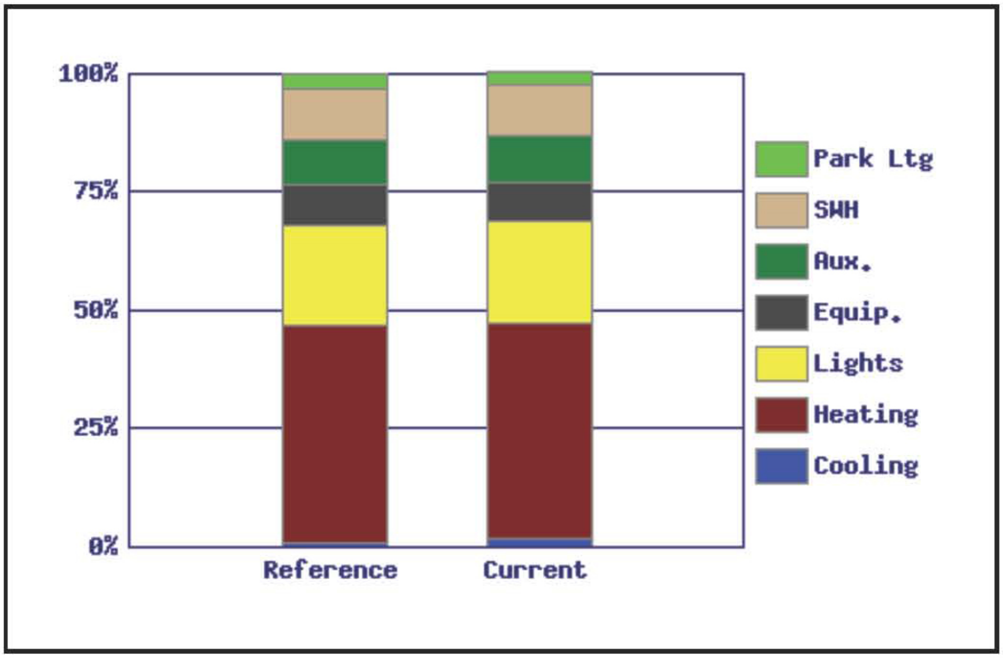
LEED® Canada Energy & Atmosphere (EA)

Does not qualify (EA Prerequisite 2 is not satisfied)

Emissions Savings

Carbon Dioxide (CO_2)	-2,005 kg

Annual Energy Use Comparison



Your Design

Annual Energy and Costs

End Use	Electricity kWh	Fossil Fuel GJ	Total Energy GJ	Costs
Cooling	9,199	0	33	$2,562
Heating	260,499	5	943	$80,674
Lights	122,787	0	442	$33,059
Equip.	47,763	0	172	$13,003
Aux.	54,894	0	198	$14,320
SWH	62,199	0	224	$18,308
Park Ltg	16,959	0	61	$4,360
Totals	574,301	5	2,073	$166,285

Reference Building

Annual Energy and Costs

End Use	Electricity kWh	Fossil Fuel GJ	Total Energy GJ	Costs
Cooling	5,431	0	20	$1,669
Heating	260,495	5	943	$80,577
Lights	122,787	0	442	$33,059
Equip.	47,763	0	172	$13,003
Aux.	54,965	0	198	$14,337
SWH	62,199	0	224	$18,308
Park Ltg	16,959	0	61	$4,360
Totals	570,600	5	2,059	$165,312

Disclaimer

The information presented on this web page gives approximate values of energy cost breakdowns and potential savings. Because the input data are not as detailed as required under the MNECB or LEED, actual results will vary. A number of factors, such as weather variations, building occupancy, other building configurations, and operation schedules, also can affect energy usage and, consequently, energy performance and savings. Therefore, we cannot guarantee that the building will perform as indicated.

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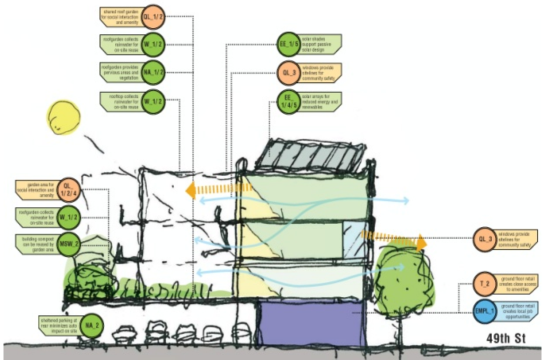
APPENDIX 2

WATER CONSUMPTION & RAIN WATER HARVESTING



Baseline / Typical Water Use Profile

	Interior							Exterior	
	Bathroom				Kitchen		Laundry	Irrigation	
Fixture	*Bath*	*Shower*	*Handwash*	*Toilet*	*Prep/Dishes*	*Dishwasher*	*Laundry Machine*	*Potable Irrigation*	*Rainwater Irrigation**
Use/Person [/day]	0.1	1	5	3	2	0.5	0.2	1	0
Per Use [L]				6		45	151	5.38	5.38
Flow Rate [L/s]	0.4	0.158	0.138		0.138				
Usage [sec]	300	600	30		120				
Volume [L]	**120**	**94.8**	**4.14**	**6**	**16.56**	**45**	**151**	**5.38**	**0**

Units	**Occupants**	**Number of Units**	**Total Occupants / Type**	**Bath**	**Shower**	**Lavatory**	**WC**	**Sink**	**Dishwasher**	**Washer**	**Potable Irrigation**	**Rainwater Irrigation**	**Interior Total Volume / day / Type**	**Interior Total Volume / day / No. Units**
Type A	3	5	15	180	1422	310.5	270	496.8	337.5	453	5.38	0	694.0	3,469.8
Type B	2	2	4	48	379.2	82.8	72	132.48	90	120.8	5.38	0	462.6	925.3
Type C	2	2	4	48	379.2	82.8	72	132.48	90	120.8	5.38	0	462.6	925.3
Type D	2	1	2	24	189.6	41.4	36	66.24	45	60.4	5.38	0	462.6	462.6
Type E	3	10	30	360	2844	621	540	993.6	675	906	5.38	0	694.0	6,939.6
Type F	5	2	10	120	948	207	180	331.2	225	302	5.38	0	1,156.6	2,313.2
Type G	4	1	4	48	379.2	82.8	72	132.48	90	120.8	5.38	0	925.3	925.3
Type H	5	1	5	60	474	103.5	90	165.6	112.5	151	5.38	0	1,156.6	1,156.6
Total Volume / Fixture / No. of Units				888	7015.2	1531.8	1332	2450.88	1665	2234.8	**Total Bdg Daily Consumption**			**17,117.7**
Volume Percentage / Fixture				**5.19%**	**40.98%**	**8.95%**	**7.78%**	**14.32%**	**9.73%**	**13.06%**				

Usage Standards, per fixture

Shower - 1.158 l/s or 9.5 LPM as per Baseline recognized by LEED NC.

Handwash - 0.138 l/s or 8.3 LPM as per Baseline recognized by LEED NC.

Toilet - 6 LPF as per Baseline recognized by LEED NC.

Prep/Dishes - 45.3 l/load as per Alliance for Water Efficiency, www.home-water-works.org

Laundry Machine - 151 l/load as per Alliance for Water Efficiency, www.home-water-works.org

Final Forecasted Water Use / Savings - December 2012

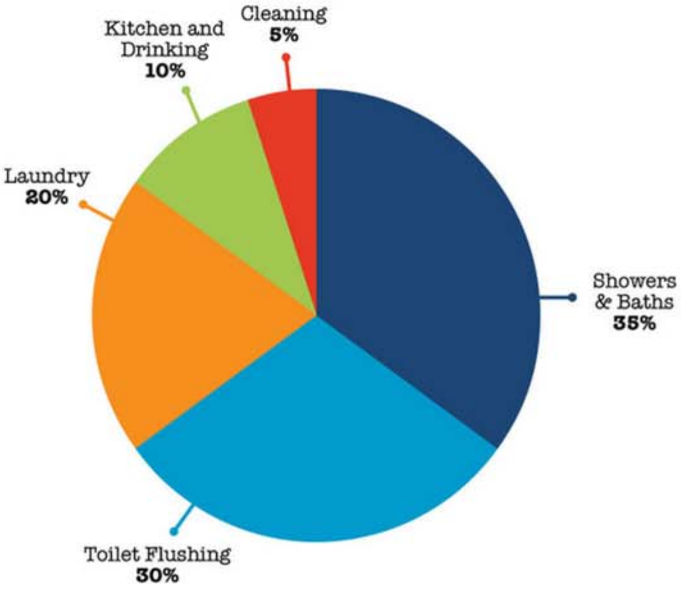
	Interior							Exterior	
	Bathroom				Kitchen		Laundry	Irrigation	
Fixture	*Bath*	*Shower*	*Handwash*	*Toilet*	*Prep/Dishes*	*Dishwasher*	*Laundry Machine*	*Potable Irrigation*	*Rainwater Irrigation**
Use/Person [/day]	0.1	1	5	3	2	0.5	0.2	0	1
Per Use [L]				3		13.14	40.43	5.38	5.38
Flow Rate [L/s]	0.4	0.078	0.033		0.095				
Usage [sec]	300	600	30		120				
Volume [L]	**120**	**46.8**	**0.99**	**3**	**11.4**	**13.14**	**40.43**	**0**	**5.38**

	Occupants	Number of Units	Total Occupants / Type	*Bath*	*Shower*	*Lavatory*	*WC*	*Sink*	*Dishwasher*	*Washer*	*Potable Irrigation*	*Rainwater Irrigation*	*Interior Total Volume / day / Type*	*Interior Total Volume / day / No. Units*
Type A	3	5	15	180	702	74.25	135	342	98.55	121.29	0	5.38	330.6	1,653.1
Type B	2	2	4	48	187.2	19.8	36	91.2	26.28	32.34	0	5.38	220.4	440.8
Type C	2	2	4	48	187.2	19.8	36	91.2	26.28	32.34	0	5.38	220.4	440.8
Type D	2	1	2	24	93.6	9.9	18	45.6	13.14	16.17	0	5.38	220.4	220.4
Type E	3	10	30	360	1404	148.5	270	684	197.1	242.58	0	5.38	330.6	3,306.2
Type F	5	2	10	120	468	49.5	90	228	65.7	80.86	0	5.38	551.0	1,102.1
Type G	4	1	4	48	187.2	19.8	36	91.2	26.28	32.34	0	5.38	440.8	440.8
Type H	5	1	5	60	234	24.75	45	114	32.85	40.43	0	5.38	551.0	551.0
Total Volume / Fixture / No. of Units				888	3463.2	366.3	666	1687.2	486.18	598.364	**Total Bdg Daily Consumption**			**8,155.2**
Volume Percentage / Fixture				**10.89%**	**42.47%**	**4.49%**	**8.17%**	**20.69%**	**5.96%**	**7.34%**	**Savings from Baseline**			**52%**

Features

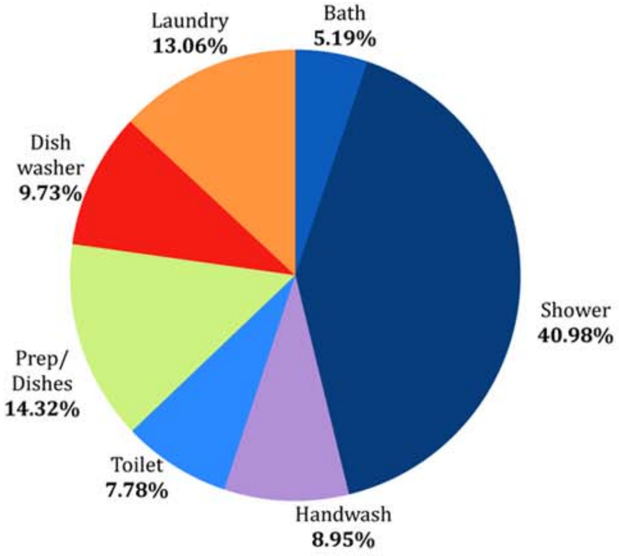
Shower - 0.0783 l/s, or 4.7LPM (1.25GPM), Showerhead
Handwash - 0.0333 l/s, or 2.0LPM (0.5GPM) Lavatory
Toilet - 3.0L/f Water Matrix Ultra High Efficiency
Prep/Dishes - 0.095 l/s, or 5.7LPM (1.5GPM) Kitchen Aerator with Pause Valve
Dishwasher - 13L/cycle Whirlpool Dishwasher
Laundry Machine - 40.43L/cycle Frigidaire 3.7cuft Clothes Washer

Residential Water Use, Canada



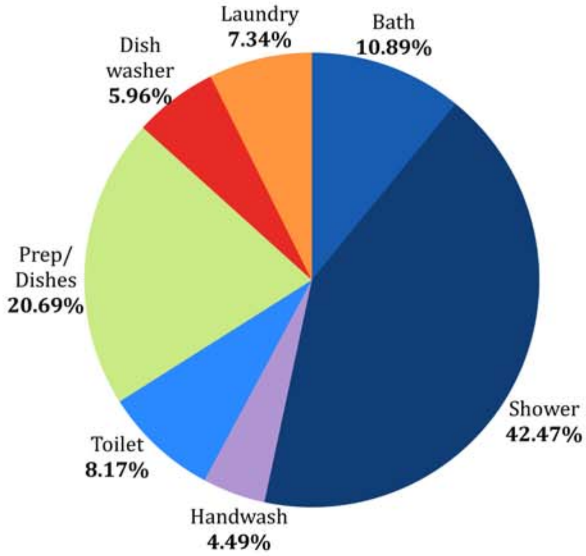
Source: Environment Canada

Baseline / Typical Water Use Assumptions



Source: BSN Architects

Forecasted Water Use / Savings



Source: BSN Architects

Rainwater Harvesting and Irrigation Potential

					Irrigation Season									
	Jan	Feb	Mar	Apr	*May*	*Jun*	*Jul*	*Aug*	Sep	Oct	Nov	Dec	Total	
Monthly rainfall (mm)	0	0	0.2	2.4	14.5	26.9	35	40.9	29.5	14.7	0.2	0.2	164.5	mm
Monthly Volume [L]				1,636	9,882	18,332	23,853	27,873	20,104	10,018				
Weekly Volume [L]				409	2,470	4,583	5,963	6,968	5,026	2,505				

YK Annual Rainfall	0.1645	m
Roof Area	681.5	m2
Potential Volume	112.1068	m3
	112,107	L

Tank Size	5000	L

Planting Area	167	m2
Optimal Weekly Water	25	mm
Weekly Water Requirement	4.175	m3
	4175	L

Weekly Irrigation Requirements

		May	*Jun*	*Jul*	*Aug*
Deficit	mm	21.375	18.275	16.25	14.775
Irrigation	Litres	3,570	3,052	2,714	2,467

Annual Savings	
47,211	Litres

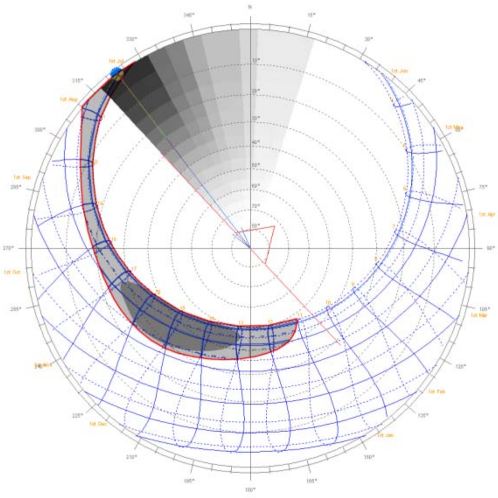
NOTES:

The 5,000 Litre rainwater storage tank is sufficient to satisfy weekly irrigation requirements, and has additional capacity to overcome dry spells.

It is forecast the rainwater harvesting system can conserve 47,211 litres of potable water annually while promoting healthy plantings.

APPENDIX 3

COST BENEFIT ANALYSIS OF WINDOW OPTIONS



DR. TED KESIK, P.ENG.
BUILDING SCIENCE ENGINEERING . BUILDING SYSTEMS INTEGRATION

December 17, 2012

Mr. Jon Neuert
Baird Sampson Neuert Architects
317 Adelaide Street West
Suite 1004
Toronto ON M5V 1P9

Re: Economic Cost-Benefit Analysis of Window Options - Yellowknife EcoHousing Project

Dear Jon:

I have completed a cost-benefit analysis of window options for the Yellowknife EcoHousing Project as per your request. The detailed results and supporting data are attached as an appendix for your review. The methodology employed in conducting this analysis is as follows:

1. Cost and performance data for candidate window options (Inline Series 325 Fixed and Casement) was processed using data furnished by your office staff.
2. HOT2000 modelling was performed for each window option to determine the annual space heating energy demand associated with each option on a per square metre basis.
3. Yellowknife energy prices and heating system conversion efficiencies provided by Williams Engineering were applied to obtain the annual energy cost per square metre of window area for each option.
4. Greenhouse gas emissions per unit of energy consumption were researched and applied in the analysis.
5. A cost-benefit analysis was performed that examined life cycle costs, internal rates of return (IRR) and discounted payback periods.
6. This report was prepared following the completion and synthesis of the analyses.

The characteristics of the windows used in the analyses are summarized in the table below.

Option	**Description**	**U-Value ($W/m^2.k$)**	**SHGC**	**VT**
Base	Pultruded fiberglass frame (insulated) with double glazing, lowE, argon, insulating spacer.	1.59	0.63	0.67
Option 1	Pultruded fiberglass frame (insulated) with triple glazing, 2-LowE, krypton, insulating spacer.	1.16	0.56	0.58
Option 2	Pultruded fiberglass frame (insulated) with double glazing, LowE + Heat Mirror suspended film, krypton, stainless steel swiggle spacer.	1.14	0.31	0.51
Option 3	Pultruded fiberglass frame (insulated) with double glazing, LowE + 2 Heat Mirror suspended films, krypton, stainless steel swiggle spacer.	0.89	0.25	0.36
U-value is area weighted based on fixed and operable window areas. SHGC (solar heat gain coefficient) and VT (visible transmittance) is based on fixed on units. *Important Note: VT less than 0.40 appears as a noticeably tinted glass.*				

The analysis did not consider system effects, such as the reduction in equipment size due to lower heat losses, cooling, comfort or condensation potential. It is especially important to note that solar gains were not considered as this would require a whole building energy analysis. It may be expected that Option 3 will have less than half the solar gains associated with Option 1 and admit significantly less daylight. All of the above considerations aside, the following conclusions may be derived from this cost benefit analysis exercise.

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Key Conclusions

These conclusions are premised on the perspective of a tenant/owner that is occupying the unit over a 25-year period corresponding to a typical mortgage. The only economic measure that can assess cost effectiveness from this perspective is life cycle cost, specifically net present value (NPV) accounting for prevailing interest rates and energy price inflation rates. Refer to the appendix attached to this report for internal rate of return (IRR) and discounted payback measures.

1. Based on life cycle costs and IRR over a 25-year study period, Option 1 provides the best value when the building is heated with electricity.
2. The most energy efficient window with the lowest life cycle cost is Option 3 when the building is heated with electricity.
3. Based on life cycle costs and IRR over a 25-year study period, Option 1 provides the best value when the building is heated with wood pellets.
4. The window with the lowest life cycle cost is Option 1 when the building is heated with wood pellets.
5. Based on life cycle costs and IRR over a 25-year study period, Option 1 provides the best value when the building is heated with propane.
6. The window with the lowest life cycle cost is Option 1 when the building is heated with propane.
7. Based on life cycle costs and IRR over a 25-year study period, Option 1 provides the best value when the building is heated with oil.
8. The window with the lowest life cycle cost is Option 3 when the building is heated with oil.

