

# carbon pricing

## a question of detail

The devil is definitely in the detail when calculating the cost of carbon pricing, writes Graham Wolfe.

**O**ver the past three years or so, HIA has provided commentary and opinion, including cost estimates on the impact of carbon pricing on new housing. In this time, the carbon goal posts have shifted, reconfigured and remodeled, and as a consequence HIA's commentary, opinion and cost estimates have also been revised to best reflect government announcements and directions at the time.

Earlier in the debate, HIA's submission to the Department of Climate Change on the Carbon Pollution Reduction Scheme (CPRS) Green Paper in September 2008, noted

the embodied energy within the construction materials used to build a new home generated 160 tonnes of carbon dioxide emissions (CO<sub>2</sub>-e) and an additional 80 tonnes for infrastructure associated with a new residence.

**Material extraction, transportation and manufacturing processes will impact significantly on the embodied energy of ... a new house**

At a carbon price of \$20, the submission estimated the additional cost to a new (house and land) residence would be calculated from a base quantum of \$4800. The estimates in the CPRS submission did not include the multiplying impact of taxes and charges, inventory holding costs, transport costs and other imposts which take the total additional cost above \$6000 per new home.

Following the federal government's announcement in February 2011 that a carbon price would be introduced from July 2012, further analysis was undertaken. That analysis was revised, enhanced and remodeled following the government's Green Energy Future announcements on 10 July 2011.

**Embodied energy in home building materials**

Earlier research by the CSIRO estimated the average house contains approximately 1,000GJ of embodied energy in its building material inputs (Australian Government, *Your Home Technical Manual* 4th Edition, 2011).





*Above: Graham Wolfe, HIA chief executive – association.*

The actual embodied energy will vary depending on the size of the home, bulk construction materials, surface finishes, fixtures, fittings, site conditions and a range of other technical specifications. While more recent ‘process’ based analysis suggests the embodied energy is lower than the CSIRO estimate, studies undertaken for HIA using ‘input-output’ based analysis indicates the embodied energy for all ‘upstream, downstream and sideways’ inputs is significantly larger. Using a more comprehensive ‘hybrid’ analysis the total embodied energy is more than 2,600GJ (study conducted for HIA by Dr Robert Crawford of Melbourne University’s Faculty of Architecture, Building and Planning).

Material extraction, transportation and manufacturing processes will impact significantly on the embodied energy of the building materials, products and systems specified in a new house.

A large proportion of building products undergo multiple phases of

processing, manufacturing and fabrication. For example, windows involve separate raw material extraction and transport; float glass processing; glass toughening, laminating and other treatments (including solar and thermal performance enhancing); aluminium, timber or other framing manufacturing; composite window assembly and fitting of hardware, hinges, rollers, etc. Similarly, the mortar used in masonry

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construction and the concrete used in floor/garage slabs and driveways undergo a number of processing, production and transport phases before their use in concrete slab, piers, footings, brickwork and roof pointing.

The bulk materials commonly used in building a new home include steel, reinforced concrete, bricks, mortar, timber framing and roofing, steel beams, columns and lintels, roofing tiles, glazing and windows, plasterboard wall and ceiling linings, wall and ceiling insulation and sarking, wall and floor tiles and cabinetry (in kitchen, bathrooms, laundry and wardrobes). The embodied energy



within these inputs alone does not properly define the aggregate embodied energy of a new home.

All other inputs must be accounted for, including water, sewerage and other service pipes; toilets, basins, baths and shower screens; tapware; electrical, telecommunication and entertainment cabling; heating/cooling ducting; timber skirting and architraves; kitchen and laundry benchtops; electrical fittings, switches and points; doors and door hardware; glass, stainless steel and composite surface finishes; external paving finishes, retaining walls and landscaping.

### **At a carbon price of \$20 per tonne CO<sub>2</sub>-e, the additional cost on a new home ... increases to \$6026**

White goods, such as built-in ovens, stove and dishwashers, hot water systems, mechanical ventilation and security systems should also be included in estimating embodied energy. Some argue further that carpet, window furnishings and driveways, side fences and even landscaping should be included. These inputs were

not included in HIA's earlier analysis. Yet the embodied energy for HIA's standard house (at just over 200m<sup>2</sup>) is estimated to be more than 2,600GJ.

In simplistic terms, modeling a house full of building materials and products using a process-based analysis corresponds to a project budget based on direct costs only. An input-output analysis brings in the indirect costs – those actual costs incurred across a business – which should be apportioned as pro-rata costs on individual projects to reflect the full project cost on the business. A 'hybrid' analysis then brings in the benefits of experience and historical data to complete the analysis. Whether it's a detailed project budget or an embodied energy analysis, the accuracy of the final calculation depends on the input data – direct, indirect (and previous experience). The hybrid embodied energy analysis accounts for these three inputs.

