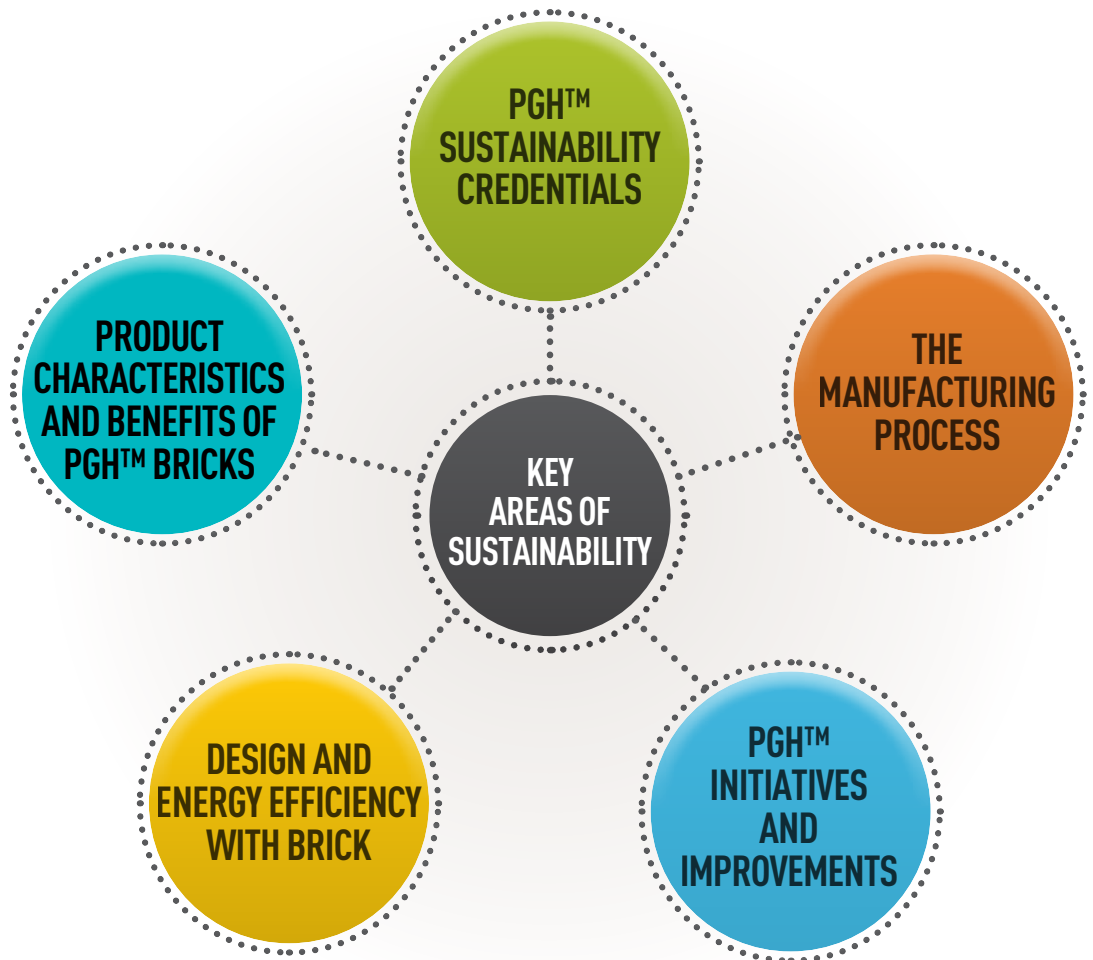


Sustainability and the Environment

INTRODUCTION

PGH Bricks and Pavers™, a division of CSR Building Products, is focused on sustainable manufacturing by improving its operations and further developing its product range to create increasingly energy efficient products and systems of building. As one of the oldest, continuously used building materials in the world, clay brick is a highly durable product made with natural materials that has a long-term life cycle, provides an energy efficient building solution and is recyclable. This document outlines the credentials of PGH Bricks and Pavers™ as a sustainable building products manufacturer and supplier.



