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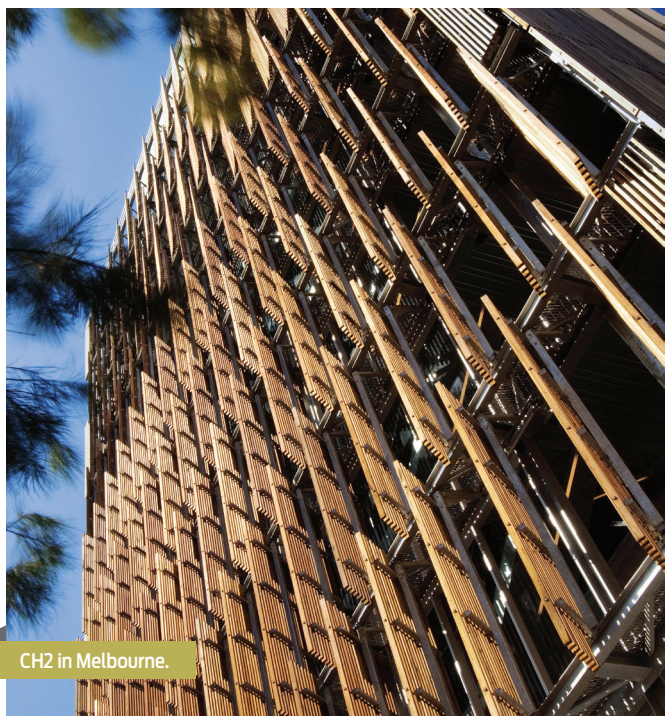
Growth in living buildings

Mimicking the shapes and materials of nature typifies the emerging field of living building design. Although requiring a rethink of traditional design, it could deliver buildings more sympathetic to people and the environment.



CH2 in Melbourne.

BUSINESS AS USUAL in the New Zealand built environment typically means conventional approaches to building design and construction. Although green or high-performance building design is increasing, in most existing and newly constructed buildings in New Zealand, few environmental sustainability issues have been considered.

Living buildings

Currently, there are exciting architecture, urban design and research projects and networking opportunities related to the idea of living buildings design. This is in line with the growth of similar ideas and design experiments internationally.

There is no set definition of what a living building is, but it may include:

- aspects of biomimicry
- biophilia
- regenerative or positive design
- projects exploring the Living Building Challenge (LBC)
- buildings that incorporate living plants or water in their exterior or interior.

Biomimicry

Biomimetic architecture is examining living organisms or whole ecosystems as models for designing buildings or urban environments. Not all biomimicry has increased sustainability as its motivation. However, there are many projects internationally showing it can potentially be a useful tool to improve sustainability outcomes in the built environment.

Mimicking how whole ecosystems work or what they are able to do rather than a single aspect of an individual organism generally results in better sustainability outcomes.

Biophilic design

Biophilic design is the exploration and articulation of relationships between nature, built environments and human physical and psychological wellbeing.

For example, there are clear benefits when people have visual access to a natural vista, either real or through a photograph or other means. Recovery time after illness or accident, productivity in a workplace and learning outcomes in education environments can be measurably improved.

Regenerative design

In regenerative design, rather than aiming for reduced energy or water use or other environmental impacts, designers aim for built environments to produce more ecosystem services than they consume. It is similar to the idea of net positive design.

Buildings act as producers of energy, water and habitat and as filters or sinks of pollution rather than contributors to the degradation of ecosystems and climate as is the norm.

Living Building Challenge

The LBC originated in the US and is a building certification programme similar to Green Star in New Zealand. However, its focus is more on regenerative design.

The LBC pushes designers to 'fix the damage' rather than just 'do less harm'. It is now global in scope with projects in the US, Europe, Asia and Australasia including several in New Zealand.

To be fully certified, a building must demonstrate after a year of occupation that it:

- produces or collects more energy and water than it consumes
- is net zero positive in terms of waste
- uses no toxic materials
- fulfils requirements in terms of habitat exchange, equity and beauty among others.