Estimating carbon emissions from the building materials is even more complicated. The heating, curing, crushing, cutting and pressing processes and other treatments used in the production and manufacture of different building materials, building

### **How much is too much?**

Depending on the analysis and the level of detail used, the embodied energy in the materials and construction of an average-sized new home (252m<sup>2</sup>) will be in a range from 700GJ to more than 3,000GJ. Again, depending on the source of the materials, the fuels used in the multiple production/fabrication phases and a number of other variables, the estimated CO<sub>2</sub>-e footprint ranges from around 80 tonnes to more than 160 tonnes.

Depending on the extent to which cost increases are passed on through the production phases and the extent of product substitution and offshore procurement, the estimated cost increase for an average new house due to the carbon tax will be in the range of 0.8 per cent up to 1.7 per cent.

**NB:** Due to the complexity of CO<sub>2</sub>-e analyses and the nature of the carbon tax arrangements, consumers will pay more but gain little, if any, insight into the CO<sub>2</sub>-e footprint of their new home, or the relative cost differentials arising from discrete specification decisions.

Members should also be aware that the ACCC has indicated it will be looking at the nature and quantum of price increases due to the carbon tax. The ACCC has advised that it may investigate price adjustments based on the carbon tax. It has further advised that it will issue a guide on 'carbon price representations' to inform businesses on matters to consider should they increase prices due to the carbon tax.

products and finishes vary significantly, as do the fuels and energy sources. Natural gas, electricity and coal are the most commonly used fuel sources. Other sources take in LPG, recycled waste (including used tyres) and liquid fuels.

In addition to the complex range of material production, manufacture and fabrication process emissions, the

fuel and transport emissions and construction emissions, some raw material extraction processes also emit CO<sub>2</sub> (or equivalent) directly into the atmosphere.

Analysing the CO<sub>2</sub>-e footprint of a finished and fitted/installed product requires an account of each emission component. Deconstructing every building product and assembly down to its raw material and then reconstructing through each processing stage, while accruing the CO<sub>2</sub>-e along the way, is grueling – and can involve potentially billions of individual processes.

Even basic electrical energy sources used across the industry vary in CO<sub>2</sub>-e footprint.

Aggregate fuel estimates can be used to apportion emission conversions across all building inputs, based on most commonly used Australian manufacturing and processing operations. Alternatively, discrete processes can be tracked for fuel inputs and proportioned against building material outputs. Multiple production processes and material outputs make the analysis more difficult, and the task increases exponentially as the number of separate downstream production/fabrication phases increases.

### Impact on new housing costs

Including the land development and infrastructure construction (the services and facilities to support a new allotment), the CO<sub>2</sub>-e contained in an average new house and land package was initially estimated to be 220.8 tonnes.

At a carbon price of \$20 per tonne CO<sub>2</sub>-e, the additional cost on a new home (house and land) was estimated to be \$4416.40 (\$20 x 220.82). Including flow-on cost increases relating to taxes and charges, holding costs and other factors, the additional cost increases to \$6026, while compensation measures hold down the cost increase to \$5200.

Final details on the government's Clean Energy Future package were released on 10 July and we now know that the CO<sub>2</sub>-e fixed price will be \$23 per tonne (not \$20), the EITE compensation will be set at 94.5 per cent and on-road transport fuel will



receive compensation. We also know that the compensation measures will change over time, with the fixed price set to increase to \$25.40 by 2014/15 before moving to a variable pricing scheme in July 2015.

So how much will carbon pricing add to the cost of building a new home? That will depend on the style, size and design of the home, the material specifications and inclusions, site conditions, the extent to which increased costs are passed on to builders and contractors and ultimately the consumer, and the degree of product substitution – including substituting locally made building materials and products with materials and products manufactured off-shore.

The cost of building material inputs and hence the cost of every new home will inevitably increase. Housing affordability will inevitably fall and as a consequence push housing further from the grasp of too many more Australians.

Excessive taxation on new housing is a major cause of both Australia's

undersupply of housing and the resultant affordability problems. The tax system has major impacts on housing supply, housing affordability, and hence the ability of the community to access shelter. The tax burden on new housing has grown substantially over the past decade and there exists an inequitable treatment of new housing compared to existing housing.

### The cost of building material inputs and hence the cost of every new home will inevitably increase

A recently completed study for HIA on the taxation of housing highlights results that are concerning. First, the total tax burden on a new home in our three largest capital cities ranges from 36 per cent in Brisbane to 38 per cent in Melbourne to 44 per cent in Sydney.

Carbon pricing will add to the tax burden and to the inequity between new and existing housing. **H**