

Green Energy Bricks: A Step Towards Smart and Sustainable Structures

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ABSTRACT

The construction industry is growing fast in India. Energy sources used in the clay brick making process worldwide are dominantly derived from fossil fuels. However, through innovative development it has been shown possible for these traditional sources to be successfully replaced by renewable alternatives reducing greenhouse gas emissions to almost zero. In a further innovative step it has been possible to introduce a selective blend of solid by-products wastes into the manufactured bricks to partially replace normally quarried clay. The challenge we face is to achieve an equitable development for all human beings, including future generations, while preserving the integrity of the global environment. One way to do so is to aim at a new growth paradigm and a higher quality of life through wealth creation and competitiveness on the basis of products with a smaller environmental footprint using fewer resources.

Key words : Green Brick, Energy saving, Sustainable structures

Introduction

Organic, ecological/environmentally friendly, sustainable, these terms are frequently interchanged one for the other leading to misunderstandings. In daily life we use the term "organic" commonly for food that is produced respecting existing complex eco-systems and their interactions. Ecology defines interactions between organisms and their physical habitat, which can be described as the sum of local factors like climate and geology, as well as the other organisms which share its ecosystems and biosphere. Environmentally friendly describes products or services that have a lesser or reduced effect

on human health and the environment when compared with competing products or services that serve the same purpose. Sustainable stands for the ability to maintain into perpetuity our habitat and lifestyle without exhausting any natural resources (Backas and Betlam, 1999).

The degree of sustainability of a production process can be measured by these criteria:

- Total energy content, i.e. the energy that is required to produce, package, distribute, use and dispose of a specific product;
- Consumption of the environment – land for building or mining, forest depilation;
- Emissions – greenhouse gases, dust, other

- chemical and natural substances;
- Raw materials – non renewable resources and their depletion;
- Waste generation – packing, production, use;
- Recyclability – generation of secondary waste cycles;
- Capital – least cost;
- Durability – longer periods of usage mean lesser consumption of resources.

Green brick is the simplified building construction material. It introduces the latest innovation that is revolutionizing the way we think about building. They are the newest and exciting material for building purpose. A single brick is 600 mm long × 300 mm high × 320 mm wide and is equivalent in size to laying 18 standard clay bricks in double brick, yet so much quick, cheaper and easier.

They have been designed with a massive R8+insulation rating, they cut down on construction time, save on construction cost, are load bearing, require no care filling, are light weight are easy to install, are fire resistant, and can be used in all cyclonic zones and much more (CEC, 2000).

Green Energy Bricks is committed to energy savings, and this is the reason our bricks have been such a winner with home owners and builders alike. The external envelope of any building is the most important part of any structure when it comes to heat loss or heat gain. Up to 35% of heat can be lost through non-insulated walls, with a further 25% through single glazed windows.

As we consider this in more detail, it is necessary to ensure that this is one of the first areas tackled in trying to reduce heat loss or heat gain.

Simply put, the Energy Bricks are a revolutionary product that goes far beyond the energy saving performance values of any other brick or wall lining on the market today (CEC, 2000).

Outstanding results were achieved in the Heat Transfer Test conducted on the Green Energy Bricks by the CSIRO. When the surface of the Green Energy Bricks reached 900 °C, the opposite side surface only registered an average temperature of 28 °C. These results are amazing in terms of the insulation qualities of the Energy Brick.

The Energy Brick can be used in concrete slab or raised floor construction slab or raised floor construction, No mortar is required, no core filling is required with concrete. Using Green Energy Brick will also allow to reach the requirements of 5 or 6 star homes much easier because of their energy effi-

ciency. In fact, it will help to go far beyond this minimum standard.[4]

Brick Manufacturing and Sustainability

In order to understand how brick can contribute to sustainable building design, it is important to consider how brick is made, as well as how it is used. Brick manufacturing is a highly efficient process incorporating many sustainable practices.

Raw Material Use

Brick is made primarily from clay and shale, which are abundant natural resources. Most of the clays and shales used in brick making are mined in open pits located near brick manufacturing facilities - many of which are less than a mile away. Once the clay is mined, it is ground to suitable particle size and then mixed with water. This mixture is then formed into brick. Non-hazardous waste products are sometimes incorporated into the mixture. For example, petroleum-contaminated soil or sludge can be used. Recycled waste from other industries, such as bottom ash and fly ash from coal-fired generators, glass, stone dust, and ceramic tile may be incorporated. Reclaimed industrial metallic oxides can be used as colorants in brick. Because fired brick are inert, brick can safely encapsulate many materials.

Sustainable Practices in Manufacturing

The majority of brick plants use renewable materials within the brick-making process. Lubricants made from a waste by-product derived from processing organic materials can be used in the forming of brick.

Heat required for dryer chambers usually is supplied from the exhaust heat of kilns to maximize thermal efficiency.

Water used in brick production is recycled and reused. Improvements in automation result in even less energy being used.