Summary

The average difference in 25-year study period life cycle costs between electric baseboard and central boiler heating (wood pellets, propane & oil) is $838.75 per m2 of window area. Looking at a total window area of 218.2 m2, the central boiler heating options only make financial sense if they can be installed at a marginal cost premium of $183,016 inclusive of all equipment, piping, radiators, controls, individual meters and taxes. This alternative scenario also carries greenhouse gas emission implications if the propane or oil energy sources are selected.

Given the cost premiums associated with Options 2 and 3, it appears the best value and daylighting quality is obtained from Option 1 - Pultruded fiberglass frame (insulated) with triple glazing, 2-LowE, krypton, insulating spacer. It is very important to appreciate, however, that Option 3 thermal performance was assumed in the preliminary whole building energy analysis in order to achieve the 50% better than MNECB energy target. I wish to convey to the design team and project steering committee at this time that window selection has numerous system cost and performance implications. It is also highly advisable to obtain samples of the Option 1 and 3 glazing before concluding window selection.

I trust this cost-benefit analysis proves helpful in your deliberations.

Sincerely,

TKesik

Dr. Ted Kesik, P.Eng.

Economic Cost-Benefit Analysis of Window Options - Yellowknife EcoHousing

Energy analysis is based on HOT2000 energy simulation software, NRCan.
Life cycle costing is based on ASTM E917 Practice for Measuring Life Cycle Costs of Buildings and Building Systems.
Costs associated with externalities not included. Benefits associated with improved health and comfort not included.
Avoided costs due to lower sized equipment/services not included. Solar gains not included.
LCCA is based on a 1 m2 window area. Total project window area = 218.2 m2

Energy Rates:	Wood Pellets	78%	$0.48	kg	$0.118	per kWh
	Electricity	100%	$0.27	kWh	$0.269	per kWh
	Propane	90%	$0.78	litre	$0.121	per kWh
	Oil	82%	$1.22	litre	$0.139	per kWh

Window Types

Base Window: Pultruded fiberglass frame (insulated) with double glazing, lowE, argon, insulating spacer.
Option 1: Pultruded fiberglass frame (insulated) with triple glazing, 2-LowE, krypton, insulating spacer.
Option 2: Pultruded fiberglass frame (insulated) with double glazing, LowE + Heat Mirror suspended film, krypton, stainless steel swiggle spacer.
Option 3: Pultruded fiberglass frame (insulated) with double glazing, LowE + 2 Heat Mirror suspended films, krypton, stainless steel swiggle spacer.

Window Type	**Unit Cost (m2)**	**Annual Energy (kWh)**
Base (RSI 0.63)	$452	394
Option 1 (RSI-0.86)	$568	260
Option 2 (RSI-0.88)	$699	255
Option 3 (RSI-1.12)	$807	199

Greenhouse Gas Emissions

1 kWh	Wood Pellets	0	kg CO2e
1 kWh	Electricity	0	kg CO2e
1 kWh	Propane	0.218	kg CO2e
1 kWh	Oil	0.265	kg CO2e

Economic Assessment Parameters
Two interest (discount) rate and energy cost escalation rate scenarios are considered in this analysis.

	Current	***High***
Interest Rate	**1.5%**	**2.0%**
Escalation Rate	**2.5%**	**3.5%**
Study Period (yrs)	**5**	**5**
	10	**10**
	25	**25**

ELECTRIC SPACE HEATING

	Energy Consumption	**Capital Cost**	**Annual Energy**	**NPV of Energy**		**NPV of Energy + Window Option**	
				Current	***High***	***Current***	***High***
Base Case		**$452**	**$105.84**	**$545**	**$553**	**$997**	**$1,005**
Electricity (kWh)	394			**$1,118**	**$1,148**	**$1,570**	**$1,600**
Annual CO2 (kg)	0			**$3,013**	**$3,217**	**$3,466**	**$3,669**
Option 1		**$568**	**$69.83**	**$360**	**$365**	**$928**	**$933**
Electricity (kWh)	260			**$737**	**$757**	**$1,305**	**$1,326**
				$1,988	**$2,122**	**$2,556**	**$2,690**

Payback (years)	3.15	@ Current energy escalation rate	**IRR =** 34.3%
	3.12	@ High energy escalation rate	**IRR =** 35.6%
Annual Savings	$36.02		
Cost Premium*	$116		
Annual CO2 Credit	0	kg	

	Energy Consumption	**Capital Cost**	**Annual Energy**	**NPV of Energy**		**NPV of Energy + Window Option**	
				Current	***High***	***Current***	***High***
Option 2		**$699**	**$68.60**	**$353**	**$358**	**$1,053**	**$1,058**
Electricity (kWh)	255			**$724**	**$744**	**$1,424**	**$1,443**
				$1,953	**$2,085**	**$2,652**	**$2,784**

Payback (years)	6.39	@ Current energy escalation rate	**IRR =** 17.4%
	6.28	@ High energy escalation rate	**IRR =** 18.6%
Annual Savings	$37.24		
Cost Premium*	$247		
Annual CO2 Credit	0	kg	

	Energy Consumption	**Capital Cost**	**Annual Energy**	**NPV of Energy**		**NPV of Energy + Window Option**	
				Current	***High***	***Current***	***High***
Option 3		**$807**	**$53.62**	**$276**	**$280**	**$1,083**	**$1,087**
Electricity (kWh)	199			**$566**	**$582**	**$1,373**	**$1,389**
				$1,526	**$1,630**	**$2,334**	**$2,437**

Payback (years)	6.55	@ Current energy escalation rate	**IRR =** 15.3%
	6.43	@ High energy escalation rate	**IRR =** 15.9%
Annual Savings	$52		
Cost Premium*	$355		
Annual CO2 Credit	0	kg	

COMMENTARY

1. Based on life cycle costs and IRR over a 25-year study period, Option 1 provides the best value when the building is heated with electricity.
2. The most energy efficient window with the lowest life cycle cost is Option 3 when the building is heated with electricity.

WOOD PELLET SPACE HEATING

	Energy Consumption	Capital Cost	Annual Energy	NPV of Energy *Current*	NPV of Energy *High*	NPV of Energy + Window Option *Current*	NPV of Energy + Window Option *High*
Base Case		**$452**	**$46.30**	**$545**	**$242**	**$997**	**$694**
Wood Pellets (kWh)	394			**$1,118**	**$502**	**$1,570**	**$954**
Annual CO2 (kg)	0			**$3,013**	**$1,407**	**$3,466**	**$1,859**
Option 1		**$568**	**$30.54**	**$157**	**$160**	**$726**	**$728**
Wood Pellets (kWh)	260			**$322**	**$331**	**$891**	**$899**
				$869	**$928**	**$1,438**	**$1,496**

Payback (years)	7.07	@ Current energy escalation rate	**IRR =** 34.3%
	6.94	@ High energy escalation rate	**IRR =** 35.6%
Annual Savings	$15.75		
Cost Premium*	$116		
Annual CO2 Credit	0	kg	

	Energy Consumption	Capital Cost	Annual Energy	NPV of Energy *Current*	NPV of Energy *High*	NPV of Energy + Window Option *Current*	NPV of Energy + Window Option *High*
Option 2		**$699**	**$30.01**	**$155**	**$157**	**$854**	**$856**
Wood Pellets (kWh)	255			**$317**	**$325**	**$1,016**	**$1,025**
				$854	**$912**	**$1,553**	**$1,611**

Payback (years)	14.07	@ Current energy escalation rate	**IRR =** 17.4%
	13.60	@ High energy escalation rate	**IRR =** 18.6%
Annual Savings	$16.29		
Cost Premium*	$247		
Annual CO2 Credit	0	kg	

	Energy Consumption	Capital Cost	Annual Energy	NPV of Energy *Current*	NPV of Energy *High*	NPV of Energy + Window Option *Current*	NPV of Energy + Window Option *High*
Option 3		**$807**	**$23.45**	**$121**	**$123**	**$928**	**$930**
Wood Pellets (kWh)	199			**$248**	**$254**	**$1,055**	**$1,062**
				$668	**$713**	**$1,475**	**$1,520**

Payback (years)	14.39	@ Current energy escalation rate	**IRR =** 15.3%
	13.91	@ High energy escalation rate	**IRR =** 15.9%
Annual Savings	$23		
Cost Premium*	$355		
Annual CO2 Credit	0	kg	

COMMENTARY

1. Based on life cycle costs and IRR over a 25-year study period, Option 1 provides the best value when the building is heated with wood pellets.
2. The window with the lowest life cycle cost is Option 1 when the building is heated with wood pellets.

PROPANE SPACE HEATING

	Energy Consumption	Capital Cost	Annual Energy	NPV of Energy *Current*	NPV of Energy *High*	NPV of Energy + Window Option *Current*	NPV of Energy + Window Option *High*
Base Case		**$452**	**$47.81**	**$545**	**$250**	**$997**	**$702**
Propane (kWh)	394			**$1,118**	**$518**	**$1,570**	**$971**
Annual CO2 (kg)	86			**$3,013**	**$1,453**	**$3,466**	**$1,905**
Option 1		**$568**	**$31.54**	**$162**	**$165**	**$731**	**$733**
Propane (kWh)	260			**$333**	**$342**	**$901**	**$910**
				$898	**$959**	**$1,466**	**$1,527**

Payback (years)	6.85	@ Current energy escalation rate	**IRR =** 34.3%
	6.73	@ High energy escalation rate	**IRR =** 35.6%
Annual Savings	$16.27		
Cost Premium*	$116		
Annual CO2 Credit	29	kg	

	Energy Consumption	Capital Cost	Annual Energy	NPV of Energy *Current*	NPV of Energy *High*	NPV of Energy + Window Option *Current*	NPV of Energy + Window Option *High*
Option 2		**$699**	**$30.99**	**$160**	**$162**	**$859**	**$861**
Propane (kWh)	255			**$327**	**$336**	**$1,026**	**$1,035**
				$882	**$942**	**$1,581**	**$1,641**

Payback (years)	13.65	@ Current energy escalation rate	**IRR =** 17.4%
	13.21	@ High energy escalation rate	**IRR =** 18.6%
Annual Savings	$16.82		
Cost Premium*	$247		
Annual CO2 Credit	30	kg	

	Energy Consumption	Capital Cost	Annual Energy	NPV of Energy *Current*	NPV of Energy *High*	NPV of Energy + Window Option *Current*	NPV of Energy + Window Option *High*
Option 3		**$807**	**$24.22**	**$125**	**$127**	**$932**	**$934**
Propane (kWh)	199			**$256**	**$263**	**$1,063**	**$1,070**
				$689	**$736**	**$1,497**	**$1,543**

Payback (years)	13.97	@ Current energy escalation rate	**IRR =** 15.3%
	13.51	@ High energy escalation rate	**IRR =** 15.9%
Annual Savings	$24		
Cost Premium*	$355		
Annual CO2 Credit	42	kg	

COMMENTARY

1. Based on life cycle costs and IRR over a 25-year study period, Option 1 provides the best value when the building is heated with propane.
2. The window with the lowest life cycle cost is Option 1 when the building is heated with propane.

OIL SPACE HEATING

	Energy Consumption	Capital Cost	Annual Energy	NPV of Energy		NPV of Energy + Window Option	
				Current	*High*	*Current*	*High*
Base Case		**$452**	**$54.66**	**$545**	**$286**	**$997**	**$738**
Oil (kWh)	394			**$1,118**	**$593**	**$1,570**	**$1,045**
Annual CO2 (kg)	104			**$3,013**	**$1,661**	**$3,466**	**$2,113**
Option 1		**$568**	**$36.06**	**$186**	**$188**	**$754**	**$757**
Oil (kWh)	260			**$381**	**$391**	**$949**	**$959**
				$1,027	**$1,096**	**$1,595**	**$1,664**

Payback (years)	6.02	@ Current energy escalation rate	**IRR =**	34.3%
	5.92	@ High energy escalation rate	**IRR =**	35.6%
Annual Savings	$18.60			
Cost Premium*	$116			
Annual CO2 Credit	36	kg		

Option 2		**$699**	**$35.43**	**$182**	**$185**	**$882**	**$884**
Oil (kWh)	255			**$374**	**$384**	**$1,073**	**$1,083**
				$1,009	**$1,077**	**$1,708**	**$1,776**

Payback (years)	12.04	@ Current energy escalation rate	**IRR =**	17.4%
	11.69	@ High energy escalation rate	**IRR =**	18.6%
Annual Savings	$19.23			
Cost Premium*	$247			
Annual CO2 Credit	37	kg		

Option 3		**$807**	**$27.69**	**$143**	**$145**	**$950**	**$952**
Oil (kWh)	199			**$292**	**$300**	**$1,100**	**$1,107**
				$788	**$841**	**$1,595**	**$1,649**

Payback (years)	12.32	@ Current energy escalation rate	**IRR =**	15.3%
	11.96	@ High energy escalation rate	**IRR =**	15.9%
Annual Savings	$27			
Cost Premium*	$355			
Annual CO2 Credit	51	kg		

COMMENTARY

1. Based on life cycle costs and IRR over a 25-year study period, Option 1 provides the best value when the building is heated with oil.
2. The window with the lowest life cycle cost is Option 3 when the building is heated with oil.

SUMMARY

The average difference in 25-year study period life cycle costs between electric baseboard and central boiler heating (wood pellets, propane & oil) is $838.75 per m2 of window area. Looking at a total window area of 218.2 m2, the central boiler heating options only make financial sense if they can be installed at a marginal cost premium of $183,016 inclusive of all equipment, piping, radiators, controls, individual meters and taxes. This alternative scenario also carries greenhouse gas emission implications if the propane or oil energy sources are selected.

APPENDIX 4

TENTATIVE PRODUCTS SELECTION & MANUFACTURER REPORTS

- ELECTRIC BASEBOARD HEATER
- HEAT RECOVERY VENTILATOR
- HEAT RECOVERY DRAIN PIPE
- ELECTRIC TANKLESS WATER HEATER
- HIGH EFFICIENCY TOLIETS
- RAINWATER HARVESTING
- PHOTOVALTAIC PANEL
- FIBREGLASS WINDOWS & DOORS
- THERMALLY BROKEN CLADDING SYSTEMS
- SOLAR HOT WATER COLLECTOR

series

OFM

Electric Baseboard Heater

○ ○ ● ● ● ● ● ● ●

A distinctive style

The OFM baseboard heater is more compact than any other heater on the market while offering a high level of performance and strength.

Trim lines enhance the appearance of this unique heater. Rounded corners and edges make it safe for toddlers.

A large access compartment and a single-screw connector allow more flexibility when connecting the baseboard.

	Features
Color	- Standard: white, almond. - Optional: metallic silver, bronze, metallic charcoal, textured black, beige-grey, aluminum, semi-gloss black (upcharge of 10%). - Custom colors available upon request.
Finish	- Standard: epoxy/polyester powder paint. - May be repainted with any interior paint.
Voltage	- 120V, 208V, 240V/208V, 277V, 347V, 480V, 600V, 1-phase.
Construction	- 20-gauge steel connection box. - 22-gauge steel body. - 20-gauge steel front panel. - Rounded upper corners. - Linear high-limit temperature control with automatic reset. High altitude version available (-HA).
Heating element	- Stainless steel tubular heating element with aluminum fins. - Floating heating element on high-temperature nylon bushings eliminating expansion noises.
Watt density	- Average standard watt density of 275W/ft. (900W/m). - Average low watt density of 200W/ft. (650W/m).
Control	- A wide selection of built-in thermostats available. - Built-in thermostat kit can be installed at either end. - Built-in relay kit fits in the right end box only. - A compartment for low voltage connections (located directly under the junction box) facilitates the installation of low voltage relay in electric baseboard. *Ouellet highly recommends to use an electronic wall thermostat for greater comfort.*
Installation	- Installation directly on the floor. - Connection box at both ends of the heater. - Single-screw built-in wire holder. - Raceway for ease of installation. - Two rows of mounting holes spaced on 1 in. (25.4 mm) intervals for ease of installation. - Variety of accessories available for wall-to-wall installation.
Warranty	- 1-year warranty against defects. - Heating element has a lifetime warranty for the initial end user.
Applications	- Kitchen, living room, family room, bedroom, bay window, basement, commercial building, office building, condos, restaurant.

Average Standard Watt Density Models 275W/ft. (900W/m)

Watts	Watts 240V/208V	Product #							Length		Weight	
		120V	Price	208V	240V/208V	Price	347V	600V	Price	in.	mm	lb	kg
300	300/225	OFM0302	54.25	OFM0308	OFM0300	44.75	-	-	-	22 5/16	566	4.5	2.0
500	500/375	OFM0502	57.25	OFM0508	OFM0500	46.75	OFM0507	-	53.75	27 3/16	691	5.5	2.5
750	750/563	OFM0752	66.25	OFM0758	OFM0750	54.25	OFM0757	OFM0756	63.25	37 3/16	945	7.3	3.3
1000	1000/750	OFM1002	77.00	OFM1008	OFM1000	63.50	OFM1007	OFM1006	74.25	47 1/2	1206	9.0	4.0
1250	1250/938	OFM1252	94.50	OFM1258	OFM1250	75.50	OFM1257	OFM1256	89.75	57	1447	10.5	4.8
1500	1500/1125	OFM1502	99.00	OFM1508	OFM1500	81.25	OFM1507	OFM1506	96.25	65 11/16	1668	12.0	5.5
1750	1750/1313	-	-	OFM1758	OFM1750	97.00	OFM1757	OFM1756	116.25	75	1905	13.5	6.2
2000	2000/1500	-	-	OFM2008	OFM2000	106.25	OFM2007	OFM2006	123.75	83 13/16	2128	15.0	6.8
2250[1]	2250/1688[1]	-	-	OFM2258	OFM2250	117.50	OFM2257	OFM2256	137.00	92 5/8	2353	16.5	7.5
2500[1]	2500/1875[1]	-	-	OFM2508	OFM2500	126.00	OFM2507	OFM2506	146.75	101 13/16	2585	18.0	8.2

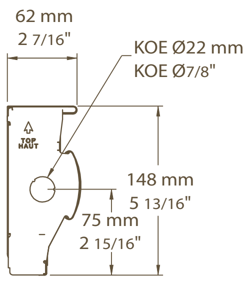
Average Low Watt Density Models 200W/ft. (650W/m)

Watts	Watts 240V/208V	Product #							Length		Weight	
		120V	Price	208V	240V/208V	Price	347V	600V	Price	in.	mm	lb	kg
300	300/225	OFM0302-691	57.25	OFM0308-691	OFM0300-691	46.75	-	-	-	27 3/16	691	5.5	2.5
500	500/375	OFM0502-945	66.25	OFM0508-945	OFM0500-945	54.25	OFM0507-945	-	63.25	37 3/16	945	7.3	3.3
750	750/563	OFM0752-1206	77.00	OFM0758-1206	OFM0750-1206	63.50	OFM0757-1206	OFM0756-1206	74.25	47 1/2	1206	9.0	4.0
1000	1000/750	OFM1002-1447	94.50	OFM1008-1447	OFM1000-1447	75.50	OFM1007-1447	OFM1006-1447	89.75	57	1447	10.5	4.8
1250	1250/938	OFM1252-1668	99.00	OFM1258-1668	OFM1250-1668	81.25	OFM1257-1668	OFM1256-1668	96.25	65 11/16	1668	12.0	5.5
1500	1500/1125	OFM1502-2128	118.50	OFM1508-2128	OFM1500-2128	106.25	OFM1507-2128	OFM1506-2128	123.75	83 13/16	2128	15.0	6.8
1750[1]	1750/1313[1]	-	-	OFM1758-2353	OFM1750-2353	117.50	OFM1757-2353	OFM1756-2353	137.00	92 5/8	2353	16.5	7.5
2000[1]	2000/1500[1]	-	-	OFM2008-2585	OFM2000-2585	126.00	OFM2007-2585	OFM2006-2585	146.75	101 13/16	2585	18.0	8.2
2250[1]	2250/1688[1]	-	-	OFM2258-2585	OFM2250-2585	126.00	OFM2257-2585	OFM2256-2585	146.75	101 13/16	2585	18.0	8.2

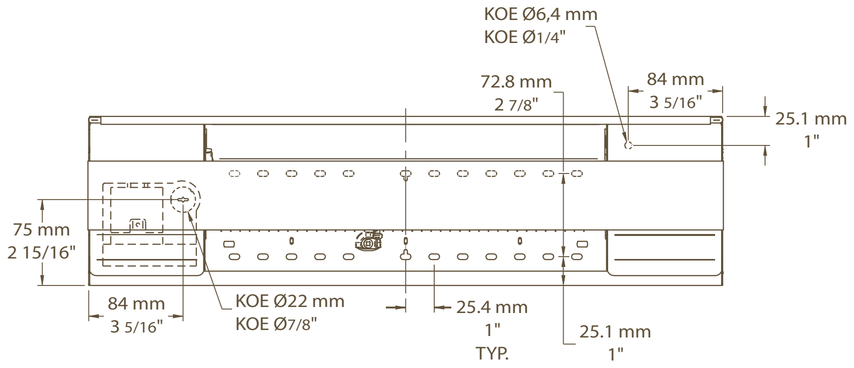
[1] These models must be ordered in pairs to reduce shipping damages.

