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THINK BRICK AUSTRALIA

1 September 2009

Rob Hansen
Research Director
Environment and Resources Committee
Parliament House
BRISBANE QLD 4000

Dear Mr Hansen

Re: Inquiry into energy efficiency improvements

Thank you for the opportunity to provide comment as part of the Queensland Government's Inquiry into energy efficiency improvements.

Think Brick Australia represents the Australian clay brick and paver market which is worth $2b to the Australian economy and employs approximately 30,000 people in the manufacture, supply and installation of its product.

Energy efficiency has been an on-going research interest for the Australian clay brick industry and Think Brick Australia for more than 10 years and more than $2m has been invested in researching how Australian building materials – in particular products with thermal mass – improve the energy efficiency of buildings.

Equally, the industry has made significant investment in improving the energy efficiency of brick manufacturing. Since FY 2001, the industry has reduced its energy consumption per brick by over 17% through process optimisation and capital investment. Much of this work has been without Government assistance (Federal or State).

The industry foresees significant changes and challenges in the medium-term that will impact not only how it manufacturers its product, but also how its product is used. Many of the questions raised in the issues paper are not unique to Queensland, and have been explored as part of other Government inquires including the Garnaut Review during 2008.

That said, Queensland has an opportunity to demonstrate leadership in the development and implementation of policies that will unlock opportunities for industry in delivering energy efficiency improvements, including:

1. Public awareness campaigns to improve community awareness of what makes an energy efficient home.
2. Up-skilling package for builders to improve their knowledge of residential energy efficiency issues and house optimisation
3. New 'blue-sky' investigative research grants for alternative technologies
4. Incentives for builders and developers to build more energy efficient homes
5. Up-skilling package for brick-layers to increase availability of skills to make more energy efficient homes

This submission outlines three key areas where barriers and opportunities exist to improve energy efficiency and the policies required to achieve these opportunities in:

- Residential house design
- Improving the energy efficiency of brick manufacturing
- Impact of CPRS on energy efficiency policies.

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Residential house design

Unfortunately there is a large amount of misinformation about what makes energy efficient houses and the impact of Queensland's climate on house design. While the Queensland Building Codes Division within the Department of Infrastructure and Planning and the Building Commission have demonstrated significant leadership in understanding building design relative to Queensland's climate, much of this information is yet to find its way into the broader community or local advocacy groups' awareness. Figure 1 is modelling conducted on a 185m2 standard detached house in AccuRate for the three major residential climate zones in Queensland.

	Total R-value (all have added R1.5 insulation)	Performance compared to standard insulated brick veneer home (R=1.87)		
		Zone 1	Zone 2	Zone 5
Insulated weatherboard	1.97	-1.57%	-8.17%	-14.09%
Insulated Autoclaved aerated concrete	2.23	0.34%	-0.98%	1.70%
Insulated extruded polystyrene	3.02	0.69%	-1.96%	-2.51%
Reverse brick veneer	2.06	1.29%	21.24%	18.10%
Insulated double brick	1.96	1.71%	21.57%	26.09%

Figure 1

This modelling, in conjunction with research by the University of Newcastle, demonstrates that 'timber & tin', contrary to popular belief, is not necessarily the best way to build in Queensland. A significant reason for this is arguably that the verandas that were synonymous with traditional housing in Queensland, rarely exist as they once did.

More than verandas or 'single bullet' housing construction, however, is the bigger issue of builders understanding the components of energy efficiency and house optimisation. Use of tools such as AccuRate and other 2nd Generation thermal modelling software needs to be more actively promoted to builders such that they can continue to use their preferred method of building and introduce other features – such as more insulation, thermal mass, double glazing or shading – to improve energy efficiency.

Recommendations

1. Develop a public awareness campaign to dispel the misinformation about housing construction and energy efficiency
2. Introduce an up-skilling package for builders to improve their knowledge of residential energy efficiency issues and house optimisation through 2nd Generation thermal modelling software.

Improving the energy efficiency of brick manufacturing

As can be seen from figure 1, clay bricks improve the energy efficiency of house. On-going research by the University of Newcastle has demonstrated that the inclusion of thermal mass – regardless of climate location – improves the thermal performance of the building above walling systems without mass. This occurs because external mass delays heat entry and loss, and internal mass (i.e. not covered by insulation) reduces internal temperature fluctuations.

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Incumbent upon the brick industry is the responsibility to provide this energy saving product without using unnecessary energy during the production process.

As previously mentioned, the Australian brick industry has undertaken to achieve this and over the past 10 years has achieved and an average energy reduction of more than 17% per brick.

In addition to this we have (1) commissioned a Life Cycle Assessment (LCA) to determine the impact of additional energy used in the production of clay bricks relative to other building products, and (2) commenced an industry-wide analysis of clays to determine, and reduce the use of, those which produce the highest levels of greenhouse gases.

The results of the LCA (to be officially released at the Australian Building Codes Board annual conference on the Gold Coast in September 2009) demonstrate that when operational energy savings are taken into consideration (ie the use of heating, cooling, appliances and hot water), the embodied energy of a house – regardless of construction – only amounts to 10% of the total energy demand. If only heating and cooling were considered (because walling construction cannot impact appliance or hot water energy efficiency), embodied energy of the housing shell – regardless of construction – had a maximum impact of 55%, however, changing the walling construction (ie from brick to timber) had a maximum impact of between 7-12% on the total greenhouse gas impacts of the house.

A key conclusion of the research was that the design of the house has a greater impact on the lifetime performance than does the selection of exterior wall building materials, and optimising house design (including orientation) not only off-sets, but in a number of situations improves the long-term energy efficiency of a house (over 50 years).

As such, while energy consumption in the manufacturing process is important, its importance is no greater to the clay brick industry than other building products. The only reason this is not the case is the availability of technology alternatives for the production of clay bricks: currently no other major forms of technology exist to produce bricks at the volume required by the Australian housing market.

The industry continues to trial and experiment with alternatives to currently methods of production, however, to achieve the high quality product demanded by the market, energy efficiency improvements have been confined to process optimisation and capital re-investment (ie building new kilns) to reduce energy consumption.

This situation is not aided by existing Federal and State energy efficiency grants (Australia-wide) that are geared toward guaranteed payback periods, ‘matching funding’, or ‘new innovation’ grants.

Across Australia, and not necessarily in Queensland, significant government assistance exists for manufacturers of products that are new and/or innovative. While this is, in and of itself, a good thing for market development in Australia, it generally excludes the clay brick industry because the product is neither new nor innovative.

This is a classic case of ‘*throwing the baby out with the bath water*’; clay brick is not new because it has proven its benefit over more than 5000 years, however, for 5000 years energy efficiency and climate change have not been significant issues, and as such, new ‘blue-sky’ investigative research grants for alternative technologies are needed. These would not only benefit the clay brick industry, but the entire building materials sector.

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Recommendation

3. The development of new 'blue-sky' research grants for building materials sector to investigate alternative technologies

Impact of CPRS on energy efficiency policies

The Australian economy is about to undergo the largest structural change introduced through climate change policy and specifically the CPRS. This change, and the implications for the economy, cannot be underestimated. To this end, it is important to understand the implications for existing policy in conjunction with the CPRS before developing new policies.

