CSR Limited PO Box 80 YARRAVILLE Victoria 3013 ABN 90 000 001 276 14 August 2009

Martin W Jones General Manager Government Relations 0419 475 962 mwjones@csr.com.au

The Research Director Environment and Resources Committee Parliament House George Street BRISBANE QLD 4000

Dear Sir/Madam,

Environment and Resources Committee Queensland Parliament Inquiry into Energy Efficiency Improvements

Thank you for the opportunity to provide our comments in relation to this important inquiry. CSR's Building Products Division has a strong interest in sustainability in the built environment.

Our submission focuses on the policy role for both new buildings and building retrofits, with an emphasis on the role that insulation and glazing and windows can play in securing more energy efficient buildings.

Yours sincerely,

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Martin Jones



Queensland Parliament Environment and Resources Committee.

Comments from CSR Limited

A. Introduction

CSR Limited has been operating in Australia for 154 years. The company is a leading diversified manufacturing company with operations throughout Australia, New Zealand, China and South East Asia. In 2009 revenues were \$3.5b with capital expenditure of \$415m and employs over 6000 people. The company essentially operates within four divisions. These comprise aluminium smelting, through our shareholding in the Tomago aluminium smelter, Sugar, Building Products and Property Development. The company is currently planning to demerge its sugar business in 2010.

CSR Building Products has invested \$50m in a green fields Bradford Gold[™] Insulation facility in Brendale, which was opened recently and is the first such facility in Queensland. The Government provided some financial assistance to the company to help attract the factory to the state. Glass wool insulation can be used to obtain very high levels of thermal insulation without loss of performance during the life of a dwelling. The Brendale plant uses recycled glass which has previously been sent to land fill in Queensland.

The Building Products division of the company was expanded in 2007 by the acquisition of Pilkington Australasia and DMS Glass, now re-branded as Viridian[™]. In Melbourne in 2009, Viridian[™] commissioned one of only seven glass coaters in the world in to produce low emissivity glass, a product of major benefit for energy efficiency in Queensland's hot climate zones.

CSR also owns Edmonds ventilation and combined with our insulation and coated glass businesses are able to offer climate control solutions to our customers, reducing energy consumed in the built environment. Edmonds ventilation provides ventilation systems which include devices to remove heat from roof spaces.

The Bricks and Roofing division operates a modern efficient brick manufacturing plant at Oxley under the PGH[™] brand and Monier[™] roof tile plants at Darra.

We welcome this review from the Parliamentary Committee to highlight the gains that can be readily made in Queensland to improve energy efficiency in the built environment.

B. Policy Opportunities

The Federal Government is introducing two important polices to set Australia on a low emissions pathway – the CPRS and the Renewable Energy Target amendments.



Further policy initiatives are necessary to ensure adequate measures are available to keep the Australian economy on track to achieve low emissions. These are in the areas of newly built or renovated buildings and retrofitting existing buildings.

a) New and Renovated Buildings

The Australian Building Codes are designed to promote consistency in building regulations throughout Australian States and Territories and to provide a consistent basis for enforcement. The jurisdictions all participate in the development and adoption of changes to the code and independently adopt the code through regulatory changes within each jurisdiction. As trade qualifications increasingly become recognised across jurisdictions, so too should there be a consistent adoption of building codes throughout Australia.

With the release of the AccuRate 2nd generation energy rating system in 2006, a 10 star scale rating was introduced. A 10 star house is a house which needs 'virtually' no heating or cooling. The energy efficiency of a building is the measure of heat loss or gain across the building fabric. Actual energy loss (measured as MJ of energy year/m² of floor area) depends on design, materials of construction and fixtures used. Climate zones were also introduced to recognise the vast range of conditions across the continent. This enables more tailored solutions to thermal losses and gains in buildings.







Queensland is regarded as being in the hot zone for the purposes of window treatment for instance.

It should be noted that the 10 star scale relates only to the efficiency of the building fabric. While other factors such as the efficiency of heating, cooling and hot water appliances and the design of lighting represent effective options for future regulations, it will continue to be important to improve fabric because of the long life of houses compared to appliances and ease of improvements while in the construction stage.

In 2007 most jurisdictions adopted an upgrade to the building codes for new housing to attain a moderate 5 star thermal rating. This recognised the climate zones and introduced a performance based system of thermal ratings designed to improve energy efficiency in the built environment.

