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Historic Building Energy Issues: Exterior Wall Systems – by Bill Hockey ACS

One can never be sure of the installation in closed wall systems in historic buildings because of the potential for voids with no insulation whatever and the risk of damage to the walls from improper application methods. The insulation of sealed wall systems should not be attempted unless there is no other choice, as exterior walls only account for 10-20% of the total of a buildings heat loss. Adding material to the inside or outside of the wall system tends to be unsuccessful when the loss of heritage character and space is weighed against the gain from the installation. Properly installed air and weather barriers will both protect the wall from damage and substantially reduce heat loss improving both the efficiency and comfort of the building.

If one is considering installing insulation in the walls of historic buildings, the approach will be limited by the type of construction, conservation of interior or exterior finishes, and how much space is available to accommodate the insulation. The weather barrier must be sound and one must be able to provide a good air seal on the interior, and a cavity in the assembly vented to the exterior. This is critical if one is going to control condensation.

Insulation types include batts or blankets, poured, blown, foamed and rigid. Each type has useful applications; however, care must be assured to assure a tight fit of the insulation to building envelope elements to ensure maximum efficiency. Foam may require fire protection installations to meet code requirements.

Insulating wood frame, solid wood, (log), and masonry will now be explored. *(Continued on page 2)*

Home Energy Monitoring: Solar Thermal Energy - by Aaron Smith

Some people say you need to track your energy before you can save it. That may not always be true but it certainly helps. In recent years energy monitoring systems are becoming more affordable and increasingly popular. The two most common types are the ones that plug into your wall receptacle and the units that attach to your electrical meter. There are also systems designed to monitor a single energy producer/consumer [i.e. your solar energy system] and more sophisticated metering systems designed to monitor multiple energy uses throughout your home

In this article I'm going to focus on a home energy monitoring system that can be configured for ... *(Continued on page 3.)*

Historic Building Energy Issues: Exterior Wall Systems – *(Continued)*

Wood Frame

If one is replacing interior finishes one should use batts horizontally, cut to fit. In some cases rigid insulation might be used. A vapour barrier must be installed on the warm side of the insulation. If the walls are not accessible, blown in insulation might be an option. Cellulose, glass fibre and mineral wool may be used as blown in insulation, and while cellulose has the highest R value and virtually eliminates air leakage if properly installed, it is more susceptible to water damage. Holes must be drilled in the wall for installation, and this may have an unacceptable impact on the building. It is recommended that it be installed from the interior; however exterior installations have been successful. Once the installation is complete, a thermograph scan must be used to confirm that every cavity has been filled.

Solid Wood - Squared or Round Timber
Generally it is not feasible to insulate solid wood walls, softwoods are fairly good insulators, having an R value of about 1.25/25mm, (1"). If the assembly is properly sealed it could outperform many contemporary wall systems. If interior or exterior finishes are being replaced or repaired, the opportunity exists for the introduction of insulation, but it should be rarely considered; as the potential for damage is high for minimal gain. Therefore, insulating historic log buildings is questionable.

Masonry Walls

Solid masonry walls are a problem. It takes about 400mm, (16") of masonry to provide the same R value as 25mm, (1"), of wood. Walls are usually constructed of solid masonry with no cavity, so moisture migration is impossible to control from the exterior, if the wall is exposed to the elements. Moisture does migrate to the interior under specific site conditions, no matter how well the wall is maintained. If one is insulating a masonry wall, one must provide a cavity between the masonry and the insulation, as well as a weather barrier to prevent the insulation from getting wet from water transmitted from the exterior. Exposed solid masonry walls largely stay dry on the interiors because the tempered air drives the moisture outward toward the exterior. Wood joists embedded in the masonry must be protected from deterioration, and if one insulates the wall system on the inside, the water content of the joist will increase and rot is more likely to occur. This can also happen when heating systems are shut down and buildings are not vented. Interfering with the equilibrium of a mass masonry wall system must be considered carefully.