PGH™ SUSTAINABILITY CREDENTIALS

Sustainability is “meeting the needs of the present without compromising the ability for future generations to meet their own needs.”¹ In complying with this, PGH™ produces a building product made from natural clay and shale, using recycled water and is kiln-fired with natural gas* in a controlled environment focused on recycling heat and waste materials. As a result, this product will continue to hold its environmental characteristics for its entire building life cycle. It can also be recycled at the end of a building’s life. As a core business principle, PGH™ focuses on saving raw materials and energy as well as recycling the elements used in brick production.

PGH™ focuses on the following points of sustainability in manufacturing:

WATER SAVING	<p>As a critical element to producing bricks in almost all manufacturing plants, sustainable and responsible water usage is important for the long term profitability and survival of the business. Water is used in the clay mix when extruding or moulding a brick. At PGH™, all factories carry out water harvesting and water recycling procedures, from clay preparation to clay mixing. Water captured in the extrusion or moulding process is also harvested, saved and recycled into the production process.</p>
RECYCLING CLAY	<p>In the manufacturing process, PGH™ recycles broken or faulty bricks and any excess clay materials. From clay extraction to the crushing or recycling of bricks, the value of clay remains important. At PGH™, any excess wet clay whilst extruding or moulding the brick is captured and fed back into the clay mixing process. Any chipped, broken or faulty bricks are crushed and fed back into the clay preparation process. In all PGH™ bricks, approximately 5% of the brick comprises some form of captured or recycled clay in its mix.</p>
RECYCLING ENERGY	<p>Effectively managing energy use during the manufacturing process is also very important to PGH™ as a means to reduce costs and minimise the impact on the environment. During the process of manufacture, PGH™ captures the heat generated whilst firing the bricks with natural gas* and feeds it back into the brick drying rooms to dry the bricks prior to firing, thus saving energy. In the process of firing the bricks, all PGH™ sites use natural gas* when firing their kilns.</p>
ADHERING TO INDUSTRY STANDARDS AND TESTING	<p>As part of our commitment to our customers, PGH™ manufactures its products in accordance with AS/NZS 4455.1 Masonry units, pavers, flags and segmental retaining walls – Part 1: Masonry units and AS/NZS 4455.2 Part 2: Pavers and flags. PGH™ bricks are suitable for use under guidance from AS 3700 – Masonry structures and the Building Code of Australia (BCA). PGH™ continually test their products through their NATA certified laboratory at their production facility in Schofields, NSW.</p> <p><small>NATA: National Association of Testing Authorities</small></p>
PRODUCT DEVELOPMENT	<p>PGH™ focuses heavily on product development. The aims are to diversify the product range and increase product useability, as well as increase environmental efficiency through the saving of water, heat and clay in the production process of PGH™ bricks. Recent improvements include the development of a new brick core pattern in our Oxley Factory in QLD, which reduces the amount of clay, energy and water used in the production process. PGH™ is in the process of developing a new range of lightweight bricks, which can be up to 20% lighter than traditional bricks.</p>

*In Oxley QLD, our production facility uses both natural gas and body fuel (coal slurry and coal stone) that generates slightly more CO2 than natural gas.