Of significant concern to the clay brick industry is the interaction of the CPRS and the Building Code of Australia.

As both pieces of legislation are currently written, they will interact to inadvertently increase household energy consumption because the CPRS only taxes production emissions and makes no allowance for life cycle emission savings (as discussed earlier and identified as part of the LCA commissioned by Think Brick Australia). Under this situation, the CPRS will distort the building materials market in favour of lightweight materials because they require less energy to meet current BCA regulations.

The CPRS distortion is expected to increase heating and cooling energy consumption because the BCA determines energy efficiency by the *total minimum thermal resistance* (commonly known as *R*-value) of a wall. This metric is problematic because (a) it assumes that a higher R-value always improves energy efficiency, and (b) it only measures the benefits provided by insulation (which is critical), but not thermal mass (the other critical component).

Understandably, the market seeks out least-cost materials irrespective of their capacity to improve thermal performance. As can be seen in Figure 1, even if equal costs are assumed, the market is likely to build using insulated extruded polystyrene for its higher R-value (builders can, and do, use the higher R-value to market their houses), however, it performs on average 1.26% worse than a standard brick veneer house, despite having an R-value 61.5% higher.

Furthermore, insulated double brick, with a total R-value of 1.96 outperforms both of the construction types by an average of 16.5%, and in Brisbane, by more than 21%.

In reality, equal costs will not the case because the CPRS taxes brick higher than extruded polystyrene, and thus builders will have two incentives to chose it over other, more energy efficient forms of construction: price and marketing claims.

Depending on the strength of market forces, the interaction of the CPRS and BCA could inadvertently increase residential heating and cooling energy consumption by 19–32 percent above Federal Treasury estimates by 2050. Before additional policies are created, the interaction of the CPRS with the BCA should be considered.

Think Brick Australia believes it is the intention of the National Energy Efficiency Strategy to consider this issue, however, Queensland, through its position on COAG, should ensure that changes are made such that *total R-value* does not drive the building material selection process.

Think Brick Australia has made various recommendations to both the Federal Government and the Australian Building Codes Board around this issue. For more information see "Wasting Energy (Jan 2009)" and the Supplementary Submission to the BCA 2010 by Think Brick Australia (Attachments A and B) for both long- and short-term solutions.

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Recommendations

4. Incentives for builders and developers to build more energy efficient homes
5. Up-skilling package for brick-layers to increase availability of skills to make more energy efficient homes

If there are any further questions, or to discuss these matter further, please do not hesitate to contact me directly on the numbers provided below.

Yours faithfully,

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Supplementary Submission to draft BCA 2010 for Heavy Walling Industry Associations, including:

- **Think Brick Australia (TBA)**
- **Cement Concrete & Aggregates Australia (CCMA)**
- **Concrete Masonry Association of Australia (CMAA), and**
- **National Precast Concrete Association of Australia (NPCAA)**

This information supports the submission made by Quasar Management Services on behalf of TBA/CCMA/CCAA/NPCAA, specifically concerning *Table 3.12.1.3a & b* within clause 3.12.1.4 "External walls". This supplementary information supports the argument to:

1. Remove the limitation on solar absorption currently in the DTS provisions for walls and roofs, with the exception being use in walling systems with a surface density greater than 220kg/m2 in zone 5 that have no insulation; and
2. The expansion of Table 3.12.1.3 into three categories rather than just two
    a. Wall with a surface density of less than 150 kg/m2
    b. Wall with a surface density between 150-220 kg/m2
    c. Wall with a surface density of greater than 220 kg/m2.

1. Removing the limitation on solar absorption

In addition to information already provided, Figure 1 further demonstrates that solar absorptance not only has a negligible impact on the thermal performance of insulated walls, but that dark solar absorptance actually improves the performance in approximately 70% of situations.

Total Number of simulations = 54	Star Rating	MJ/m2
Light solar absorptance improved performance	18.52%	29.63%
Dark solar absorptance improved performance	51.85%	70.37%
Solar absorptance had no impact on performance	29.63%	0.00%
Maximum performance improvement with light solar absorptance	3.51%	4.52%
Maximum performance improvement with dark solar absorptance	4.84%	7.52%

Figure 1

Attachment A lists the details and outcomes of each run and it can be seen that the maximum thermal performance improvement (MJ/m2) that is gained by using a light solar absorptance is 4.52%; conversely, a maximum improvement (MJ/m2) of 7.52% is achieved using dark solar absorptance.

Given this information, and that of many other submissions that demonstrate the inconclusiveness of solar absorptance as a factor influencing thermal performance, Think Brick Australia, in conjunction with the other heavy walling industry associations, recommend:

> *Removal of the limitation on solar absorption currently in Tables 3.12.1.3 a&b for external walls and roofs, with the exception being use in walling systems with a surface density greater than 220kg/m2 in zone 5 that have no insulation (for further information on this exception see second comment below).*

2. Expansion of Table 3.12.1.3 a&b

Think Brick Australia supports the move to separate Table 3.12.1.3 (BCA 2007) into separate classes of walling. This recognises the inherent differences between different walling materials to improve thermal performance.

Independent research by the University of Newcastle[1], as well as AccuRate simulations, demonstrate that walling systems with thermal mass improve the thermal performance of houses – regardless of location – over walling systems with no thermal mass.

As such, Think Brick Australia recommends expanding Table 3.12.1.3 into three categories based on the level of mass – or surface density – of the walling system.

As can be seen at Attachment B, despite having an average additional total walling system R-value of nearly 29%, the performance of no mass walling systems (ie surface density less than 150kg/m2) across Australia averages 3% less than an equivalent medium weight walling system. Put another way, to achieve the same performance of a medium weight walling system, a no mass walling system requires a higher total R-value of at least 30%.

The suggested changes to Table 3.12.1.3 (Attachment C) recognise the benefit of 'trading' various aspects of a building envelope to improve thermal performance. For the recommendations in Attachment C, thermal resistance, thermal mass, glazing, shading, and solar absorptance have been 'traded' based on how a building performs based on its level of thermal mass.

The tables also include other factors that need to be considered when using walls without mass such as air-exchange systems are required to prevent condensation and poor indoor air quality. If this is not done, the high thermal resistance required in a walling system without thermal mass produces a "fridge-like" environment that is not conducive to human health.