An NRC publication entitled, *Rehabilitation of Solid Masonry Walls* in referring to the control of heat, air and moisture flow through solid masonry walls states, "*How to do this without adversely affecting the durability of the wall is a source of debate among building-envelope scientists, designers, and builders alike....* The publication stated often the exterior appearance of a building had to be maintained and that there was little documentation on the ways of renovating solid masonry. It analysed five approaches:

1. nothing on the inside of the masonry;
2. a ventilated insulated cavity;
3. control of air and moisture flows;
4. a thermal gradient through the wall, with and without insulation; and,
5. control of air and moisture flows including the control of the heat flow with the air barrier on the warm side.

The paper concluded that the insulation of the interior of solid masonry walls is often a viable option, when combined with effective control of indoor moisture and air flows as well as proper handling of exterior moisture. Without adequate control of moisture, frost damage and deterioration of wooden members were likely to occur. Also there was the potential for increased movement and cracking due to increased temperature fluctuations. The paper effectively explained risks and predicted the outcome of rehabilitation approaches to historic masonry. In short, all interventions to masonry rehabilitation must be carefully considered, and the application of sound building science principles is paramount to the success of any intervention to historic masonry.

It has been shown, that if one controls water one generally controls deterioration. In other words, pay attention to the mechanics of water

movement. Only after controlling the sources of moisture can one consider thermal improvement of the building envelope. Any thermal upgrade must first consider the impact on the resource: second, the gains to be made in implementation.

Bill Hockey is owner/consultant of Architectural Conservation Services, and has specialized the maintenance, rehabilitation, adaptation and restoration of historic buildings for 40 years. This is the last article in the series; however, Mr. Hockey will answer your questions if you send an E-mail to bill@archconserve.ca

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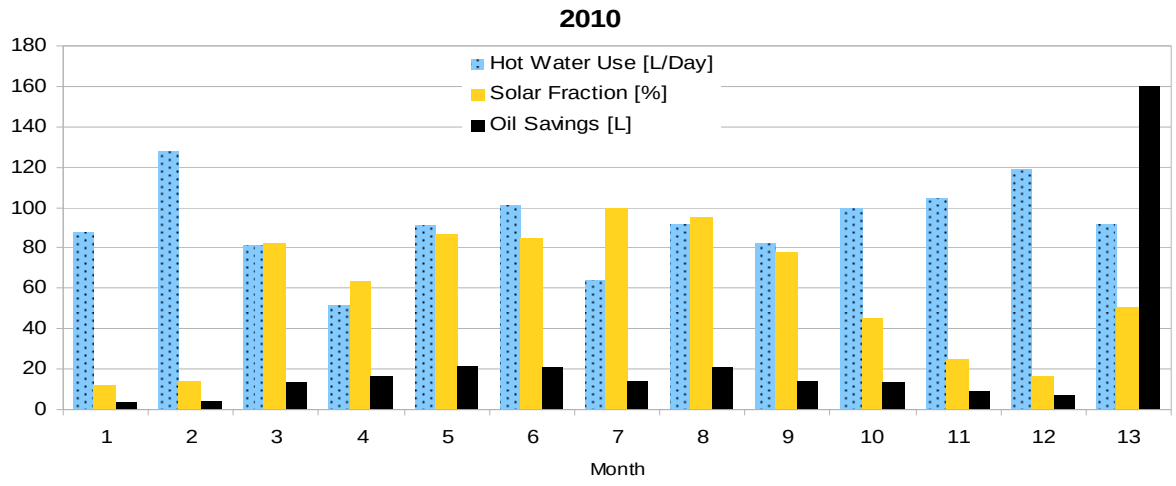
Home Energy Monitoring:
Solar Thermal Energy ***(Continued)***

... a number of different uses from a geothermal heat pump system to your clothes dryer. I purchased one of these systems almost two years ago when I was having a solar thermal system installed to preheat my domestic hot water. After some programming [note: these systems normally require some basic knowledge of energy to setup but some of the local renewable energy suppliers can offer this service] and with the purchase of a flow meter I was able to monitor our domestic hot water usage, water temperatures into and out of my tanks and the on/off operation of our oil furnace and oil-fired water heater. From this, I was able to calculate the energy use of our furnace and water heater and more importantly the energy saved from the solar system. A summary of the results from last year is shown in the chart below. "Month 13" includes the average solar fraction (energy demand met by solar) for the year, our average domestic hot water use per day and our total oil savings for the year.