Many manufacturers are using waste products such as methane gas from landfills and sawdust. While natural gas is the most frequently used fuel for firing brick, utilizing waste materials enables brick plants to reduce their consumption of fossil fuels as well as provide a beneficial means of disposal for potential wastes.

Air emissions are minimized with controls such as scrubbers installed on kiln exhausts. Lime waste that accumulates in scrubbers often is recycled as a beneficial additive to soil. Dust in brick plants is

controlled through the use of filtering and containment systems, vacuums, additives and water mists. Even vehicular emissions are being addressed, with brick manufacturers monitoring truck emissions; recycling waste oil, antifreeze and hydraulic oil; and regulating truck speeds for improved fuel efficiency.

How Energy Brick Replaces All the Conventional Building Process

1. The energy brick became the external skin and they replace all other forms of standard clay bricks, concrete block, weather boards etc.
2. Energy Brick can be laid directly onto the slab, which saves the concreter providing a rebated base.
3. Energy Brick come with a 9 mm Magnesium Oxide internal and external skin, already bonded ready for paint texture or other applied finishes.
4. Building siltation or a foil vapor barrier is not required. The Energy brick closed cell foam resists any vapor transfer.
5. The Energy Brick replaces the need for any separate structural frame, as the energy brick is load bearing.
6. No further insulation is required as the foam core has an insulation rating of R8+
7. No interior finishing like plaster is required as it already comes with an interior skin.
8. It is fire resistant because of the non-combustible Magnesium oxide skins and the PIR foam core being self extinguishing.

Design Criteria

The design criteria and objective on the development of the energy Brick is to make a radical cost effective improvement in the thermal performance of building for both concrete slab and above ground construction. The Energy Brick was developed to avoid adding extra layers of materials and labour, which would add cost to conventional construction. Previous attempts to achieve super-insulated standards have always resulted in a fairly hefty cost penalty. This often prevents mainstream adoption of the higher building standards.

The Energy Brick from Green Energy Bricks achieves 4 to 5 times the insulation rating of conventional housing in Australia, and is designed to massively reduce the labour content of wall construction.

Over 5 processes, all with different materials and trades can be reduced to one or two processes, with skills that can be learned in a few hours.

While the bricks are more expensive at present than the material components of conventional walls, the labour to assemble is considerably reduced, meaning we have a solution; Green Energy Bricks increase the insulation rating considerably, while at the same time massively reducing the labour complexity and costs.[6]

The Green Building Impact

Green building is one of the most important trends in the construction industry today. When we build a house we cannot avoid impacting the environment, but we can work towards reducing that environmental impact.

This incorporates a whole building design approach into every phase of the building process including

- Land development
- resourcing efficient building designs to enhance the well-being of the occupants,
- improving construction techniques,
- increasing energy efficiency,
- water efficiency
- minimize the negative impacts on the community and natural environment.[7]

Features of Green Bricks

Following are the features of green brick- They allow for quicker and easier construction times, therefore saving time and labor costs overall

- Even though they are light weight, the bricks from Green Energy Bricks are structural/load bearing.
- The Bricks eliminate many OH&S issues for bricklayers/builders compared with concrete or clay bricks.
- Fire resistant qualities not found in any other brick on the market

Using light weight Bricks will eliminate many of the back problems associated with laying normal bricks or blocks.[8]

Green Brick is Cost Effective

The following cost savings add up if the Energy Brick is used as part of your construction process;

- No rebate is required as part of the concrete slab – only an outer square edge is required.
- 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

- Reduces the cost for a termite barrier and other flashing requirements.
- Dramatically increases the speed of construction.
- Provide an interior or exterior finish without the need for paints or coatings.
- Provide acoustic comfort with a sound transmission class (STC) rating of 45 or greater.
- Improve indoor air quality by eliminating the need for paint and coatings (no VOCs).
- Provide a non-combustible material which does not emit toxic fumes in fires.
- Provide an inorganic wall that is not a food source for mold.
- Serve as a heat-storing element in a passive solar design
- Last for generations.
- 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 Occupational Health and safety issues.
- Smaller heating and cooling units are required, which results in less initial outlay.
- No extra costs for brick cleaning.
- These Energy Bricks are laid directly on top of the concrete slab, or the flooring material for above ground construction.

There is no major added expense to lay the Energy Bricks from ground level, or any need for any special footing.

Conclusion

Decreasing the environmental footprint of the plant operation is a win-win situation for the brick and construction industry both from a financial as from an environmental point of view. The substitution of traditional raw materials with selected waste materials and of fossil fuels with renewable fuels is a

good example that “renewable” and “sustainable” does not have to the consequence of an increase in costs but can rather lead to substantial savings. All measures have been taken without any detrimental effects on product quality or workplace safety. Using a sustainable product such as the one presented here for building is a contribution to greatly reduce the environmental footprint of an entire project without causing any additional expenses.

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