Recommendation

That the tables in Attachment C replace Tables 3.12.1.3 a&b

[1] Refer "Wasting Energy" (Jan 2009) available at www.thinkbrick.com.au for more information

Wall Colour Effect on Total Annual Energy Use MJ/m^2

Source: Deanei Drawing Board

	Light		Medium		Dark		Max % change	
Perth	MJ/m2	Star Rating	MJ/m2	Star Rating	MJ/m2	Star Rating	MJ/m2	Star Rating
Insulated double brick	57.2	7.5	55.4	7.6	53.2	7.7	7.52%	2.60%
Reverse brick veneer	58.6	7.4	56.8	7.5	54.8	7.6	6.93%	2.63%
Insulated brick veneer	75.4	6.8	74.3	6.8	73.6	6.9	2.45%	1.45%
Insulated Aerated Autoclaved Concrete	74.3	6.8	74.2	6.8	74	6.8	0.41%	0.00%
Insulated external polystyrene foam panel	73.4	6.9	73.4	6.9	73.5	6.9	-0.14%	0.00%
Insulated weatherboard	85	6.4	85.2	6.4	85.7	6.3	-0.82%	-1.59%
Melbourne								
Insulated double brick	126.8	5.9	124.5	6	120.9	6.1	4.88%	3.28%
Reverse brick veneer	126	5.9	123.7	6	120.4	6.1	4.65%	3.28%
Insulated brick veneer	130.3	5.9	128.2	5.9	125.8	5.9	3.58%	0.00%
Insulated Aerated Autoclaved Concrete	126.9	5.9	125.6	5.9	123.4	6	2.84%	1.67%
Insulated weatherboard	139.8	5.6	137.9	5.7	136.1	5.7	2.72%	1.75%
Insulated external polystyrene foam panel	121.7	6.1	120.8	6.1	119.6	6.2	1.76%	1.61%
Sydney – Hornsby								
Insulated double brick	26.9	7.9	26.4	7.9	25.3	8.1	6.32%	2.47%
Reverse brick veneer	27.5	7.9	26.9	7.9	26.2	7.9	4.96%	0.00%
Insulated brick veneer	35.7	7.2	35.4	7.3	35.2	7.3	1.42%	1.37%
Insulated Aerated Autoclaved Concrete	35.4	7.3	35.5	7.2	35.3	7.3	0.28%	0.00%
Insulated external polystyrene foam panel	34.7	7.3	35	7.3	35.2	7.3	-1.42%	0.00%
Insulated weatherboard	40.3	6.9	40.6	6.9	41	6.8	-1.71%	-1.47%
Sydney – Castle Hill								
Insulated double brick	50.9	7.7	49.9	7.7	48.4	7.8	5.17%	1.28%
Reverse brick veneer	52.2	7.6	51.4	7.7	50.3	7.7	3.78%	1.30%
Insulated brick veneer	69.9	6.8	69.8	6.8	69.6	6.8	0.43%	0.00%
Insulated Aerated Autoclaved Concrete	69.5	6.8	69.9	6.8	69.9	6.8	-0.57%	0.00%
Insulated external polystyrene foam panel	68.1	6.9	68.6	6.9	69.7	6.8	-2.30%	-1.47%
Insulated weatherboard	78.7	6.4	79.4	6.4	80.8	6.3	-2.60%	-1.59%
Hobart								
Insulated double brick	168.3	5.7	165.1	5.8	160.3	5.9	4.99%	3.39%
Reverse brick veneer	167.2	5.7	164.2	5.8	159.8	5.9	4.63%	3.39%
Insulated brick veneer	170.5	5.6	167.6	5.7	163.5	5.8	4.28%	3.45%
Insulated weatherboard	181.6	5.4	179.3	5.4	175.9	5.5	3.24%	1.82%
Insulated Aerated Autoclaved Concrete	165.7	5.8	163.7	5.8	160.7	5.9	3.11%	1.69%
Insulated external polystyrene foam panel	159	5.9	157.5	5.9	156.3	5.9	1.73%	0.00%
Adelaide								
Insulated double brick	60.7	7.4	59.7	7.4	59	7.4	2.88%	0.00%
Reverse brick veneer	62.3	7.3	61.7	7.3	60.9	7.4	2.30%	1.35%
Insulated brick veneer	79.8	6.6	79.5	6.6	79.5	6.6	0.38%	0.00%
Insulated Aerated Autoclaved Concrete	78.9	6.7	79.2	6.6	79.3	6.6	-0.50%	-1.52%
Insulated external polystyrene foam panel	76.9	6.7	77.1	6.7	77.6	6.7	-0.90%	0.00%
Insulated weatherboard	87.9	6.3	88.4	6.3	89.5	6.3	-1.79%	0.00%

Wall Colour Effect on Total Annual Energy Use MJ/m^2 (cont.)

	Light		Medium		Dark		Max % Change	
Brisbane	MJ/m2	Star Rating	MJ/m2	Star Rating	MJ/m2	Star Rating	MJ/m2	Star Rating
Insulated Aerated Autoclaved Concrete	31.8	7.3	32	7.2	32	7.2	-0.62%	-1.39%
Insulated brick veneer	31.5	7.3	31.8	7.3	31.9	7.3	-1.25%	0.00%
Insulated external polystyrene foam panel	31.7	7.3	31.8	7.3	32.6	7.2	-2.76%	-1.39%
Reverse brick veneer	24.6	8	24.9	8	25.3	7.9	-2.77%	-1.27%
Insulated double brick	24.4	8.1	24.6	8	25.1	7.9	-2.79%	-2.53%
Insulated weatherboard	33.8	7	34.4	6.9	35.4	6.8	-4.52%	-2.94%
Darwin								
Insulated external polystyrene foam panel	349.9	5.9	353.5	5.9	357.3	5.9	-2.07%	0.00%
Insulated brick veneer	351.7	5.9	354.9	5.9	360.9	5.8	-2.55%	-1.72%
Insulated Aerated Autoclaved Concrete	350.7	5.9	354.9	5.9	360.4	5.8	-2.69%	-1.72%
Insulated double brick	344.6	6.1	349	6	355.2	5.9	-2.98%	-3.39%
Reverse brick veneer	342.4	6.1	347.1	6	353.3	5.9	-3.09%	-3.39%
Insulated weatherboard	355.8	5.9	361.7	5.8	370.6	5.7	-3.99%	-3.51%
Canberra								
Insulated double brick	166.5	5.9	163.1	6	157.8	6.2	5.51%	4.84%
Reverse brick veneer	165.6	5.9	162.4	6.1	158.4	6.1	4.55%	3.28%
Insulated brick veneer	176.1	5.8	173.6	5.8	169.9	5.9	3.65%	1.69%
Insulated Aerated Autoclaved Concrete	171.7	5.9	170.2	5.9	167.8	5.9	2.32%	0.00%
Insulated weatherboard	190.3	5.4	188.5	5.5	186.5	5.6	2.04%	3.57%
Insulated external polystyrene foam panel	165.5	5.9	164.7	6	163.5	6	1.22%	1.67%

Notes

- All walling systems have R1.5 added insulation
- Roof has R3 insulation

ATTACHMENT B

		Performance compared to medium weight walling system (150kg/m2 - 220kg/m2)												
	Additional R-value compared to Medium weight walling system	**Perth**	**Adel**	**Sydney - Hornsby**	**Sydney - Castle Hill**	**Hobart**	**Melb**	**Cbr**	**Bris**	**Darwin**	**Ave. (Aust)**	**Ave. (Zone 5)**	**Ave. (Zone 6)**	**Ave. (Zone 7)**
Insulated weatherboard	5.30%	-14.65%	-12.05%	-15.57%	-13.96%	-5.71%	-4.36%	-6.39%	-8.17%	-1.57%	-9%	-14%	-9%	-6%
Insulated Autoclaved aerated concrete	19.30%	0.71%	0.80%	3.59%	6.53%	0.39%	2.77%	-1.69%	-0.98%	0.34%	1%	2%	5%	-1%
Insulated external polystyrene foam panel	61.50%	2.13%	-12.05%	2.40%	-13.96%	3.70%	6.79%	1.88%	-1.96%	0.69%	-1%	-3%	-4%	3%
Insulated double brick	4.80%	26.03%	25.30%	26.95%	29.14%	1.95%	5.87%	6.90%	21.57%	1.71%	16%	26%	18%	4%
Average additional R-value of no mass walling system compared to medium mass walling system	28.7%													
Average performance of walling system with no mass compared to medium weight walling system		-3.94%	-7.77%	-3.19%	-7.13%	-0.54%	1.73%	-2.07%	-3.70%	-0.18%	-2.98%	-5%	-3%	-1%

