MANAGE OF ENERGY EFFICIENCY IN BUILDING

Mohd Shahiq Khan*

Saiful Islam**

ABSTRACT

This paper presents short guidelines of the thermal insulation materials which can be used to manage of energy efficiency in building. One of the most important and cost-effective energy-saving building materials in a home or building is the insulation. Many types of insulation materials are rapidly becoming incorporated into conventional construction. They may provide a convenient or sometimes a healthier approach to increasing the energy efficiency of a building. However, it is important to note that because some materials have been on the market for only a short time they may not be widely available and performance and durability of some materials may not be well documented. Always care fully research material characteristics for suitability for your purposes. The insulation tips in this paper will help you save on heating and cooling bills and create a comfortable home or building all year round.

Keywords: *Thermal insulation, Energy-saving building material, Energy efficiency.*

*Professor, Department of Civil Engineering, RGGI, Meerut, India,

**Associate Professor, Department of Civil Engineering, RGGI, Meerut, India,

1. INTRODUCTION

Of the Kingdom of Saudi Arabia's 24 million subjects, more than 40 percent are under 18 years of age. While still manageable, the country's infrastructure is not prepared to deal with its explosive population growth. The two biggest problems facing Saudi Arabia are potential water and electricity shortages [1]. True, its super oilfields may also have peaked in production and might move into tertiary recovery, but that is unknown. One need only look at the widespread electricity shortages Syria experienced in the 1980s and early 1990s. As reported in the October 14, 2004 issue of ***Arab Oil and Gas***, the Saudis lag well behind Bahrain, Kuwait, Qatar, and the United Arab Emirates in per capita energy consumption. The rate of natural gas consumption, which produces Saudi's electricity, increased less than Egypt and Syria. Total energy consumption dropped by 3.5 percent in 1999 and 2000. The internationally heralded "Gas Initiative" of 1998 was the Kingdom's attempt to lure major western oil companies back into the country to help develop its natural gas reserves. After major oil companies spent $100 million in due diligence to evaluate the Saudi natural gas reserves, the initiative quietly dropped off the world's radar screen. A Shell Oil executive, whose company is exploring for gas in the country's Empty Quarter, told Bloomberg Daily Energy News that this was a high-risk venture with a low probability of finding sizeable reserves. In Matthew Simmons' ***Twilight of the Desert*** [1]**,** he repeated what he was told by an anonymous senior oil executive, "The reservoirs are crummy." So, Saudis need water and electricity to match their population growth.

Today, we know more about how to save energy than ever before. When it comes to our homes, the more energy efficient we make them, the lower the monthly utility bills are going to be and reduce the consumption of electricity. Home that are constructed to the latest energy codes using energy efficient appliances, windows, doors, lighting and heating/ air conditioning equipment will be more energy efficient. One of the most important and cost-effective energy-saving building material in a building is the insulation. Without insulation, many of the other energy-efficient components would not perform as intended.

The benefits of insulation have been well documented, but the question that remains for environmentally conscious builders is which insulation provides the best insulating properties while being the most healthful to both humans and the planet. The answer, unfortunately, may not be as easy as it seems. There are a variety of factors one must consider when choosing the best environmentally friendly insulation for each application. Although recycled content is the most immediately noticeable environmentally beneficial feature of a product,

other attributes have to be considered. Factors such as resource depletion, energy savings, manufacturing processes, pollutants given off during the product's life-cycle, service life and reuse/disposal are just a few. It is no longer sufficient to select a product based solely on its R-value.

2. INSULATION MATERIALS

The right insulation material for your home depends on where it will be used.

2.1. Fiberglass

Fiberglass is the most common type of insulation. It is made from molten glass spun into microfibers. It is usually pink or yellow and comes in the form of batts or rolled blankets in various thicknesses (R-values). Most common R-values are R-11, 13, 15, 19, 21, 22, 25, 30 and 38. Both batts and rolls are available **with or without a facing**.

2.1.1. Faced insulation

Faced insulation is usually a vapor retarder. Vapor retarding facing usually consists of asphalt-coated kraft paper, aluminum foil or plastic film. Vapor retarder is generally applied toward the warm-in-winter portion of the building to help resist the movement of the moisture vapor to cold surface where it can condense. Fiberglass batts and rolls are most commonly installed in the sidewalls, attics, floors, crawlspaces, cathedral ceilings and basements of home.

2.1.2. Unfaced insulation

Unfaced wall insulation is sometimes made wider to permit installation by pressure fitting between either wood or metal framing. No fastening is required if the insulation material is held in place on all four sides like a typical wall cavity. The insulation in knee walls should be held in place with wire lacing or some equivalent method to prevent the insulation from falling out of the wall cavity over time. A separate vapor retarder may be required when unfaced insulation is used.

2.2. Rock wool

Rock wool is literally made from rock. It is manufactured similar to fiberglass, but with molten rock instead of glass. The gray or brown fibers come in batts or blankets, or as shredded loose-fill. Loose-fill insulation is designed for 'open blow' applications such as attic spaces or closed cavity application such as those found inside walls or covered attic floors. Loose-fill insulation is available in two forms-either processed from a by product of manufacturing batts or rolls, or from 'prime' fibers produced especially for blowing applications. Both must be applied using a mechanical blowing machine.

2.3. Slag wool

Slag wool is made by spinning molten slag into long fibers, a process similar to that used to make fiberglass. One advantage of mineral wool (Rock and Slag wool) is that it is totally fireproof and won't melt or burn in a house fire (Fiberglass insulation doesn't burn, but it does melt). Mineral wool is the only loose fill material that requires no chemicals or additives. A very dusty yet dense product, this material is generally used only in commercial applications where acoustical and fire-retardant properties are especially important.

