



Newsletter #2 - June 2009

SESCI Board Members

Frederic Pouyot - President
Ottawa, ON
Ram Sahi - Vice-President
Ottawa, ON
Roy Joseph - Treasurer
Ottawa, ON
Bruce Donovan - Newsletter Editor
Sherwood Park, AB
Bill Eggerston - Vice Treasurer
Ottawa, ON
Brent Crowhurst - Conference Committee
Waterloo, ON
Phillip R. Winters
Toronto, ON

Newsletter Articles

We are hoping you will support our Newsletter by submitting articles. You can also submit articles from your area of expertise for publication that are relevant to our cause. We can get permission from people that wrote other articles. You can also find some information and do research on a certain topic and put your research in your own words. You could contact someone that has done a great article and get them to submit their article. We welcome articles on solar energy and wind power topics especially. Please contact Bruce, the Newsletter editor to submit articles to bruce@techonfoot.com Please get the essence of the article approved before you go to all the work of doing it.



Inside of Solar Demo Trailer

Click on the link below and it will take you to the page where the article is.

Table of Contents

Page 1. Board Members

Page 2. Membership Application

Page 3. Is Super Insulation Worth It?
By Jerry Shaw Ph.D.

Page 8. Riverdale NetZero House
By Gordon Howell

Page 9. Solar Heating Growing More Popular in Nova Scotia
By Josh Mclean

If you have some nice pictures of a solar or wind installation we would like to hear from you. Please contact us and send the pictures in the highest resolution that you have. We will adjust them to our publications needs. I would like to thank Larry Thomson for providing us with pictures of his solar hot water installation for this publication.



MEMBERSHIP APPLICATION

Name: _____

Mailing Address: _____

Telephones: (h) _____ (w) _____ (cell) _____

E-Mail: _____

Membership Category: (per year)

- _____ **Student - \$20.00**
- _____ **Senior Citizen - (Over 60) - \$35**
- _____ **Individual - \$65**
- _____ **Library - \$100**
- _____ **Corporate - (5 or less employees) - \$175**
- _____ **Corporate - (6 or more employees) - \$350**
- _____ **Supporting Corporate - \$1500**
- _____ **Sustaining Lifelong (individual) - \$3000**
- _____ **ISES (International Solar Energy Society) - available on request**

Total Amount Enclosed: _____ Signature: _____ Date: _____

____ I would like to volunteer on one of SESCO's projects. Please contact me.

What areas are of major interest to you?

- ____ Solar Electric ____ Passive Solar Construction ____ Water Power ____ Solar Water Heating
- ____ Wind Power ____ Solar Space Heating ____ Conservation ____ Energy Efficient Building
- ____ Biomass ____ Electric Cars ____ Other: _____

THE BENEFITS OF MEMBERSHIP

- Receive notification of all of the great SESCO programs, seminars, and classes
- A 10% discount on solar society-sponsored classes and workshops.
- Support the wonderful work of the Solar Energy Society
- Receive the Newsletter electronically

All mailings are sent by e-mail.
We do not share member e-mail addresses with anyone.
Please print this and give it to potential new members



Is Super-Insulation Worth It?

by Jerry Shaw Ph D

In April, 2007 a report entitled “The Insulation Dilemma: R-Value vs Real Value” by Icynene Inc., in the magazine, Home Builders was published. This report set forth the argument that super-insulating beyond current code for exterior walls was not worth the extra cost. Additional costs would not be recovered through lower fuel bills in the number of years that people normally occupy a particular residence building. At first this appears unbelievable because super-insulated passive solar houses have been built and are quite energy efficient (Shaw 2005). Many others have built similar houses and the recent Riverdale Netzero House (www.riverdalenetzero.ca) sets a new super-insulation level with R56 walls and R100 ceiling for the exterior envelope.

Single and two story houses were simulated with different levels of insulation in walls and ceiling in Hot 2000™, version 9.33 to test the argument set forth by Icynene Inc. The current and double costs of using natural gas from Direct Energy in Edmonton, Alberta were used in the simulations.