Add "BL" for white, "AM" for almond. Optional colors shown in the color chart section are available with a 10% upcharge.

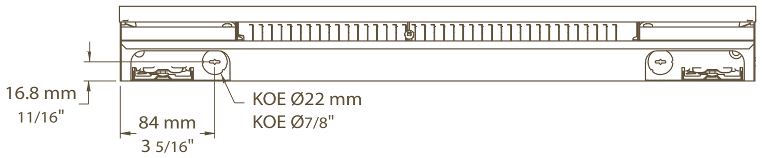
Other voltages available upon request.



Side View



Rear View



Bottom View

Options

Product #	Description	Factory Installed	Kit	Price
OFM-CI	Corners (inside and outside)	-	✓	**60.25**
OFM-DIS20	Disconnect switch, double-pole, 20A at 250V max.	✓	✓	**93.00**
OFM-JT	Splice plate 3 9/16 in. (90 mm)	-	✓	**28.25**
OFM-RO1	Baseboard section 6 in. (152 mm) - Surface-mount 5-15R receptacle - 15A at 120V	-	✓	**47.00**
OFM-RO2	Baseboard section 6 in. (152 mm) - 240V splitter box toward a surface-mount, 6-20R receptacle (20A switch, double-pole, double-throw)	-	✓	**160.25**
OFM-RO2B	Baseboard section 6 in. (152 mm) - Surface-mount 6-20R receptacle - 240V	-	✓	**130.25**
OFM-R-347	Single-pole relay, coil 24V, without transformer: 22A at 120V, 208V, 240V - 18A at 347V	✓	✓	**49.75**
OFM-R-600	Single-pole relay, coil 24V, without transformer, 10A at 600V	✓	✓	**68.00**
OFM-RT-120[1]	Single-pole relay, coil 24V, with transformer, 25A at 120V (2-wire only)	✓	✓	**129.00**
OFM-RT-208	Single-pole relay, coil 24V, with transformer, 22A at 208V	✓	✓	**70.25**
OFM-RT-240	Single-pole relay, coil 24V, with transformer, 22A at 240V	✓	✓	**70.25**
OFM-RT-277	Single-pole relay, coil 24V, with transformer, 19A at 277V	✓	✓	**70.25**
OFM-RT-347	Single-pole relay, coil 24V, with transformer, 18A at 347V	✓	✓	**70.25**
OFM-RT-600[1]	Single-pole relay, coil 24V, with transformer, 10A at 600V (2-wire only)	✓	✓	**101.25**
OFM-240SPLITTER	Baseboard section 6 in. (152 mm) - 240V splitter box to permanently connect an air conditioner (20A switch, double-pole, double-throw)	-	✓	**69.25**
OFM-SR	Baseboard section 6 in. (152 mm) for the installation of a 24V relay (relay not included)	-	✓	**50.25**
OFM-TB6[2]	Single-pole bi-metal thermostat: 25A at 120V, 208V, 240V, 277V - 10A at 347V, 480V, 600V	✓	✓	**27.25**
OFM-TB26[2]	Double-pole bi-metal thermostat: 25A at 120V, 208V, 240V, 277V - 10A at 347V, 480V, 600V	✓	✓	**32.25**
OFM-TB6-AV[2]	Single-pole bi-metal thermostat, tamperproof: 25A at 120V, 208V, 240V, 277V - 10A at 347V, 480V, 600V	✓	✓	**48.00**
OFM-TB26-AV[2]	Double-pole bi-metal thermostat, tamperproof: 25A at 120V, 208V, 240V, 277V - 10A at 347V, 480V, 600V	✓	✓	**49.50**
OFM-THRF-KLE-XX[3]	Wireless thermostat and relay module for heaters factory installed at left end - English display (XX = Length (mm) of the OFM unit) Ex.: OFM-THRF-KLE-566 for OFM0300BL	✓	-	**280.50**
OFM-THRF-KLF-XX[3]	Wireless thermostat and relay module for heaters factory installed at left end - French display (XX = Length (mm) of the OFM unit) Ex.: OFM-THRF-KLF-566 for OFM0300BL	✓	-	**280.50**
OFM-THRF-KRE-XX[3]	Wireless thermostat and relay module for heaters factory installed at right end - English display (XX = Length (mm) of the OFM unit) Ex.: OFM-THRF-KRE-566 for OFM0300BL	✓	-	**280.50**
OFM-THRF-KRF-XX[3]	Wireless thermostat and relay module for heaters factory installed at right end - French display (XX = Length (mm) of the OFM unit) OFM-THRF-KRF-566 for OFM0300BL	✓	-	**280.50**
OFM-THRF-ML-XX[4]	Wireless relay module for heaters factory installed at left end (XX = Length (mm) of the OFM unit) Ex.: OFM-THRF-ML-566 for OFM0300BL	✓	-	**188.75**
OFM-THRF-MR-XX[4]	Wireless relay module for heaters factory installed at right end (XX = Length (mm) of the OFM unit) FM-THRF-MR-566 for OFM0300BL	✓	-	**188.75**
OFM-TRIAC-347	Single-pole electronic relay, coil 24V, without transformer, 15A at 347V max.	✓	✓	**49.25**
OFM-TRIAC-347T	Single-pole electronic relay, coil 24V, with transformer: 15A at 208V, 240V, 347V	✓	✓	**69.00**
OFM-TRIAC-600	Single-pole electronic relay, coil 24V, without transformer, 6A at 600V max.	✓	✓	**90.00**

[1] 2-wire relay with transformer not for use with 3-wire low voltage remote thermostat.

[2] "Off" position.

[3] See features at page 113.

[4] See features at page 114.

For options available as factory installed and kit, if not mentioned on the order, will automatically be shipped as a kit.

LIFEBREATH®
THE ULTIMATE AIR EXCHANGER

HEAT RECOVERY VENTILATOR

Model 195ECM

ENGINEERING DATA

THERMALLY CONDUCTIVE, PATENTED ALUMINUM CORE

The cross-flow heat recovery core transfers heat between the two airstreams. The two cores are arranged for highly efficient counter current airflow.

MOTORS AND BLOWERS

Each air stream has one centrifugal blower driven by a common ECM motor. 5 speed fan operation. 120 VAC, 1.7 Amps.

FILTERS

Washable air filters in exhaust and supply air streams.

MOUNTING THE HRV

Four threaded inserts at corners of the cabinet designed to accept the “S” hooks and hanging straps supplied with the unit.

DEFROST

Damper defrost system.

CASE

Twenty gauge prepainted galvanized steel (G60) for superior corrosion resistance. Insulated to prevent exterior condensation. Drain connections 2 - 1/2" (12 mm) OD.

WEIGHT 88 lbs. (40 kg) **SHIPPING WEIGHT** 92 lbs. (41.8 kg)

CONTROLS & ELECTRONICS

The **Lifestyle MAX Digital Control** (included with unit) can be wall mounted in a central location of the home. (3 wire) 20 gauge wire (min.) 100' length

Electronic features include:

- 5 Speed Operation on each mode
- 2 user selectable operational modes: Continuous Ventilation, 20 ON/40 OFF
- Humidity Control through dehumidistat
- Adjustable Dehumidistat function built into the main wall control
- Built-in Relay for Interfacing to furnace

OPTIONAL PROGRAMMABLE CONTROL

99-LS-01	**Lifestyle MAX Programmable Control** - contains all the features of the Lifestyle MAX Digital Control with 7/24 programmable ventilation, (3 wire) 20 gauge wire (min.) 100' length

OPTIONAL TIMERS

99-DET01	**Lifestyle 20/40/60 Minute Timer** - Initiates high speed ventilation for 20, 40, or 60 minutes, (3 wire) 20 gauge wire (min.) 100' length
99-20M01	**Lifestyle 20 Minute Timer** - Initiates high speed ventilation for 20 minutes, (3 wire) 20 gauge wire (min.) 100’ length.
99-101	**Mechanical Timer** - Initiates High speed ventilation for up to 60 minutes, (2 wire) 20 gauge wire (min.) 100' length

OPTIONAL ACCESSORIES

99-DH-01	**Lifestyle Dehumidistat -** Initiates high speed ventilation when the indoor humidity level is above the set point. (3 wire) 20 gauge wire (min.) 100' length
99-163	**Duct Heater w/ Electronic SCR Thermostat,** 1 Kw, 6” (150 mm)
99-186	**Weatherhoods**, Two - 6” (150 mm) c/w 1/4” (6 mm) mesh screen

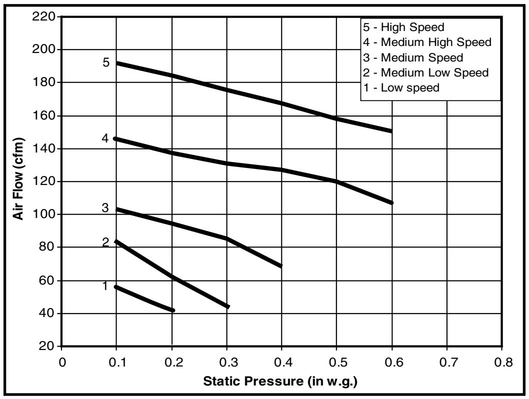
Performance

Net supply air flow in cfm (L/s) against external static pressure

E.S.P (external static pressure)		***[cfm (L/s)]***
@ 0.1" (25 Pa)		191 (90)
@ 0.2" (50 Pa)		184 (86)
@ 0.3" (75 Pa)		177 (83)
@ 0.4" (100 Pa)		169 (80)
@ 0.5" (125 Pa)		159 (75)
@ 0.6" (150 Pa)		152 (71)
Max. Temperature Recovery		88%
Sensible Effectiveness @ 114 cfm (54 L/s)	32°F (0°C)	85%
*Sensible Efficiency @ 114 cfm (54 L/s)	32°F (0°C)	78%
*Sensible Efficiency @ 119 cfm (56 L/s)	-13°F (-25°C)	69%
VAC @ 60HZ		120
WATTS / Low speed		34
WATTS / High speed		129
Amp rating		1.7

**Sensible Efficiency – thermal **Latent Efficiency – moisture*

Note: Effectiveness - based on temp. differential between the 2 airstreams
Efficiency – takes into account all power inputs



All units conform to CSA and UL standards.

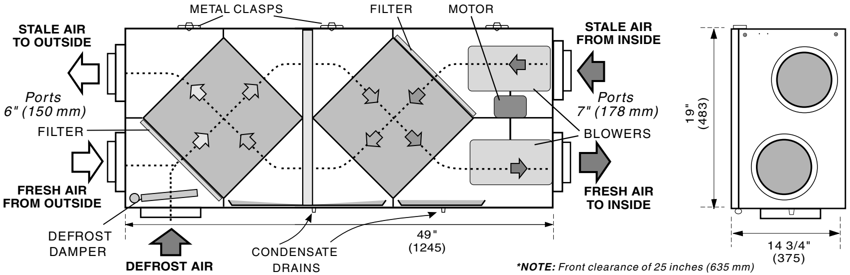
WARRANTY

Units carry a LIFETIME warranty on the heat recovery core and a 5 year replacement parts warranty.

⚠ ATTENTION

The ECM motor produces a tone that some may find objectionable. We recommend the installation of the optional 99-SILENCER6 on the ‘Stale Air from Inside’ and ‘Fresh Air to Inside’ ducts.

DIMENSIONS 195ECM *inches (mm)*



***NOTE:** Front clearance of 25 inches (635 mm) is recommended for servicing unit.*

Date: ______________________________

Tag: ________________Qty:______________

Project: ______________________________

Engineer: _____________________________

Contractor: ___________________________

Supplier: _____________________________

Quote#: ______________________________

Submitted by: _________________________

AIRIA
BRANDS INC.

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London, Ontario N5W 4C8
T (519) 457-1904
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Email: info@lifebreath.com

270 Regency Ridge, Suite 210
Dayton, Ohio 45459
T (937) 439-6676
F (937) 439-6685
Website: www.lifebreath.com

ISO 9001 REGISTERED

The Three Methods of Installation

The three methods of installation for the HRV system are:

- The Simplified installation.
- The Partially Dedicated Installation
- The Fully Dedicated Installation

Simplified Installations

The Simplified Installation draws stale air from the cold air return duct of the air handler/furnace and introduces an equal amount of fresh air farther downstream into the cold air return. Refer to *"Simplified Installation Diagrams"*.

The air handler/furnace blower must be running when the unit is operating for this system to be effective. Refer to *"Interlocking the HRV to an Air handler/Furnace Blower"*.

Partially Dedicated Installations

The Partially Dedicated Installation draws stale air from specific points in the house and introduces an equal amount of fresh air into the cold air return. Refer to *"Partially Dedicated Installation Diagrams"*.

Stale air ducts should be installed in areas of the home where the poorest indoor air quality exists (bathrooms and kitchen). Each location with a stale air duct should have a timer to initiate high speed ventilation. Refer to "*Optional Timers*" in this manual.

The air handler/furnace blower should be running when the HRV is operating to evenly distribute the fresh air throughout the house. Refer to *"Interlocking the HRV to an Air handler/Furnace Blower"*.

Fully Dedicated Installations

The Fully Dedicated Installation draws stale air from specific points in the house and delivers fresh air to specific locations of the house. This system is not connected to an air handler/furnace. Refer to "*The Fully Dedicated Installation Diagrams*" in this manual.

Stale air ducts should be installed in areas of the home where the poorest indoor air quality exists (bathrooms and kitchen). Each location with a stale air duct should have a timer which will initiate high speed ventilation. Refer to "Optional Timers" in this manual.

Fresh air ducts should be installed to all bedrooms and living areas, excluding bathrooms, kitchen and utility areas. Grilles should be located high on a wall or in ceiling locations. Grilles that diffuse the air comfortably are recommended. Refer to "Grilles" in this manual. Special care should be taken in locating grilles if the floor is the only option available. Areas such as under baseboard heaters will help to temper the air.

Optional in-line duct heaters are available for mounting in the supply duct work to add heat if required. Refer to the equipment specification sheet in this manual for your Max Series model in this manual for duct heater part numbers.

Installing the Ducting Between the HRV & Living Areas in the House

A well designed and installed ducting system will allow the HRV to operate at its maximum efficiency.

All ducts should be kept short and have as few bends or elbows as possible to maximize airflow. Forty-five degree elbows are preferred to 90° elbows. Use "Y" tees instead of straight tees whenever possible.

All duct joints must be fastened with screws, rivets or duct sealant and wrapped with mastic or quality duct tape to prevent leakage. Mastic is preferred but if duct tape is used, we recommend aluminum foil duct tape.

Galvanized (rigid) ducting from the HRV to the living areas in the house is recommended whenever possible although flexible duct can be used in moderation if necessary.

A short length (approximately 12 inches or 300mm) of non-metallic flexible insulated duct should be connected between the HRV and the supply/exhaust duct system to avoid possible noise transfer through the duct system.

All ducts running through attics and unheated spaces must be sealed and insulated to code.

⚠ ATTENTION

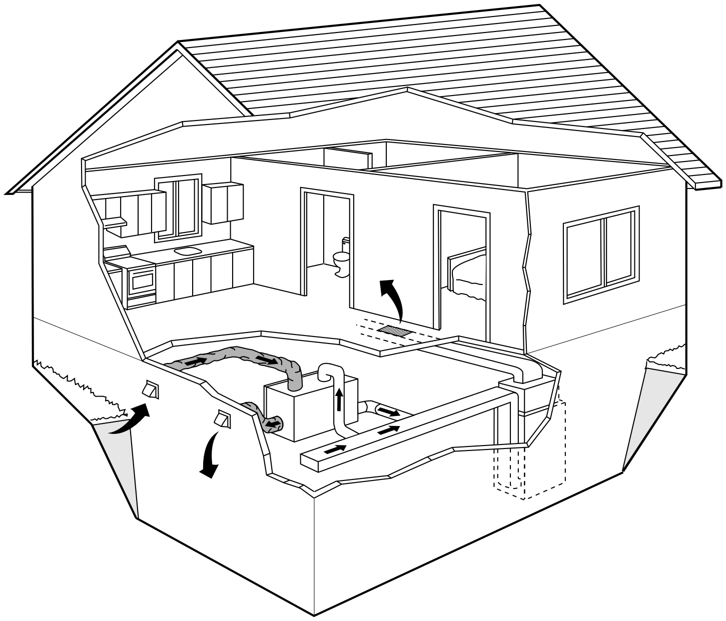
Applications such as greenhouses, atriums, swimming pools, saunas, etc. have unique ventilation requirements which should be addressed with an isolated ventilation system.

Simplified Installation Diagrams

Simplified Installation (Return/Return Method)

Key Points

- The HRV must be balanced.
- It is mandatory that the furnace blower run continuously or HRV operation be interlocked with the furnace blower.
- The duct configuration may change depending on the HRV model. See specifications for your unit.
- Check local codes / authority having jurisdiction for acceptance.
- A backdraft damper is required in the exhaust air duct to prevent outdoor air from entering the unit when the Furnace/Airhandler is running and the unit is in Standby, OFF or Recirculate.