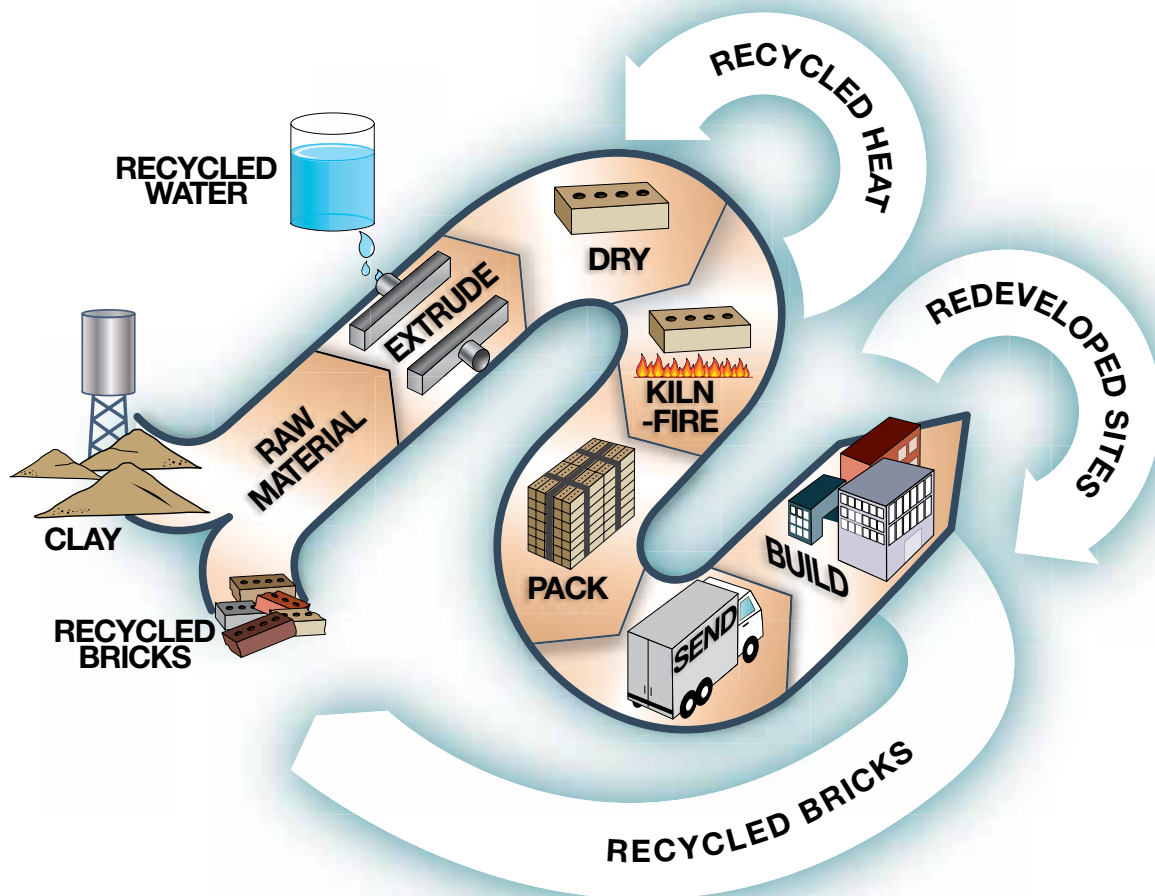
THE MANUFACTURING PROCESS OF PGH™ BRICKS

To understand why we focus on saving and recycling our clay, water and heat resources, it is necessary to understand how bricks are made. There are three common ways PGH™ bricks are made: extruded, dry pressed and moulded. For PGH™, the most common type of production method is extrusion, which is used at all our production sites. PGH™ endeavours to use world best practice in the manufacturing process.

The following table outlines what types of bricks are produced in each specific PGH™ production site:

PGH™ PRODUCTION SITE	EXTRUDED	DRY PRESSED	MOULDED
Schofields, NSW	All Products		
Horsley Park, NSW	Glazed Products	Dry Pressed Range	Sandstock Range
Cecil Park, NSW	All Products		
Oxley, QLD	All Products		
Golden Grove, SA	All Products		