Notes

- All walling systems have R1.5 added insulation
- Roof has R4 insulation
- No mass walling systems are
    - Insulated weatherboard
    - Insulated Autoclaved aerated concrete
    - Insulated external polystyrene foam panel
- Medium weight walling system comparison is an insulated brick veneer wall with R1.5 added insulation and total R-value of 1.87
- AccuRate simulations used for comparison by Accredited ABSA assessor Deanei Drawing Board

Table 3.12.1.3a

Wall with a surface density of less than 150 kg/m^2		
Climate		Rationale
1,2,3,4 & 5	(a) i achieve a minimum *Total R-Value* of 3.0; and ii the solar absorptance of the external surface of the *external wall* be not more than 0.45; and iii maximum glazing no greater than 10% of wall area iv incorporates permanent air exchange system	Heat gain via glazing is trapped inside walls with high thermal resistance necessitating less glazed area or shading in conjunction with a permanent ventilation system to prevent condensation.
	(b) i Achieve a minimum *Total R-Value* of 2.5; and ii the solar absorptance of the external surface of the *external wall* be not more than 0.45; and iii A: shade the *external wall* of the storey with a verandah, balcony, eaves, carport of the like, which projects at a minimum angle of 15 degrees in accordance with Figure 3.12.1.2; or B: external glazing complies with 3.12.2.1 with applicable value for C_{SHGC} reduced by 20%; and iv incorporates permanent air exchange system	
6 & 7	(a) Achieve a minimum *Total R-value* of 3.5	Without thermal mass more insulation is required to prevent heat loss
8	(a) Achieve a minimum *Total R-value* of 4	Without thermal mass more insulation is required to prevent heat loss

Table 3.12.1.3b

Wall with a surface density between 150 - 220 kg/m2 (and mass is not completely insulated; ie not core-filled polystyrene)		
Climate Zone		Rationale
1,2,3&4	(a) i the *external wall* incorporates insulation with an R-Value of not less than 2; and ii shade the *external wall* of the storey with a verandah, balcony, eaves, carport of the like, which projects at a minimum angle of 15 degrees in accordance with Figure 3.12.1.2; and iii external glazing complies with 3.12.2.1 with applicable value for C_{SHGC} reduced by 20%; and	
	(b) i the *external wall* incorporates insulation with an R-Value of not less than 2.5; and ii the *external wall* of the storey with a verandah, balcony, eaves, carport of the like, which projects at a minimum angle of 15 degrees in accordance with Figure 3.12.1.2;	
5	(a) i the *external wall* incorporates insulation with an R-Value of not less than 1.5; and ii shade the *external wall* of the storey with a verandah, balcony, eaves, carport of the like, which projects at a minimum angle of 15 degrees in accordance with Figure 3.12.1.2; and iii external glazing complies with 3.12.2.1 with applicable value for C_{SHGC} reduced by 15%;	
	(b) i the *external wall* incorporates insulation with an R-Value of not less than of 2; and ii A: shade the *external wall* of the storey with a verandah, balcony, eaves, carport of the like, which projects at a minimum angle of 15 degrees in accordance with Figure 3.12.1.2; or B: external glazing complies with 3.12.2.1 with applicable value for C_{SHGC} reduced by 15%;	
6	(a) i the *external wall* incorporates insulation with an R-Value of not less than 2; and ii shade the *external wall* of the storey with a verandah, balcony, eaves, carport of the like, which projects at a minimum angle of 15 degrees in accordance with Figure 3.12.1.2; and iii external glazing complies with 3.12.2.1 with applicable value for C_{SHGC} reduced by 15%;	

	(b) i the *external wall* incorporates insulation with an R-Value of not less than 2.5; and ii A: shade the *external wall* of the storey with a verandah, balcony, eaves, carport of the like, which projects at a minimum angle of 15 degrees in accordance with Figure 3.12.1.2; or B: external glazing complies with 3.12.2.1 with applicable value for C_{SHGC} reduced by 15%;	
7 & 8	(a) i the *external wall* incorporates insulation with an R-Value of not less than 2.5; and ii external glazing complies with 3.12.2.1 with applicable value for C_{SHGC} reduced by 15%;	Shading is not necessary because it reduces solar radiation entry necessary to assist heating loads

Table 3.12.1.3c

Wall with a surface density greater than 220 kg/m^2		
Climate		Rationale
1 & 2	(a) i For a storey other than one with another storey above, shade the wall with a verandah, balcony, eaves, carport or the like which projects at a minimum angle of 15 degrees in accordance with Figure 3.12.1.2; and ii When the *external* walls are not shaded in accordance with (i) and there is another storey above, external *glazing* complies with 3.12.2.1 with applicable value for C_{SHGC} reduced by 20%; and iii the *external wall* incorporates insulation with an R-Value of not less than 0.5; and iv the lowest storey containing *habitable rooms* has- (A) a concrete slab-on-ground floor, or (B) masonry internal walls	
3 & 4	(a) i For a storey other than one with another storey above, shade the wall with a verandah, balcony, eaves, carport or the like which projects at a minimum angle of 15 degrees in accordance with Figure 3.12.1.2; and ii When the *external* walls are not shaded in accordance with (i) and there is another storey above, external *glazing* complies with 3.12.2.1 with applicable value for C_{SHGC} reduced by 15%; and iii the *external wall* incorporates insulation with an R-Value of not less than 1; and iiii the lowest storey containing *habitable rooms* has- (A) a concrete slab-on-ground floor, or (B) masonry internal walls	Zones 3 & 4 are characterised by large diurnal swings were internal masonry walls are most effective
5	(a) i For a storey other than one with another storey above, shade the wall with a verandah, balcony, eaves, carport or the like which projects at a minimum angle of 15 degrees in accordance with Figure 3.12.1.2; and ii When the *external* walls are not shaded in accordance with (i) and there is another storey above, external *glazing* complies with 3.12.2.1 with applicable value for (A) C_{SHGC} in Table 3.12.2.1 reduced by 15%; and (B) C_u in Table 3.12.2.1 reduced by 15%; and iii the *external wall*- (A) has a solar absorptance of its external surface of not more than 0.45 (B) incorporates insulation with an R-Value of not less than 0.5; and iv the lowest storey containing *habitable rooms* has- (A) a concrete slab-on-ground floor, or (B) masonry internal walls	
6,7 & 8	As written	

THINK BRICK AUSTRALIA

Wasting energy

How current energy efficiency regulations and the Carbon Pollution Reduction Scheme will increase household energy consumption.

New Australian research identifies the solution.

January 2009

This report explores
the unintended consequences resulting from the interaction of the Carbon Pollution Reduction Scheme and the Building Code of Australia

…and concludes
that without changes to the BCA the CPRS will make inefficient houses cheaper and more appealing to the market

The case for better energy efficiency metrics

Executive Summary

Australia is at a crossroads. Having made a commitment to embark upon the climate change challenge, Australia must now devise a strategy with market instruments and government intervention to reduce emissions whilst promoting economic growth.