As you can see from the chart, the system was able to heat 51% of our domestic water over the year – from 12% in January to 100% in July. You may remember March 2010 which felt more like summer than winter – 15 to 20°C and sunny everyday – leading to a fraction of over 80%. Our domestic water use ranged from 50 to 125L/day (we took some vacations in there). Total oil savings was 160L which is equivalent to almost half tonne of greenhouse gas savings.

One of the larger challenges was estimating the efficiency of my oil-fired water heater; they normally have a stated efficiency factor of less than 0.6 (60%) meaning that almost half of the oil they burn is wasted. I used 50% but calculated that its efficiency was much lower than that in the dead of winter due to standby losses – the tank temperature dropped 1°C an hour. I think most of this was up the chimney because adding insulation to the tank didn't help. Earlier this year we changed our heating systems so I'll report on how that is working out in a future column. Real-time data on my system can be found online at http://welserver.com/WEL0252/.

Aaron Smith is a local consulting engineer and member of the Board of Directors for the Solar Nova Scotia Society.



FROM THE CHAIR

Fall is always a busy time for SNS and this year especially so with builder courses starting up in Halifax and Bridgewater; our Ideal Home Show booth and workshops; new editions for our Solar Design Manual, now being sold in Europe; an Industry Committee working to raise standards for installations and installers; Halifax's SolarCity planning moving forward; the first edition of our solar E-News bulletin and new policy initiatives soon to be announced. And, all of this is being accomplished with a volunteer board and no paid staff.

One of our more notable involvements has been our contribution to the HRM SolarCity Project. Although delayed, HRM staff are continuing to work diligently to bring this project full circle and place Halifax firmly on the national, solar map. SNS corporate members have been working with HRM to provide industry insights and best practices to help move SolarCity forward. Based on comments from HRM staff, the input received from SNS has been instrumental in facilitating continuous progress. A special note of thanks is extended to Dan Roscoe, our Industry Committee Chair for coordinating this effort.

Additional solar news and related topics will be forthcoming as we continue with our solar E-News bulletins. So, standby for more on solar and thanks for your support!

Richard Vinson, Chair, Solar Nova Scotia

Upcoming Solar Shelter Courses

Solar Nova Scotia is offering practical, how-to courses on designing and building Solar Shelters, including Greenhouses, Solariums, additions and especially Solar Homes. Topics include: 1. Solar Basics; 2/3 Climate Control; 4. Site Designing; 5. Shelter Designing; and, 6. Making it Happen. This course is intended for the general public and for those in design and construction.

Registration: for courses with a phone number for registration, instructor Don Roscoe.

There's a course outline at http://solarns.ca/course.php . Up coming Courses:

HALIFAX: Citadel Community Centre (North of the High School), Six Thursdays 7-10:00pm October 13 to November 18, 2011. Register with Solar NS, by phone at 852-4758 or email at solardon.ns@gmail.com.

BRIDGEWATER: 25 Register with Solar NS at 852-4758 at Bridgewater High School. Six Tuesdays 7-10:00 October 11 to November 15. For Information and Registration call 543-2274.

The cost of the course is $90.00 for an individual, $150.00 couples, which includes handouts. An optional textbook, the Canadian Solar Home Design Manual is offered at $35.00. Don offers a Solar Construction Course based on demand in the spring. Contact him at solardon.ns@gmail.com

A course is also offered by Andy O'Brien in the Annapolis Valley, see Solar NS website for further details.

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