Forest&Wood Products Australia
Knowledge for a sustainable Australia

Understanding the carbon footprint of material choice in Australian housing using life cycle assessment (LCA)

An investigation by RMIT into the environmental impact of various building materials for a standard house design using life cycle assessment has demonstrated that the use of wood products rather than alternative materials could reduce greenhouse gas emissions by up to 51%.

Overview

Life Cycle Inventory data provided by the Australian forest and wood products industry has been used in an independent Life Cycle Assessment (LCA) study to assess the environmental impact across the full life cycle of a typical single-storey Australian home, in three different climates of the major cities.

Methodology

The study, undertaken by RMIT University, is a true cradle to grave analysis which used ISO 14044 compliant LCA methodology to compare environmental indicators of five different construction methods across 5-star and 6-star energy efficiency homes in three Australian cities.

Building material, construction, operation, maintenance and end-of life management phases are included. Operational aspects were limited to the provision of heating and cooling, as these are closely related to the design of the home. Other operational aspects such as household appliances were excluded as these are not related to the design of the home.

Table 1: Construction methods used in the LCA and volumes of wood used in each

House	Construction method	Volume of wood (m^3)	
		Sawn timber	Particleboard flooring
I	Insulated steel frame, brick clad, suspended steel & particleboard floor	0.6	3.0
II	Insulated steel frame, brick clad, concrete slab	0.6	0
III	Insulated timber frame, brick clad, concrete slab	8.7	0
IV	Insulated timber frame, brick clad, suspended timber & particleboard floor	11.0	3.0
V	Insulated timber frame, timber clad, suspended timber & particleboard floor	13.7	3.0

Key findings

- Substituting wood products from well managed forests and plantations for more greenhouse gas (GHG) intensive building products in cladding, wall, roof and floor framing could reduce the GHG emissions of a typical house by up to 18 tonnes over its life.
- The biggest GHG reductions can be made by;
    - substituting timber cladding for brick veneer
    - using timber for wall and roof framing instead of steel
    - using timber for a suspended floor instead of either steel or concrete slab on ground.
- Only minor additional building materials (and resulting GHG emissions) are needed to improve the energy efficiency of Australian homes from 5 to 6-star in all climates studied
- The GHG emissions from the building materials contribute 14-45% of the total GHG emissions of a 5-star energy efficient house over a 50-year life cycle
- In Melbourne GHG emissions from building materials contribute 14-24% of GHG emissions of a 5-star home and 17-29% of a 6-star home
- The contribution of GHG emissions from the building materials increases to up to 50-51% of total GHG emissions when steel framing is used in the temperate climates of Brisbane and Sydney where the house is designed for 6-star energy efficiency.

Conclusions

The findings of this study conclusively demonstrate that using wood can significantly reduce total residential GHG emissions, which reinforce similar findings in other whole-of building Australian and overseas LCA studies.

The GHG emissions from building materials are a very high proportion of the total GHG emissions of a home, particularly in milder climates of Sydney and Brisbane but even in cooler Melbourne.

The contribution of building material GHG emissions becomes even more important as minimum energy efficiency regulatory requirements are increased to 6-star (or equivalent) and beyond.

The GHG emissions avoided by using wood are very significant. For example, for a 5-star timber framed and clad home compared to a 5-star steel framed brick clad house the GHG emissions avoided can be equivalent to 8, 19 and 21 years of emissions from heating and cooling a home in Melbourne, Brisbane and Sydney respectively. For a 6-star home, the GHG emissions avoided can be equivalent to 11, 20 and 26 years of emissions from heating and cooling a home in Melbourne, Brisbane and Sydney respectively.

