BC LOG & TIMBER BUILDING INDUSTRY ASSOCIATION

FACTSHEET

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Insulating Factors – Energy Efficiency

Log homes have boasted a warm and friendly feeling for centuries but until recently the insulating factors of log homes has been unknown. If you are researching this topic, you will find a variety of reports that will say everything from log homes are poor performers to log homes are superior performers.

The answer to this question lies in the total log home package, not just the energy efficiency of the log wall components of the home. The number and type of window and door openings as well as the roof and foundation materials all play a roll in determining the energy efficiency of a log home.

The National Association of Home Builders (NAHB) Log Homes Council conducted a comprehensive review of available studies that document log homes' energy-efficiency and thermal mass benefits to gain a greater understanding of the proper representation of thermal performance of buildings having greater "heat capacity" or thermal mass in their walls, compared to typical lightweight wood framing practices.

What they found was there are several reasons supporting the "energy efficiency" of log construction including:

- Use of fundamentally renewal resources (timber);
- The potential to use bug-killed, fire killed or wind downed timber that could be more difficult for conventional saw-mill process;
- Less energy and labor are consumed processing the timber for log components between harvest and emplacement on site;
- Logs are often shipped to construction sites within smaller distances of harvest locations, resulting in lower transportation energy-use than conventional framing lumber
- Log walls provide "surface as finish" saving material and labor costs since added layers of other building materials are not required;
- Fewer (albeit proportionally stronger) fasteners are needed to erect a log-walled building, resulting in lower quantities of metals employed to complete the job (manufactured metals have high embodied energy);
- Modern log homes save energy compared to similarly well insulated stick-framed homes; and
- In the future, when log buildings are demolished there is a high potential for recycling logs (log homes would more likely be "deconstructed" for their valuable timbers).

The actual energy efficiency of a home is determined by R-values (resistance to thermal flow) of building segments such as walls, floors, windows and so on, and by the air tightness of all the building components that make up the home. In addition the there is also the heat mass that influences the heat holding ability of the structure.

R-value measures a material's resistance to the transfer of heat from one side to another. Logs have a relatively low resistance to heat transfer. In fact, they actually absorb and store heat in their cellular structure.

Thermal mass is a material's capacity to absorb, store and slowly release heat over time. Logs do this well. Logs have thermal mass because of their cellular structure, bulk and thickness. This thermal mass provides significant energy-saving benefits because it releases heat back into the house when temperatures drop.

Early studies proved thermal mass properties significantly reduce heating and cooling loads in moderate climates. The National Institute of Standards conducted the most important of these studies for HUD in 1981-82. However, energy experts continued to question the value of thermal mass during the winter months in northern climates. They doubted its benefit when heat is needed constantly and thermostat settings are opposite outdoor temperature.

Two recent studies, both conducted in cold climate states, answer this question to the log home industry's benefit. In 1990, an independent testing agency, Advanced Certified Thermography, conducted a study for the Energy Division of the Minnesota Department of Public Service. It focused on heat loss through air leakage, assumed to be a problem with log walls because of their many joints. The study found the industry has substantially reduced air infiltration rates in the past 15 years. It credited this reduction to improve joint construction and the use of expanded foam sealants and gaskets on all joints and corner intersections. Leakage in the 23 test homes occurred where it in the same places it does in frame houses: at the peak of the cathedral ceilings, around window and doorframes and along the tops of walls. The study concludes air leakage in well-built, modern log homes is not due to their log walls.

NAHB's Research Center conducted the second study for the LHC in 1991. It showed the thermal mass of log walls does significantly reduce energy use for heating in cold climates. It based its conclusion on a comparison of the actual energy use of eight log homes to the actual energy uses of eight well-insulated foam houses during one winter. The number of houses was evenly divided between upstate New York and Montana. The study also compared the homes actual energy use to their predicted energy consumption. The results led to the conclusion that log homes were as energy efficient as the frame houses.

According to research studies in both Canada and the US, the heat loss experienced through log homes can be attributed to the interface between the log components and the other building components. The most common areas of heat loss are:

- The ridge area of vaulted ceilings
- The joint between the plate log and the roof
- The protrusion of logs through he exterior walls (both frame and log)
- The connections between the floor and a sill log
- The connection of the log with the frame wall
- The window/door-to-wall log interfaces
- The log-corner interface

To reduce the likelihood of heat loss in these areas, the use of gasket materials combined with tightened through-bolts perform better than those just using fiberglass. In areas where the natural process of shrinking and shifting may occur, the use of chinking materials can reduce heat loss.

In summary, a well built handcrafted log home will provide you with equal or better energy efficiency when compared to a stick frame home provided your designer and builder pay special attention to these structural areas during the design and construction and take the appropriate measures to seal the potential areas of energy loss.

References:
- The Energy Performance of Log Homes – 2003 Log Homes Council
View the complete report at http://www.loghomes.org/publications.phtml?catid=8
-Thermal Properties of Log Homes LBN 38
- National Bureau of Standards Test Confirm Energy Conserving "Thermal Mass Effect" for Heavy (Log) Walls in Residential Construction
View the report summary at http://www.cedar-log-homes.com/log_homes_energy_consumption.htm#Energy-Efficiency