

# Study of green energy bricks construction essay



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## **ABSTRACT:**

**This paper deals with our primary objective of gaining knowledge in the field of green buildings which includes the study of green energy bricks. Conventional brick is made of a mixture of clay, sand and water mixed with a binding material. It has many disadvantages such as CO<sub>2</sub> emission, needs maintenance, destruction of top layer soil, etc. But, Energy Brick fulfills all the criteria to save time and cost yet gives the maximum energy savings to build a home. The finish offers an attractive appearance with minimal maintenance and high load bearing capacity coupled with the highest in acoustic and thermal performance. The brick's unique formulation consists of a central core of rigid Polyisocyanurate Foam (PIR) with an external and internal skin of Calcium Silicate Board. Green Energy Bricks helps to accelerate the adoption of building practices that result in energy-efficient and environmentally sustainable buildings. With a massive R8+ energy rating the Energy Brick has a minimum of four time's greater R rating than most other standard construction methods.**

## **INTRODUCTION:**

Energy Bricks are a revolutionary product that goes far beyond the energy saving performance values of any other brick or wall lining in the market today. Green Energy Bricks have been designed with a massive insulation rating. This in turn reduces the construction time, reduces the cost of construction. They are light in weight; they can be installed very easily. They have high load bearing capacity. These energy bricks do not require any core

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filling. These Energy bricks are having a good resistant towards fire. Further insulation is not required as the foam core has an insulation rating. Using the Energy Bricks, a wall can be constructed much faster than conventional bricks. These energy bricks can be used in all cyclonic zones. Energy brick is fire resistant because of the non-combustible Calcium Silicate skins along the sides of the brick and the PIR foam core having the self-extinguishing property. The brick's unique formulation consists of a central core of rigid Polyisocyanurate Foam (PIR). This foam is fire safe with a non-combustible blowing agent who has zero greenhouse gas emissions, zero ozone depletion, and nontoxic. Calcium Silicate Board of 10mm thickness is provided along the sides of PIR Foam. This makes the brick light in weight, supports high load bearing along with an attractive finish. With a massive energy rating the Energy Brick has a minimum of 4 time's greater R rating than most other standard construction methods. Mortar is not required in the construction of buildings using these Energy bricks. During the construction filling with concrete is not required. Usually Single wall system is constructed using energy bricks, but it has superior properties and functions more than a double brick wall. The design includes a 30mm diameter hole running vertically every 300mm to allow for running of electrical cabling, telephone lines or television lines after the wall has been constructed. The brick has special location lugs, which helps us to lay the brick in exact position. By default the brick comes with an interior finish. A different internal finish can also be applied according to the style of an individual. Energy bricks save labor cost, facilitates faster construction and saves money. Green Energy Bricks has taken the initiative to assist builders and consumers with a unique

environmentally friendly building technique, to reduce the impact on our environment.

## **PROCESS OF MAKING:**

### **MANUFACTURING OF PIR FOAM**

PIR foams are produced by mixing Polyester Polyol and methylene diphenyl di-isocyanates in stoichiometric ratio (1: 2), together with amine catalysts and other additives. PIR is obtained by the following reaction: At elevated temperatures, Methylene diphenyl di- isocyanate in excess reacts with itself forming a highly cross-linked thermosetting complex polymer with a ring-like structure which means difficult to break and have high density. This MDI reaction will results in the compound named tri-isocyanate isocyanurate. Remaining MDI and polyol mixed with tri-isocyanate which finally forms polymer of isocyanurate. This isocyanurate polymer has a relatively strong molecular structure, because of the combination of strong chemical bonds contributing to the greater strength. The greater chemical bond also means it has difficulty to break, and resulting in stable PIR foam in both the properties of chemistry and thermally. PIR typically has an MDI/polyol ratio, also called its index (based on isocyanate/polyol stoichiometry to produce urethane alone), higher than 180. By comparison PUR indices are normally around 100. As the index increases material stiffness but also brittleness also increase, although the correlation is not linear. Depending on the product application greater stiffness, chemical and/or thermal stability may be desirable. As such PIR manufacturers can offer multiple products with identical densities but different indices in an attempt to achieve optimal end use performance. A method of manufacturing a calcium silicate board having

a bulk specific gravity of approximately 0.5 to 0.8, which method achieves a decrease in the bulk specific gravity and an increase in the matrix strength of the board without impairing productivity, and the calcium silicate board obtained by this method. The method is characterized in that a material slurry comprising 5 to 30 wt % of calcium silicate hydrate slurry as a solid component, 17 to 50 wt % of calcareous material, 13 to 45 wt % of silica containing material, 2 to 8 wt % of fiber material, and 5 to 40 wt % of inorganic fillers is formed through conventional processes and the obtained molded body is subjected to a hydrothermal reaction in a pressure container. A method for making an asbestos-free calcium silicate board, which comprises (a) preparing a slurry of a mixture of 20-50% of silicic acid material, 20-50% of lime material, 10-40% of fibrous wollastonite, 2-10% of pulp selected from the group consisting of N-BKP, N-UKP, flax pulp and waste paper and 1-30% of calcium silicate crystals prepared by hydrothermal synthesis, with water; (b) forming the slurry into a raw board; (c) steaming the raw board; and then (d) drying, all of the said percentages being based on the weight of the total solids content.