In Australia, houses typically have a 70 year life. Housing starts at present are very low at an annualised rate of around 120,000 pa. For the year ended March 2009, residential housing commencements in Australia declined 22% from the previous year. An average rate of commencements would be 150,000 pa or higher. Thus every house that gets built today that does not meet 5 star will build into it a poor energy efficiency rating, leaking energy for years to come. Retrofitting to upgrade energy efficiency is far more costly and difficult to achieve than including it in a new premises. Owners benefit from lower energy costs and in some cases lenders are prepared to be more generous with the mortgage conditions for energy efficient housing. The higher cost and market failures associated with retrofits can be avoided.



Queensland nominally adopted the 5 star rating in March 2009 and committed to moving to 6 star in 2010. This is commendable and welcomed. However it should be noted that in doing so Queensland diluted the impact. Queensland, while claiming to adopt 5 star, effectively has only achieved an estimated standard of 4.0 star by allowing a waiver for "outdoor living areas". Much of Queensland has a similar climate to Austin, Texas where the equivalent rating is 6 stars, although there are moves to increase the ratings in the US by 30%. In other words if you built a deck, which is very popular and common in Queensland, compliance with the higher thermal performance standard is waived. CSR does not believe there is a scientific basis for these exceptions.

Australian Climate Zones		Current Star Rating requirements	USA, UK and Canada Equivalent Climate Zones	Requirements Star rating using AccuRate				
Zone 1	Darwin	3.5	Florida	7				
Zone 2	Brisbane	5*	Texas	6				
Zone 3	Longreach	3.5	Nth. Carolina	5.4				
Zone 4	Dubbo	3.5 equiv	Arizona	7				
Zone 5	Perth	5	California (Bakersfield)	7.5				
Zone 6	Melbourne	5	California (San Francisco)	7.6				
Zone 7	Hobart	4.0**	UK & Canada	7.2				
Zone 8	Thredbo	3.5 equiv.	Pennsylvania	6.8				
All Zones Average		<5.0		6.8				

International Comparison using Australian energy efficient rating software (AccuRate)

Data Sourced from Insulation Council of Australia and New Zealand

* Queensland is thought to approximate 4 star in practice due to "outdoor living allowances".

**Tasmania is moving to 5 star in 2010

CoAG recently announced a commitment to adopt the 6 star rating nationally in 2010. The benefits in energy savings for 6 star over 5 star are considerable. As we will describe later, additional benefits come from upgraded window treatment as the star rating levels rise.



ENERGY SAVINGS FOR HIGH STAR RATING LEVELS COMPARED TO CURRENT 5 STAR MINIMUM

The table below shows the energy savings over 5 Stars that the 6 to 10 star rating levels produce in a number of Australian cities:

Location	Percentage savings compared to 5 stars						
	6 stars	7 stars	8 stars	9 stars	10 stars		
Brisbane	22	38	55	69	82*		
Sydney	22	40	56	70	88		
Canberra	24	44	64	84	99		
Melbourne	23	44	64	83	99		
Adelaide	23	44	63	82	98		
Perth	21	42	62	81	96		

Data Sourced from Insulation Council of Australia and New Zealand

(* Assumes some energy use for dehumidification still required)

CSR strongly encourages the Queensland Government to support the adoption of the Building Code of Australia changes to 6 star rating and to adopt this into State Regulations *without* any dilution in 2010 as committed by the Premier in March 2009.

Heat Transfer in Buildings

There are two mechanisms for heat transfer in a building

- Conduction this occurs through all building materials
- Radiation occurs only through materials transparent to radiated energy e.g. glass and other "transparent" substances.

Conduction can be reduced through choice of building materials, including the use of insulation. Radiation occurs largely through glass. Windows also conduct heat. It is now possible to provide glass and window solutions which also insulate. So insulation can come in the form of glass wool batts in ceilings, walls and floors and now with new technology certain forms of glass.

The effective star rating in Queensland however means that the insulation requirement in Texas of R5.3 batts, is only R2.5 here. (Metal/ventilated roof). (The R value means the thermal resistance (m^2k/w) of a material calculated by dividing the thickness by its thermal conductivity, in this case for insulation). Furthermore Texas has mandated double glazing as a means of reducing the requirement for



new power stations. Windows in Queensland are effectively only R 0.1, providing plenty of opportunity for heat gain or losses depending on the season.

There are some potentially significant opportunities to improve the energy efficiency of residential homes across Queensland.



The theoretical maximum heat load from the sun is around 750W/m2. Windows don't see all of this due to the angle of incidence and shading from eaves etc. In tropical climates, radiant solar heat gain equals or surpasses conductive heat gain. *Direct sunlight on a square metre of ordinary glass during summer has the equivalent heat output of a single bar radiator.* It is like a car parked in the sun.