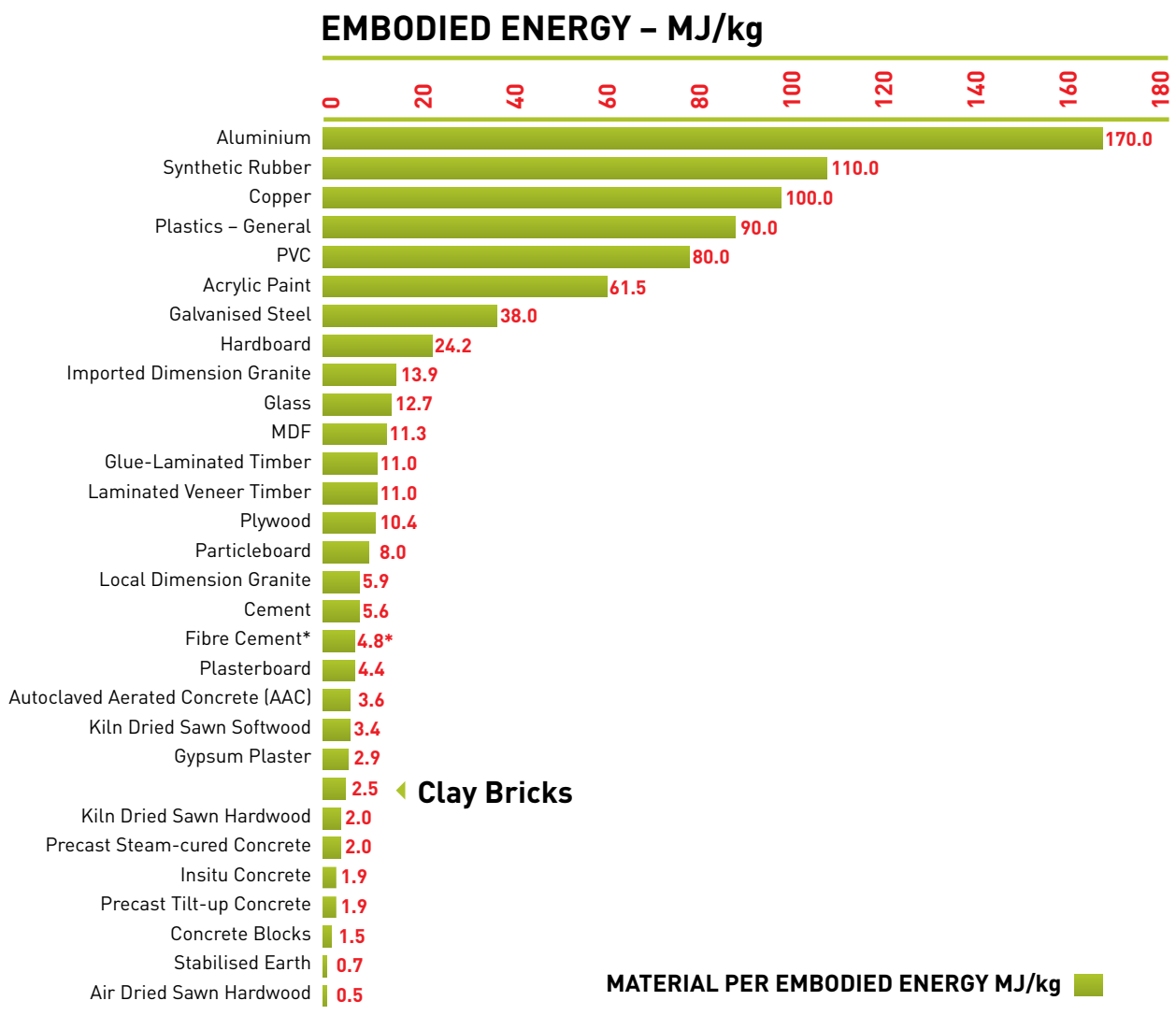
The diagram below shows how bricks are made through the extrusion process and how we focus on energy saving and recycling in the process:



Bricks are at the lower end of the embodied energy scale.

Embodied energy is the energy consumed by all of the processes associated with the production of a building material, from the mining and processing of natural resources to manufacturing, transport and product delivery. Embodied energy does not include the operation and disposal of the building material. This would be considered in a life cycle approach.