## **ENERGY EFFICIENT OF R+:**

Energy efficiency is one of the most important considerations in choosing building materials to use in homes and all forms of building construction. Usually the largest area of heat loss is only through un-insulated walls. This has therefore been our main area of focus. The top priorities for energy efficient buildings is to be able to keep actual energy consumption low whilst decreasing the loss of heat from a building during winter, and minimizing the entry of heat during the summer months. The Green Energy Brick provides a

continuous, unbroken layer around the building envelope and ensures airtight walls with the highest in energy rating performance. This allows for the purchase of much smaller sized heating and cooling equipment. With smaller equipment comes less initial outlay, and less ongoing costs.

Advances in modern technology have produced light weight, super energy efficient, yet stronger materials that can out perform many of the traditional construction materials. Our unique Energy Brick, gives the look and feel of brick construction and yet vastly improves the energy rating of homes with their massive R8+ energy rating, and so provides the very best in energy performance, in any climate. An energy-efficient home is one that lowers energy bills and helps cut heating and cooling costs while enjoying more consistent temperatures in your home, all year round. Choosing the correct wall construction material makes all the difference regarding energy efficiency, so make sure it is the Energy Brick from Green Energy Bricks.

## **TEST RESULTS:**

Test Results are one of the most important aspects of any product and the same applies to the Energy Brick.

### **1. Calcium Silicate Board Test**

The Calcium Silicate Board forms the protective barrier in any fire situation in the Energy brick. The Calcium Silicate Board is tested by exposing to excessive temperature in degrees Celsius. A naked flame of 500 degrees Celsius was positioned to directly burn the Calcium Silicate Board, for a period of 10 minutes. The Calcium Silicate Board did not catch fire, ignite or was not penetrated in any way by the flame. A mark was left on the Calcium Silicate Board where the most intense heat of the middle of the flame was

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situated. The Energy Brick is therefore found to have fire retardant qualities that are required for fire prone areas.

## **2. PIR Foam Core Test**

The Rigid Polyisocyanurate (PIR) foam, which forms the central core of the Energy Brick, is been tested under naked flame at excessive temperature in degrees Celsius. The PIR foam core is exposed to a naked flame of temperatures 3, 000 degrees Celsius. The PIR foam core was subjected to a small amount of smoke at the center of the flame without actually igniting at these extremely high temperatures. It is observed that once the naked flame was removed the PIR foam self extinguished immediately and is said to be a Non-flammable material. Though the foam did not actually ignite or catch fire at extreme temperatures, it does not have any effect on the rigid PIR foam core when the naked flame was removed. It is also found that the chances of any fire flame reaching the rigid PIR foam core would be very minimal because of the protective 9mm layer of Calcium Silicate Board.

## **3. Compressive Strength Test:**

Compressive strength tests of the Energy Brick is been done with the help of Universal Testing Machine (UTM). From the test it is observed that the stress/strain relationship is linear up to the yield point where collapse of the Brick occurs. This yield point sets the maximum strength of the block. This condition will apply in wall building and a small pre-compression load should be applied through the top wall plate.

#### **4. Thermal Transfer Test:**

To determine the degree of heat transferred through the Energy Brick when exposed to high temperatures, and record temperature changes of the unexposed face, a test wall was built using the Energy Bricks. At the internal and external surfaces of the wall, Temperature sensor were placed in varying positions to determine maximum, minimum and average temperatures of heat transferred at the positions. One side of the Energy Brick wall was placed against a furnace, and temperatures were set to 200°C. The exposed side of the Energy Brick reached 200°C after 15 minutes. The temperature sensor indicated an average temperature of only 27°C on another side of brick masonry, with the maximum temperature recorded as 35°C. The extreme heat on the exposed Energy Bricks was not transferred through the Bricks. This clearly indicates that the Energy Bricks have excellent thermal resistance in extreme heat. An important observation to note is that the heat source did not have an effect on the Energy Bricks until after 10 minutes had elapsed, when temperatures had reached 170°C. After 25 minutes, the temperatures on the unexposed face began to be consistent at the average temperature of 28°C, even though the temperature on the exposed face was still steadily climbing beyond 200°C. Similar thermal resistance can be expected in regard to the Energy Bricks when exposed to extreme cold conditions.

#### **ADVANTAGES OF GREEN ENERGY BRICKS OVER CONVENTIONAL BRICKS:**

The following cost savings add up if the Energy Brick is used as part of your construction process: It's a single wall system which:

- Replaces the external



skin of brickwork or any other type of lining• Replaces the need for a structural stud wall as the Energy Brick itself is load bearing• Replaces any need for insulation as it is already at a massive R8+. Reduces the cost for a termite barrier and other flashing requirements. Dramatically increases the speed of construction. The Energy Bricks can be laid from inside where it is a flat platform. This avoids the use of expensive scaffolds to perform the work from the outside and lessens the possibilities of OH&S issues. Smaller heating and cooling units are required, which results in less initial outlay. Reduces ongoing utility costs, which equates to continued savings year after year. When the Energy Bricks are used for double storey extensions, they can be laid from inside which reduces the need for further scaffolding and the need for tradesmen to walk on the roof. This in turn flows on to greatly reduce the damage or replacement of the existing roof. The Energy Bricks are laid directly on top of the concrete slab, or the flooring material for above ground construction.

## **CONCLUSION:**

Green Energy Bricks deliver the new innovation in building construction. The bricks are structural but also light weight, have superior properties with a massive insulation rating, and will withstand temperatures of 1000°C. Energy Bricks are a sustainable product that saves construction and ongoing energy costs.