Importantly for Queensland the uptake of air conditioners is the highest in Australia with over 60% of houses owning at least one air conditioner and yet only 42% of houses have roof insulation, the lowest in Australia. Increasingly Queensland has a problem with summer peak loading, exacerbated by water shortages for power generators.



The incremental cost of each 3 kW of air conditioner is estimated by the Queensland Government at \$9,000 per unit in increased utility and transmission investment.



According to the Australian Bureau of Statistics, around 800,000 Queensland homes remain uninsulated. Whilst historically this has not been a major issue for energy efficiency, as energy use was low, with the increase in brick veneer and concrete block construction and the rapid growth in air conditioning in Queensland homes, the role of insulation is now far more important.

Lifestyles have changed from the traditional model of sitting out on the Queensland deck at night. Government should recognise that people living in regional centres are adopting the lifestyles of their city cousins. Modern houses are installed with home theatre systems and multiple air conditioning systems, with up to five split units in many new houses in north Queensland being common. Entertainment is more likely to be computer games and large screen TV's with cable or satellite access. The elderly, retiring to Queensland for the winter sunshine are more likely to be extensive users of electricity for air conditioners in summer as they have less tolerance for heat and spend more time at home. Every house that is built to the lower modified less than 5 star rating today will penalise these people as power charges rise and will force extensive retrofitting of energy efficiency measures, requiring Government subsidy as proposed under the Federal Government's Carbon Reduction Pollution Scheme.



The Nation Building Package will go a long way towards redressing the existing housing stock, but Queensland will continue to under-insulate new housing until it adopts 6 star without dilution.

The impact of climate zones on the use of energy is clearly reflected in this graph which reinforces Queensland's issue with air conditioners.



Growth in house size

House size has been steadily increasing in all states for a number of decades:



As house size increases so too will the area of houses heated and cooled.

Consequently, even without an increase to the hours of heating and cooling or comfort requirements, energy use for heating and cooling will naturally increase.



Source: Tony Isaacs Consulting

Central heating and air conditioning makes a home more comfortable but of course uses energy, costs money and creates greenhouse gases. In Queensland in particular, this energy is in the form of black coal derived electricity. The objective for the type of houses being built in the state today is to keep the dwelling at the right temperature through good design and choice of materials for the walls, ceilings, flooring, roofing and windows. Glass is the only building material that not only insulates from temperature extremes, it can also control the passage of light and radiant heat into homes.

From an energy perspective, Australia's windows are the worst in the developed world. In general the longstanding old standard Australian 3mm windows typically represent 8% of the total house envelope, but account for 87% of the heat gain and 49% of the heat loss in an otherwise well insulated house. According to a study undertaken in Victoria by the Glass and Glazing Association of Australia in 2006, homes with standard glazing in windows require 60% more energy to heat and cool than do homes with energy efficient windows and glass.

CSR's Viridian[™] float glass factory in Melbourne has installed one of only seven glass coaters in the world to produce energy efficient glass. In addition the company is investing heavily in capacity to produce double glazing for those climate zones where this is required. Studies by the Queensland University of Technology conducted by Prof John Bell on behalf of the Australian Glass and



Glazing Association found that efficient windows and glazing treatments could raise the star rating by 1.5 to 2 for a 5 star house. The impact is less for a house of 3.5 stars – another reason for Queensland to quickly adopt a 5 star or greater rating without dilution.

The Queensland analysis also showed that best single glazed options can result in savings of 21-32% in energy consumption and costs, with the best double glazed solutions saving in the range of 31-44%. The potential reduction in greenhouse emissions in Queensland alone from advanced glazing are of the order of 1 mt per annum.

In a report prepared by Horne et al, 2005, on behalf of the Australian Greenhouse Office it was demonstrated that well insulated homes whether in Australia, North America or the UK cannot generally attain more than 6.5 stars unless they have high performance windows. Performance windows are the standard in California – the cost of single glazing is higher than double glazing as single glazing is regarded as a "special". The reverse is somewhat true here. Poorly designed windows can act as an 'energy leak' in an otherwise well insulated home. A typically well insulated building with ordinary clear single glazing allows up to 87% of solar heat gain during summer. But it doesn't have to be this way – the use of windows with performance glass can vastly improve these figures by:

- Maximising the use of natural solar energy which enters a home as light and heat when it is desirable, but limiting it at times and in areas when it is not.
- Reducing dependency on artificial lighting by allowing more natural light into homes where and when it is required.
- Maintaining cooler temperatures for longer by reducing unwanted heat into the home.