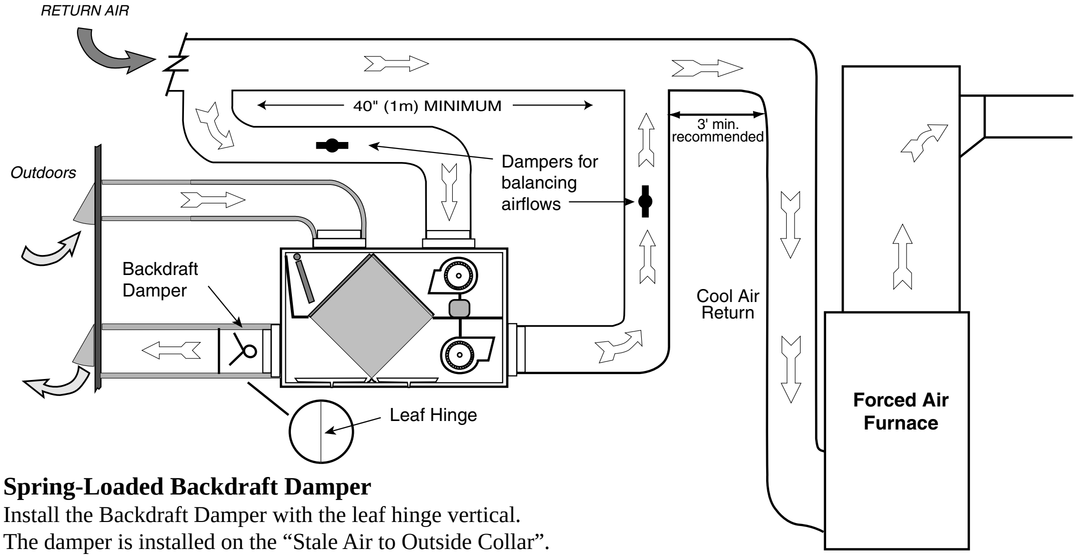


Sizing the Ductwork

It is the responsibility of the installer to ensure all ductwork is sized and installed as designed to ensure the system will perform as intended.

The amount of air (cfm) that an HRV will deliver is directly related to the total external static pressure (E.S.P.) of the system. Static pressure is a measure of resistance imposed on the blower by length of duct work plus the number of fittings used in the duct work.

DIRECT CONNECTION of both the HRV SUPPLY AIR STREAM and EXHAUST AIR STREAM to the FURNACE COLD AIR RETURN



Spring-Loaded Backdraft Damper

Install the Backdraft Damper with the leaf hinge vertical.
The damper is installed on the “Stale Air to Outside Collar”.

4” (102mm) Backdraft Damper Part No. 99-RSK4
5” (127mm) Backdraft Damper Part No. 99-RSK5
6” (152mm) Backdraft Damper Part No. 99-RSK6
8” (203mm) Backdraft Damper Part No. 99-RSK8

Installation Notes

- Unit is normally balanced on HIGH speed with the furnace blower ON.
- A minimum separation of 40 inches (1m) is recommended between the two direct connections.
- The exhaust air connection should be upstream of the supply air connection to prevent exhausting any fresh air.
- Weatherhood arrangement is for drawing purposes only. Six feet (2m) minimum separation is recommended. The Weatherhood must also be 18" (460mm) above grade minimum.
- The airflow must be confirmed on site using the balancing procedures found in this manual

⚠ WARNING

The Stale Air to Outside air duct requires a Backdraft Damper. This damper prevents outdoor air from entering the HRV during the operation of the Furnace/ Airhandler while the HRV is in standby, OFF or Recirculate.

watercycles
energy recovery inc.

Watercycles Energy Recovery Inc.
Phone: (780)628-7421
(306)531-9478
Fax:: (306)771-2885
Box 231—110 Brewer St
Edenwold, SK S0G 1K0 E-mail: info@watercycles.ca

DX-3058 Commercial and Residential

Fits 3 inch drain pipe Our number one unit for residential applications
57.75 inches long
ASTM B306 DWV wrapped with ASTM B88 Type L waterline
Most energy effective 3” model Connected in parallel

Heat Recovery Rate:* **7.54** kW **25740** BTU/hr PSI drop– 2.4 psi @ 2GPM

Simple Design
Consumes no Energy
Passive
No moving parts

100% Recyclable
Pre-heats water
Reduces Carbon Emissions
Maintenance free

Extends Life of Hot Water Heater - Tank/Tankless

Complies with UPC 603.3.4

Applications:

<u>Residential</u>	<u>Commercial</u>
2-3 bathroom per unit	Commercial dishwashers
2-6 person household	Institutional showers
3/4 inch water lines	Condominiums

Code Compliance

DWHR units are double-walled heat exchangers covered by the Uniform Plumbing Code, Section 603.3.4; 1995 CABO (Council of American Building Officials) One and Two Family Dwelling Code, Section 3402.3.1; 1998 ICC (International Code Council) One and Two Family Dwelling Code, Section 3402.4.2.1; and the 2000 and 2003 ICC International Residential Code, Section P2902.4.2 - Heat Exchangers.

THE ABEX AWARDS
2007 WINNER

*Testing completed by the Saskatchewan Research Council

HEAT RECOVERY DRAIN PIPE

PROJECT DESCRIPTION

Choose Building Types:

New Construction - MURB

Project Name:

Yellowknife Eco-Housing

Building Owner:

Organization:

Email Address:

Phone Number:

ENERGY SAVINGS

Flow conditions, assumptions and constants

Drain water flow [liters/minute]:	9.5
Cold water flow through Power-Pipe™ [liters/minute]:	4.655
Water specific heat (Cp) [kJ/Kg-k]:	4.187
Power-Pipe™ hot side effectiveness under specified flow conditions:	21.90%
Average drain water temperature [C]:	37
Average cold water temperature [C]:	9
Average shower duration [minutes]:	4.5
Water-heater efficiency:	100.00%
Energy Content of Electricity [KJ/KWh]:	3600

Configuration and operation conditions

Total number of apartments served by Power-Pipe™ units:	1
Total number of Power-Pipe™ units:	1
Average occupation [persons/apartment]:	2
Average number of showers per person per day:	2

Savings Calculation

Number of apartments per Power-Pipe™ unit:	1.00
Total daily shower time per Power-Pipe™ [minutes/day]:	18.00
Pre-heated water temperature [C]:	21.5
Total annual heat energy available in drain stack [GJ]:	7.32

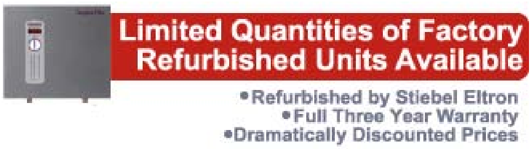
Total annual heat energy recovered by Power-Pipe™ units [GJ]::	1.6
Effective annual heat recovered by Power-Pipe™ units (considering water-heater efficiency) [GJ]:	1.60
Cost of Electricity [$/KWh]:	$ 0.27
Annual energy savings[kWh/year]:	$ 444.44
Annual savings [$/year]:	$ 119.55
Annual GHG emissions reduction [tons of CO2 / year]:	0.0

COST ESTIMATE

Description	Unit Price	Quantity	Total
Power-Pipe™ model R2-36 (Shipping and connectors included):	$ 499.00	1	$ 499.00
Installation cost - Plumbing contractor (Parts and labour):	$ 350.00	1	$ 350.00
Total:			**$ 849.00**

FINANCIAL

Description	Total
Power-Pipe™ systems:	$ 499.00
Installation cost - Plumbing contractor:	$ 350.00
Total project cost (before incentives):	**$ 849.00**
Total incentive rebates:	($ 0.00)
Net Total:	**$ 849.00**
Annual dollar savings:	$ 119.55
Payback Period [year]:	7.10
Net Present Value (50 years, discount rate of %):	$ 5,828.50
Internal Rate of Return:	100%



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whole house point-of-use model selector how it works compare installation & support f.a.q. warranty info

Stiebel Eltron Tempra Series Electric Tankless Water Heater Models

The Stiebel Eltron Tempra Series of electric tankless water heaters provide an endless supply of hot water on demand to your whole house while saving you up to 50% off your water heating cost!

The Stiebel Eltron Tempra and Tempra Plus electric tankless water heaters uses a sophisticated thermostatic temperature control that constantly monitors the incoming water flow water and temperature to modulate power to the heating elements to maintain a precise, user-set temperature. Convenient controls allow you to set the output temperature to your desired level (between 86 and 140F (30 to 50C) [Note, maximum temperature setting on some models is 125F (52C)]. Most competitor's tankless water heaters are not able to compensate for changes in water flow rate and temperature, making their units fluctuate when simultaneous water demands are run, when well pump pressures change, etc. This is because their systems operate either on a "full on / full off" basis or they have relatively crude power modulation technology.

Tempra Plus series models take temperature control to another level, offering the industry's only Advanced Flow Control technology. This technology automatically adjusts the flow of water when the unit's sensor's detect that the flow demand is exceeding the heater's capacity. This feature is particularly useful in cold climates and other applications where the electrical service size does not permit the installation of a larger model where it may be desirable to handle occasional high flow demands. It is also desirable where high output temperatures are required for temperature-critical applications (commercial dishwashers, etc.) where flow rates are not always predictable.

Stiebel Eltron manufactures Tempra and Tempra Plus Series models, for almost every conceivable water heating application. All Tempra Series models are essentially the same except for the maximum heating power. Similarly, all Tempra Plus Series models are essentially the same at each other except for their power rating. They differ only in the quantity and power rating of the heating modules.

The following chart highlights the key differences between the current Tempra Series models....

	Tempra Plus Series	Tempra Series
Full micro-processor-based thermostatic temperature control featuring full power modulation based on flow rate and incoming water temperature.	Yes	Yes
Dynamic Advanced Flow Control Technology - adjusts the flow of water when the unit's sensor's detect that the flow demand is exceeding the heater's capacity.	Yes	No
Digital Temperature Selector	Yes, all models	No
Hinged Case	Yes	Yes
Power Levels Available (KW @ 240V)	36, 28.8, 24, 19.2, 14.4, 12	24, 19.2, 14.4, 12

The most appropriate model for each application is generally a function of your incoming water temperature (where you live) and your water usage needs and what features you desire. Please use our model selector or use the technical specifications below to assist you in selecting the best tankless water heater model for your application. Stiebel Eltron tankless water heaters are designed to completely replace your conventional hot water tank. They can also be configured in parallel or in series with conventional tanks (or multiple tankless units in series) for certain extra high-volume or commercial applications.

You can purchase a Stiebel Eltron water heater with confidence! All Tempra and Tempra Plus models are manufactured in

You can purchase a Stiebel Eltron water heater with confidence! All Tempra and Tempra Plus models are manufactured in Germany at Stiebel Eltron's ISO-9001 certified factory. Nobody knows electric tankless water heaters like Stiebel Eltron which has been manufacturing electric heaters since 1924!

Please see the important information listed at the bottom of this page about confirming your electrical service requirements before purchasing a tankless water heater.

Lowest Price Guarantee

At E-Tankless.com, we take great pride in offering the very best products and prices to our customers.
We will meet or beat any advertised price for Stiebel Eltron tankless water heaters on the Internet and all of our prices for the Tempra Series and Tempra Plus Series now include ground shipping at no extra charge!
Please call our toll free customer service line at 1-877-374-2696 to order.

Stiebel Tempra Plus Series Whole House Electric Tankless Water Heaters

	Tempra 36 Plus	**Tempra 29 Plus**	**Tempra 24 Plus**	**Tempra 20 Plus**	**Tempra 15 Plus**	**Tempra 12 Plus**
Application	Extreme North and/or Very High Flow Rates	Northern Regions or High Flow Rates	Northern USA or Higher Flow Rates	Southern USA / Moderate Flow Rates	Tropical / Point of Use	
Temp Control	Full micro-processor-based thermostatic temperature control featuring digital temperature selector / display and full power modulation based on flow rate and incoming water temperature. Dynamic Advanced Flow Control Technology - adjusts the flow of water when the unit's sensor's detect that the flow demand is exceeding the heater's capacity.					
Digital Temp. Setting Display	Yes					
Hinged Case	Yes					
Power (KW's @ 240v)	36 KW	28.8 KW	24 KW	19.2 KW	14.4 KW	12 KW
Power (KW's @ 208v)	27 KW	21.6 KW	18 KW	14.4 KW	10.8 KW	9 KW
Max Temp Rise @ 1.5 GPM 240v (208v)	92F (92F)	92F (92F)	92F (82F)	88F (66F)	65F (49F)	54F (41F)
Max Temp Rise @ 2.25 GPM 240v (208v)	92F (82F)	87F (66F)	73F (54F)	58F (44F)	43F (37F)	36F (27F)
Max Temp Rise @ 3 GPM 240v (208v)	82F (61F)	66F (49F)	54F (41F)	44F (33F)	33F (25F)	27F (20F)
Max Temp Rise @ 4 GPM 240v (208v)	55F (41F)	44F (33F)	37F (27F)	29F (22F)	Not Recommended	
Max Output Temperature**	140F (60C)					
Heating Modules	3 heating modules		2 heating modules			1 heating module
Dimensions	16.6" x 14.5" x 4.6" (55.2 x 36.7 x 11.6cm)					
Weight	17.6 lbs (8.6kg)		15.4 lbs (7.3kg)			13.2 lbs (6.1kg)
Energy Efficiency	99%+ energy efficient					
Activation Flow Rate	0.87 GPM / 3.3 LPM		0.58 GPM / 2.2 LPM			0.37 GPM / 1.4 LPM
Pipe Fittings	3/4" NPT					
Working Pressure	Max. Recommended Pressure = 150 psi (10 bar) - tested to 300 psi (20 bar).					
Voltage Requirements	208 - 240 volts / single phase / 50 - 60 Hz					
Max. Amps (@ 240 volts)	150 Amps	120 Amps	100 Amps	80 Amps	60 Amps	50 Amps
Max. Amps (@ 208 volts)	132 Amps	105 Amps	88 Amps	70 Amps	52 Amps	44 Amps
Breakers Recommended*	3 x 60 Amp	3 x 50 Amp	2 x 60 Amp	2 x 50 Amp	2 x 40 Amp	1 x 60 Amp
Minimum amps to home	300 Amps	200 Amps		125 Amps	100 Amps	
Recommended Wiring* (AWG Copper)	3 x #6	3 x #8	2 x #6	2 x #8	2 x #8	1 x #6
Maximum recommended input temperature:	131F (55C)					
Safety	ETL Listed (US & Canada) Independently tested to conform all applicable safety standards including ANSI/UL 499 (USA) and CSA-E335-1/3E-94 (Canada)					
Price USA	US$864.00 shipping included BUY NOW	US$814.00 shipping included BUY NOW	US$780.00 shipping included BUY NOW	US$744.00 shipping included BUY NOW	US$710.00 shipping included BUY NOW	US$534.00 shipping included BUY NOW
Price Canada	CDN$949.00 shipping included BUY NOW	CDN$895.00 shipping included BUY NOW	CDN$859.00 shipping included BUY NOW	CDN$819.00 shipping included BUY NOW	CDN$779.00 shipping included BUY NOW	CDN$589.00 shipping included BUY NOW
	MORE INFO. **Stiebel Eltron Tempra 36 Plus Tankless Water Heater**	MORE INFO. **Stiebel Eltron Tempra 29 Plus Tankless Water Heater**	MORE INFO. **Stiebel Eltron Tempra 24 Plus Tankless Water Heater**	MORE INFO. **Stiebel Eltron Tempra 20 Plus Tankless Water Heater**	MORE INFO. **Stiebel Eltron Tempra 15 Plus Tankless Water Heater**	MORE INFO. **Stiebel Eltron Tempra 12 Plus Tankless Water Heater**

Stiebel Tempra Series Whole House Electric Tankless Water Heaters

flow rate and incoming water temperature.

Digital Temp. Setting Display	No			
Hinged Case	Yes			
Power (KW's @ 240v)	24 KW	19.2 KW	14.4 KW	12 KW
Power (KW's @ 208v)	18 KW	14.4 KW	10.8 KW	9 KW
Max Temp Rise @ 1.5 GPM 240v (208v)	92F (82F)	88F (66F)	65F (49F)	54F (41F)
Max Temp Rise @ 2.25 GPM 240v (208v)	73F (54F)	58F (44F)	43F (37F)	36F (27F)
Max Temp Rise @ 3 GPM 240v (208v)	54F (41F)	44F (33F)	33F (25F)	27F (20F)
Max Temp Rise @ 4 GPM 240v (208v)	37F (27F)	29F (22F)	Not Recommended	
Max Output Temperature**	140F (60C)		125F (52C)	140F (60C)
Heating Modules	2 heating modules			1 heating module
Dimensions	16.6" x 14.5" x 4.6" (42 x 36.8 x 11.7cm)			16.6" x 14.5" x 4.6" (42 x 36.8 x 11.7cm)
Weight	15.4 lbs (7.3kg)			13.2 lbs (6.1kg)
Energy Efficiency	99%+ energy efficient			
Activation Flow Rate	0.58 GPM / 2.2 LPM			0.37 GPM / 1.4 LPM
Pipe Fittings	3/4" NPT			
Working Pressure	Max. Recommended Pressure = 150 psi (10 bar) - tested to 300 psi (20 bar)			
Voltage Requirements	208 - 240 volts / single phase / 50 - 60 Hz			
Max. Amps (@ 240 volts)	100 Amps	80 Amps	60 Amps	50 Amps
Max. Amps (@ 208 volts)	88 Amps	70 Amps	52 Amps	44 Amps
Breakers Recommended*	2 x 60 Amp	2 x 50 Amp	2 x 40 Amp	1 x 60 Amp
Minimum amps to home	200 Amps	125 Amps	100 Amps	
Recommended Wiring* (AWG Copper)	2 x #6	2 x #8	2 x #8	1 x #6
Safety	ETL Listed (US & Canada) Independently tested to conform all applicable safety standards including ANSI/UL 499 (USA) and CSA-E335-1/3E-94 (Canada)			
Maximum recommended input temperature:	131F (55C)	107F (42C)	107F (42C)	107F (42C)
Price USA	US$674.00 shipping included BUY NOW	US$640.00 shipping included BUY NOW	US$604.00 shipping included BUY NOW	US$450.00 shipping included BUY NOW
Price Canada	CDN$739.00 shipping included BUY NOW	CDN$699.00 shipping included BUY NOW	CDN$669.00 shipping included BUY NOW	CDN$495.00 shipping included BUY NOW
	MORE INFO. **Stiebel Eltron Tempra 24 Tankless Water Heater**	MORE INFO. **Stiebel Eltron Tempra 20 Tankless Water Heater**	MORE INFO. **Stiebel Eltron Tempra 15 Tankless Water Heater**	MORE INFO. **Stiebel Eltron Tempra 12 Tankless Water Heater**

* Breaker size and wire gauge must meet all applicable local, state, provincial, and national electrical codes for your area - these are only guidelines that will apply to most installations. Some codes require use of electrical sub-panel for installation, especially when heater is not mounted within line-of-sight of the main electrical panel. Wiring should be sized to maintain a voltage drop of less than 3% under load. Please consult your electrician for more details.

** The maximum output temperature is a function of incoming water temperature and water flow rate. For residential applications, all units are factory pre-set to permit a temperature setting from 86F (30C) to either 125F or 140F (52 to 60C). The temperature setting can be easily adjusted using the adjustment dial on the front of the heater.

All models of the Stiebel Eltron Tempra Series Tankless Water Heater are ETL Listed in the USA and Canada. This confirms that they have been independently tested by ETL to ensure they comply with all applicable safety standards, including ANSI/UL 499 (USA) and CSA-E335-1/3E-94 (Canada).