The report by Icynene Inc uses the premise that “In reality, R-8 insulation already controls 90 per cent of potential energy loss through a material”. Upgrading the insulation from R-8 to R-12 or R-20 would cost \$1200 and \$3200, respectively. The annual savings would be \$22.50/yr and \$45/yr, respectively, and take 53 years and 71 years, to recover the extra cost. From this one might expect upgrading from R-12 to R20 (a more common upgrade at present) might take 18 years at an annual savings of \$22.50. Attributes of the building and its environment, such as furnace efficiency, air changes per hour of the house air mass, etc were not given in the report.

On the Icynene Inc website (www.icynene.com) the Design Note (The Economic Thickness of Thermal Insulation) has more detail and appears to be the basis of the Home Builders report. In this Design Note (DN) conductive heat flow (kBtu’s) through a wall of 1000 sq ft is plotted against the thickness of insulation, disregarding convective and radiant heat movements in the wall. The valid assumption is that the wall(house) has a good vapour barrier to stop convective and radiant heat movements. The percentage of the heat flow blocked by each inch of insulation with an R value of 3.6 is placed at the top of the bar for each inch of insulation. The first bar for the zero inches of insulation (= boundary surfaces) shows 100%, but is clearly slightly below 45000 Btu, a representative heat flow. The wall without insulation would still have outer and inner surface boundaries with R values of 0.2 and 0.7, respectively. Table 1, 23.3 (ASHRAE 1985) describes the boundary R value to vary at least 10 fold in relation to reflectivity of the surface and amount of air movement. Pink fiberglass insulation has valid R values/ inch from 3.6 to 2.97(Alberta Agriculture, 1983; some googled websites on the internet). Such laboratory determined R value ratings are usually all legitimate because the methods of determination are governed by standard’s organizations in Canada and the United States. Table 1 shows a basis for the computation of the figure 1.1(DN).



This table was produced in Excel software and is repeated here except for the deleted boundaries row of Fig 1.1(DN). The standard equation for Q (heat flow); ie, $Q = \text{Area} \times \Delta T / R$ was used.

The value for ΔT is a reasonable design differential between average outside and constant indoor temperature in winter. The calculations are done in the same units used for Fig 1.1 (DN). The last column of Table 1 is the same as Fig. 1.1 (DN).

Table 1
Percent Conductive Heat Loss from Increased Insulation (R=3.6/inch as per Fig. 1.1 DN)

Inches	Area:sqft	ΔT	R	Sum R	Q:kBtu	Heat Saved	%	%Heat Loss
1	1000	40	3.6	8.910	36.089	80.2	19.8	
2	1000	40	7.2	4.945	40.055	89.0	11.0	
3	1000	40	10.8	3.422	41.578	92.4	7.6	
4	1000	40	14.4	2.616	42.384	94.2	5.8	
5	1000	40	18.0	2.118	42.882	95.3	4.7	
6	1000	40	21.6	1.779	43.221	96.0	4.0	
7	1000	40	25.2	1.533	43.467	96.6	3.4	
8	1000	40	28.8	1.347	43.653	97.0	3.0	
9	1000	40	32.4	1.202	43.798	97.3	2.7	

However, the calculation for boundary considerations was deleted because it does not change the conclusion to which they came, but will lead you into trying to understand the weird anomaly of negative “Heat Saved” values when exploring variation in boundary R values. Only changes in insulation type and its R value, ΔT and reasonable variations from 45 Kbtu could lead to other useful conclusions.

House simulation with Hot2000™ was chosen to examine the argument against super-insulation. Hot2000™ software (www.sbc.nrcan.gc.ca/software_and_tools/) is a residential house simulator which is continually upgraded and has been validated (Haltrecht and Fraser 1997, Shaw 2005). Three each of single and two storey houses (40 ft [South side] x 25 ft, interior side of exterior wall) with basement (BCEA_4, R 15 walls and floor) were modeled. Each wall had one (two for two storey house) clear triple pane square window (16 ft², R-2.49). The north side had one standard door (R10). Only, the R value of walls and ceiling were varied between simulators (Table 2). Air Tightness level of 1.5 ACH at 50 Pa, a heat return ventilator and a 90% steady state efficient, condensing furnace were used in all simulations. Default values provided by the software were used for other energy using aspects such as air conditioning. The indoor temperature of the main floor was set at 72 degrees F. Only a few effect data for the two storey simulators are shown (Table 2.)