Typical figures for some Australian building materials are provided in the chart below.² Generally, the more highly processed a material, the higher its embodied energy. In comparing a range of building materials, clay bricks are at the lower end of the embodied energy scale in contrast to aluminium, copper, plastic materials, steel, glass and plywood, which are at the higher end of the scale.



Embodied energy of common building materials

Source: chart adapted from figures found in: Lawson, B, Building Materials, Energy and the Environment (1996);
 *fibre cement figure updated from earlier version and endorsed by Dr Lawson.²

PGH™ INITIATIVES AND IMPROVEMENTS AT A GLANCE

PGH™ has had a strong focus on sustainability of its manufacturing processes and continues to do so. Below is a list of improvements that relate directly to the manufacturing process and initiatives that PGH™ has taken³:

- Capturing waste water from wash-down areas for re-use in the production of bricks.
- Re-using waste water created by the sites' manufacturing processes and returning it to factory dams.
- The brick plant at Oxley in QLD has a stormwater pit, which catches 6 million litres of water per year, which equates to approximately 40% of its consumption.
- From 2009 to 2010, the Schofields site in NSW has drawn approximately 1,300 – 1,400 kiloliters each month from stormwater reserves.
- In 2009, the Horsley Park site in NSW saved approximately 18 million litres of potable water through the use of captured stormwater and these water saving methods are ongoing.
- Cecil Park in NSW is targeting a 50% level of stormwater use through plans to use stormwater in production and recycling waste water to potentially save up to 15,000 kilolitres of potable water per year.
- Water saving initiatives has helped CSR Bricks and Roofing to save 8% of its water consumption from 2008 to 2011.
- From 2008 to 2011, CSR Bricks and Roofing have reduced their solid waste by 33%.
- CSR Building Products as a whole had a reduction of 8% of greenhouse gas emissions from 1 July 2009 – 30 June 2010 to 1 July 2010 – 30 June 2011.
- The introduction of a new core pattern at our Oxley brick production site in QLD in 2012 will see an increase in void area of about 8% and will require less drying and firing time in the kilns.

For further information, please refer to CSR Sustainability Reports 2008, 2009, 2010, 2011, which can be accessed via www.csr.com.au/Community-and-Sustainability

PGH™ focuses on continual improvement

Given that sustainability advancements in the building product industry are ongoing, PGH™ continues to focus on improvements in the following areas to reduce the impact on the environment:

All of these initiatives of continual improvement will create a clean more sustainable product which will use less natural resources and leave a lighter carbon foot print in the local and national environment.

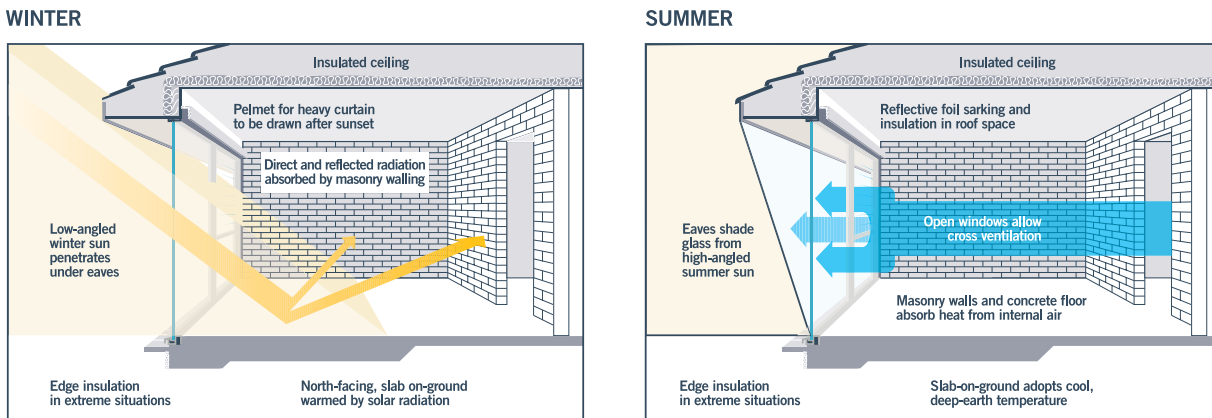
- **The ongoing reduction of greenhouse gas emissions:**
 - Reducing CO₂-e emissions
- **Continual water use reduction:**
 - Self-sufficiency of water use due to water harvesting
 - The “never waste a drop” process is already in place
 - Harvesting all water in our plants of operation
- **Minimising air pollution:**
 - Dust reduction
- **Recycling:**
 - Recycling heat in the drying and firing processes
 - Recycling broken or faulty products
- **New product development:**
 - An ongoing commitment to develop new products, which reduce the use of raw materials, firing time in the kilns and drying time in the manufacturing process
 - The development of lightweight clay bricks and cladding products
 - Increasing manufacturing standards and improving methods of clay sourcing by producing a lower amount of seconds or faulty products