The Federal Government's *Carbon Pollution Reduction Scheme* (CPRS) is the centrepiece of Australia's climate change strategy. Energy efficiency is critical to ensuring the CPRS does not dramatically increase the cost of living for Australian households.

Despite discriminatory provisions in the Building Code of Australia, one of the easiest ways to create more energy efficient buildings is using building materials that have *thermal mass*. As demonstrated in this report, materials such as clay bricks and concrete can reduce Australia's heating and cooling energy consumption up to 22%.

Thermal mass improves energy efficiency by up to 22%

This report explores the relationship between the Carbon Pollution Reduction Scheme (CPRS) and regulated energy efficiency requirements in the Building Code of Australia (BCA) for the residential sector. It outlines how these two pieces of legislation will interact to inadvertently increase household energy consumption despite the best intentions of regulators.

Increased household energy consumption is expected because the CPRS only taxes production emissions and makes no allowance for life cycle emission savings. The CPRS will distort the building materials market in favour of lightweight materials because they require less energy to meet current BCA regulations. Under Australia's climate change strategy this is an unintended consequence because houses made with lightweight materials are less energy efficient over the life cycle of the building.

The CPRS distortion is expected to increase heating and cooling energy consumption because the BCA determines energy efficiency by the *total minimum thermal resistance* (commonly known as R-value) of a wall. This sole metric is problematic because it measures the benefits provided by insulation (which is critical), but not thermal mass (the other critical component).

Understandably, and with issues such as housing affordability and financial downturns exerting influence, the market will seek out lowest cost materials irrespective of their capacity to improve thermal performance. Depending on the strength of these market forces, the CPRS and BCA could increase residential heating and cooling energy consumption by up to 32% above Federal Treasury estimates by 2050.

These conclusions are drawn from three separate pieces of research:

- Phase 1 of an Australian Research Council funded, eight-year empirical research program in the Priority Research Centre for Energy at the University of Newcastle;
- thermal modelling of 120 different houses in three BCA climatic zones;
- dynamic modelling of the interaction between the CPRS and BCA.

The conclusions reinforce the Phase I recommendation by the University of Newcastle that thermal mass is critical to improving energy efficiency, and that alternative science-based energy efficiency metrics are needed to accurately reflect building performance. Such a metric (or metrics) could off-set the distortion caused by the CPRS and if used in conjunction with life cycle analysis across the building products market, could prevent the energy consumption increase projected in this report. This report recommends that the Federal Government:

- Replace R-value from Deemed-to-Satisfy (DTS) provisions in the Building Code of Australia;
- Complement the CPRS with life cycle analysis across the building products market;
- Fund the Priority Research Centre for Energy at the University of Newcastle to expand Phase II of the research program to develop new, more accurate thermal performance metrics.

Introduction

The importance of greater energy efficiency in Australian homes is well accepted and supported.

Currently there are at least three major policy debates that have an interest in not just the energy efficiency of Australian homes, but the entire Australian economy. These debates cover housing affordability, climate change and future energy demand and generation.

Australia's energy generation is expected to more than double by 2050[1] to meet growing residential, commercial and industrial consumption, and by 2020 alone, the Federal Government has estimated there will be a 56% increase in residential sector energy consumption over 1990 levels.[2]

It is no surprise then that the Federal Government includes energy efficiency as a key priority in its climate change strategy. The long-term cost to the Government – either directly through energy generation investment, or indirectly through market intervention to support struggling families – is obvious.

This report explores the relationship between the Carbon Pollution Reduction Scheme (CPRS) and regulated energy efficiency requirements in the Building Code of Australia (BCA) for the residential sector. It outlines how these two pieces of legislation will interact to inadvertently increase energy consumption despite the best intentions of regulators.

The report is divided into four sections:

1. The limitations of R-value for determining thermal performance
2. How current energy efficiency regulations actually limit improved energy efficiency
3. How the CPRS will exacerbate the limitations of current energy efficiency regulations
4. The energy efficiency solution.

The report is based on the interim results of an empirical eight-year research program undertaken by the University of Newcastle investigating the actual – rather than simulated – thermal performance of typical housing construction types under Australian climatic conditions.[3] The primary findings of the research are:

- Thermal mass is critical in improving the energy efficiency of a building; and
- There are limitations with the current energy efficiency regulations that rely only on *total minimum thermal resistance* (R-value) to measure the energy efficiency of a building envelope.

A recommendation from the research is that R-value be replaced in legislation by an alternative energy efficiency metric that combines the benefits of both thermal mass and thermal resistance.[4]

This report expands the research by the University of Newcastle in two ways:

- Modelling the thermal performance of two house plans in three different BCA climate zones (2, 5 and 6 which covers over 80% of the Australian population), using five different construction types across four different orientations; and
- Dynamic modelling of market forces based on the interaction of current energy efficiency regulations and the CPRS to determine future energy consumption.

Furthermore, this report explores the impact of the CPRS on the building products market which is characterised by horizontal – rather than vertical – competition between many products including (but not limited to) brick, concrete, timber, glass and fibre cement. The CPRS will have a different, disproportionate and inequitable impact on these products and in many instances will not be reflective of the products' contribution to improving energy efficiency or reducing long-term emissions.

Ultimately, this report argues that better energy efficiency metrics provide clear market guidance for the property sector and its stakeholders to tackle the problems of long-term housing affordability, future energy generation and climate change.

1. http://www.treasury.gov.au/lowpollutionfuture/report/html/03_Chapter3.asp
2. Department of the Environment, Water, Heritage and the Arts Energy Use in the Australian Residential Sector 1986 – 2020 2008
3. Sugo, H.O Thermal Performance Studies at the University of Newcastle 2007
4. Sugo, H.O, Page, A.W, Moghtaderi, B. Thermal Performance of Buildings – Is R-value the Correct Measure 2008

The limitations of R-value for determining thermal performance

The Thermal Performance Research was initiated by the brick industry in conjunction with the Australian Research Council at the Priority Research Centre for Energy within the University of Newcastle during 2001.

The aim of the research was to undertake a comprehensive study of the thermal performance of typical housing under Australian climatic conditions. The research includes the construction and monitoring of four full scale housing test modules, each with 105 sensors.

> The worst performing building consumed 173% more energy than the best performing building despite having a 16% higher R-value

After six years of data collection, the University of Newcastle has identified that there are significant limitations with the R-value metric to determine building thermal performance.

Typical Australian walling constructions were evaluated for their capacity to maintain a thermal comfort range of 18-24°C in (a) free-floating, and (b) controlled state (artificially heated and cooled) environments.

Under free-floating conditions (Table 1), the best performing building performed 14.4% better than the highest R-value building despite 18% less R-value.

When measured in a controlled state environment (Table 2), R-value was even less effective in determining the thermal performance of a building. The worst performing building consumed 173% more energy than the best performing building despite having a 16% higher R-value.

Furthermore, two buildings with almost identical R-values had nearly a 50% difference in energy consumption when artificial heating and cooling was used.