Table 2
Annual Effects of Wall & Ceiling R Value: Input and Output Data for Hot2000™ Simulators

Variable	Base R House 1	+ R wall House 2	% Reduction	++ R ceiling House 3	% Reduction
R (W/C)	20/40	60/40		60/80	
% HeatLoss-W	20.3	7.8	12.5	8.9	11.4
% HeatLoss-C	8.02	9.3		5.5	2.5
% HeatLoss –M	39.4	29.9	9.5	29.1	10.3
% HeatLoss –B	32.4	37.4		33.2	
% HeatLoss –V	28.3	32.7		37.7	
DHL(Btu/hr/ft ³)	1.80 (2.32)	1.60 (1.95)	11.1 (15.9)	1.44 (1.88)	20.0 (19.0)
NG Use (Mft ³)	69.6 (91.3)	58.81(71.5)	15.5 (21.7)	50.43 (68.3)	27.5 (25.2)
GGemission(t/yr)	10.31	9.73	5.6	9.21	10.7
Electricity(kWhr)	12208	12184		12041	
Cost NG at 8\$/Gj	792 (974)	700 (807)	12 (17)	629 (780)	20.4 (20)
Cost NGat16\$/Gj	1283 (1648)	1100 (1314)	14 (20)	959 (1261)	25.2 (24)
Cost Electricity	1402	1400.0		1386.4	

W: wall, C: ceiling, M: main floor, B: basement, V: ventilation, DHL: winter design heat loss at -25.6 F, NG: natural gas, GG: green-house gas, 1 storey (2 storey) values.

Just saving energy and green house gas emissions of 27% and 10%, respectively (Table 2) may be the major worth of super-insulating.

Using the values in the third and second last rows of the above table the expected cumulative dollar savings per year of increased insulation levels are shown in the following Table 3.

Table 3
Natural Gas Cumulative Cost Savings (\$/Gj) per Year for House H2 vs 1 & House H3 vs 1

Year	←—single storey—→				←—two storey—→			
	\$8/Gj 2 vs 1	\$8/Gj 3 vs 1	\$16/Gj 2 vs 1	\$16/Gj 3 vs 1	\$8/Gj 2 vs 1	\$8/Gj 3 vs 1	\$16/Gj 2 vs 1	\$16/Gj 3 vs 1
1	92	163	183	324	167	194	334	387
2	184	326	366	648	334	388	668	774
skip	---	---	---	---	---	---	---	---
7	644	1141	1281	2268	1169	1358	2338	2709
8	736	1304	1464	2592	1336	1552	2672	3096
9	828	1467	1647	2916	1503	1746	3006	3483
10	920	1630	1830	3240	1670	1940	3340	3870
skip	---	---	---	---	---	---	---	---
13	1196	2119	2379	4212	2171	2522	4342	5031
14	1288	2282	2562	4536	2338	2716	4676	5418
15	1380	2445	2745	4860	2505	2910	5010	5805
skip	---	---	---	---	---	---	---	---
19	1748	3097	3477	6156	3173	3686	6346	7353

92=792-700 from Table 2. 644=year7*92.

The years to recovering only the cost of insulation are indicated by bolded values.



In June of 2008 the cost of pink fiberglass batts of insulation was obtained from a retail home builder supplier (Table 4).

Table 4
Pink Fiberglass Batt Attributes in June 2008: Single and Double Wall(DW) Construction

Batt Dimensions	4'.15".6.7"	4'.23".6.7"	DW	DW	Ceiling:House 3
Cost:#batt/bag	29.77:10	46.77	-	-	-
R (RSI) Value	20 (3.5)	20 (3.5)	40 (7.0)	60 (10.6)	80 (14.1)
Usual Cavity Depth	5.5"	5.5"	11 – 13"	16.5-20"	4 layers of R20
\$ Cost/sqft	0.60	0.61	1.22	1.83	2.44
Batt Dimensions	4'.15".6.7"	4'.23".6.7"	DW	DW	Ceiling:House 3
Cost:#batt/bag	29.77:10	46.77	-	-	-
R (RSI) Value	20 (3.5)	20 (3.5)	40 (7.0)	60 (10.6)	80 (14.1)
Usual Cavity Depth	5.5"	5.5"	11 – 13"	16.5-20"	4 layers of R20
\$ Cost/sqft	0.60	0.61	1.22	1.83	2.44

Higher R valued insulation costs more per square foot (ie R28 is \$0.95). The insulation values are marked on the bags. The effective insulative value in a wall cavity will be less because of slight compression in the single wall and adjustments for thermal bridging to the extent you don't avoid it by construction techniques. The thickness of an uncompressed R 20 batt of pink fiberglass could vary from 6.7 (20/2.97) to 5.5 for batts of R=3.6/inch.