Buildings incorporating nature

Buildings that are 'alive' in some way may also utilise green roofs, living walls, water features and access to views, outdoor areas, natural ventilation and daylight.

Health-giving architecture

The growth in living building projects nationally and internationally may be due to the increasing urgency with which built environment professionals are responding to issues of climate change and biodiversity.

By aiming for regenerative design, even if only in parts of a project, sustainable architecture can become a health-giving vehicle to both people and ecosystems. This contrasts with the more traditional response of sustainable architecture simply working to reduce negative ecological impact.

Local living building projects

The Zero Energy House in Auckland was the first LBC building in New Zealand, achieving net zero energy building certification in 2014. It was designed by A Studio Architects with the owners and eCubed Building Workshop.

The home produces as much energy as the people living in it consume over a year by using roof-integrated solar photovoltaic panels and solar hot water panels along with other energy-reduction strategies.

Built in 2014, Tūhoe Tu Uru Taumatua in Taneatua, in which Jasmax and Arrow International were instrumental, is one of New Zealand's first buildings built to strict LBC criteria. Claimed by the architects to be 'New Zealand's most advanced sustainable building', it is described as a culturally and environmentally rich project with a strong social drive.

Using net-zero energy and water to produce zero waste and no toxic materials, the building is mostly constructed from timber, 95% sourced from local forests with Forest Stewardship Council certification. The building has New Zealand's largest solar electric array, innovative stormwater retention mechanisms, rainwater collection management, a purpose-designed botanical wastewater system and materials sourced as locally as possible.

Tennent Brown Architects in Wellington are also involved with Tūhoe building projects using LBC principles including a visitor centre in Waikaremoana. Two further projects are in development.

Several new LBC building projects are under way in New Zealand including an education centre on the Auckland waterfront for the Sustainable Coastlines charity.

Local networks

A New Zealand LBC Collaborative has been established in Auckland with over 1,000 people involved. Local groups have been formed in Wellington and Christchurch.

These networks are for built environment professionals to work together to understand and incorporate LBC principles into real projects, to share ideas and to seek collaborative opportunities. The groups also host international visitors and training seminars.

Declare label

Associated with the LBC is the Declare label, developed to enable people to specify non-toxic building materials as part of LBC projects. A Declare label lists the ingredients of a building product. Although a simple idea, it can be surprisingly difficult and time consuming to obtain this information from materials specifiers.

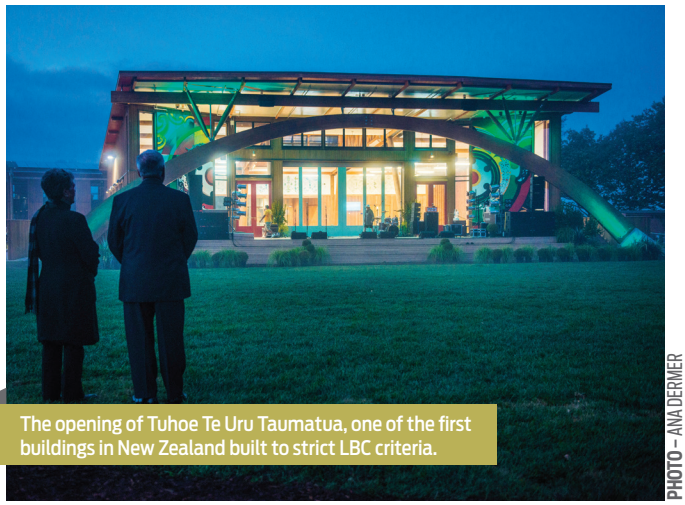
More than 30 New Zealand products have gone through certification with more in the pipeline – see www.declare.nz.

Meetup connecting people

In Wellington, local designers, architects, students and others have formed a Meetup group called Wellington Living Architecture. The group explores local and international innovations relating to living buildings and urban design. Experts and practitioners are invited to share their work and give practical demonstrations. Over the course of 2 years, the group has grown from a membership of a dozen to over 100.