Effectiveness of R-value under free-floating conditions*

R-value (m^2k/w)	% of time in thermal comfort range
0.60	51.6
1.45	61.8
1.67	55.1
1.74	54.0

Table 1: Effectiveness of R-value under free-floating conditions

Effectiveness of R-value under controlled state conditions*

R-value (m^2k/w)	Approximate annual energy consumption (MJ)	Energy consumption compared to best performing building[5]	Energy consumption compared to highest R-value building
0.60	11,414	+108.1%	+15.5%
1.45	5,485	N/A	-44.5%
1.67	14,981	+173.1%	+51.6%
1.74	9,882	+80.2%	N/A

Table 2: Effectiveness of R-value under controlled state conditions

* Analysis conducted in zone 5

5. Note that best performing building does not have the highest R-value

How current energy efficiency regulations actually limit improved energy efficiency

Energy efficiency for buildings is regulated in Australia by State Governments through the Building Code of Australia.

There are two general methods to comply with the energy efficiency regulations in the BCA: (1) *Deemed-to-Satisfy* (DTS), and (2) *Alternative Solutions*. The DTS method is prescriptive and based on *Total Minimum R-values* for walling systems; the Alternative Solutions method is performance based and compliance is generally demonstrated using second generation thermal modelling software which requires specific skills and knowledge[6] (eg AccuRate, BERS or Energy Plus).

Table 3 is an excerpt from the DTS provisions for external walls in Section Three of the BCA[7]. While there are a number of different ways to meet the minimum requirement, within the market the additional costs (real or perceived) of using methods (b), (c) or (d) (zone 5) or methods (b) or (c) (zone 6) (refer Table 3), is creating a convergence of thinking toward achieving compliance through method (a): "Achieve a minimum Total R-value".

As outlined in the excerpt below, this convergence is reinforced by the BCA because it outlines DTS provisions and places the onus on the builder to demonstrate compliance if these are not used. It is currently estimated that less than 20% of houses pass their BCA requirements using the *Alternative Solutions* method[8]; arguably in the competitive marketplace, the DTS provisions are seen as an easier and cheaper solution.

"There is no obligation to adopt any particular option contained in Section 3 of the Housing Provisions, if it is preferred to meet the Performance Requirement in some other way. However if one of the options described in Section 3 is not complied with, then the appropriate authority must be satisfied that the Performance Requirements have been met."[9]

Zone	(a)		**Achieve a minimum Total R-value of 1.9**
5	(b)	(i)	Achieve a surface density of not less than 220 kg/m2; and
		(ii)	Incorporate insulation with an R-value of not less than 0.5.
	(c)	(i)	Achieve a surface density of not less than 220 kg/m2; and
		(ii)	Be constructed on a flooring system that is in direct contact with the ground, such as a concrete slab-on-ground or the like.
	(d)	(i)	Achieve a surface density of not less than 220 kg/m2; and
		(ii)	Have masonry internal walls.
6	(a)	**Achieve a minimum Total R-value of 2.2**	
	(b)	(i)	Achieve a surface density of not less than 220 kg/m2; and
		(ii)	Incorporate insulation with an R-value of not less than 0.5; and
		(iii)	Be constructed on a flooring system that is in direct contact with the ground, such as a concrete slab-on-ground or the like.
	(c)	(i)	Achieve a surface density of not less than 220 kg/m2; and
		(ii)	Incorporate insulation with an R-value of not less than 1.0.

Table 3: BCA Minimum Energy Efficiency Requirements

6. From 1 May 2009 only 2nd generation software will be accepted under the BCA
7. Building Code of Australia ***Volume 2, Section** 3.12, **Table** 3.12.1.3*, pp 512-514
8. UDIA WA Presentation by SEDO, October 24 2008
9. Building Code of Australia ***Volume 2, Section** 3.12, **Table** 3.12.1.3*, pp 512-514

Since the introduction of mandatory minimum energy performance requirements in the BCA on 1 January 2003 there has been a small, but noticeable change in the building materials market. According to a recent ABS survey[10], from 1999 until 2005 there was an 11% increase in the number of brick veneer homes constructed and a decrease in lightweight materials such as timber (12%) and fibre cement (23%).[11]

In contrast, since 2005 there has been an increase in lightweight materials (fibre cement 19% and timber 1%) and a decrease in heavyweight materials (brick veneer 1% and double brick 6%) which are more expensive to construct but have similar R-values.

In all cases the most energy efficient building contained thermal mass

In spite of these trends, the same ABS report stated that, "High thermal mass materials such as brick and stone are more energy efficient as they take longer to respond to temperature changes, compared to fibro *(sic)* cement and timber." This statement is supported by the comprehensive thermal modelling analysis undertaken for this report to test the outcomes by the University of Newcastle.[12]

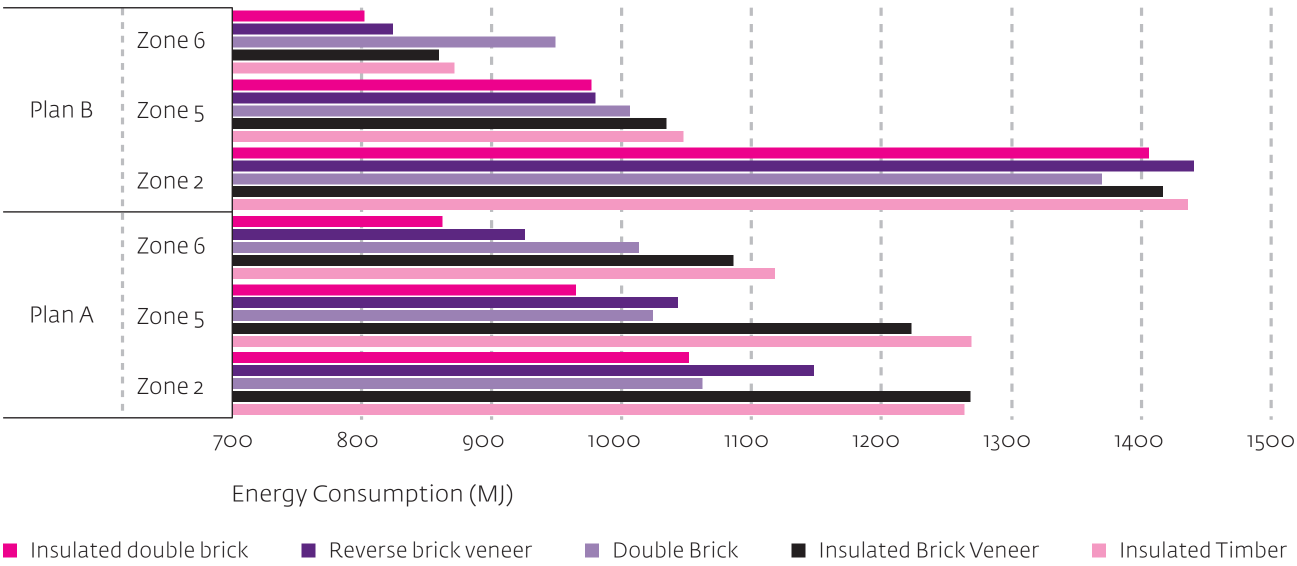
Using DTS provisions on two floor plans (Plan A and Plan B), the thermal modelling analysis compares 120 different building constructions to determine if *total minimum R-value* without thermal mass could improve energy efficiency. To ensure the widest sample possible, the modelling considers:

- three different BCA climatic zones (2, 5 & 6),
- four different orientations (north, south, east, west), and
- five different housing constructions
  - insulated brick veneer
  - insulated timber
  - double brick
  - insulated double brick
  - reverse brick veneer.