Table 5
Total Cost of Insulation (\$\$) for Simulator Houses 1, 2 and 3:
Insulated Areas(sqft): Walls -1071.5 or 2065.6, Ceiling- 999.9.

House #	R Value	←— 1 storey —→			←— 2 storey —→		
		Walls	Ceiling	Cost	Walls	Ceiling	Cost
1	20/40 standard	654	1220	1874	1260	1220	2480
2	60/40 high	1961	1220	3181	3780	1220	5000
3	60/80 highest	1961	2440	4401	3780	2440	6220

654=1071.5*0.61 from table 4, 1260=2065.5*0.61

The extra cost of insulation alone to build house 2 compared to the standard house would be **\$1307** at today's \$8/Gj (Table 5, 3181-1874). Similarly, the extra cost of insulation for house 3 over the standard cost would be **\$2527**. Similar figures for the two storey house would be **\$2520** and **\$3740**, respectively. Now go back to Table 3 to find the years closest these bolded values. For the single storey house it takes 14-15.5 years to recover the costs of super-insulating. But if gas prices double it only takes 7-8 years. Similarly, the values for the two storey house are 15-19 and 7.5-10 years, respectively.

Icynene Inc did not specify the type of insulation or its cost (Home Builder, 2007) so comparisons are not possible. But, from both their report and this paper, the conclusion is that one should plan to live in a super-insulated house many years longer than most people occupy a house (5-8 years thumb rule from a realty statistics person) in order to recover the current costs of super-insulating.



This is not the only numerical method of examining the benefit cost relationship (see RET-Screen software: www.sbc.nrcan.gc.ca) nor does the method consider the costs of extra structural materials or of labor to do the additional work. To the extent that these increase the cost of super-insulating, the number of years to recover the extra costs of super-insulating will increase and perhaps double if you are not using “sweat equity” as a single retail buyer.

In the residential construction industry some builders are starting to build whole wall sections in factories to lower costs and improve quality. In addition, labour and material costs undoubtedly would be lower for commercial builders than for non-trades people buying at retail outlets. So, for building a home there are many factors to consider before determining how long you must live in the home to recover the costs of super-insulating.

These methods of analyzing cost benefit relationships in the construction of buildings can be used for individual applications such as an energy star appliance vs an “old clunker”. The relative performance of each should be compared in building simulation software with known bias in order to get the best estimate of potential savings.

In several countries realty valuation is beginning to include energy efficiency in the sale price of homes. Placing an ‘Energy Star’ or ‘Energuide’ rating on a house may be the way in future realty. Such a scheme would favor the earlier recovery of super-insulation costs.

Hot2000™ is a good building simulator for low-rise residences. Larger multiunit residences such as are built for apartments or retirement homes should be modeled with newer versions of “ee4” and other such software (www.sbc.nrcan.gc.ca). It may be that a builder/owner(person paying fuel bills for 25-50 years) should super-insulate. Governments and retirement home owners paying the fuel bill for such large buildings should have software output data interpreted by a knowledgeable third party on this super-insulation question before spending money on construction.

It is encouraging to see that the Alberta government adopted the LEED Silver standard (includes “high performance building envelope”) for the design of new government-funded buildings (Alberta News Release, May 11, 2006).

Literature Cited

Alberta Agriculture, Low Energy Home Designs. Page 65. 1983.

Alberta Government, New Standard for new provincial buildings will reduce energy costs. May 11, 2006. www.gov.ab.ca/acn/200605/198592420D8D9-C123-56F9-40D43A37954C8E00.html

ASHRAE, American Society of Heating, Refrigerating and Air Conditioning Engineers Inc., Fundamentals Handbook, Chapter 23 p 3, 1985.