Solar heat gain is the amount of the sun's radiant energy that hits a window, heating the interior surfaces of a dwelling and the window itself to ultimately increase the temperature inside a house. Because the sun's position in the sky changes throughout the day, and from season to season, window orientation has a significant impact on solar heat gain. However, to reduce cooling costs in summer, the objective is to minimise the amount of solar heat gain. Modern performance glass has a huge role to play in this area.

Traditional window treatment in Queensland has been to install either clear windows with shading or tinted or toned glass, typically grey, which makes houses dark. People prefer large windows to bring the outside in and want natural light. In the past this has been in conflict with energy efficiency objectives.

Not all visible light entering a home is good light. With daylight can come glare – uncomfortably bright light entering a home – directly from the sun or scattered off reflective surfaces. These conditions often arise with east and west facing windows, but also in any orientation where outside reflective surfaces face



windows, such as light coloured roofs, concrete or water. There is also the light we can't see, such as infrared light that we feel as radiant heat, and ultraviolet (UV) light which is one of the main contributors to the fading and discolouration of fabrics and the premature aging of household furnishings. It's important to manage both these sources of energy entering buildings and that's where windows play a vital role. We might seek to control the amount of light entering through the windows using devices such as pergolas, curtains and even trees and shrubs. Unfortunately, these approaches all require some level of on-going maintenance and in the case of blinds and curtains people need to open and close them at appropriate times. And by their nature, all forms of physical barrier will tend to detract from the views and spaciousness that prompted the need for windows in the first place.

There are better solutions available today. Toned glass works in much the same way as sunglasses, by consistently reducing the total amount of UV, visible light and radiant heat, which can pass through it. However, it continues working at all times, not just when these factors present a problem. So the trade-off between desirable natural light and excessive UV, glare and radiant heat, should be balanced as a part of the overall design of the home. In a perfect world, we'd have glass in our windows that admits visible light, but rejects a significant amount of the heat and UV. And this glass would be available in optically clear versions for those windows where we want to maximise the natural light in our homes, but also in tones for those windows susceptible to glare. These materials are now available for houses in Queensland.

Managing solar gain is likely to be the most significant factor in determining how frequently occupants use air conditioning. Traditionally, simple toned glass has been used to control solar heat gain, especially in Queensland. But toned glass also reduces the amount of natural daylight entering a home. To tip the balance more in favour of natural light, Viridian offers a range of Solar Control toned glass, specially tuned to admit more visible light while reducing solar heat gain by absorbing a relatively high share of the sun's heat

Also, because toned glass absorbs much of the solar energy striking its surface, the glass itself can become hot. In the case of simple toned glass, around half of this heat will be re-radiated into the home.

This can be reduced by introducing low-emissivity (Low E) glass, providing even greater solar control performance. This special coated glass acts as a 'heat barrier', reducing the amount of absorbed heat in the solar control glass that is conducted into the home.



A further development incorporates solar control toned glass with Low E glass to provide up to 39% better solar control than ordinary glass. This is achieved through a lamination process. The Low-E glass has a microscopically thin yet durable coating which controls the flow of heat into windows and acts as a heat barrier. This reduces the amount of absorbed heat in the solar control glass that is permitted to enter the home.



Rules of thumb:

In "Hot" places control of Solar Heat Gain is king, and then the insulation factor

- Shading
- Window placement and size
- Glass used





The diagram summarises the discussion.

Under current design practice windows offer significant stand-alone energy efficiency improvement.

As the star ratings increase then so too does the performance requirements for windows. At much higher ratings it becomes necessary to introduce Integrated Glass Units (IGUs) or double glazing for houses.





There are higher performing products which are more suited to commercial premises where the trade-offs for Heating Ventilation and Air Conditioning (HVAC) capital costs can be reduced, along with reduced energy consumption.