Stiebel Eltron is:

ISO 9001 CERTIFIED

All Stiebel Eltron Tankless Water Heaters are tested and certified by WQA against NSF/ANSI 372 for "lead free" compliance.

3 convenient ways to order:
Secure online order form, by Fax (250) 374-2692, or by Phone:

Toll Free Customer Service
1-877-374-2696
Monday to Friday
8:00am to 5:00pm (Pacific)

PROFICIENCY

ULTRA HIGH EFFICIENCY TOILET

Our patented BSB flush chamber and air transfer system delivers a very swift and quiet, yet powerful flush with just 3 litres of water.

N7716 | Round Front, 3.0 lpf
Single flush, Two-piece toilet

Features

Ultra High Efficiency Flush
Proficiency delivers a swift and powerful flush with an ultra-efficient 3 litres of water.

Large Water Surface
Air is transferred to the trapway during filling of the tank, exerting positive pressure on the water in the bowl and creating a larger surface.

Compact Design
Install and renovate with ease. Have more room for vanities, shelving, or cabinets.

Superior Engineered Ceramics
High-glazed vitreous china provides a smooth, low-friction surface.

Stylish Flush Lever
Inconspicuous, top-mounted, and break-resistant. Spring-loaded and finished in polished chrome.

WaterSense Meets EPA Criteria
Certified by IAPMO R&T

UPC

BUILD GREEN
accrue LEED Canada credit points:

UP TO 6 for commercial buildings

2 for residential homes

Canadian Design - Global Impact

Hennessy & Hinchcliffe

www.watermatrix.com

PROFICIENCY

ULTRA HIGH EFFICIENCY TOILET

N7716 | Round Front, 3.0 lpf
Single flush, Two-piece toilet

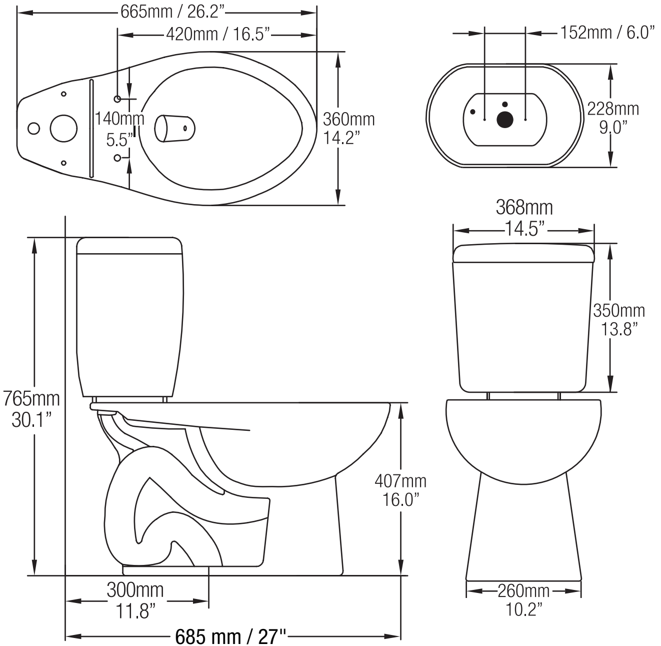
PERFORMANCE

Proficiency harnesses the energy of water filling the tank to pressurize the trapway via a patented air transfer system. When flushed, air is sucked out of the trapway, initiating the highly efficient siphonic action. This new technology gives Proficiency the leading edge in water efficiency, achieving the lowest flush volume of any toilet in the industry.

SPECIFICATIONS

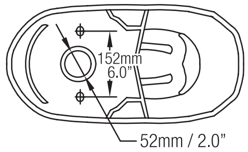
Water Usage	3.0 lpf / 0.80 gpf
Flush System	Patented BSB Flushing Technology - Canadian-engineered
MaP Rating	600g
Water Pressure Range	Variable
Water Surface Area	7¼" X 9¼" (184 mm X 235 mm)
Trap Diameter	2" (51 mm)
Trap Seal	2-3/8" (60 mm)
Rough-In	12" (305 mm)
Large Footprint	10-1/5" X 20-3/5" (260 mm X 525 mm)
Material	High glaze vitreous china
Colours	White, Biscuit
Warranty	Lifetime on china 10-year warranty on parts; 1-year on valves
	Eligible for the highest tier of municipal toilet rebates, where available
	Complies with ASME A112.19.2 and CSA B45 codes and surpasses standards for MaP and drainline carry capacity

DIMENSIONS



Ultra High Efficiency Toilet

UHET



SHIPPING DIMENSIONS AND WEIGHT

N7715 TANK
16" X 16" X 10"
(406 mm X 406 mm X 254)
30 lbs. (13.6 kg)

N7716 BOWL
27" X 15" X 18"
(686 mm X 381 mm X 457 mm)
52 lbs. (23.6 kg)

Seat not included
Specifications are subject to change without notice.

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WATER EFFICIENCY BY DESIGN...

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Email: sales@watermatrix.com Website: www.watermatrix.com

PROFICIENCY

ULTRA HIGH EFFICIENCY TOILET

Our patented BSB flush chamber and air transfer system delivers a very swift and quiet, yet powerful flush with just 3.0 litres of water.

N7799 | Comfort Height, ADA-Compliant Elongated Front, 3.0 lpf Single-Flush, Rear Outlet Toilet

Features

Ultra High Efficiency Flush
Proficiency delivers a swift and powerful flush with an ultra-efficient 3.0 litres of water.

Soft-close Seat
The toilet lid and seat close with a light touch, preventing slamming. Moulded with durable, heavy-duty break-resistant plastic.

Large Water Surface
Air is transferred to the trapway during filling of the tank, exerting positive pressure on the water in the bowl and creating a larger surface.

Compact Design
Install and renovate with ease. Have more room for vanities, shelving, or cabinets.

Superior Engineered Ceramics
High-glazed vitreous china provides a smooth, low-friction surface.

Stylish Flush Lever
Inconspicuous, top-mounted, and break-resistant. Spring-loaded and finished in polished chrome.

WaterSense Meets EPA Criteria
Certified by IAPMO R&T

UPC

BUILD GREEN
accrue LEED Canada credit points:

UP TO 6
for commercial buildings

2
for residential homes

Canadian Design - Global Impact

Hennessy & Hinchcliffe

www.HandHToilets.com

PROFICIENCY

ULTRA HIGH EFFICIENCY TOILET

N7799

Comfort Height, ADA-Compliant
Elongated Front, 3.0 lpf
Single-Flush, Rear Outlet Toilet

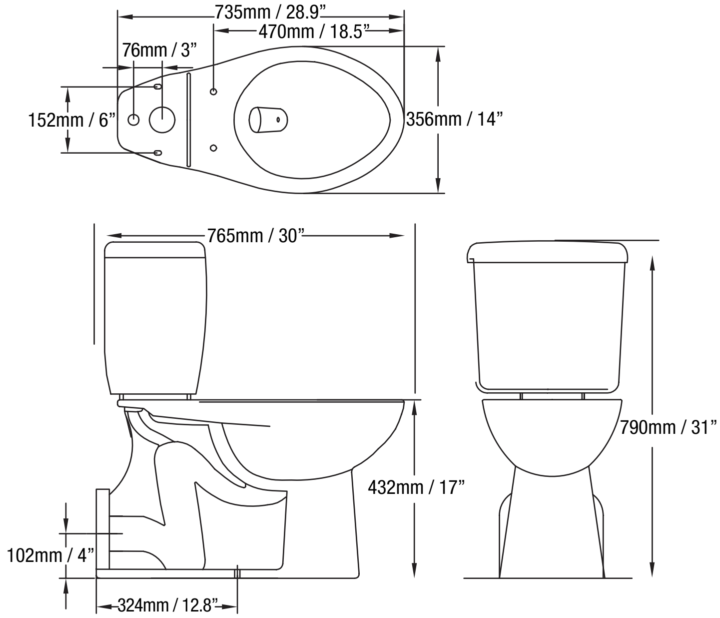
PERFORMANCE

Proficiency harnesses the energy of water filling the tank to pressurize the trapway via a patented air transfer system. When flushed, air is sucked out of the trapway, initiating the highly efficient siphonic action. This new technology gives Proficiency the leading edge in water efficiency, achieving the lowest flush volume of any toilet in the industry.

SPECIFICATIONS

Water Usage	3.0 lpf / 0.80 gpf
Flush System	Patented BSB Flushing Technology - Canadian-engineered
Water Pressure Range	Variable
Water Surface Area	7¼” X 9¼” (184 mm X 235 mm)
Trap Diameter	2” (51 mm)
Trap Seal	2-3/8” (60 mm)
Rough-In	12” (305 mm)
Footprint	25.2” X 10.2” (640 mm X 260 mm)
Material	High glaze vitreous china
Colours	White
Warranty	Lifetime on china 10-year warranty on parts; 1-year on valves
WaterSense Meets EPA Criteria Certified by IAPMO R&T	Eligible for the highest tier of municipal toilet rebates, where available
UPC	Complies with ASME A112.19.2 and CSA B45 codes and surpasses standards for MaP and drainline carry capacity

DIMENSIONS



Ultra High Efficiency Toilet

UHET

SHIPPING DIMENSIONS AND WEIGHT

N7715 TANK
16” X 16” X 10”
(406 mm X 406 mm X 254)
30 lbs. (13.6 kg)

N7799 BOWL
29” X 14” X 17.5”
(737 mm X 356 mm X 445 mm)
59.3 lbs. (26.9 kg)

Specifications are subject to change without notice.

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Water Efficiency by Design...

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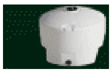
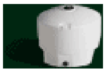
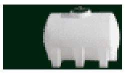
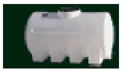
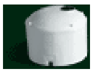
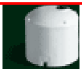
- COMMERCIAL TANKS
- ACCESSORIES

POLYETHYLENE HAULING AND LARGE VOLUME STORAGE TANKS

Click on the images below for a larger photo.

POLYETHYLENE HAULING AND STORAGE TANKS

Model		Capacity Imp. Gal / Litres	Diameter In. / (mm)	Height In. / (mm)
E-250W-U		250 (1136)	64” (1625)	30” (762)
E-420W-U		420 (1910)	64” (1625)	45” (1143)
E-100LEG		100 (455)	29” (737)	45” (1143)
E-175LEG		175 (795)	38” (965)	51” (1295)
E-305LP		305 (1385)	73” x 59”	25” (635)
E-325LEG		325 (1475)	42” (1067)	80” (2032)
E-500LEG		500 (2275)	48” (1220)	83” (2110)
E-915V		915 (4154)	86” (2184)	53” (1345)
E-1250V		1250 (5675)	86” (2184)	70” (1778)

POLYETHYLENE HORIZONTAL TANKS

Model	Capacity Imp. Gal / Litres	Diameter In. / (mm)	Legth In. / (mm)
10-H	16 (406)	16” (406)	19” (483)
25-H	23 (584)	23” (584)	18” (457)
50-H	23 (584)	23” (584)	37” (940)
90-H	30 (762)	30” (762)	49” (1245)
125-H	32 (813)	32” (813)	55” (1397)
165-H	32 (813)	32” (813)	71” (1803)
166-H	38 (965)	38” (965)	51” (1295)
250-H	38 (965)	38” (965)	72” (1830)
415-H	48 (1220)	48” (1220)	74” (1880)
625-H	54 (1370)	54” (1370)	82” (2080)
835-H	65 (1650)	65” (1650)	87” (2210)

POLYETHYLENE LARGE VOLUME STORAGE TANKS

Model	Capacity Imp. Gal / Litres	Diameter In. / (mm)	Height In. / (mm)
E-2000V	**2000 (9092)**	**95 (2413)**	**87 (2210)**
E-2500V	**2500 (11365)**	**95 (2413)**	**107 (2718)**
E-3000V	**3000 (13638)**	**102 (2591)**	**126 (2591)**
E-5000V	**5000 (22730)**	**102 (2591)**	**182 (4623)**

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E-mail: info@eqnx.biz

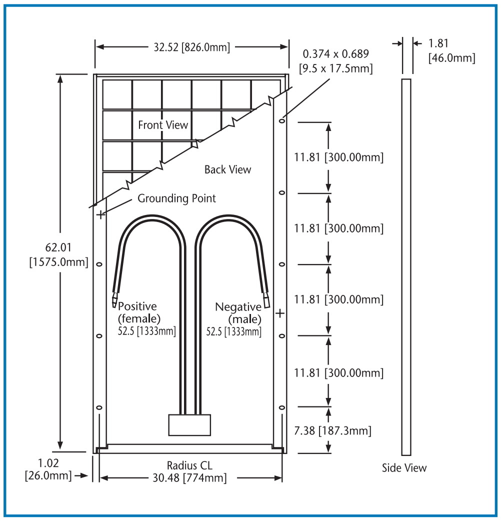
PHOTOVALTAIC PANEL

High-Efficiency 170 Watt Mid-Sized Module

The SAPC-170, SCHOTT

Solar's 170 watt photovoltaic module, is designed for large electrical power requirements. With a 25 year warranty, the SAPC-170 has superb durability to withstand rigorous operating conditions. Ideal for grid-connected and remote power systems, the SAPC-170 offers high usable power per square foot of solar array.

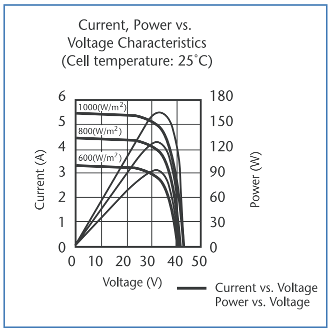
- High-power module using 125mm square poly crystal silicon solar cells with 13.1% module conversion efficiency
- Bypass diode minimizes the power drop caused by shade
- Textured cell surface to reduce sunlight reflection
- Tempered glass, EVA resin, and weatherproof film, and aluminum frame for extended outdoor use
- Nominal 24VDC output, perfect for grid-connected systems
- UL Listings: UL 1703, cUL
- 25-year limited warranty on power output



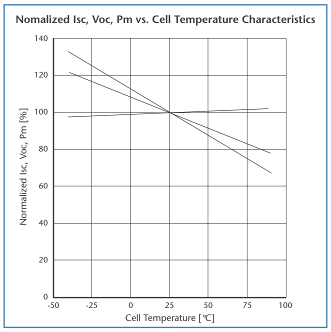
SAPC-170 Physical Specifications

SAPC-170 Solar Module Pictured

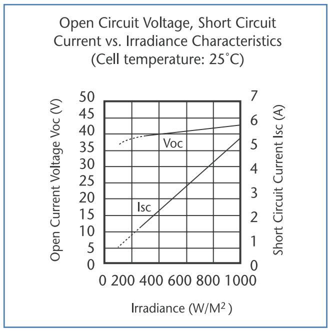
SCHOTT
solar



SAPC-170 Current Power Graph



SAPC-170 Normalized Isc



SAPC-170 Open Circuit Voltage

Electrical Data

The electrical data applies to standard test conditions (STC): Irradiance at the module level of 1,000 W/m^2 with spectrum AM 1.5 and a cell temperature of 25˚ C

Power (max.)	P_P (watts)	170W
Voltage at maximum-power point	V_P (volts)	34.8V
Current at maximum-power point	I_P (amps)	4.9A
Open-circuit voltage	V_{OC} (volts)	43.2V
Short-circuit current	I_{SC} (amps)	5.7A

The rated power may only vary by -5/+10%. Other electrical characteristics may only vary by +/- 10%.

Dimensions and Weights

	170W Module
Length mm (in)	1575 (62.01")
Width mm (in)	826 (32.52")
Depth mm (in)	46 (1.81")
Weight kg (lbs)	17 (37.485 lbs)
Area m^2 (ft^2)	1.299 (13.99)

Characteristic Data

	170W Module
Solar cells per module	72
Type of solar cell	Poly-crystalline silicon solar cells, 125 mm square
Connections	Multi-Contact connector

Module Temperature Coefficients

		170W Module
Power	T_k (P_p)	-0.8446 (W/C)
Open-circuit voltage	T_k (V_{oc})	-0.1728 (V/C)
Maximum Power Voltage	T_k (V_{mp})	-0.1796 (V/C)

Limits

Maximum system voltage	600V DC
Operating module temperature	-40˚ to +90˚ C
Dielectric voltage withstood	2200V max.

The right is reserved to make technical modification.
For detailed product drawings and specifications please contact SCHOTT Solar or an authorized reseller.

CEC Certified

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THERMAL PERFORMANCE VALUES

600 SERIES > SLIDING PATIO DOOR(see notes at end)

SLIDING PATIO DOOR	**U Value**	**SHGC**	**Vt**
Dual Pane - Low-E / Hard Coat	0.32	0.54	0.57
Dual Pane - Low-E / Soft Coat	0.29	0.31	0.54
Dual Pane - Low-E 366	0.28	0.21	0.49
Triple Pane - Low-E / Hard Coat x 2	0.21	0.42	0.47
Triple Pane - Low-E / Soft Coat x 2	0.19	0.27	0.43
Super Quad	0.17	0.23	0.30

ER

Note: All values have been verified by the NFRC and Energy Star Canada. The reader is cautioned that test results should be used for comparison purposes only. Results are size and installation dependent.

For recommendations as to what glazing configurations are best suited for your application, please feel free to contact us.

For a full listing of thermal performance values, visit www.NFRC.org. All information can be found in the "Certified Products Directory". Please feel free to contact us if any assistance is required.

INLINE also complies with all North American Energy Star zoning requirements.

600 SERIES
CONVENTIONAL SLIDING PATIO DOOR
Standard Sizes

Rough Opening	TYPE	STYLE*	Overall FRAME SIZE	
		(from Exterior)	Millimetres	Inches
60" x 80'	2-Panel	FO or OF	1511 x 2026	59-1/2 x 79-3/4
72" x 80"	2-Panel	FO or OF	1816 x 2026	71-1/2 x 79-3/4
96" x 80"	2-Panel	FO or OF	2426 x 2026	95-1/2 x 79-3/4
90" x 80"	3-Panel	FFO or OFF	2267 x 2026	89-3/8 x 79-3/4
108" x 80"	3-Panel	FFO or OFF	2724 x 2026	107-3/8 x 79-3/4
144" x 80"	3-Panel	FFO or OFF	3639 x 2026	143-3/8 x 79-3/4
117" x 80"	4-Panel	FOOF	2959 x 2026	116-1/2 x 79-3/4
141" x 80"	4-Panel	FOOF	3569 x 2026	140-1/2 x 79-3/4
189" x 80"	4-Panel	FOOF	4788 x 2026	188-1/2 x 79-3/4

***F = Fixed Panel**
O = Sliding Panel

600 SERIES
SLIDING GLASS DOOR

TEST REPORT SUMMARY
In compliance to AAMA/
101/I.S.2/ CSA A440

TEST SIZE	1816mm x 2025mm
	71 1/2" x 79 3/4"

STANDARD	**REQUIREMENTS**		**RESULTS**	**GRADE**	
	TEST METHOD	**TEST PRESSURE**		**AAMA**	**CSA**
Air Tightness	ASTM E 283	+@ 75 Pascals +@ 1.57 psf	0.30 L/s.m² +/-0.06 CFM/ft²	A3	A3
Water Tightness	ASTM E 547	@ 525 Pascals @ 11 psf	No Leakage	DP 70	B5
Wind Load Resistance	ASTM E 330	+@ 3375 Pa @ 70 psf	No Deformation	DP 45	C3
Series 600 sliding glass door is rated SD-R-45, Design Pressure 45 @ test pressure 266 kph (166 mph).					