Haltrecht, D and Fraser, K “Validation of HOT2000™ Using HERS BESTEST”, Proc. Building Simulation 1997, Fifth International IPPSA Conference pp. 63-69.

Home Builder The Magazine of the Canadian Home Builders Association. March/April 2005.

Shaw, J “ A Super-Insulated Passive Solar Home: Performance & HOT2000™ Results”
Proc. SESCO 2005 Conference, Solar Energy Society of Canada Inc.

Please read delta T as change in Temperature anywhere you see ``T in the paper``.

Riverdale NetZero House

By Gordon Howell

Have you visited the newest efficient house in Edmonton? The Riverdale Net Zero house generates electricity when the sun is shining and puts the extra into the grid. Whenever the sun is not shining it takes electricity from the grid. At the end of the year it will not owe anything for electricity other than the monthly service charge. It will generate as much electricity as it uses.

A note from the NetZero people:

We are opening the Riverdale NetZero energy house for afternoon tours each Saturday.

Why:

— to encourage and empower people to find answers for the energy and environmental issues around us;

— so that you can get ideas about energy efficiency and solar energy for your own new or existing home.

When: 1pm to 4pm, most Saturdays. Check www.riverdalenetzero.ca to see which Saturdays are not open.

Where: 9926 87 Street

Directions: from Jasper Avenue, go south on 95 Street and follow the road next to the river valley for 1 km

Format: self-guided. One of us will be available for Q&A.

Registration: not needed

Cost: free

Info: here a lot of info posted on the walls. Lots of technical details are on our RNZ web site. You are welcome to bring family, friends, staff, and associates. You can send around the attached poster or put it up on your bulletin boards at work.



Solar Heating Growing More Popular in Nova Scotia

Prepared for: SESCO – May 2009

By: Josh McLean, Conserve Nova Scotia

Now more than ever, Nova Scotians are harnessing the sun’s energy by installing solar air and water heating systems. A marked increase in rebate applications means more Nova Scotians are using this abundant source of renewable energy and injecting much needed resources into the local green economy.

Conserve Nova Scotia is the provincial government’s agency responsible for energy efficiency and conservation. The Agency works with all sectors (residential, commercial, industrial, institutional and transportation) to help Nova Scotians make wise energy choices.

In October 2005, the Province of Nova Scotia announced a 10% rebate on solar water heating systems. This rebate was available to all sectors, and had a rebate cap of \$5,000. The 10% rebate was available for both material and installation costs for solar water heating systems until December 31, 2007.

On January 1, 2008 the program expanded in a variety of ways. The rebate increased from 10% to 15%, and the rebate cap increased from \$5,000 to \$20,000. In addition to this cap, projects that would exceed the \$20,000 rebate were considered and approved based on available funding. Finally, the rebate was expanded to also include solar air heating systems.

Over the past few years we have seen a continual increase in the number of solar installations in Nova Scotia. During this past fiscal year alone we processed more than \$275,000 in rebates. This translates into more than \$1.8 million invested in residential and commercial solar installations in Nova Scotia. The following table and figure provides some additional details of interest:

Fiscal year	Applications	# panels	Useful area (m ²) where known	Total rebate	Total expenditures by clients
2005/06	2	2	5.74	\$1,048	\$10,486
2006/07	49	130	306.56	\$48,385	\$483,854
2007/08	64	156	388.54	\$63,749	\$603,171
2008/09	205	542	1,460.84	\$275,522	\$1,843,400
TOTAL	320	830	2,161.68	\$388,704.97	\$2,940,911

* Rebate announced half way through 05/06 fiscal (Oct 2005)

As you can see, there has been a significant increase in the number of solar applications received over the past few years. We also noted that during the first few years of the program, most of the applicants were homeowners. In recent months, there has been an increase in the number of commercial installations, including housing co-ops, apartment buildings and even a hotel. We hope that this interest in solar energy will continue to grow into the future.

The program is currently scheduled to end on March 31, 2010. Between now and then, Conserve Nova Scotia will conduct a program review to determine if the program should be extended and identify opportunity for improvement. For more information about Conserve Nova Scotia’s solar rebate programs, please visit www.conservens.ca