In relation to the commercial sector CSR welcomes the Queensland Government's introduction of a 4 star rating for commercial buildings by 2010.

b) Energy Efficiency Retrofits

There are many barriers to retrofitting for energy efficiency. This is why CSR is a strong advocate of building in energy efficiency to new buildings now. To deal with those barriers, CSR recommends that Queensland consider a White Certificate Scheme, similar to the Victorian Energy Saving Incentive and the NSW Energy Savings Scheme, but tailored to its particular climate zones. This can be introduced to provide households with greater leverage on energy efficiency measures if it is done in conjunction with and aligns to the Federal Government Green Loans Policy. A program such as this will conserve energy by improvements to the thermal performance of the building fabric. Consumers are not as strongly driven by the return criteria typically used in making business decisions. The homeowner looks for a low initial purchase price, rather than the return on investment criteria mostly used by business. They are motivated by comfort and appearance. A decision to install energy saving insulation or energy efficient glazing and windows in a new house will be traded off against decisions to have granite bench tops or other features which appear to have more apparent benefit. Building codes are one measure used to deal with new homes and renovations.

In the case of energy efficient retrofits, decision making is more complex and involves a different decision cycle by the consumer. Appointments need to be made, trades engaged and booked for the task to be completed for a product that can't really be seen as is the case for insulation. This requires commitment by the consumer to overcome inertia. It is easy to opt out or purchase other discretionary items, even where the consumer has information. Our experience shows that Government support for products/processes and behaviours in reducing energy used in the home does make an impact and can be a driver of change, although on its own it is not a sufficient measure.

More difficult is the tenant/landlord asymmetry whereby the landlord does not want to invest the capital where the perceived benefit lies with the tenant. If the tenant is unhappy they move on. A landlord is even less likely to retrofit a rental property in a tight rental market where tenants are queuing to lease property. It is well documented however, that there is less turnover and superior health outcomes for houses which have good thermal protection. It is this area of market failure where white certificate schemes can make a difference or where a grants program may assist.



1) Schemes to Upgrade Existing Dwellings

Queensland has approximately 1.5 million homes which were constructed before the introduction of 3.5 star requirements. The previously uninsulated 800,000 homes are contributing around 360,000 tonnes pa of greenhouse gas or about 0.6 t per house. On this basis the GHG emissions in producing the glass wool insulation would be saved in one year. Thus each house will save 40 tonnes over the life of the property on average. There is a vast opportunity to reduce energy consumption and therefore greenhouse gas emissions in the state. Power demand, including peak power, would also drop by an estimated 200MW. More if improved window treatment was included. The Nation Building Package will provide for ceiling insulation, however it only applies where there is effectively no insulation. The State could provide for top up to the R3.0 standard as well as provisions for walls and floors.

i. Disclosure of building's energy efficiency measures on sale

The ACT has introduced a policy of mandatory disclosure of a dwelling's energy efficiency on sale of the property. Evidence is suggesting that those properties with higher standards of energy efficiency are able to obtain a premium in the market. This policy has been an objective of the National Framework for Energy Efficiency (NFEE).

The policy could be extended over time to require houses to meet a minimum standard of efficiency of say 3.5 stars before sale.

As energy prices increase from the introduction of emissions trading and other measures, renters and owners will become increasingly sensitive to the costs of heating and cooling. At present there are no disclosure provisions and yet the energy spend at home may be set to rival that at the pump. All cars have disclosure requirements on fuel consumption. It would seem obvious that housing should be next.

CoAG has also taken a position that all commercial premises will be rated before sale or leasing in 2010, followed by similar measures for residential properties.

CSR encourages the Queensland Government to introduce these measures as agree at CoAG,

ii. White Certificate Scheme

White certificate schemes such as the Victorian Energy Saving Incentive can easily be adapted for introduction to Queensland. As a starting point we would encourage the Government to examine the Victorian scheme and create a scheme of fungible certificates which can be traded through the machinery established for this purpose.



Thus Queensland could adopt a tradeable scheme creating a larger pool of certificates and a more liquid market.

The credits can be adjusted for the Queensland climate zones and if the scheme follows the Victorian regulatory pathway, retailers can use identical back office solutions.

The Victorian scheme includes both insulation and glass as eligible activities. Insulation shows very rapid paybacks which again demonstrate the rapid performance benefits which can be achieved through insulation retrofits.

Glass activities cover both window replacement and glass replacement as separate eligible activities. Given that only 5% of homes in Australia have double glazing or performance based window systems and that there is very little retrofit activity, then almost all installations of performance glass will be additional. Work done for the Brotherhood of St Lawrence by Viridian suggests that a standard sheet of glass replaced by a thermally efficient piece of glass can reduce energy consumption by 23%. While the company has not determined the full cost of replacement it is expected to be of the order of \$2000. Housing for the socially disadvantaged in a white certificate scheme could be allocated a double credit to encourage retailers to target the poor as part of a social obligation to those whose energy bills form the largest proportion of their income.

Martin Jones General Manager Government Relations 12-Aug-09