The construction types chosen above represent over 80% of the current housing stock (detached or semi-detached); brick veneer (44.5%), double brick (24.3%) and timber (13.1%).[13] Insulated double brick and reverse brick veneer were included in the modelling because they both represent emerging trends.

Graph 1 compares the lowest energy consumption for each construction type and orientation. It shows that in all cases the most energy efficient building contained thermal mass and furthermore, insulated double brick outperforms all other types of construction except for Plan B in zone 2 where uninsulated double brick performs 2.7% better than insulated double brick.

APPROXIMATE ANNUAL HEATING AND COOLING ENERGY CONSUMPTION



Graph 1: Annual energy consumption per construction type & zone

10. ABS *Environmental Issues: Energy Use and Conservation* 4602.0.55.001 March 2008
11. During this period there was also a 5% decline in double brick homes which can arguably be attributed to builder preference toward timber-framed homes. It is assumed part of the 11% increase in brick veneer homes was the shift from double brick to brick veneer.
12. Thermal modelling was conducted by *Energetics* who is Australia's leading energy and greenhouse consultancy, and is on the verification and life cycle assessment panel of the Federal Government's *Greenhouse Friendly Program*
13. ABS *Environmental Issues: Energy Use and Conservation* 4602.0.55.001 March 2008

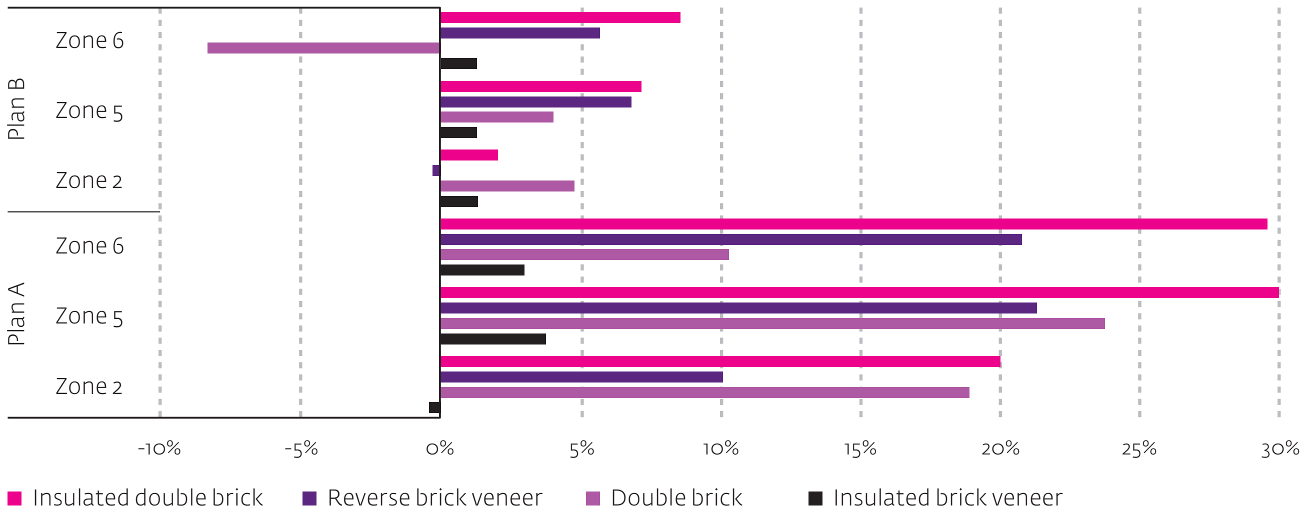
Graph 2 is a comparison between insulated timber and construction types that include thermal mass. In 21 of the 24 cases thermal mass improves the energy efficiency of a home, and in every case except Plan B in zone 2 (where double brick performs the best), insulated double brick improves energy efficiency by at least 7.1%. The large exception (double brick on Plan B in zone 6) is caused by the cooler winter months where the addition of insulation (eg insulated double brick) will prevent excess heat loss and improve energy efficiency by nearly 17%.

These are best-case scenario figures where thermal mass improves performance by 9.5%. Using worse-case scenario figures thermal mass improves energy efficiency in 23 of the 24 examples used in Graphs 1 and 2, and on average by 22%. Furthermore, insulated double brick can improve energy efficiency by nearly 48% in zone 6 compared to lightweight materials.

Across the averages of best and worst case scenarios thermal mass improves energy efficiency by more than 13%.

To put these results into perspective, an average improvement of 13% for heating and cooling equates to approximately 151kg of carbon dioxide equivalents per Australian household. Across Australia in 2008 this is equal to more than 900,000 additional tonnes of greenhouse gases (Table 4). Using the 22% worse-case scenario figures, this is equal to an additional 1.6 million tonnes of greenhouse gases.[14]

ENERGY EFFICIENCY IMPROVEMENTS PROVIDED BY THERMAL MASS



Graph 2: Comparison to no thermal mass

	Emissions Intensity factor	Approx. tonnes of Co2 per household from 22% reduction	Number of Households	Approx. tonnes of Co2 saved per state
VIC	1.22	0.18422	1,601,811	295,086
NSW	0.89	0.13439	2,071,900	278,443
QLD	0.91	0.13741	1,267,862	174,217
TAS	0.12	0.01812	170,897	3,097
WA	0.87	0.13137	678,380	89,119
NT	0.69	0.10419	49,571	5,165
SA	0.84	0.12684	546,895	69,368
Australia Total			6,387,316	914,494

Table 4: Impact of Energy Efficiency Savings

14. These calculations assume that 100% of electricity is used for heating and cooling.

How the CPRS will exacerbate the limitations of current energy efficiency regulations

The CPRS will have a different, disproportionate and inequitable impact on individual products and companies within the building products market.

These impacts will not reflect the products' ability to improve energy efficiency or reduce long-term emissions, but rather be based on the energy used to make each product.

While this approach in general can reduce energy use across the economy, the way the BCA is written necessitates alternative and/or complementary policies for the building products market to ensure the CPRS doesn't inadvertently increase energy consumption by exacerbating the principal – agent barrier.

Already, one of the most striking consequences of the current energy efficiency legislation is the number of new building products in the market that are promoted specifically as having a high R-value. Given the reduced efficiency of homes built without incorporating thermal mass, these new products are examples of innovation driven not by improving energy efficiency, but rather meeting and exceeding legislative requirements at the lowest possible cost.

Graph 3 depicts the principal – agent barrier as it exists today. It compares average external walling costs in 2008 across Australia[15] with average energy consumption across climate zones 2, 5 and 6. At either end of the spectrum there is a considerable difference in price to build compared to price to operate with insulated timber approximately 39% cheaper and up to 22% less efficient than insulated double brick.

Market behaviour dictates that in most examples, builders and developers choose the building products that enable them to sell their product for the greatest profit. Without changes to the BCA the CPRS will make inefficient houses cheaper and more appealing to the market because carbon costs for lightweight materials will be less than heavyweight alternatives.

