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National Story

Now it's green grow the houses

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By Geoff Cumming

In the future, we will live in homes made out of straw. If we're serious about minimising the carbon footprint of our homes, then straw bales, coated in plaster, are the way to go - and the Clark Government does seem serious.

If you thought the food miles debate was global warming moved too close to the sun, the Government's sudden focus on the embodied energy in our homes is even more esoteric. Embodied energy is the energy used to produce a final product from raw materials, from reinforced concrete to taps.

It's the front end of a bid to put a carbon footprint on our homes by calculating their whole-of-life energy output. It's a whole new way of looking at a plank of wood.

Patrick Fontein says prices will come down once competition increases among manufacturers. Photo / Paul Estcourt

Climate Change
Brian Fallow: Carbon prices need close watch

Setting an example

It promises much: lower greenhouse gas emissions, lower household energy bills, healthier homes and, some say, cheaper homes. Manufacturers will need to adapt products to minimise their carbon cost or face extinction. Our homes will be rated according to their lifetime carbon output - the more efficient, the higher the market value.

The "world first" plan to assess the carbon cost of buildings in the new building code was announced last weekend by Building Minister Clayton Cosgrove.

"The Labour-led Government believes New Zealand should aim to be the world's first truly sustainable nation," said Cosgrove. "We know the way we design our buildings and homes will be central to that effort."

Lifecycle assessment was billed as the centrepiece of the latest discussion document on the new code. Recommended changes are to be announced in November and the new code operational in 2009. Straw bale homes may not replace brick and timber quite that quickly; the science behind lifecycle assessment is still under construction.

Sustainable housing is a path we're already some way down, and law changes require double glazing and more insulation in most areas, energy efficient lighting in new commercial buildings and incentives on offer for solar water hearing. Many homeowners and some property developers are voluntarily going further, aiming to reduce a building's operational energy output.

But lifecycle assessment goes the whole buffalo: considering the energy used in the manufacture of components, and the transporting of materials, through to the energy used in the building's eventual demolition.

What's envisaged is a time when houses will be rated according to their lifetime energy consumption, or carbon output. Architects will design to a carbon maximum, choosing

long-lasting materials with low-embodied energy. Potential for end-use recycling will be factored in.

Even the humble nail has a carbon cost, says Cosgrove. "In a truly green building, that cost might be included in the building's overall energy efficiency."

Houses and offices use nearly a quarter of New Zealand's energy and more than half the country's electricity output is used in buildings in some way. But it's not just about minimising the country's carbon emissions or your home energy bill. Making it easier to maintain a healthy temperature for less cost has obvious health benefits, particularly in low-income households: less asthma, fewer doctors' visits. In classrooms, studies have shown that better air quality creates an improved learning environment and reduces the spread of infection.

There's a point, however, where the cost of thicker insulation - particularly the carbon cost of its production - outweighs the operational savings over the lifetime of the home.

The calculations and scope for variations quickly become mind-numbing.

New Zealand scientists are at the forefront of international research in this field. A Victoria University PhD student, Andrew Alcorn, has calculated the embodied energy and carbon output of a range of building materials.

The manufacture of a cubic metre of baled, compressed straw consumes 31 megajoules. A cubic metre of ready mix concrete uses 2350 megajoules. Convert that to carbon-equivalent emissions and the obvious conclusion: concrete bad; straw bales good. But it's not that simple - what, for instance, if the concrete is recycled?

According to Alcorn's data, a cubic metre of expanded polystyrene (a good, cheap insulator) produces 59.9 grams of CO2, compared with 24.6g for fibreglass and 4.7g for cellulose insulation.

As with food miles, it's at this point that the science gets complicated. Production of anodised aluminium just about busts the scale in terms of carbon output: 9359g per kilogram. But it's long lasting and recyclable. Throw in variables such as the type of electricity - renewable or not? What about the energy used to build the hydro dam?

Timber which sequesters carbon may look good from an embodied energy point of view but has only a 50-year lifespan compared with 150 years for concrete and steel.

Mike Donn, director of Victoria University's centre for building performance research, says, tongue-in-cheek, that Alcorn's data leads irresistibly to plaster-coated straw bales. "It's a renewable resource, it recycles grain production waste, it stores CO2, it's a great insulator, and it's cheap."