DESIGN & ENERGY EFFICIENCY WITH BRICK

Bricks are an essential part of energy efficient building design. The key reason for this, is that bricks provide thermal mass when used in a building. This thermal mass is a key part of passive design, a proven method of keeping your home at a comfortable temperature all year round and reducing the need for heating and cooling devices, which in turn decreases electricity loads, providing cost savings.

According to the Department of Climate Change and Energy Efficiency, “Thermal mass acts as a thermal battery. During summer, it absorbs heat, keeping the house comfortable. In winter, the same thermal mass can store the heat from the sun or heaters to release it at night, helping the home stay warm.”⁴

Principles of passive solar design



Brickwork can be very energy efficient. When designing a house to be cool in summer and warm in winter, the wall material as well as other factors need to be taken into account. There are five key passive design features:

<p>Orientation: Placement of the house in relation to the sun.</p> <p>Insulation: A wall's ability to isolate temperature.</p> <p>Climate: The maximum day-time and minimum night-time temperatures (diurnal range). Thermal mass is most appropriate in climates with a large diurnal temperature range.</p>	<p>Thermal Mass: Heavy-weight wall materials slow the passage of heat through a wall, a process called 'thermal lag'. And, the easiest way to get this heavy mass into walls is by using brickwork. The heavier the brick, the higher its thermal value.</p> <p>Ventilation: Air flow through the house.</p>
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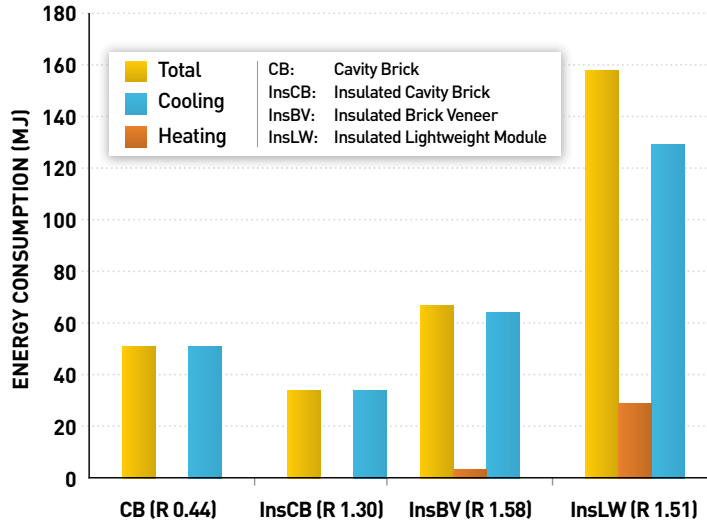
Tailoring these passive design features to each climate is important. Think Brick Australia has put together a Climate Design Wizard that provides sustainable design strategies for designing ecologically sustainable buildings for the unique climatic conditions within Australia.