Wellington biophilic map under way

Wellington Living Architecture teamed up with VUW School of Architecture and the Wellington City Council to create a biophilic map of Wellington City in 2016. Wellington is a member of the ➤



The opening of Tuhoe Te Uru Taumatua, one of the first buildings in New Zealand built to strict LBC criteria.

PHOTO – ANA DERMER

international Biophilic Cities Register, which means that the city strives to incorporate nature into the built environment by designing the city with urban-nature connectivity in mind.

The biophilic map project hopes to make the concept more tangible to the people of Wellington and visitors to the capital. By highlighting examples of biophilic design in the city, the aim is to inspire similar projects and to share what is happening in Wellington with other cities in New Zealand and internationally.

Although no projects have been built in New Zealand that exclusively investigate biomimetic design, Biomimicry Aotearoa and Biomimicry Wellington are also recently formed networks working in the area of living architecture and can be found online.

Notable international buildings and research

Many different approaches to living buildings can be found internationally. The works of Zimbabwe architect Mick Pearce, including the Eastgate building in Harare and CH2 in Melbourne, exemplify low-energy biomimetic approaches to architecture.

Eastgate and CH2 work with passive ventilation techniques modelled on how termite mounds work to passively regulate temperature and, in the case of CH2, harness underground aquifers for extra cooling.

CH2 mines sewer water from under Melbourne, cleans it and then, in combination with phase change materials and an innovative chilled beam and external shower tower system, uses it to cool the building. CH2 is estimated to use 85% less energy, reduce greenhouse gas emissions by 87%, and use 70% less water than typical comparable buildings.

On an urban scale, Belgian architect Luc Schuiten inspires with his Vegetal city project, a set of fantastical city theoretical redesigns taking cues from nature. They include a metropolis with buildings fabricated from a transparent silicate concrete that copies the properties of coral and mollusc shells to absorb carbon and become self-healing growing structures.

Although untested in built form, materials and technologies that copy nature are being developed by researchers at Stanford University and at the Sandia National Laboratories in the US.

Research from Sandia investigates how abalone or paua is able to grow a crack-resistant shell approximately 200% harder than human ceramics using only seawater and a series of proteins. This could lead to lightweight, extremely strong, optically clear building materials or to alternatives to concrete. This process of biomineralisation stores carbon much like the growing of forests locks carbon into the structure of the trees and soil until released.

The closest to a built example of this kind of biomineralisation is Biorock, which was developed by marine biologist Thomas Goreau and engineer Wolf Hilbertz in the 1970s.

The original intent of the technology was to develop low-cost structures on land. It is typically used, however, to restore coral reefs. Frames of steel are placed onto ocean floors, and low-voltage current that is not harmful to marine life is passed through the frames.

This encourages minerals dissolved in the seawater to crystallise and begin to build up within a few days. The resulting material has self-repairing characteristics. A Master of Architecture student at Victoria University is currently investigating the idea as a possible tool to adapt to climate change-induced rising sea levels in some Pacific islands.

Quantum shift

Shifting from a built environment that is degenerating ecosystems to one that regenerates capacity for ecosystems and communities to thrive requires a rethink of typical architectural and urban design.

Living building design, in its many forms, reflects a shift from human-only or style-oriented design approaches. It requires a systems approach when designing the built environment where relationships between people and the rest of the living world are understood, harnessed and celebrated in a quantifiable way.

Get involved

- Join an online network or group.
- Visit projects.
- Apply the ideas to your own projects or collaborate.
- Read up on the Living Building Challenge – see www.living-future.org/lbc.
- Seek further training, such as:
  - Otago Polytech's online *Creating Living Buildings – A professional practice short course* – see www.op.ac.nz.
  - Victoria University's School of Architecture – contact Dr Maibritt Pedersen Zari, maibritt.pedersen@vuw.ac.nz