

# The Next Frontier in Sustainable Construction





By most metrics, climate change is worsening. Scientists expect global temperatures to continue to rise because of human-caused greenhouse gases, according to NASA's Vital Signs of the Planet, and more extreme and dangerous weather events will be a result.

That's the bad news. The good news: the building and construction industry can make a substantial impact in efforts to minimise greenhouse gas emissions and cut energy consumption. The industry contributes a whopping 37% to the world's energy-related emissions, according to United Nations.

What's more, interest in green building – from regulators, investors and consumers – is growing. The green buildings industry is projected to grow to US\$1.3 trillion (AU\$2 trillion) by 2030, a 138% increase from 2021.

# Green Building Growth

Green building, also called sustainable or green construction, relies on environmentally responsible and resource-efficient materials and processes to reduce the impact on the natural environment and human health.

When done right, green construction triggers many benefits:



Reducing carbon emissions and mitigating climate change by promoting energy-efficient designs and technologies such as green cement and heat recovery systems.



Conserving resources such as water and materials by prioritising their efficient use and reducing waste, including building with recycled steel and modelling design options to produce the most sustainable version.



Promoting public health with designs that boost energy efficiency and create healthy and comfortable indoor spaces.



Offering economic benefits such as lower operating costs with the deployment of energy-efficient designs and appliances and increased asset value.

152%

Increase in LEED residential projects from 2017 to 2021

93%

Increase in LEED Building Design and Construction projects from 2017 to 2021

50%

Biennial growth in the number of verified net-zero buildings

# How Green Building is Changing

Interest in green building and adoption of its practices is skyrocketing, but that hasn't always been the case. A lack of accepted and proven sustainable building practices and difficulty finding the right materials and systems are two major hurdles.

But as the impacts of climate change become clear, plenty of other forces are boosting interest in sustainable construction, making it more accessible to builders.



## Those forces include:

- **New funding:**  
Lawmakers globally are funding green construction through various financial incentives. In the US, the 2022 Inflation Reduction Act provides tax credits, grants and other funding for green construction. In the EU, the European Green Deal has accelerated financial support for sustainable building through various programs.
- **Growing regulations:**  
Amid clear signs of escalating climate and weather events, regulators are mandating sustainable construction practices. In the US, states are putting net-zero-energy building codes in place or approving higher standards for energy-efficient building. In the EU, the Energy Performance of Buildings Directive sets minimum standards for energy-efficient construction where there is room to improve.
- **Better access to materials and technology:**  
This new funding and increased compliance requirements are helping to fuel major advancements in materials and technologies, providing broader awareness and access to innovative green building methods. In fact, investment in green construction technologies totalled about US\$2.2 billion (AU\$3.3 billion) in 2022, according to A/O PropTech's 'The Future of Building in a Low Carbon World', which forecast continued and accelerated future growth.



# Technology Advancements in Green Buildings

The lack of data and insights has long been a challenge for the green building industry. The inability to track the impacts of green construction methods and materials has made it difficult to determine how successful those efforts actually are and demonstrate those benefits to stakeholders.

But today, technology is revolutionising the sector, providing real-time and real-world information about the pros and cons of different designs and materials. The data is enabling the sector to fine-tune projects and ensure buildings deliver sustainability benefits as promised. Once projects open, technologies can optimise a building's operations to boost energy efficiencies and cut operations costs.

## Technology advancements that are supporting green construction include:

### Energy Management Systems (EnMS)

Monitor and adjust a building's real-time energy needs, driving energy efficiencies and operational cost savings.

### Renewable Energy Integration

Incorporates renewable energy technologies such as wind turbines, geothermal heat pumps and solar panels into project designs to reduce reliance on fossil fuels.

### Building Information Modelling (BIM)

Reduces waste in the design process and facilitates the work to model and collaborate on various designs to produce the most sustainable options that optimise the use of natural resources and enhance energy efficiencies.

### Energy Analysis Software

Forecasts how much energy a building will use pre-construction, allowing designers, contractors and project owners to make informed decisions about a project's design.

### Artificial Intelligence

Boosts green construction by harnessing AI algorithms to streamline the design process, letting professionals compare the benefits of different options and forecast a project's environmental impact.

### Construction Equipment Technologies

Track the performance of construction equipment, including through digital control systems, which automate some tasks, and telematics, which remotely track equipment use.

# Growth in Green Materials

Just as technological advancements have transformed the green building industry, so has progress in sustainable materials and construction practices.

## 1. Concrete Innovations

Cement, a key component of concrete, accounts for about 7% of greenhouse gas emissions across the globe, and scientists and green builders have been laser-focused on making concrete more sustainable. Advancements include using supplementary cementitious materials (SCMs) such as fly ash or silica fume for traditional cement.