Energy Ratings

The Thermal Performance Values shown below, are based on products glazed glazed with 7/8" (22mm) insulating glass units comprising one lite of Low-E glass, an argon filled cavity and double sealed aluminum spacer bar.

Higher performance may be achieved by using various glass coatings, inert gasses, and/or warm edge spacers.

Performance	**CSA 440.2**	**NFRC 100** Residential 72" x 82"	**NFRC 100** Non-Residential 72" x 96"
U-Value Frame	2.29 W/m²/c	0.41 Btu/hft²/F	0.41 Btu/hft²/F
U-Value Window	1.99 W/m²/c	0.35 Btu/hft²/F	0.35 Btu/hft²/F
SHGC - No Grill	0.51	0.51	0.49
SHGC - With Grill	0.45	0.45	0.44
VLT - No Grill	0.56	0.56	0.56
VLT - With Grill	0.50	0.50	0.50

Note: The reader is cautioned that test results should be used for comparison purposes only. Results are size and installation dependent. In-Service performance can be significantly different from those shown. Product tested indicates design potential.

ENERMODAL ENGINEERING
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Inline Fiberglass

ILF12001, Aug. 7, 2012

600 Patio Door as per EN ISO 10077-2 and EN673

Glazing	Frame Section	U-Factor Total Window (W/m^2-K)	U frame (W/m^2-K)	Ψ (W/m-K)	U centre of Glass (W/m^2-K)	SHGC centre of glass	Frame Height (mm)
272-arg-Cl-arg-180, se	Fixed Head	0.98	1.42	0.026	0.685	0.372	111.3
	Fixed Jamb		1.17	0.026			104.7
	Fixed Sill		1.50	0.026			112.7
	Operable Head		1.28	0.026			111.3
	Operable Jamb		1.21	0.026			104.8
	Operable Sill		1.79	0.026			112.7
	[9]Meeting Rail		1.42	0.011			71.0
180-arg-Cl-arg-180, se	Fixed Head	1.00	1.42	0.026	0.711	0.561	111.3
	Fixed Jamb		1.17	0.026			104.7
	Fixed Sill		1.50	0.026			112.7
	Operable Head		1.28	0.026			111.3
	Operable Jamb		1.21	0.026			104.8
	Operable Sill		1.79	0.026			112.7
	[9]Meeting Rail		1.42	0.010			71.0

Notes:

1. U-value simulations performed according to EN 673 and EN ISO 10077-2 using Therm 6 and BFRC EN 673 calculation spreadsheet
2. SHGC simulation used Window 6.3
3. Cl is clear glass
4. arg is 90% argon, 13.8mm air gap
5. 272 is Cardinal's 272 low-e, 3 mm
5. 180 is Cardinal's 180 low-e, 3 mm
6. se is Edgetech's Super Spacer (E-class)
7. The size was 2000mm x 2000mm as per standard North American ratings
8. See report ILF11001w-i for product information
9. $\Psi/2$ reported for meeting rail

Architectual Catalogue

Project Name: FIBERGLASS WINDOWS AND DOORS

Manufacturer:

Accurate Dorwin Company
1535 Seel Avenue
Winnipeg, MB R3T 1C6
Toll Free: 1.888.982.4640
Website: www.accuratedorwin.com

Material and Resources:

Division 8 – Section 085XX: Windows (Fiberglass)
Division 8 – Section 088XX: Glazing

Prepared By:

Document Owner(s)	Project/Organization Role
Norm Tremblay	Project Estimator
Cory Loewen	Project Estimator
Yuki Shiokawa	Project Estimator

Catalogue Version Control

Version	Date	Author	Change Description
1	12/28/2005	MJR / AJF	Document Created.
1	2/23/2006 3:43 PM		Print Date

ABOUT US

1952

Profile & History

Accurate Dorwin Co (Dorwin Industries), a leader in the fenestration industry has been in the business of making the finest quality and highest energy rated windows and doors since 1952. Well established in Central Canada, Accurate Dorwin Co. is dedicated to providing exceptional customer service to all residential and commercial customers throughout North America.

1983

In 1983, Dorwin Industries of Winnipeg introduced the first fiberglass window to the world. The idea evolved from a simple concept of using a composite material that is thermally superior to steel, wood, vinyl aluminum, and other materials.

It was a revolutionary idea that proved to be a challenge. Nothing existed to fabricate the required window profiles. As a result, Dorwin Industries developed a new manufacturing process now known as “pultrusion”. Pultrusion involves saturating parallel strands of glass fibers with resin and pulling it through a heated die. The result is a pultruded fiberglass profile.

Fiberglass is paintable, stronger than vinyl, more weather-resistant than wood, and less thermally conductive than steel and aluminum. It has a low thermal expansion and contraction coefficient similar to glass making it the ideal frame for most high performance IG units. Fiberglass is a strong frame material ideal to handle heavier dualpane and tripane IG units. In addition, fiberglass frame system has narrower sightlines offering a higher ratio of glass area (daylight) to frame area than most conventional frame materials.

Dorwin Industries pioneered and developed a system that combines the most dimensionally stable window frame material with foam insulation and high performance IG units. This system is what Accurate Dorwin Co. now proudly calls, ***“The Fiberglass Advantage”.***

2006

Philosophy

“A Company That Service Built”

With over 50 years experience and a reputation for offering the best product, Accurate Dorwin backs every product sold with the very best customer service. Customer satisfaction is a priority and Accurate Dorwin is committed to delivering the very best service.

Commitment

Accurate Dorwin is committed to being the leader in the fenestration industry and will continue to adapt to the demands of today’s residential and commercial customers.

To the consumer, Accurate Dorwin is committed to providing you the very best product, service, and warranty out there.

To the design community, builders, and other professionals, Accurate Dorwin is committed to providing you the right product for the right application and continues to offer unparallel technical support.

Accurate Dorwin is fully committed to a continued product development in order to meet the design requirements of today’s projects. We will improve and learn from the past. Accurate Dorwin will make fiberglass frame the material of the present and an exciting alternative to metal, wood, vinyl, and aluminum frames.

Beyond

Vision

With a proven track record in the residential market, Accurate Dorwin is slowly venturing into the light and heavy commercial sector. With the continued demand for green building products and energy efficiency, Accurate Dorwin is in a good position to deliver the very best product backed by the very best customer service.

ENVIRONMENTAL ASSESSMENT OF FIBERGLASS WINDOWS

INTRODUCTION

The environmental impacts of windows were studied as part of the design process for the Waterloo Region Green Home. There were eight environmental factors that were considered when the decision was made to install windows with pultruded fiberglass frames and a high efficiency glazing system as outlined below. A comparison to aluminum-clad and vinyl-high performance windows was made.

MATERIALS USED

Fiberglass for window frames is made of 65 to 85% glass fibres and 15 to 35% resin. Silica sand is melted and spun into the glass fibres. The resin is thermoset polyester, which is a petroleum-based alkyde containing styrene, glycols and acids. The insulation in the frames is expanded polystyrene. The pultruded lineals were produced by Omniglass of Winnipeg using fiberglass and resin from Owens Corning. The windows were manufactured and assembled by Accurate Dorwin of Winnipeg. The high-performance glazing units consisted of three panes of glass with LOF Energy Advantage Low-E coatings on surfaces 2 and 5, low-conductivity silicone Super Spacer from Edgetech and two argon gas fills.

Aluminum-clad wood framed windows require aluminum sheeting and high quality clear lumber. Some finger-jointed lumber is used in interior components that are not visible once the window is installed. Vinyl windows are made from polyvinyl chloride and often contain steel reinforcement.

RESOURCE DEPLETION

The raw material reserves for silica sand are very large at present and are not expected to be exhausted. Quality control concerns in the production of glass fibre presently preclude the use of recycled fibre and waste is not recycled into the process though these options are being investigated.

In-plant waste resins for fibre glass are re-used and re-blended. The raw material reserves are based on the limits of petroleum products. The amount of petroleum is relatively small and contributes to a durable product that has a long life and energy efficiency not available from other materials.

The polystyrene insulation is a petroleum product and as mentioned above, has reserves based on the limits of petroleum. Again, a durable insulation is produced that has advantages in energy use reduction during the life of the window compared to other products.

Vinyl windows require a large quantity of polyvinyl chloride resins which use petroleum as feed stock. Wood windows require clear heartwood for visible components placing a strain on old growth forests.

EMISSIONS DURING MANUFACTURE

Glass fibre production is said to be a closed process with few emissions escaping into the environment. Resin manufacture is also said to be a closed process with very few emissions in the environment. There is a chemical risk from the resins but it is less than that of PVC production. Expanded polystyrene is not produced in a closed process and some of the pentane blowing agent and other volatile compounds are able to escape.

The production of PVC releases petroleum byproduct into the atmosphere. The production of aluminum releases two fluorine gasses with potent greenhouse warming potential.

EMBODIED ENERGY

The energy intensity (18 MJ/kg) of fiberglass is lower than that of PVC (26MJ/kg). Fiberglass frames are slightly heavier than vinyl but have a lower embodied energy. Wood windows have a lower embodied energy but aluminum cladding increases energy requirements significantly.

All of the components for fiberglass windows are manufactured in North America so that transportation energy is relatively low as shipping distances are short. Fiberglass window frames are extremely durable and are expected to last the life of the house. This means that embodied energy (and all of the other issues discussed) must only be dealt with once rather than several times, as would be the case if the windows required replacement (as would probably occur with other materials).

ENERGY USED DURING THE LIFE OF THE WINDOWS

The space heating energy consumed as a result of the windows is much greater than the energy required to construct the windows. With fiberglass windows, the space heating energy is actually an energy gain on average. The Accurate Dorwin windows used at the Green Home have an energy rating (ER) of +7.2 for the operable versions. This means that averaged over the four cardinal directions and across the Canadian climate, they gain 7.2 watts per square meter of window over the heating season. These are only windows listed for the Ontario Hydro incentive program that have a positive energy rating for an operable model.

A standard double-glazed wood window has an energy rating of -33 W/m2. The highest triple-glazed wood window rating is -5 W/m2. Vinyl windows have similar ratings as wood.

OZONE DEPLETION

There are no ozone-depleting chemicals used in the manufacture of the fiberglass windows. The expanded polystyrene however, uses pentane (approximately 7% by volume) as a blowing agent (a greenhouse gas).

ENVIRONMENTAL EMISSIONS DURING THE LIFE OF THE PRODUCT

Polyesters and keytones will off-gas for some time after fiberglass is manufactured. The painted finish on the surface of the frames is however expected to reduce the rate of emission. Vinyl windows and to a lesser extent, wood windows, also have emissions.

DISPOSAL

There are at present no recycling possibilities for the fiberglass frames to produce new materials. Fiberglass is a relatively inert material and will not create leachate or other problems if sent to landfill. Because of the long-term durability of the frames, it is expected that there is a potential for re-use as windows if they are removed for re-modeling or other reasons that would see the house demolished. Vinyl and Aluminum have the potential to be recycled.

SUMMARY

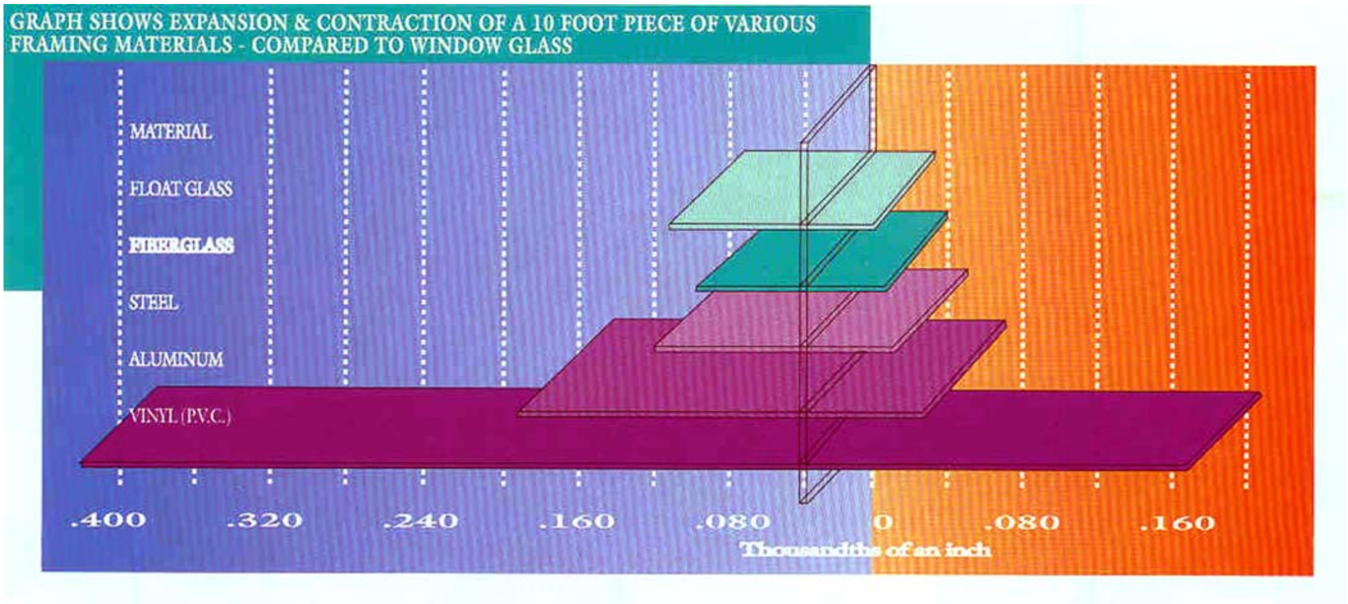
Table 1 summarizes how the three window frame materials compare in addressing the eight environmental issues. Energy use was considered to be the most important environmental factor. From this analysis, it was found that fiberglass windows have the lowest overall environmental impact. The energy efficiency and long life of fiberglass windows significantly reduces the need for purchased energy, which means that their impacts on resource depletion and embodied energy are also limited. The high energy use and to a lesser extent the emissions during production of aluminum-clad, wood and vinyl windows were the principal factors working against these products.

Enermodal Engineering Limited
March 22, 1993

TABLE 1 – Environmental Comparison of Windows

	Materials Used	Resource Depletion	Manufacturing Emissions	Embodied Energy	Energy Used During Life	Ozone Depletion	Emissions During Life	Disposal
Fiberglass	Glass fibre and resin	L	L	M	L	L	M	M
Aluminum Clad Wood	Wood and Aluminum	M	M	M	M	L	L	M
Vinyl	Polyvinyl Chloride	H	H	M	M	L	L	M

Note: L = Low M = Medium H = High Environmental Impact



ADC325 SERIES: AWNING

Features

- Projecting window hinged at the top (opening up to 13 1/2”).
- Custom sizes up to 32”w x 60”h [813mm x 1524mm] or 92 UI
- Daylight Size / Frame Size = Up to 75%
- Standard 3 1/4" open-back insulated frame. Standard non-insulated close-back sash.
- Available with dualpane, tripane, dual-plus (plexiglass), or 1” [25mm] IG Units.
- Available in standard white, custom, split-finish, and/or veneer wrap (oak, fir, others).
- Standard rotogear operators with standard collapsible handles. Standard multi-point locks where applicable (19” nominal height). Available limit device.
- Standard concealed hinges – tamper resistant for added security.
- Exterior glazed window with aluminum stops.
- Sash unhooks for interior service if necessary.
- Optional grille (3/8”, 5/8”), simulated divided lite (SDL), muntin (3/4" aluminum, 1 1/4" fiberglass), drywall return (1/2", 5/8”, 3/4"), jamb extension (vinyl wrap, oak, fir).

Specification

- Frame & Sash: Pultruded 0.090” nominal wall fiberglass (52-62% glass fibers + 35-45% resin + 7-13% filler)
- Insulation: Expanded Poly Styrene (EPS) Type 1
- Weatherseal: Santoprene Rubber Seals (main, secondary, spline), 1/16” glazing tape, dust
- Sealant: Low VOC (environmentally friendly)
- Brickmould: Extruded 0.040” nominal wall aluminum. See brickmould options.
- Paint & Finish: Advanced polyurethane baked on or electrostatically applied finish. Low VOC (EPA Compliant) whenever possible.
- Hardware: Truth Maxim Series hinges, locks, and rotogear operators. Standard white or black. Other finish available from supplier. See options and accessories.
- Insect Screen: Standard full screen. Removable stamped aluminum frame with black fiberglass mesh. Other screen materials are available.
- Insulating Glass (IG) Unit: IGMAC Certified Suppliers (AFGD, PPG, Others) – IG Units available with 3mm – 6mm depending on design requirements, low-E, argon gas fill, architectural grade Superspacer, Vilda V-92 spacer, tinted, reflective, laminated, tempered, heat strengthened (HS), opaque, spandrel, plexiglass, and others.
- Optional Items: See options and accessories.

Certification

- **NFRC Certified & EnergyStar Qualified***
- **CAN/CSA :** *In compliance with CAN/CSA A-440.1 and CSA A-440.2 standards.*
- **AAMA*:** *Equivalent ratings in accordance with 101/I.S. 2/NAFS-02.*
- **LEED:** *Information available upon request. Projects assessed on a case-by-case basis.*

* *See ADC2006 Performance Chart.*

Technical Information

- Limits (Min / Max): 18”w x 22”h [458mm x 559mm] / 32”w x 60”h [813mm x 1524mm]
- Egress (Canada / USA): *Non-egress / Non-compliant due to hardware interference.*
- Fire Index / Rating Information: *Available upon request.*
- AutoCAD & Bills of Materials: *Available upon request.*
- Installation Manual / Guide: *Available upon request.*
- Warranty Information: *See commercial and residential warranty.*

ADC325 SERIES: CASEMENT

Features

- Projecting window hinged at the jamb (opening up to 90°).
- Custom sizes up to 32"w x 72"h [813mm x 1829mm] or 104 UI
- Daylight Size / Frame Size = Up to 75% +/-
- Standard 3 1/4" open-back insulated frame. Standard non-insulated close-back sash.
- Available with dualpane, tripane, dual-plus (plexiglass), or 1" [25mm] IG Units.
- Available in standard white, custom, split-finish, and/or veneer wrap (oak, fir, others).
- Standard rotogear operators with standard collapsible handles. Standard multi-point locks where applicable (19" nominal height). Available limit device.
- Standard concealed hinges – tamper resistant for added security.
- Exterior glazed window with aluminum stops.
- Sash unhooks for interior service if necessary.
- Optional grille (3/8", 5/8"), simulated divided lite (SDL), muntin (3/4" aluminum, 1 1/4" fiberglass), drywall return (1/2", 5/8", 3/4"), jamb extension (vinyl wrap, oak, fir).

Specification

- Frame & Sash: Pultruded 0.090" nominal wall fiberglass (52-62% glass fibers + 35-45% resin + 7-13% filler)
- Insulation: Expanded Poly Styrene (EPS) Type 1
- Weatherseal: Santoprene Rubber Seals (main, secondary, spline), 1/16" glazing tape, dust
- Sealant: Low VOC (environmentally friendly)
- Brickmould: Extruded 0.040" nominal wall aluminum. See brickmould options.
- Paint & Finish: Advanced polyurethane baked on or electrostatically applied finish. Low VOC (EPA Compliant) whenever possible.
- Hardware: Truth Maxim Series hinges, locks, and rotogear operators. Standard white or black. Other finish available from supplier. See options and accessories.
- Insect Screen: Standard full screen. Removable stamped aluminum frame with black fiberglass mesh. Other screen materials are available.
- Insulating Glass (IG) Unit: IGMAC Certified Suppliers (AFGD, PPG, Others) – IG Units available with 3mm – 6mm depending on design requirements, low-E, argon gas fill, architectural grade Superspacer, Vilda V-92 spacer, tinted, reflective, laminated, tempered, heat strengthened (HS), opaque, spandrel, plexiglass, and others.
- Optional Items: See options and accessories.

