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Solar swimming pool heating is a thriving industry weathering the ups and downs of renewable energy markets over the last 40 years. PV and boxed and glazed collector promotions have come and gone but solar pool heating has always been popular especially on residential pools. Canada has always had a reasonable market considering the climate and several manufacturers have competed for decades. Occasionally the idea to use boxed and glazed or evacuated tube collector styles on an indoor pool arises but never without a full and proper analysis.

NRCAN has funded some of the best collector solar performance software in the world over the decades. Swimming pool heating balances are rigorously evaluated using ENERPOOL PRO downloadable at [www.h2otsun.com/enerpool.html](http://www.h2otsun.com/enerpool.html). This software incorporates collector performance data for unglazed solar collectors determined in a facility in Canada (now Exova) that includes wind effects. Boxed and glazed or evacuated tube collector curves can also be inputted. This simulation was verified with three high level monitored pools in Canada 14 years ago. Since then numerous studies have been done across Canada to determine the feasibility of solar pool heating. The fact is its tough to see better than a 5 year return on investment in Canada so few of the studied projects ever went ahead.

The following is a computer simulation study summary comparing an unglazed collector system with a boxed and glazed collector system. The sample simulated pool has almost 2000 sq ft of solar collector. Its an indoor pool in Saskatoon with many of the inputs assumed but kept the same for the simulation with a typical boxed and glazed collector vs a typical unglazed collector.of exactly the same area.

The results of the simulation are:

Enerpool v. 3.0.0 - Swimming Pool Simulation  
Simulation File: C:\Users\Ken\Documents\Enerpool\saskunglazed.epl  
Run on: Thu Dec 02 16:37:15 2010

POOL CONFIGURATION:

- Solar Collector
- No Heat Exchanger
- Auxiliary Heater
- Weather file: C:\Users\Ken\Documents\Enerpool\Climate\SASK.TMY
- No Alternate Input File

POOL CHARACTERISTICS:

Pool Volume: 350 m3  
Pool Area : 280 m2  
Evaporation Model: RSPEC  
Wind Correction Factor (Pool): 0.5  
Total Collector Area: 185.6 m2

FIRST: UNGLAZED COLLECTORS

SIMULATION SUMMARY UNGLAZED

	Passive	Active	Auxiliary	Total	Residual	Average
Mon	Gains	Gains	Heating	Losses	Gains	T Pool
	(GJ)	(GJ)	(GJ)	(GJ)	(GJ)	(C)
Jan	0.00	0.09	116.76	94.80	22.05	24.93
Feb	0.00	4.14	81.72	85.86	-0.00	24.99
Mar	0.00	14.22	80.69	94.91	0.00	24.99
Apr	0.00	24.45	67.54	91.99	-0.00	25.00
May	0.00	46.05	49.27	95.32	-0.00	25.01
Jun	0.00	58.34	34.17	92.51	0.00	25.04
Jul	0.00	72.08	26.42	97.58	0.93	25.16
Aug	0.00	72.67	25.08	98.68	-0.93	25.24
Sep	0.00	35.41	56.78	92.19	-0.00	25.01
Oct	0.00	17.34	77.63	94.97	0.00	24.99
Nov	0.00	0.90	91.14	92.03	0.00	25.00
Dec	0.00	0.17	91.91	92.08	-0.00	25.00
Tot	0.00	345.87	799.11	1122.94	22.05	25.03

SOLAR SUMMARY UNGLAZED

	Available	Collected	Piping	Pump	Active
Mon	Energy	Energy	Losses	Gains	Gains
	(GJ)	(GJ)	(GJ)	(GJ)	(GJ)
Jan	55.23	0.09	0.00	0.00	0.09
Feb	75.39	4.10	0.01	0.05	4.14
Mar	120.77	14.12	0.02	0.12	14.22
Apr	115.11	24.30	0.02	0.17	24.45
May	125.87	45.78	0.03	0.29	46.05
Jun	126.59	58.00	0.03	0.37	58.34
Jul	136.07	71.71	0.02	0.40	72.08
Aug	130.32	72.32	0.02	0.37	72.67
Sep	94.84	35.20	0.02	0.23	35.41
Oct	73.43	17.22	0.01	0.14	17.34
Nov	42.40	0.88	0.00	0.02	0.90
Dec	39.57	0.17	0.00	0.00	0.17
Tot	1135.59	343.89	0.19	2.17	345.87

NEXT THE BOXED AND GLAZED PANEL RESULTS:

SIMULATION SUMMARY BOX AND GLAZED

	Passive	Active	Auxiliary	Total	Residual	Average
Mon	Gains	Gains	Heating	Losses	Gains	T Pool
	(GJ)	(GJ)	(GJ)	(GJ)	(GJ)	(C)
Jan	0.00	15.53	101.12	94.61	22.05	24.92
Feb	0.00	28.73	57.44	86.16	0.00	25.01
Mar	0.00	54.31	42.54	96.84	0.00	25.09
Apr	0.00	59.18	35.18	94.36	-0.00	25.14
May	0.00	70.41	27.33	97.74	0.00	25.15
Jun	0.00	73.96	21.21	94.90	0.27	25.17
Jul	0.00	84.44	16.85	100.73	0.56	25.34
Aug	0.00	82.51	17.73	101.08	-0.83	25.37
Sep	0.00	50.87	42.78	93.65	0.00	25.09
Oct	0.00	34.99	60.60	95.59	0.00	25.02
Nov	0.00	12.43	79.63	92.06	0.00	25.00
Dec	0.00	10.34	81.57	91.91	0.00	24.99
Tot	0.00	577.70	583.98	1139.62	22.05	25.11

## SOLAR SUMMARY BOXED AND GLAZED

	Available	Collected	Piping	Pump	Active
Mon	Energy	Energy	Losses	Gains	Gains
	(GJ)	(GJ)	(GJ)	(GJ)	(GJ)
Jan	55.23	15.43	0.03	0.13	15.53
Feb	75.39	28.57	0.04	0.20	28.73
Mar	120.77	54.08	0.05	0.28	54.31
Apr	115.11	58.89	0.04	0.33	59.18
May	125.87	70.04	0.04	0.41	70.41
Jun	126.59	73.56	0.03	0.43	73.96
Jul	136.07	84.00	0.03	0.46	84.44
Aug	130.32	82.12	0.02	0.42	82.51
Sep	94.84	50.60	0.03	0.29	50.87
Oct	73.43	34.79	0.03	0.23	34.99
Nov	42.40	12.35	0.02	0.10	12.43
Dec	39.57	10.26	0.02	0.10	10.34
Tot	1135.59	574.71	0.38	3.37	577.70

## COMPARISON:

The main consideration is the GJ output over the year. For glazed we have 574 GJ and for unglazed we have 345 GJ in this example. This unglazed system of almost 2000 sq ft would have cost \$27,000 but done with boxed and glazed collectors, insulated copper pipes, glycol and heat exchangers which weren't even factored into the performance numbers, at least \$200,000.00 The cost per GJ/year for the unglazed example is \$78 and the cost with boxed and glazed is \$348. Unglazed collectors are 4.4 times as cost effective as boxed and glazed based on these numbers and an unglazed system is warranted much longer. The boxed and glazed collectors are not even warranted long enough than they come close to paying for themselves. If you pay \$10/GJ and your boiler is 80% efficient the unglazed system pays for itself in 7 years whereas the glazed system takes 28 years. This is before any rebates or financial assistance.

The sales pitch for the boxed and glazed collectors is always that they will perform better year round in the cold winter but look at the collected and available energies in both cases. In January there is 55 GJ available and the boxed and glazed collector can only collect 15 of it. That is better than the 0.09 the unglazed system would collect but looking at all the numbers reveals the true picture.

Furthermore it is very important to point out that an unglazed system can be set up to drain down when off meaning it can usually operate year round. A boxed and glazed collector system must use a glycol antifreeze with high temperature corrosion inhibitors and a heat exchanger. This factors into the performance dramatically. For the heat exchanger to be a reasonable size and cost and effectiveness we must elevate the collector loop temperature significantly. Warmer collectors are less efficient. This is a tradeoff and if we factor in a 40% performance penalty our boxed and glazed collector system does not produce more energy than the equally sized unglazed swimming pool collector system on a size per size basic.

We don't have the ability to include this penalty in the performance simulations because back in the day no-one ever thought that this would ever be done this way.

We published most of <http://www.h2otsun.com/PG3.html> in 1995. This knowledge has been in place for a long time but the recent mad rush to solar heat commercial pools came quickly and most of the decision makers that spent a lot of money 20 years ago determining the above are long gone. We've waited decades for solar feasibility on indoor municipal pools in Canada to be recognized and we fear the incorrect application of technology is taking place.

Sincerely

A handwritten signature in blue ink, appearing to read 'Ken Wright', written in a cursive style.

Ken Wright , Pres  
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