Key Charts

Figure 1: Volume of timber in house construction systems

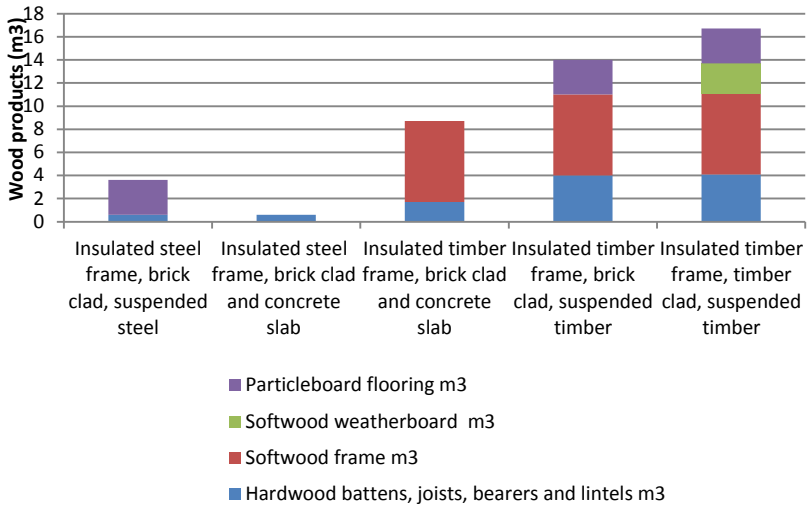
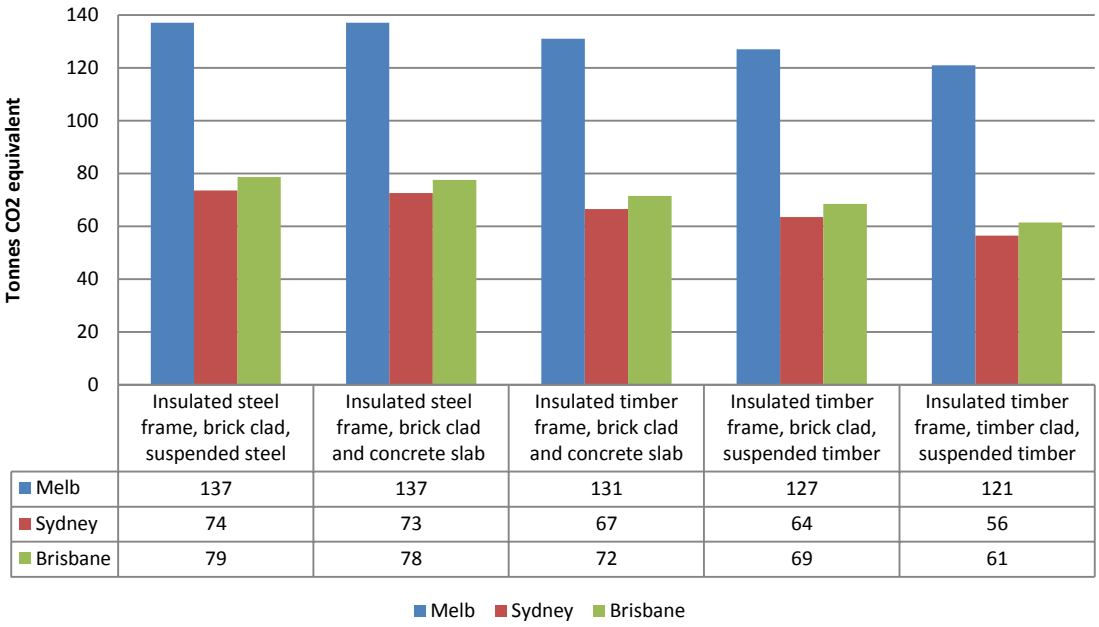


Figure 2: Total greenhouse gas emissions of house construction systems



	Insulated steel frame, brick clad, suspended steel	Insulated steel frame, brick clad and concrete slab	Insulated timber frame, brick clad and concrete slab	Insulated timber frame, brick clad, suspended timber	Insulated timber frame, timber clad, suspended timber
Melb	137	137	131	127	121
Sydney	74	73	67	64	56
Brisbane	79	78	72	69	61

Figure 3: Embodied greenhouse gas emissions of house construction systems (Melbourne)