Certification

- **NFRC Certified & EnergyStar Qualified***
- **CAN/CSA:** *In compliance with CAN/CSA A-440.1 and CSA A-440.2 standards.*
- **AAMA*:** *Equivalent ratings in accordance with 101/I.S. 2/NAFS-02.*
- **LEED:** *Information available upon request. Projects assessed on a case-by-case basis.*

* *See ADC2006 Performance Chart.*

Technical Information

- Limits (Min / Max): 15"w x 15"h [381mm x 381mm] / 32"w x 72"h [813mm x 1829mm]
- Egress (Canada / USA): 25"w x 42"h [635mm x 1067mm] / 32"w x 42"h [813mm x 1067mm]
- Fire Index / Rating Information: *Available upon request.*
- AutoCAD & Bills of Materials: *Available upon request.*
- Installation Manual / Guide: *Available upon request.*
- Warranty Information: *See commercial and residential warranty.*

ADC325 SERIES: PICTURE

Features

- Custom sizes up to 60"w x 84"h [1524mm x 2134mm] or 144UI
- Daylight Size / Frame Size = Up to 90% +/-
- Standard 3 1/4" open-back insulated frame. Standard non-insulated close-back sash.
- Available with dualpane, tripane, or dual-plus (plexiglass) IG Units.
- Available in standard white, custom, split-finish, and/or veneer wrap (oak, fir, others).
- Drain caps at each corner available in standard white or black.
- Interior glazed window with fiberglass stops.
- Serviceable from inside.
- Optional grille (3/8", 5/8"), simulated divided lite (SDL), muntin (3/4" aluminum, 1 1/4" fiberglass), drywall return (1/2", 5/8", 3/4"), jamb extension (vinyl wrap, oak, fir).

Specification

- Frame & Sash: Pultruded 0.090" nominal wall fiberglass (52-62% glass fibers + 35-45% resin + 7-13% filler)
- Insulation: Expanded Poly Styrene (EPS) Type 1
- Weatherseal: Santoprene Rubber Seal (spline), 1/8" glazing tape
- Sealant: Low VOC (environmentally friendly)
- Brickmould: Extruded 0.040" nominal wall aluminum. See brickmould options.
- Paint & Finish: Advanced polyurethane baked on or electrostatically applied finish. Low VOC (EPA Compliant) whenever possible.
- Hardware: Block and tackle spring balancers, die cast camlock, tilt-latches
- Insect Screen: *Not Applicable*
- Insulating Glass (IG) Unit: IGMAC Certified Suppliers (AFGD, PPG, Others) – IG Units available with 3mm – 6mm depending on design requirements, low-E, argon gas fill, architectural grade Superspacer, Vilda V-92 spacer, tinted, reflective, laminated, tempered, heat strengthened (HS), opaque, spandrel, plexiglass, and others.
- Optional Items: See options and accessories.

Certification

- **NFRC Certified & EnergyStar Qualified***
- **CAN/CSA:** *In compliance with CAN/CSA A-440.1 and CSA A-440.2 standards.*
- **AAMA*:** *Equivalent ratings in accordance with 101/I.S. 2/NAFS-02.*
- **LEED:** *Information available upon request. Projects assessed on a case-by-case basis.*

* *See ADC2006 Performance Chart.*

Technical Information

- Limits (Min / Max): 12"w x 12"h [305mm x 305mm] / 60"w x 84"h [1524mm x 2134mm]
- Egress Information: *Not Applicable*
- Fire Index / Rating Information: *Available upon request.*
- AutoCAD & Bills of Materials: *Available upon request.*
- Installation Manual / Guide: *Available upon request.*
- Warranty Information: *See commercial and residential warranty.*

MORRISON HERSHFIELD

Thermal Performance of Engineered Assemblies Thermal Clips Summary

The Engineered Assemblies Thermal Clip System is an aluminum thermal clip system for attaching rain-screen cladding systems for steel stud wall assemblies with exterior insulation. Morrison Hershfield was contracted by Engineered Assemblies Inc. (E.A.I) to model the system in order to provide thermal performance values.

The system is comprised of aluminum clips connected to horizontal and vertical sub-girts that support rain-screen panel cladding. The clips are attached to a steel stud back-up wall. Thermal breaks are provided at the connection between the sub-girt and clips via a cork/neoprene pad and between the clips and exterior sheathing via an aerogel insulation pad. See Figure 1 for a simplified rendering.

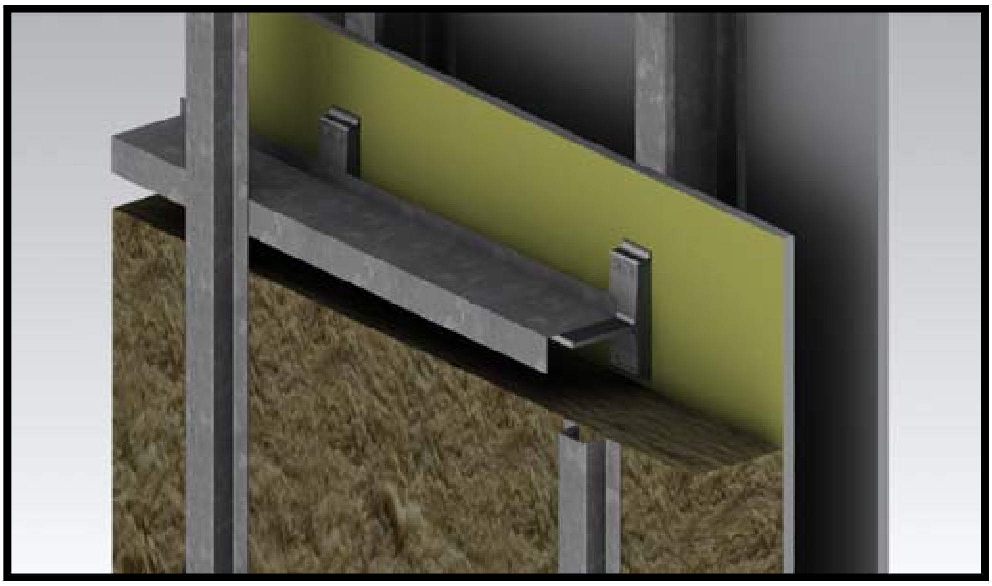


Figure 1: Simplified E.A. clip system

Modeling was done using a general purpose computer aided design (CAD) and finite element analysis (FEA) package. The thermal solver and modeling procedures utilized for this study were extensively calibrated and validated for ASHRAE Research Project 1365-RP “Thermal Performance of Building Envelope Details for Mid- and High-Rise Construction (1365-RP)[1].

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[1] http://www.morrisonhershfield.com/ashrae1365research/Pages/Insights-Publications.aspx

Three clear field clip systems available from Engineered Assemblies were modeled: T100, T125 and T150 clip systems, which accommodate 4”, 5”, and 6” of exterior mineral wool insulation (R-4.2/inch) respectively. The results for U-values and Effective R-Values are shown below, in Tables 1 and 2 respectively, for various spacings of clips. Additionally, the E.A. clip systems are compared to two common cladding attachment systems; continuous vertical and continuous horizontal girts. The steel stud backing for each of these systems is spaced at 16”o.c.

Table 1: Clear Field Thermal Transmittance

Clip System (Inches of Mineral Wool)	**Exterior Insulation Nominal R-Value** hr·ft^2·°F/BTU (m^{2}K/W)	**Assembly U-Value** BTU/hr·ft^2·°F (W/m^{2}K)				
		E.A. Clip System			Continuous Vertical Girts	Continuous Horizontal Girts
		34” Vertical Clip Spacing	41” Vertical Clip Spacing	48” Vertical Clip Spacing		
T100 (4”)	16.8 (2.96)	0.061 (0.346)	0.059 (0.336)	0.058 (0.329)	0.099 (0.562)	0.084 (0.477)
T125 (5”)	21.0 (3.70)	0.051 (0.288)	0.049 (0.278)	0.048 (0.272)	0.090 (0.511)	0.074 (0.420)
T150 (6”)	25.2 (4.44)	0.044 (0.251)	0.042 (0.241)	0.041 (0.235)	0.084 (0.477)	0.069 (0.392)

Table 2: Clear Field Effective Thermal Resistance

Clip System (Inches of Mineral Wool)	**Exterior Insulation Nominal R-Value** hr·ft^2·°F/BTU (m^{2}K/W)	**Assembly Effective R-Value** hr·ft^2·°F /BTU (m^{2}K/W)				
		E.A. Clip System			Continuous Vertical Girts	Continuous Horizontal Girts
		34” Vertical Clip Spacing	41” Vertical Clip Spacing	48” Vertical Clip Spacing		
T100 (4”)	16.8 (2.96)	16.4 (2.89)	16.9 (2.99)	17.2 (3.04)	10.1 (1.78)	11.9 (2.10)
T125 (5”)	21.0 (3.70)	19.6 (3.45)	20.4 (3.59)	20.8 (3.67)	11.1 (1.96)	13.5 (2.38)
T150 (6”)	25.2 (4.44)	22.7 (4.00)	23.8 (4.19)	24.4 (4.30)	11.9 (2.10)	14.5 (2.55)

Without any thermal bridging, the nominal thermal resistance of the whole assembly (including sheathings and air films) is R-3.2 plus the amount of exterior insulation, which is R-20.0, R-24.2 and R-28.4 for 4”,5” and 6” of mineral wool respectively. Comparing the thermal resistance of the continuous vertical girt system to the nominal resistance, the vertical girt system is only 40-50% effective due to the continuous connection between the girt system and the steel studs. The continuous horizontal system is slightly better by only overlapping the metal parts at certain locations, however the steel is still continuous and the system is only 50-60% effective. The E.A. thermal clip system greatly reduces the amount of conductive paths through the insulation and creates a thermal buffer between metal parts and as a result the system is 80-86% effective (depending on insulation amount and girt spacing).

Thermal images for the exterior insulated vertical and horizontal systems and the T125 clip system are shown in Figures 2-5 using a temperature index (1 = indoor temperature, 0 = outdoor temperature).

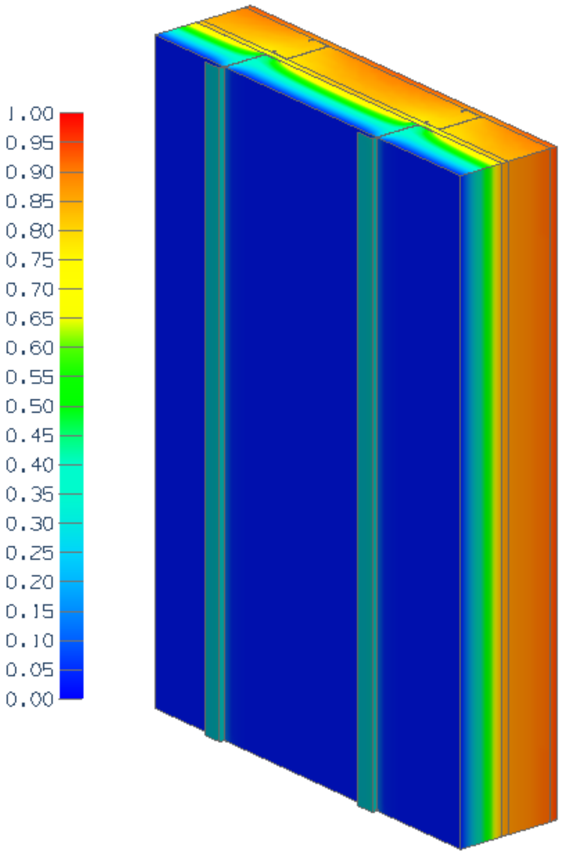


Figure 2: Thermal profile for continuous vertical girt system

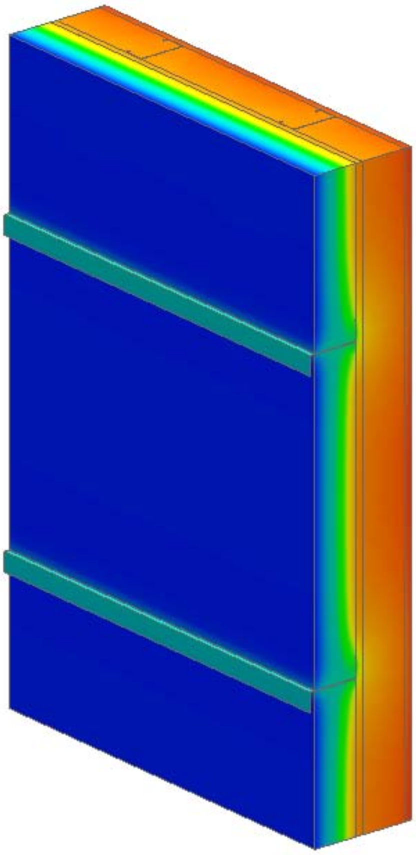


Figure 3: Thermal profile for continuous horizontal girt system

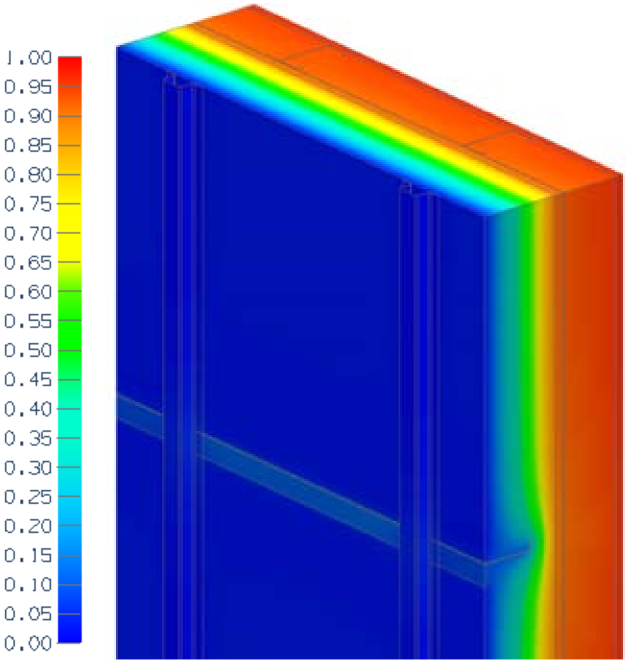


Figure 4: Thermal profile for E.A. Clip System T125 spaced vertically 41" o.c.

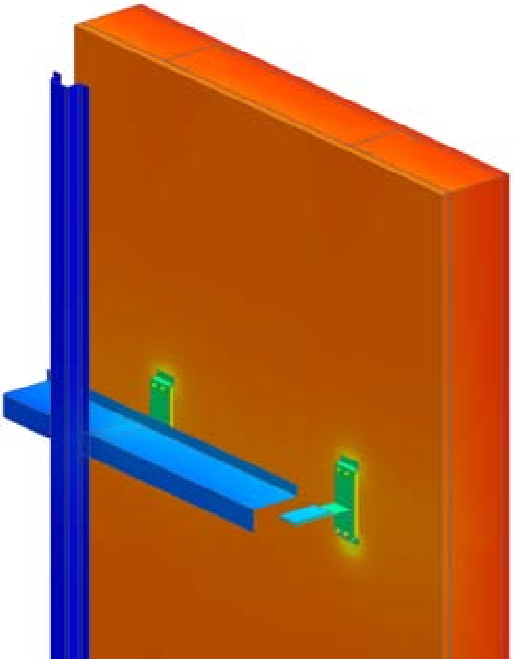


Figure 5: Thermal profile for E.A. Clip System T125 spaced vertically 41" o.c. with insulation and girts hidden

Based on the modeling done in this report, the three E.A. clip systems, T100, T125 and T150, will meet the prescriptive requirements for non-residential steel stud walls in ASHRAE 90.1-2007/2010 for all climate zones. For further modeling and analysis of the E.A. clip systems, please see the full report.

Morrison Hershfield Ltd.

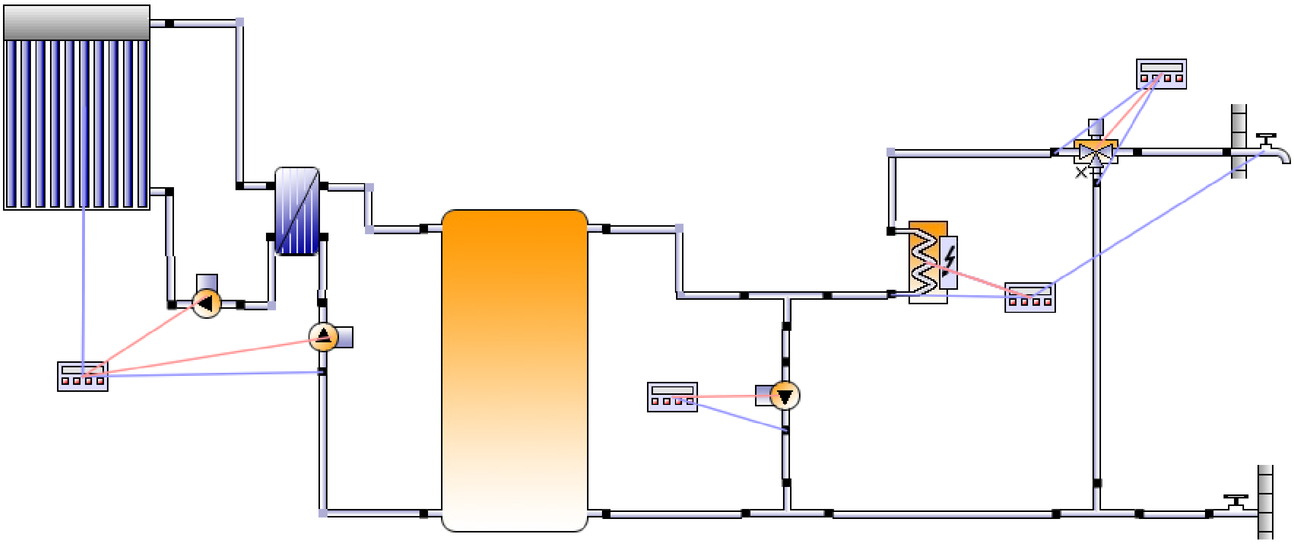
Neil Norris, M.A.Sc.
Building Science Consultant

David Fookes, P.Eng.
Principal, Technical Director
Building Envelope Specialist

Professional Report

Eco Housing 24 Units
Yellowknife NWT

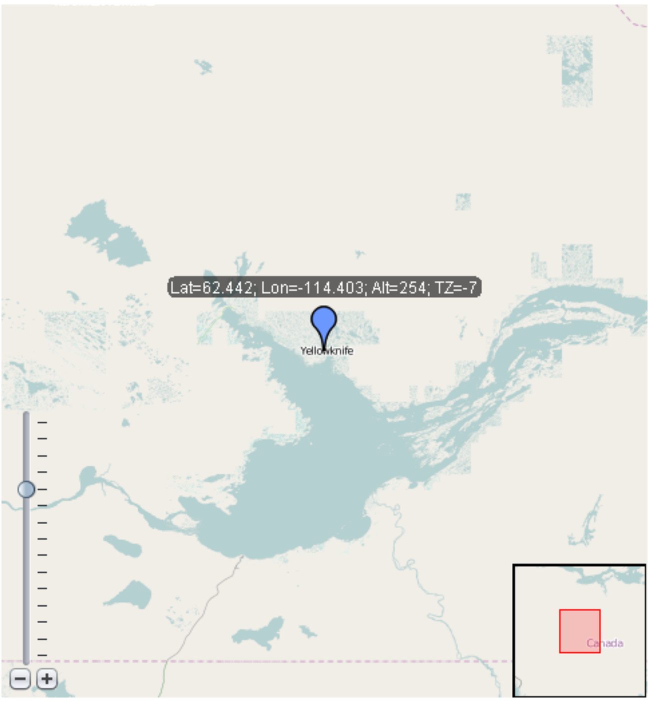
OPT 1 - 20 x 20/2000 HP with 80kW SEU and storage tanks



Location of the system

Yellowknife
Longitude: -114.403°
Latitude: 62.442°
Elevation: 254 m

Map section



This report has been created by:

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Comments on the project

Solar:
20 x S-Power HP 20/2000 evacuated tube collectors tilted at 60 deg and facing South.

