RESPONSE TO STATEMENTS IN THE ICANZ RESPONSE #8 Additional Information

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If Mr Thompson of ICANZ is serious he would provide detailed references from credible researchers of peer reviewed research to back his claims. He stated he would have "*no problem to align a long list of local and international experts including CSIRO, BRANZ in New Zealand, European and USA government and independent technical experts to support the basic building science above and we will do this if required*." As the leading manufacturer of insulation in Australia, who benefited substantially from the Home Insulation Program - please do this for Australia, Mr Thompson. We need it. The House-Energy web site included in this submission is definitely not adequate.

The supporting evidence from Tony Isaacs is astounding as there are no supporting references to any of his claims – only the output from a discredited Home Energy Rating software. (see Kordjamshidi et al, 2007; Williamson 2000; Williamson et al, 2001 for research discrediting the results of our HER software).

If we are to learn anything from recent events it is that it is extremely important that we base future decisions on sound information verified by physical measurements in the field.

Water Absorption by Bulk Insulation

The next disaster about to happen is widespread damage from condensation in buildings due to lack of understanding of vapour barriers and construction ventilation in the Australian building industry and the consequences that can arise from tighter buildings and increased bulk insulation.

Let me make this perfectly clear about moisture and bulk insulation. Condensation, on the underside of metal roofs, falls on to bulk insulation across a ceiling during the night. It penetrates down through the insulation mass (not into the fibres). As the air temperature in the roof spaces increases during the day any moisture in the upper levels of the bulk insulation is evaporated off. But moisture further down in the cooler insulation is often retained. There are numerous people who can attest to the black mould-infested bulk insulation removed from attics affected with condensation. Two examples are condensation problems at Nabalco Pty Ltd's buildings at Gove, NT in 1987, and the Engineering building James Cook University mid 1990s. Both were air-conditioned buildings.

A long study in Florida has shown that reflective foil insulation did not deteriorate over the many years of the study – in fact it "dried by 10am" each day (Parker and Sherwin, 1998). Even in marine environments there was only small corrosion at the very outside edge (Beal and Chandra, 1995).

The Home Insulation Program was largely a retrofit operation where, in many cases, bulk insulation was laid on top of ceilings below unsarked tiles or metal roofing. This is a recipe for disaster in the humid tropics. Cautions regarding condensation under metal roofs it is clearly spelt out in AS 1562.1:1992 p.13.

Question. What is the next government going to do when the ceilings of such houses become damp and mould affected due to accumulated condensation within bulk insulation materials on top of the ceiling? Such houses, if they do not suffer ceiling collapse, are likely to need demolition because of the health effects of mould infestation. We never seem to learn from similar problems in the UK, NZ and the USA more than a decade ago.

These problems will surely occur and the fibreglass industry, which is aware of this problem, should be held accountable for the millions of dollars of damage. ICANZ has walked away with a very large

profit having provided around 70% of all product for the Home Insulation scheme. Surely they should be held responsible for the defects that have occurred, that they were fully aware of, and they did nothing to stop.

Home Insulation Program - Electrical Safety
AS/NZS 4859.1:2002 3.1 has safety instructions on page 18 – Emphasised in upper case letters. Electrical safety prevents *FIRES* !! The industry should be aware in its dealings with AS/NZS 4859.1 that a significant amount of installations would be retrofit on top of ceilings where electrical wiring is present.

Thompson remarks re what happens in ceilings is not supported by hundreds of research studies by international research institutions or field studies I have conducted.

Firstly reflective insulation stops over 90% of radiant heat which is the main source of heat flow downwards in roofs (fibreglass would be up to 20% based on its emissivity and other bulk insulations less than this). Heat still enters buildings through poorly insulated walls especially through unshaded windows. Ventilation brings in hot air as well as breezes during the day. Inside hot air trapped between door head height and a highly insulated ceiling provides a source of additional radiant heat onto the occupants of the house. Ceiling temperatures are often more than 4K above ambient air temperature and are known to create radiant heat loads onto people below (Su and Aynsley, 2006).

Tony Isaacs Comments

Law of Diminishing Returns
There was a very extensive cost benefit appraisal of optimum economic R-Values for houses in specific locations throughout Australia which resulted in AS 2627. While there are always assumptions made that can be argued, this was a consensus document, and the R-Values provided in that standard are way below those proposed under the new BCA requirements. Until detailed calculations for the proposed BCA R-Values are made public it is difficult to imagine that such an increase in R-Values is justified. It should be noted that the procedures used in the past have been highly criticised by experts from Energy Users Research Association in UK. Published in AIRAH journal (Harris, 1995).

Insulation Levels and climate zones.
My comments to the senate committee were directed towards houses in warm humid climate zones one and two. Mr Isaacs fully concurs with my recommendations.

Horses for Courses
It is clear from Tony Isaacs comments that he is not familiar with a large body of research conducted the past 30 years in the USA particularly that at Kansas State University, Oak Ridge National Laboratory and the Florida Solar Energy Center. All these researchers have shown economic and performance benefits gained by using reflective foil in roof spaces in warm climates. A substantial portion of this research was done on full-scale buildings.

There is a glaring scarcity of similar research and full scale studies in Australia. However recent full scale studies in test buildings at University of South Australia, led by Dr Martin Belusko, demonstrated significant differences in the physical performance of bulk insulation compared to claimed performance – up to 60% less (Belusko et al 2009).

Diodal effect of radiant barriers

Tony Isaacs has obviously not lived on the tropical coast of Queensland. While he talks about night ventilation he obviously does not understand that there is a predominance of CALM conditions after sundown which makes it difficult to achieve natural ventilation in houses during the evening. Hot air trapped between door head height and a highly bulk-insulated ceiling heats the ceiling and provides a source of additional radiant heat onto the occupants of the house. Ceiling temperatures, often more than 4K above ambient air temperature, are known to create radiant heat loads onto people below. Bulk insulation traps the heat inside but foil allows heat flow in the upwards direction.

Critical Difference between radiation and other modes of heat transfer

Tony Isaacs misses the point that radiant heat transfer is a much more efficient mode of heat transfer than conduction or convection given the same temperature difference through roof spaces. Research in the USA shows that bulk insulation is somewhat transparent to infrared radiation.

For Mr Isaacs' information AccuRate does oversimplify radiant and other modes of heat transfer through the most common roofs in Australia with attic spaces. He obviously has never heard of view factors for triangular prismatic spaces or ASTM1340 which provides a detailed account or the complexity of heat transfer in roof spaces. This standard has been validated by physical tests in the full scale simulator at Oak Ridge National Laboratory unlike software such as AccuRate.

ICANZ Consultant, Tony Isaacs, report dated June 18, 2007.

Use of AccuRate to assess the real performance of free running houses is highly questionable. The Faculty of the Built Environment at the University of NSW researchers published an article 2007 detailing a comparison of conditioned and free running house rating approaches. It clearly shows that AccuRate is not an appropriate tool for assessing free running (naturally ventilated houses). One of the researchers, Deo Prasad, was a principal member of the original Nathers work. (Kordjamshidi et al, 2007).

This problem of the reliability of HERS has been known for a long time:

Professor TJ Williamson at Univ Adelaide has clearly identified the conceptual problems of the Nathers approach to energy rating of houses (Williamson, TJ et al, 2001 and Williamson, TJ, 2000))

And from USA "Accuracy of Home Energy Rating Systems" by Jeff Stein http://EETD.LBL.gov/Reports/40394 .

<u>Computer simulation is no substitute for physical measurement.</u>

<u>References</u>

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