With many new building products entering the market, it's important to consider what will be best for the long term sustainability of building designs and the environment and what will minimise energy usage after installation.

Clay bricks outperform their lightweight counterparts

In Australia, a significant proportion of the end energy usage in residential buildings is used for space heating and cooling.⁵ Research findings from an eight-year thermal research program on masonry housing, conducted by Think Brick Australia in conjunction with the Faculty of Engineering and the Built Environment at the University of Newcastle, found that clay bricks outperformed their lightweight counterparts in relation to thermal performance, providing superior, energy efficient environments for people to live, work and play in.⁶

The thermal research findings concluded that the lightweight building was the worst performing in all seasons, brick veneer performed better than lightweight materials and insulated cavity brick performed the best. It also showed that the R-value is not the sole predictor of thermal performance and that there is no correlation between the R-value of a wall and energy usage. (R-value: is a measure of thermal resistance used in the building and construction industry.)

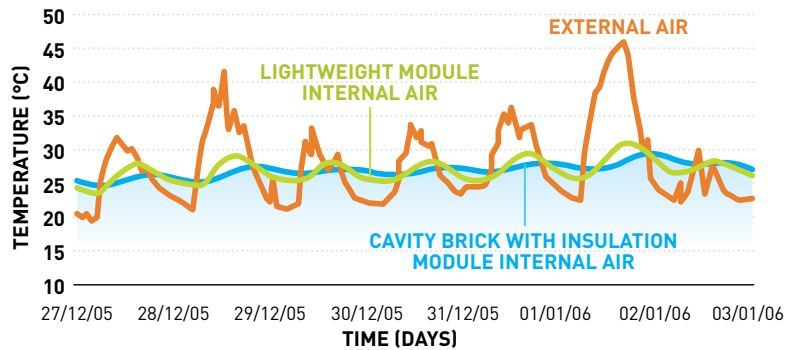


Total energy consumption, October 2007.⁶

The graph above shows that the insulated lightweight module (R 1.51), with over three times the R-value of cavity brick (R 0.44), used over three times the energy to maintain the temperature in the comfort zone. This data shows a clear difference between clay bricks and lightweight products with insulated cavity brick performing the best in relation to energy efficiency in a temperate climate.

Clay bricks provide superior thermal control

This research also found that insulated lightweight buildings exhibit greater variations in internal temperature and minimal thermal lag, resulting in daily temperature swings of more than twice that of insulated cavity brick dwellings during hot conditions.⁶



External and internal air temperatures for lightweight and insulated cavity brick modules, January 2006.⁶

The graph above shows that the lightweight module responds directly to the external environment with a rapid increase and reduction in temperature due to its low thermal mass, unlike insulated cavity brick. The lightweight module exhibited no properties with the potential to assist in maintaining adequate thermal comfort. Clay bricks have always been known for their thermal comfort properties and this research confirms this.

CSR HOUSE

Commitment to high performance systems and sustainability is demonstrated in the CSR House, the recently completed research facility. The house is built to an 8 star energy efficient rating to provide a tangible experience for how CSR products and systems can be used to provide high levels of affordable, cost-effective energy efficiency in home designs.

Houses with an 8 star rating typically require around 75% less heating and cooling energy than the average Australian home. (NatHERS Starbands climate zone 2B. Average Australian home based on CSR research.)

A range of PGH™ bricks and pavers feature in and around the house, providing functional and aesthetic qualities to the project. The construction consists of an insulated double brick cavity wall on the western facade to achieve a total system R-value of above 6 in summer and winter.⁷ Also, brick veneer walls (with wall wrap, insulation and plasterboard) have been used in other areas of the building to allow for not only strong design aesthetics and minimal maintenance but thermal and acoustic insulation, contributing to the energy efficiency of the built home design.

