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Designing to achieve net zero

Our low-carbon future will demand momentous changes to the way designers work that, while initially challenging, will become familiar over time.

At a glance

- Architects and designers have a critical role to play in helping the construction sector reduce carbon emissions.
- A fundamental – and initially challenging – re-evaluation of the way all buildings are designed will be required.
- Holistic design is key – from site selection through to end-of-life considerations.
- Comprehensive carbon modelling is the first step.
- Circular use of materials, basic building shapes, windows and interior décor are all part of reduced-carbon design.

As we approach 2050 and our net-zero carbon emissions target looms, it's time to consider the role architects and designers will need to play in the transition. The construction sector, which contributes approximately 20% of Aotearoa New Zealand's greenhouse gas emissions, has a huge part to play, and reduction efforts will initially be driven by building design.

Re-evaluating design

We won't achieve the target by incremental tweaks to the specifications of the relatively small number of our new buildings specifically designed to meet their embodied and operational carbon targets. It will take a complete re-evaluation of the way we design all buildings.

This cannot be limited just to new buildings. We must apply the same rigour to residential alterations and additions and any other buildings we may be adapting or repurposing.

The first step will be to require comprehensive carbon modelling of each building we design. While this will initially be a challenge, it's a task we ultimately must take on.

For under-resourced architects and designers, it might be work contracted out to external specialists. However, there's a strong imperative for each of us to upskill and master as much of this process as possible. The more we do, the easier and quicker it becomes.

Ultimately, we should be looking to develop an instinctive feeling for the best design choices to make and establish best-practice go-to options we can draw on without the need for detailed repetitive analysis and evaluation.

What lies ahead will be a significant change in the way we design our buildings. If architects and designers genuinely want to achieve low-carbon buildings, we will be reappraising almost all the basic design tenets we have used thus far and taking a more long-term, holistic view.

We will need to consider everything from site selection, building location and sketch design – including building shape and size, orientation and perimeter/area ratios – to materials used, embodied carbon, life cycle energy use and building end of life.

While this may initially appear onerous, within the next generation, it may well become the new normal.

With these changes, new ideas and opportunities will arise. I compare it to the traditional preference for designers to stick to Acceptable Solutions for compliance when submitting building consent applications.

When legislation changes, however, they may find Alternative Solutions provide scope to do things differently and are often much easier than first thought. Designers and architects for future buildings will

Timber floors have longevity and are a good low-carbon design choice.

similarly need to positively embrace the wide variety of options and new opportunities that become available.

Let's take a quick tour through a few of the ideas I've mentioned.

Circular use of materials

Reusing materials or repurposing existing building stock will play a key role in the reduction of embodied carbon emissions as well as reducing the use of new resources during construction.

Some European local authorities are already preferring planning proposals that favour repurposing or retrofitting over demolition. To reinforce this preference, they may introduce whole-life carbon limits for a new building that must be less than or equal to a retrofit option.

The corresponding reduction in new resources and materials required will also dovetail nicely with the circular economy goals of reuse and recycling. Again, the concept of holistic design is manifested and advantages are accumulated.

Simpler building shape

Another basic concept is the use of simpler, compact, efficient building shapes. An early indicator of the overall efficiency of the building is provided by the simple calculation of the perimeter/area ratio.

Complicated building footprints require more junctions and greater quantities of materials along with larger surface areas to be constructed to deal with thermal gain and heat loss. Compact and less-complex shapes are inherently more carbon efficient.

The building envelope must also be carefully considered, even during the preliminary design phase. The cladding selection, for example, can influence other components of the design and impact on both the embedded and operational carbon footprints of the building.

The importance of windows

As always, the fenestration will be a critical factor. The materials used, orientation, size, glazing, durability, cost and maintenance all play a huge role. While double glazing offers many advantages when considering operational carbon performance, insulating glass units (IGUs) do not last forever.

Replacement must be factored into the carbon equation, including scaffolding, removal, purchase, transport and installation – an example of the importance of a holistic design approach.

Don't forget interiors

Interiors are also a consideration currently less likely to be evaluated. It's generally accepted that interior décor has a limited life expectancy and will require periodic redecoration. However, this built-in obsolescence is unnecessarily wasteful.

The culture of following interior fashion trends doesn't need to remain. It's possible to create pleasant – even luxurious – environments by following classic design principles using natural or recycled products and materials and finishes that age well. Some might look even better as they develop a characterful patina.

All the while, we must be conscious of and look for low-carbon options. Another example is flooring finishes. Carpet may last as little as 10–15 years before needing to be replaced while timber floors have well-known longevity.

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