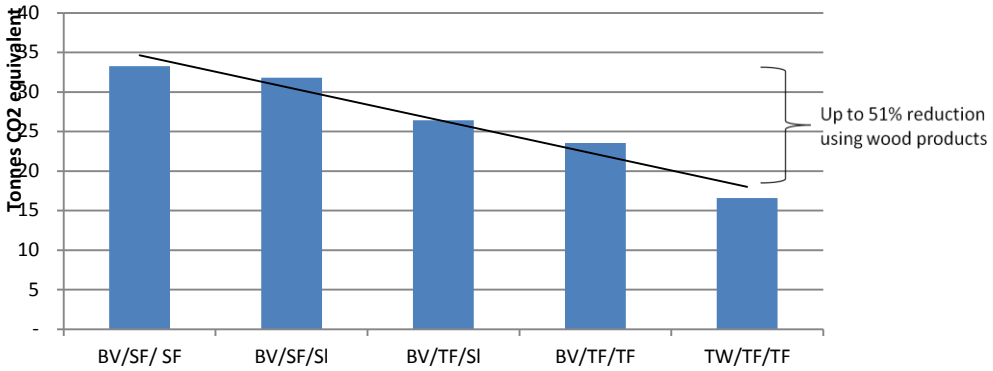


Figure 4: Proportion of total greenhouse gas emissions across all house construction systems from materials/construction and operations (5-star)

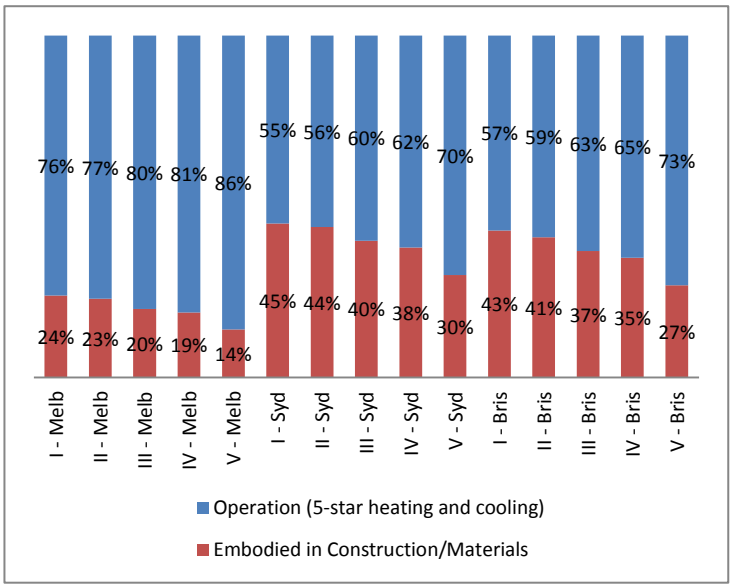
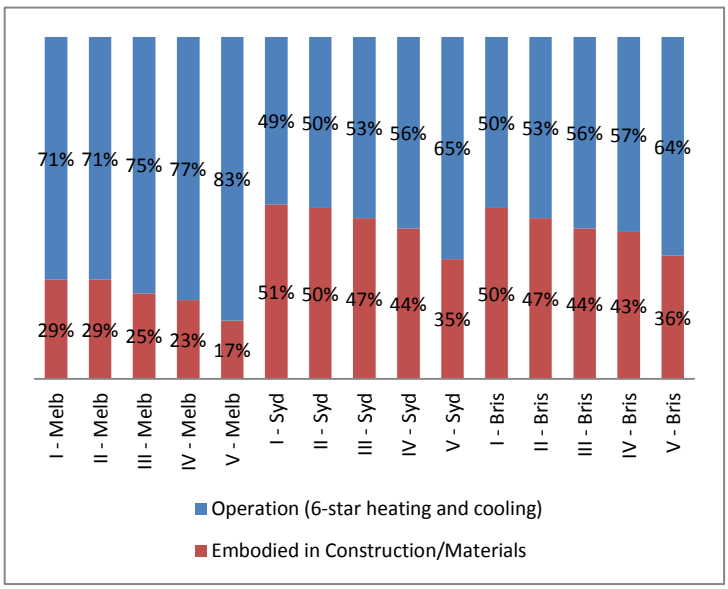


Figure 5: Proportion of total greenhouse gas emissions across all house construction systems from materials/construction and operations (6-star)



More information:

FWPA Project PNA147-0809
Comparative Life Cycle Assessment study of various residential buildings
By Dr Andrew Carre, RMIT University