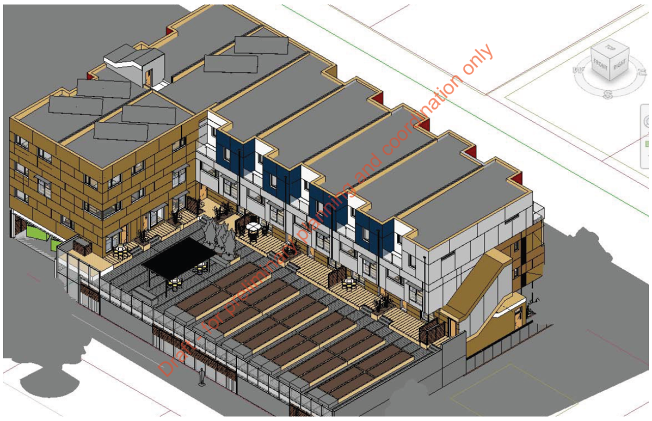
Load:
Inlet water Temp = Calculated from Yellowknife NT
Outlet water temp = 55
Consumption = 2060 L/day
Load Profile = Multi-Family Residential

Option1:
Operating with one 80 kW SET and 3,600 L (960 US gallons) of solar
storage capacity (water).

Option2:
Operating with 4 x SST120 SS Tank with internal coil.

Option3:
Operating with glycol as the storage medium. 3,600L of glycol storage

Photograph of property



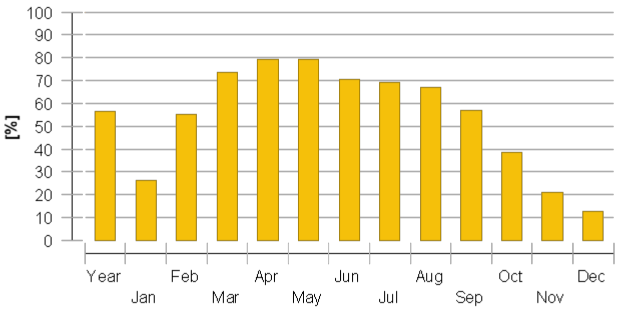
System overview (annual values)

Total fuel and/or electrical energy consumption of the system [Etot]	25,262.1 kWh
Total energy consumption [Quse]	46,523 kWh
System performance [(Quse+Einv) / (Eaux+Epar)]	1.84
Comfort demand	Energy demand covered

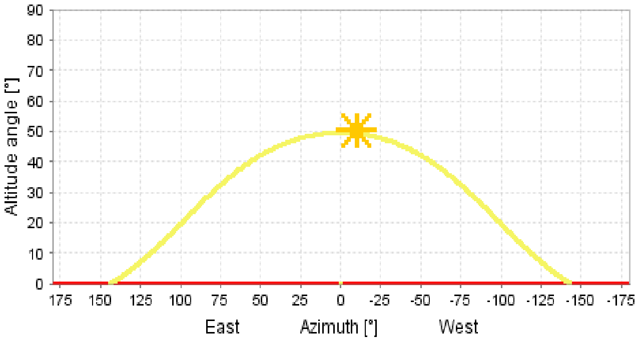
Overview solar thermal energy (annual values)

Collector area	65 m²
Solar fraction total	56.3%
Total annual field yield	29,284.8 kWh
Collector field yield relating to gross area	450.5 kWh/m²/Year
Collector field yield relating to aperture area	673.2 kWh/m²/Year
Max. energy savings	30,826.1 kWh
Max. reduction in CO2 emissions	16,535.1 kg

Solar fraction: fraction of solar energy to system [SFn]



Horizon line



Meteorological data-Overview

Average outdoor temperature	-3.6 °C
Global irradiation, annual sum	1,068.9 kWh/m²
Diffuse irradiation, annual sum	393.2 kWh/m²

Component overview (annual values)

Boiler 2	**Continuous flow electric heater 200kW**	
Power	kW	200
Total efficiency	%	94.6
Energy from/to the system [Qaux]	kWh	22,745.8
Fuel and electrical energy consumption [Eaux]	kWh	24,038.1
Energy savings solar thermal	kWh	30,826.1
CO2 savings solar thermal	kg	16,535.1
Fuel savings solar thermal	kWh(el.)	30,826.1

Collector North America	HP 20/2000 TPS Inside	
Data Source		SRCC
Number of collectors		20
Number of arrays		5
Total gross area	m²	65
Total aperture area	m²	43.5
Total absorber area	m²	43.5
Tilt angle (hor.=0°, vert.=90°)	°	60
Orientation (E=+90°, S=0°, W=-90°)	°	0
Collector field yield [Qsol]	kWh	29,284.8
Irradiation onto collector area [Esol]	kWh	101,118
Collector efficiency [Qsol / Esol]	%	29
Direct irradiation after IAM	kWh	63,676.3
Diffuse irradiation after IAM	kWh	28,935

Hot water demand	Multi family dwelling	
Volume withdrawal/daily consumption	l/d	2,063.4
Temperature setting	°C	55
Energy demand [Qdem]	kWh	47,214

External heat exchanger	SC_EW_5221 W/K Gen 2 80 kW SET	
Transfer capacity	W/K	5,221

Pump 1	Grundfos UPS 26-150	
Circuit pressure drop	bar	0.441
Flow rate	l/h	3,600
Fuel and electrical energy consumption [Epar]	kWh	788.1

Pump 2	Grundfos UPS 26-99BFC w Check Valve	
Circuit pressure drop	bar	0.122
Flow rate	l/h	875.4
Fuel and electrical energy consumption [Epar]	kWh	100.1

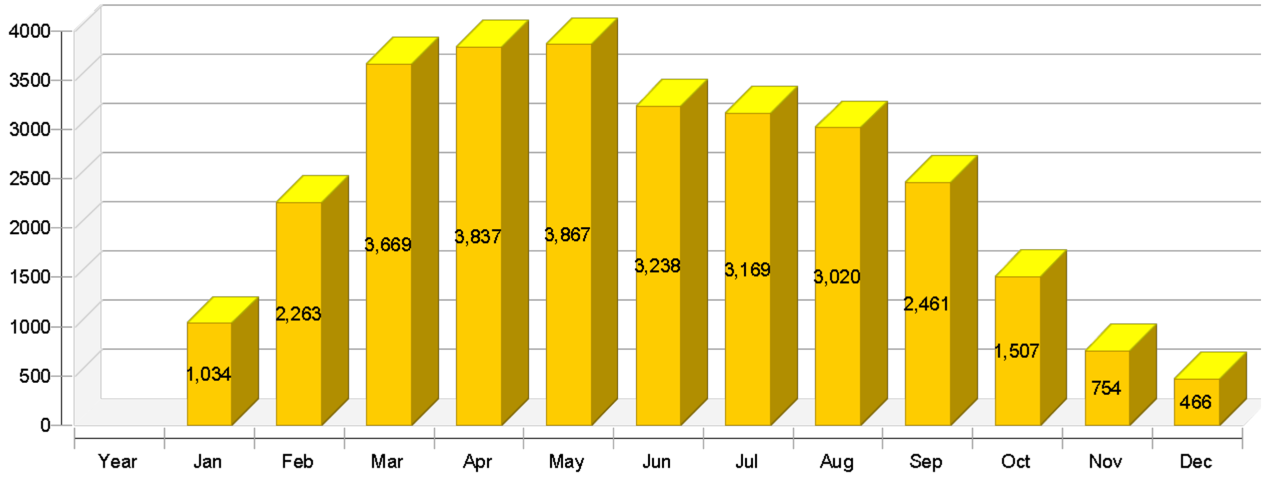
Pump 3	Grundfos UPS 26-99BFC w Check Valve	
Circuit pressure drop	bar	0.128
Flow rate	l/h	3,600
Fuel and electrical energy consumption [Epar]	kWh	335.7

Storage tank Solar	**SC_EW_960 G**	
Volume	l	3,634
Height	m	2.44
Material		S235 JR G2
Insulation		Rigid PU foam
Thickness of insulation	mm	50
Heat loss	kWh	426.2
Connection losses	kWh	56.1

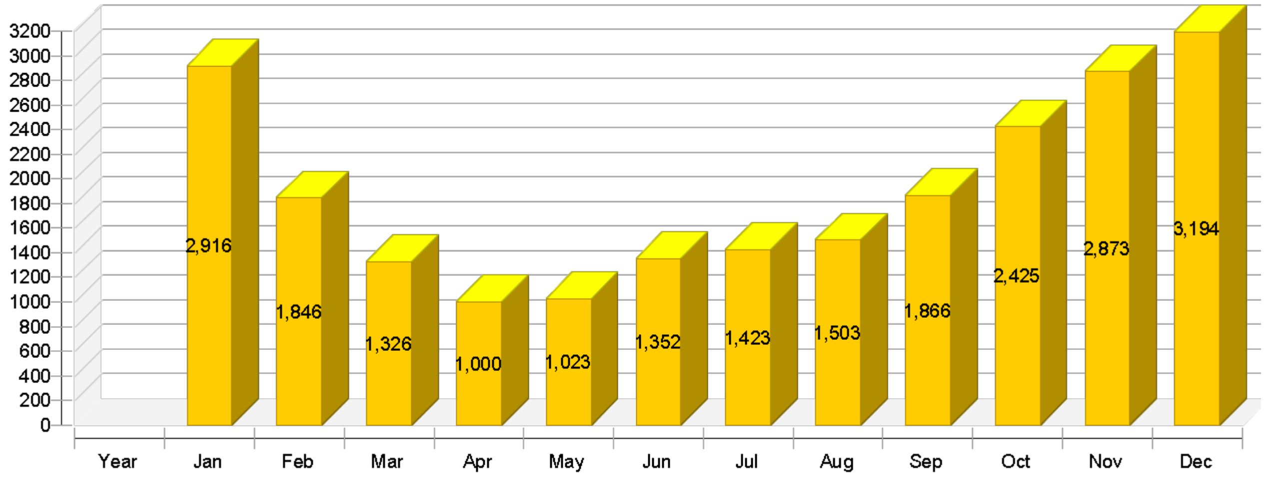
Loop

Solar loop		
Fluid mixture		Propylene mixture
Fluid concentration	%	50
Fluid domains volume	l	124.9
Pressure on top of the circuit	bar	3

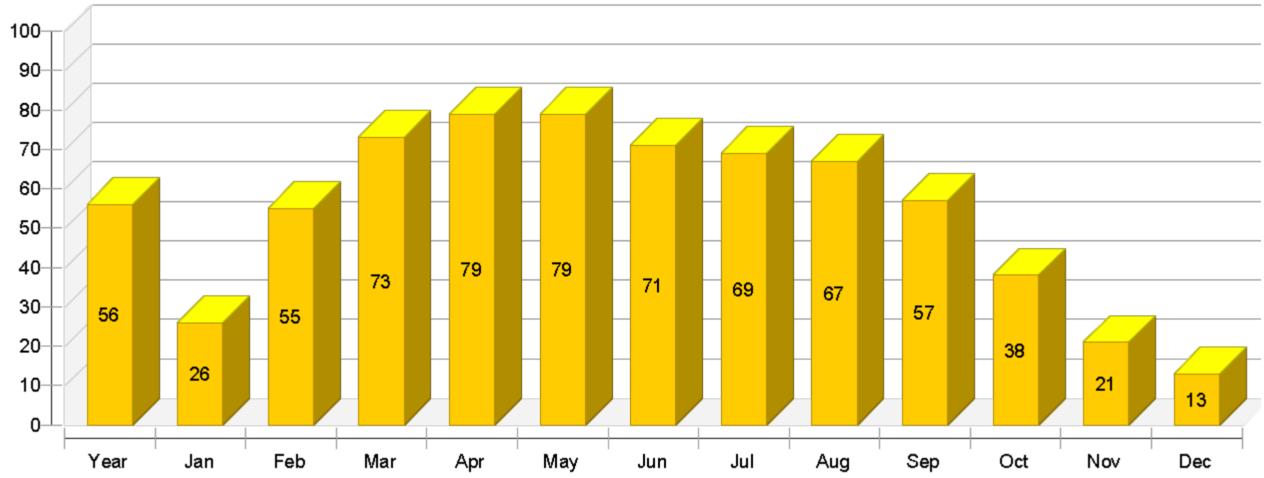
Solar thermal energy to the system [Qsol] kWh



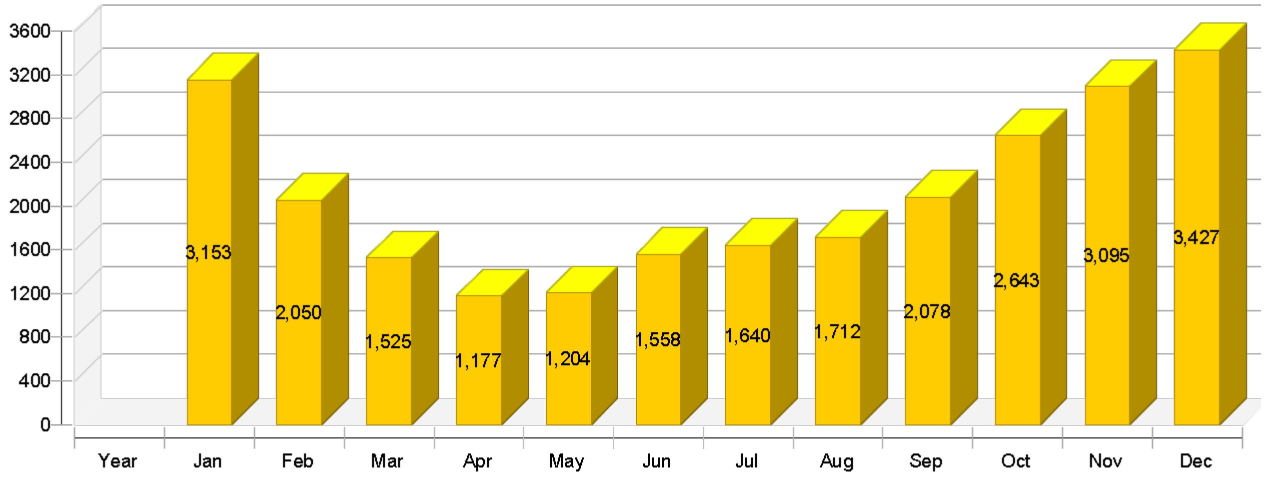
Heat generator energy to the system (solar thermal energy not included) [Qaux] kWh



Solar fraction: fraction of solar energy to system [SFn] %



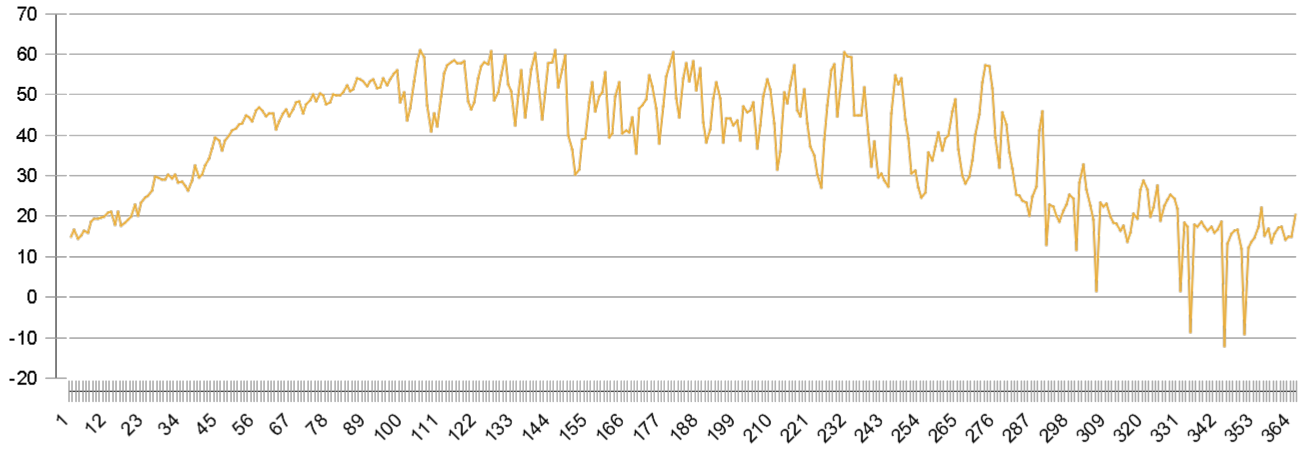
Total fuel and/or electrical energy consumption of the system [Etot] kWh



	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Solar thermal energy to the system [Qsol]													
kWh	29285	1034	2263	3669	3837	3867	3238	3169	3020	2461	1507	754	466
Heat generator energy to the system (solar thermal energy not included) [Qaux]													
kWh	22746	2916	1846	1326	1000	1023	1352	1423	1503	1866	2425	2873	3194
Heat generator fuel and electrical energy consumption [Eaux]													
kWh	24038	3077	1950	1404	1060	1085	1431	1506	1590	1972	2560	3032	3370
Solar fraction: fraction of solar energy to system [SFn]													
%	56.3	26.2	55.1	73.5	79.3	79.1	70.5	69	66.8	56.9	38.3	20.8	12.7
Total fuel and/or electrical energy consumption of the system [Etot]													
kWh	25262	3153	2050	1525	1177	1204	1558	1640	1712	2078	2643	3095	3427
Irradiation onto collector area [Esol]													
kWh	101118	4008	7980	13131	13603	13630	10840	10378	9833	7972	5139	2692	1913
Electrical energy consumption of pumps [Epar]													
kWh	1,224	76.4	99.6	121.5	117.2	118.7	126.5	133.8	122	106.8	82.8	62.3	56.3
Total energy consumption [Quse]													
kWh	46523	3950	3564	3963	3844	3974	3834	3962	3925	3798	3949	3820	3940
Heat loss to indoor room (including heat generator losses) [Qint]													
kWh	5228	-11	380	748	803	820	679	702	639	441	212	-38	-147
Heat loss to surroundings (without collector losses) [Qext]													
kWh	2795	192	303	440	390	341	219	191	202	178	144	94	101

Collector North America

Daily maximum temperature [°C]



Energy flow diagram (annual balance)