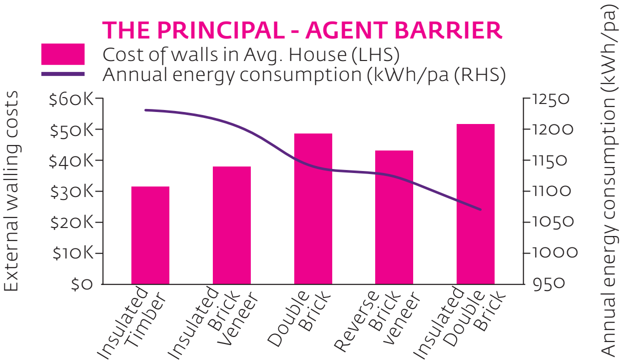
In addition to this, Emissions Intensive Trade Exposed (EITE) payments are also likely to further distort the building products market where manufacturing facilities cater for both domestic and export markets. In these cases, because the trade exposed component of the business cannot be quarantined, it is likely to manifest itself as investment in technologies which the EITE payments help off-set.

Graph 4 demonstrates the increased energy consumption that results from the interaction of the CPRS and BCA. This occurs because the market will change the mix of housing over the next 40 years in favour of cheaper lightweight building materials.

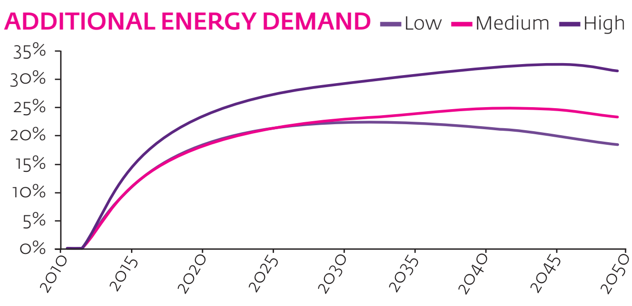
Graph 4 illustrates a sharp rise during the first 5-10 years of the CPRS, after which energy increases flatten out. This is based on the assumption that through Government assistance and technology development both in Australia and internationally, heavy walling industries will reduce their carbon exposure and reduce the price difference between building materials. If this does not occur, the additional energy demand will be higher.

Other differences between the high, medium and low scenarios illustrated in Graph 4 are: the degree of shift toward lightweight housing (based on the up-front impact of the CPRS); how long it takes the brick industry to develop and implement new technologies that reduce kiln emissions; and the introduction and full implementation of 100% clean energy in both new and existing houses.

It should be noted that although 100% clean energy for new and existing homes will address climate change issues, this modelling assumes solar passive principals will also improve energy efficiency as a standard design feature for most houses within 25-35 years. If this does not occur – and the current energy efficiency metrics do not promote solar passive design – while additional carbon dioxide will no longer be a problem, long-term affordability and energy generation issues will still impact the economy.



Graph 3: The principal – agent problem



Graph 4: Additional Energy demand caused by CPRS and BCA interacting

15. Compiled from Rawlinsons Construction Cost Guide 2008

The energy efficiency solution

Although the energy efficiency benefits of thermal mass are widely acknowledged, legislation has been forced to focus exclusively on R-value because no equivalent, simple metric exists to recognise thermal mass.

Instead of attempting to correct the unintended consequences resulting from the interaction of the CPRS and BCA by using additional compensation or incentives for builders to use thermal mass, the Government should focus on developing alternative energy efficiency metrics to simplify and provide assurance that the emission reduction targets are achieved.

A metric that combines the benefits of thermal mass and thermal resistance in one simple measure (based on climate zone) will minimise long term energy consumption in Australian homes and provide clear market guidance for the development of more energy efficient new homes (and renovations).

Although alternative metrics have been suggested before, the difficulty has been in developing a metric that reflects how thermal mass works (especially when used in conjunction with insulation). To date, mathematical equations and models have struggled to simulate the real world performance of thermal mass, however, because of its nature and extent, the research by the University of Newcastle can potentially overcome this problem.

Since 2003 the University has been measuring the interaction of thermal mass with the Australian climate and has developed one of the most extensive databases in the world that is now capable of overcoming the limitations of previous mathematical models based purely on theory.

At the current stage of the Thermal Performance Research the University of Newcastle is confident that with one-off additional support, the database can be used as a key component in developing appropriate and fully representative alternative energy efficiency metrics.

Recommendations for a more energy efficient future

To improve the long-term energy efficiency of Australian houses, promote innovation in the building products market, and reduce the time to develop effective new energy efficiency metrics, it is recommended that the Federal Government:

- Replace R-value from Deemed-to-Satisfy (DTS) provisions in the Building Code of Australia;
- Complement the CPRS with life cycle analysis across the building products market;
- Fund the Priority Research Centre for Energy at the University of Newcastle to expand Phase II of the research program to develop new, more accurate thermal performance metrics.

These actions cut to the core of the energy efficiency problem and provide clear market guidance for not only building product manufacturers, but also builders, developers and the entire property sector.

Facts and Figures

- Australia's energy consumption is expected to more than double by 2050 to meet growing residential, commercial and industrial consumption
- An unintended consequence of the CPRS could be 32% higher energy consumption above Government forecasts. This is possible for two reasons: the BCA energy efficiency regulations favour lightweight building materials, and the CPRS currently makes no allowance for the life cycle emission savings provided by building materials with thermal mass
- Updating energy efficiency indicators could remove up to 1.6 million tonnes of greenhouse gas from the atmosphere
- Thermal mass can reduce household heating and cooling energy consumption by up to 22%
- The Thermal Performance Research is a partnership between the University of Newcastle and the Australian clay brick industry (jointly funded by the Australian Research Council) to learn how building materials can reduce energy consumption
- The Thermal Performance Research is conducted independently by the University of Newcastle and includes actual buildings, each with 105 sensors taking measurements every five minutes
- The major recommendation from the University of Newcastle is the need to update energy efficiency indicators to include thermal mass (eg clay bricks).

Introducing Think Brick Australia

In Australia the brick industry is worth $2.6bn to the economy and employs 30,000 people nationwide in the manufacturing and installation of its product.

The peak body representing Australia's leading clay brick and paver manufacturers is Think Brick Australia. Think Brick Australia has been conducting research that contributes to innovation and improvement in building standards and technical training for the construction industry for over fifty years and continues this proud tradition today.

In partnership with the world-ranked University of Newcastle and the Australian Research Council, Think Brick Australia is currently undertaking Australia's most extensive research into the thermal performance of Australian housing. The findings of this research will assist Government and the building and construction industry create more energy efficient buildings.

University of Newcastle Priority Research Centre for Energy

The University of Newcastle consistently ranks in the top 10 research higher education institutions in Australia. World-class facilities and talent, teamed with forward-thinking local and global corporate partners are a key part of the University's research success.

The University's Priority Research Centres focus resources into our research strengths across a range of areas, including energy. The Priority Research Centre for Energy (PRCfE) focuses on one of the most challenging contemporary issues: the management of Greenhouse Gas Emissions (GHG).

Through its research themes, the PRCfE members are undertaking cutting edge research and development across a range of fields including: Renewable Energy Systems, Energy Efficiency (particularly in buildings and process industries), Energy Conversion & Transportation Fuels, as well as Low Emission Coal Technologies.

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