2.4. Cellulose

Cellulose is made from shredded recycled paper, such as newsprint or cardboard. It is treated with chemicals to make fire-and insect-resistant, and is applied as loose-fill or wet-sprayed blown into walls and attics through a machine. The research suggests that the performance of cellulose versus fiber glass is as much as 38 percent better. Cellulose achieves a tighter building cavity, allowing less heat loss due to air infiltration and its overall performance appears to be about 26 percent better in tempered climates [2, 3].

2.5. Synthetic insulation

Usually polystyrene or polyurethane foam is commonly used in rigid boards for insulating basements, cathedral ceilings or sidewalls. It is also manufactured as a spray-on expanding foam (the same synthetic material found in small aerosol cans); when applied, it poofs up two or four times its original size, filling even the smallest nooks and crannies.

3. BENEFITS OF THERMAL INSULATION

3.1. Acoustics

Fiber glass and rock and slag wool insulations are excellent sound absorbers as well as energy savers. When installed in the walls and ceilings, they can reduce the transmission of sound from other rooms or from the outside.

3.2. Energy efficiency

One of the most important building materials in a home is the insulation. Without the insulation, many of the other energy-efficient components won’t perform as intended. A well-insulated home, particularly one that is insulated with fiber glass or rock and slag wool insulation, is one of the most cost-effective ways of saving energy and helping to reduce heating and cooling bills. The benefits from insulation far outweight the cost, with the ratio of energy saving having a range of (12 to 1) per year. This ratio means that for every btu invested in the manufacture of thermal insulation, 12 btu in energy saving are realized in the first year of service.

3.3. Sustainability

Fiber glass and mineral wool insulations help keep a home tight and moisture-free. Coupled with other good building practices, insulation helps a building last longer.

3.4. Thermal Comfort

Fiber glass and mineral wool insulations resist the flow of heat. Heat is a form of energy; it always seeks a cooler area, flowing outward in winter and inward in summer. By reducing heat flow, a properly insulated home uses less energy in winter for heating and less in summer for cooling.

4. A REUSABLE SOURCE

Most buildings will, one day, be subjected to remodeling, expansion or renovation. As more flexible building designs are put into practice the more a building is taxed to adapt to the needs of the occupants it houses. Because of this expanding need, fiberglass and slag wool insulation are uniquely poised to play a key roll in maintaining the life-cycle approach while continuing to perform as required. Fiberglass and slag wool batt insulation can be removed with little effort and reused in another location. This is not true of all insulation products that may require extensive removal techniques that could be harmful to existing building materials. Fiberglass and slag wool insulation require no maintenance and can last for the life of the building if left undisturbed.

5. THE HEALTH DEBATE

Debates have been intensifying since the mid-1980s as to the safety of using fiberglass insulation. The concern has been that fibers that comprise fiberglass might replicate the affects of the fibers found in asbestos which, like fiberglass, is manufactured from silicon dioxide. These fibers could enter the air and be breathed-in which could result in serious health complications.

The 1996 NRDC report studied three insulating materials available to consumers in the U.S.: fiberglass, cellulose (from recycled paper) and recycled cotton.

The report states, “Of the three insulation materials reviewed by NRDC, the most substantial and well documented public health threats are associated with fiberglass. It is listed by the International Agency for Research on Cancer (IARC) as a potential carcinogen and by the National Toxicology Program (NTP) as ‘reasonably anticipated to be a carcinogen.’” Studies that have been performed, the report claims, indicate that cellulose and cotton insulation products pose fewer health risks than fiberglass.

The greatest threat of fiberglass, however, is not necessarily aimed at the occupants surrounded by the insulation but to the installers of the insulation. Fiberglass can cause skin, eye and upper respiratory system irritations though most of the effects are temporary. As of 1996 there are no federal standards that installation workers must follow.

The NRDC report continues to state that, "Although IARC and NTP report that there is inadequate evidence to include fiberglass on the smaller list of 'known carcinogens,' several epidemiological studies have concluded that there is an increased risk of lung cancer among workers in fibrous glass manufacturing facilities." Though occupational and residential exposures to fiberglass fibers are low when compared to past asbestos exposures, all fiberglass insulation is required to have a cancer warning label as mandated by the Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard.

6. NAIMA RESPONDS

The fiberglass industry has conducted research on the health and safety of fiberglass for the past 50 to 60 years," says NAIMA Director of Communications Catherine Imus, "and that research involves insulation studies in the route of exposure that show how people would be exposed to fiberglass fibers."

Imus sited numerous studies performed by researchers worldwide that have conclusively proven fiberglass insulation is safe. Studies by the Research and Consulting Company of Geneva, Switzerland, the University of Pittsburgh, the Canadian Government, Tulane University, the Insulation Wools Research Advisory Board, and even the American Conference of Governmental and Industrial Hygienists (ACGIH) serve as proof to the safety of fiberglass.

REFERENCES

[1] Matthew R. Simmons' ***Twilight of the Desert***, John Wiley & Sons, Inc.

[2] Boonyartikarn, S. and Speiezle, S. (1990), "Fiber glass vs cellulose installed performance", University of Colorado.

[3] Daniel Lea (1996), "Cellulose: Building insulation with high recovered concrete, low embodied energy", Green Building Materials' 96, Gainesville, FL, USA.