For further information, visit www.csr.com.au and www.youtube.com/user/csrhouseproject



Featured PGH™ bricks and pavers include:

Building facade – Pewter from the PGH™ Alchemy collection – double brick cavity wall and brick veneer walls

BBQ area – Wasabi bricks from the PGH™ Vibrant collection

Garage parapet wall – Northbridge Roman Splits from the PGH™ Roman Splits collection

Front perimeter wall to the front of CSR House and garden area – Gledswood Blend bricks from the PGH™ Dry Pressed collection

Paved pathway – Peppercorn and Chestnut pavers from the PGH™ Wirecut collection

CSR House
75 Townson Road
Schofields NSW 2762

THE BENEFITS OF PGH™ BRICKS AS A BUILDING PRODUCT



Bricks are sustainable – natural clay, recyclable, energy efficient



Acoustic insulation – clay bricks reduce noise and let you enjoy a quiet haven



Temperature control – with proper design, your home will be warm in winter and cool in summer



Durable – non-combustible, termite resistant, weather resistant and they won't decay or rot



Low maintenance – face bricks have an enduring colour, so no need to paint or render



Cost effective – less upfront costs and virtually no ongoing costs



Design flexibility – whatever the design or colour trend, there's a brick to suit your individual needs

SUSTAINABILITY SUMMARY



As a CSR business, PGH Bricks and Pavers™ is committed to providing environmentally sustainable and energy efficient solutions. This is in relation to improvements made within the business and to the wide product range offered to the end user. For PGH™, sustainability involves the life-cycle of the product; natural clay is used from the ground, moulded with recycled clays and water, dried with recycled heat, fired with natural gas*, packed and delivered on re-usable pallets or no pallet at all. PGH™ bricks, which are durable and long-lasting, can then be used to build a building design. At the end of a building's life, there is the opportunity to recycle the product into another building or crush and recycle the product back into controlled landfills. From cradle to cradle and the savings in between, PGH™ offers a sustainable, natural and extensive product range for building projects that can enhance a design, whilst providing energy efficiency in its application.

*In Oxley QLD, our production facility uses both natural gas and body fuel (coal slurry and coal stone) that generates slightly more CO2 than natural gas.



PGH Bricks & Pavers™ is a member of Think Brick Australia, the Australian authority on bricks, brickwork and segmental clay paving. An eight-year thermal research program on masonry housing was conducted by Think Brick Australia in conjunction with the Faculty of Engineering and the Built Environment at the University of Newcastle, which found that clay brick is a superior building material in producing energy-efficient environments for people to live and work in.

www.thinkbrick.com.au



CSR supports the Green Building Council of Australia and is committed to providing environmentally sustainable and energy efficient solutions.

www.gbca.org.au

References:

1. Sustainability definition from 'Our Common Future: Report of the World Commission on Environment and Development'. 1987
2. Lawson, B, 'Building Materials, Energy and the Environment: Towards Ecologically Sustainable Development', Royal Australian Institute of Architects, Canberra, 1996.
Cited in 'Your Home Technical Manual - Fourth Edition, Section 5.2 Embodied Energy', Department of Climate Change and Energy Efficiency, Commonwealth of Australia, 2010.
www.yourhome.gov.au/technical/pdf/TechManual_4th_edition2011.pdf
3. 'CSR Sustainability Reports 2009, 2010, 2011'
www.csr.com.au/Community-and-Sustainability
4. www.yourhome.gov.au/technical/pdf/TechManual_4th_edition2011.pdf (pg.114)
5. Australian Residential Building Sector Greenhouse Gas Emissions 1990–2010, Australian Greenhouse Office, 1999.
6. 'Energy Efficiency and the Environment – The Case for Clay Brick – Edition 4', Research conducted by Think Brick Australia in conjunction with the Faculty of Engineering and the Built Environment at the University of Newcastle, 2009. A Study of the Thermal Performance of Australian Housing is the full report.
www.thinkbrick.com.au/energy-efficiency-using-brick-and-the-environment
7. 'CSR House Thermal Performance Certificate', May 2012.



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