### Builders are also taking advantage of new kinds of concrete:



Green concrete relies on recycled materials and waste products.



Cool concrete reduces heat absorption and can cut a building's energy use.



Permeable concrete limits stormwater runoff impacts from the built environment with a more porous material.

## 2. Recycled and Renewable Materials

Instead of buying new materials, green builders are increasingly turning to recycled and renewable materials that have less impact on the environment.

Renewable resources such as fast-growing cork and bamboo offer a more sustainable flooring option. Sheep's wool is used by some as a greener alternative to traditional synthetic insulation.

Among recycled construction materials, steel, metal, wood, plastics and fixtures often have a second life left in them, and projects are increasingly reusing these common building materials to reduce waste and lower their carbon footprints. Still, the so-called circular economy for construction materials is just getting started as the market and opportunities come together. The circularity rate of all building materials in the EU increased from 10.8% in 2010 to just 11.7% in 2021, according to ING.

### 3. Modular Construction

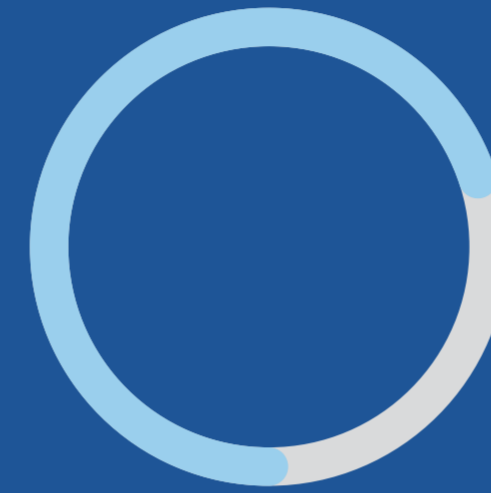
Instead of building anew on every site, modular construction is an increasingly popular way to more efficiently build projects and take advantage of green construction benefits at the same time. The global modular construction market is forecast to explode in the coming years, growing from a US\$131 billion (AU\$198 billion) value in 2021 to US\$235 billion (AU\$356 billion) by 2031.

### 4. Energy-Efficient Fixtures

The cost to operate appliances and fixtures can add up over time, totalling about 22% of a commercial building's energy use, according to a US Department of Energy report. That's why adding energy-saving fixtures and appliances has been a longtime favourite green building practice that can translate into major cost savings for building owners. Energy-efficient fixtures can reduce energy consumption by as much as one-third in commercial projects, according to the Energy Department's report.

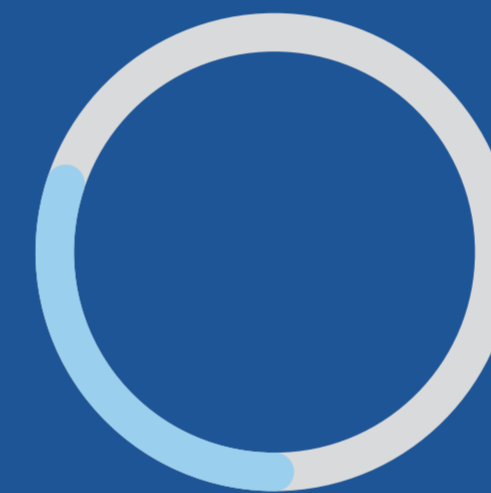
#### Market Interest:

The global green building material market is projected to grow by nearly 170% by 2032.



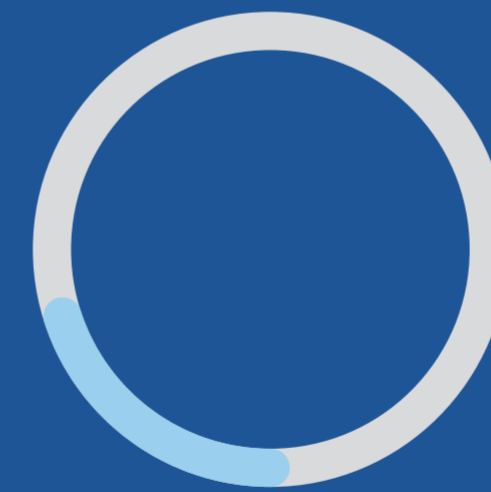
# 75%

The percentage emissions were cut when new projects reused materials or existing structures instead of tearing down and building anew.



# 35%

The percentage of less energy used when buildings have Energy Star certification.



# 15%

The percentage of building materials that go unused and are tossed during construction.



# Green Building Certifications, Standards

When it comes to green building, there's no need for builders to reinvent the wheel. Around the world, green construction certifications and standards lay a foundation for the industry.