Lifecycle assessment is not as simple as ascribing a score, or rating, to particular products, says Barbara Nebel, group leader, sustainability frameworks, at Scion (formerly the Forest Research Institute).

"We wouldn't compare a tonne of steel with a tonne of timber. The useful basis for comparison is to look at the actual usage of these materials. So you compare a square metre of wall built from solid masonry with a timber-framed wall. With timber you have to take into account cladding and insulation."

Last year, Scion looked at the energy required to build and run an average house for 50 years. The study concluded that operational energy use was more significant over the life of the house. But embodied energy is still significant and can be as high as 30 to 40 per cent of carbon equivalent emissions over the 50 years, says Nebel.

"The more insulation you put into the house, obviously the higher the embodied energy will be. So it's not necessarily a bad thing to have high embodied energy. You have to take the two in combination - you need quite a lot of insulation before you reach the tipping point."

That study has led to further work on the energy used to manufacture all the components that go into the wall of a timber framed house: exterior cladding, building paper, framing timber, insulation and the internal lining. But is it useful?

"We know that it's worthwhile - and not just for policy makers. It helps manufacturers to analyse and improve their products. We now have to assess doing it in a practical way.

"The great value in lifecycle assessment is the systems approach. Designers will have a maximum to work to but can take various approaches - it's a system for thinking about the whole house."

You could be forgiven for thinking, after the leaky homes disaster, the building code review was about ensuring homes are less likely to rot and become a financial nightmare for owners. The review recommendations are due in November, so it may seem a bridge too far to be clipping on carbon footprint measures. Cosgrove says the review was not a response to leaky homes. "It's 16 years since the building code was reviewed and because of technological changes in the industry it's out of date."

Last weekend's announcement was timed to steal the limelight from any sustainability initiatives emerging from the National Party conference. There were none. But with Helen Clark making carbon neutrality a cornerstone of Labour's re-election strategy, we're going to be hearing more about the carbon footprint and embodied energy of our homes.

Despite lifecycle assessment's potential to pit the concrete industry against the timber industry against the steel industry, reaction has been muted. Building Industry Federation chief executive Bruce Kohn said practical implementation of the changes "will be especially challenging".

"Designers and regulators will have to be particularly careful in their decision making in this area if they are not to push housing and material costs to higher levels and cause confusion in the marketplace.

"The key will be to ensure that regulators and policy makers adopt an approach based on proven methodologies, not unsubstantiated theories."

Green Building Council chief executive Jane Henley is worried the Government is too focused on emissions. "From a sustainability perspective we risk losing sight of other environmental impacts such as waste and water." The biggest issue seems to be where to draw the line.

"It could be bigger than Ben Hur - but I don't think that's their intention," says Branz science communications manager Chris Kane. Designing within a carbon-maximum is the right approach, allowing flexibility, he says. But architects will have to have reliable, up-to-date data about the carbon output of different materials.

"It's one of those situations where the more you learn the more you need to learn. We're going to have to arbitrarily set some boundaries."

Energy-saving measures halve power costs

Developer Patrick Fontein is adapting green building approaches to major subdivisions.

His 600-unit Kensington Park project in Orewa includes eco-homes and apartments, recycling of construction waste, on-site stormwater treatment and garden waste recycling.

Fontein chairs the Green Building Council, which has developed GreenStar, a rating system to measure energy efficiency in buildings.

The system is gaining acceptance.

He says bringing life-cycle assessment into the building code is the next logical step in energy efficiency gains. With thoughtful design, the extra costs are "quite negligible and the payback is quite quick".

Energy-efficiency measures in the Orewa houses include compacted pumice insulation beneath concrete slabs, extra-thick insulation in walls and ceilings, double glazing, solar water heating, heat pumps, energy efficient lightbulbs and induction cookers.

The measures add significantly to the cost of a house but as competition increases among manufacturers, costs will come down, Fontein says.

At the moment the "extras" may add $50,000 to a one-off four-bedroom house or $30,000 per house in a subdivision - but he says the additional costs could soon be no more than $20,000.

And the measures more than halve the estimated $2000 a year power bill for the four-bedroom homes at Orewa, he says.

But they are just the beginning if designers are forced to adopt a full life-cycle approach including embodied energy.

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