## These benchmarks help builders:

- Optimise and validate green building practices.
- Differentiate their work in the market.
- Take advantage of a variety of financial benefits, including tax breaks and lower operations costs.



## Global programs, including EU, UK, US, APAC:

**LEED:** The most popular green building rating system across the globe, available for every building type and phase.

**Green Globes:** This system evaluates the environmental sustainability, health and wellness, and resilience of commercial real estate.

**WELL Building Standard:** A performance-based system that measures the attributes of buildings and how they impact occupant health by considering seven factors – air, water, nourishment, light, fitness, comfort and mind.

**BREEAM:** This sustainability assessment method measures how well buildings meet sustainability goals and perform into the future.

**Living Building Challenge:** A building certification program that considers seven performance areas or 'petals': place, water, materials, equity, energy, beauty, and health and happiness.

## United States

- **National Green Building Standard:**  
A residential green building standard designed to produce homes and apartments that are sustainable, cost-effective and geographically appropriate.
- **Energy Star Certification:**  
The US Environmental Protection Agency program certifies homes, commercial buildings and industrial plants that take advantage of energy-saving strategies.

> 800

Living Building Challenge projects certified or registered.

## Australia

- **Green Star:**  
This rating system, which was developed for the Australian environment, sets standards for healthy, resilient and positive buildings and places that reduce the impact on climate change and restore and protect biodiversity and ecosystems.
- **NABERS:**  
The National Australian Built Environment Rating System measures a building's energy and water use, waste and indoor environment to understand what it's doing well and where there is room for improvement.

> 371 million

Square metres of WELL spaces were built between 2014 and 2022.

~ 160%

increase in total BREEAM certifications in the US from 2021-2022.

# Case Study: EllisDon, London, Ontario

- Employee-owned construction services company, operating across Canada.
- Capital services, infrastructure services and technology, construction sciences, digital and data engineering.
- Expert: Navisa Jain, senior project manager of EllisDon's Climate and Sustainability team.

EllisDon has committed to reduce absolute Scope 1, 2 and 3 greenhouse gas emissions by 42% by 2030 and to be net zero by 2050. The Climate and Sustainability team at EllisDon manages its corporate sustainability commitments, with the goal of driving to zero emissions in the built environment, materials used, operations and the industry.

'Knowledge, awareness and education are a big part of the whole exercise here,' Jain said. To build that library of information about opportunities and ways to reach net zero, the team is focused on the following key areas:

## 1. Business Operations

Both its business and construction operations account for a large part of EllisDon's carbon footprint, and Jain's team is focused on developing targets and roadmaps to reduce emissions, including optimising heat and power, increasing renewable energy use, trialling alternative fuels, collaborating with stakeholders to measure and reduce emissions and delivering low-carbon projects.

'Our current focus is on piloting representative projects across different locations in the country to quantify our emissions and identify opportunities for emission reductions. We hope to scale up these efforts to all of our projects within the next couple of years,' Jain said. 'We are currently in the understanding phase, and our goal is to reduce emissions based on our findings.'

## 2. Material Procurement

EllisDon is reducing carbon emissions in the building materials used by working with suppliers to increase transparency and innovation toward low-carbon materials and products. It is investing in building knowledge and capacity to drive low embodied carbon practices, using in-house expertise to identify opportunities to reduce carbon in structural materials. The company is also working collaboratively with owners and consultants to determine effective structural and envelope solutions for their projects, and it is leading the use of low-carbon concrete in high-rise construction.

## 3. Built Environment

With new construction, EllisDon is committed to building low-carbon buildings and infrastructure and using technology to measure and manage its carbon footprint and increase energy efficiency with its full building lifecycle expertise. The company also manages and operates more than 1.1 million square metres of real estate through its Facilities Services department, guaranteeing energy and carbon performance on a subset of its portfolio.



# Case Study: Chandos Construction, Edmonton, Alberta

- Employee-owned commercial builder, operating across North America.
- First and largest B Corp Certified commercial builder in North America.
- Expert: Audrina Lim, director of carbon transition.

A certified B Corp since 2016, Chandos Construction has long focused on building more sustainable and thoughtful operations for its people and the communities it serves. And Chandos' goal to reach net zero by 2040 is a natural extension of those efforts – striving to meet that goal a decade ahead of the Paris Agreement's 2050 target.

As an employee-owned business, Lim said there is tremendous company-wide support for the work. 'We're trying to make sure that we keep in tune or try and incentivise ourselves to meet that goal,' Lim said. 'And to do it by 2040 is just an incentive for us to keep our eyes on the prize.'

**To meet that 2040 goal, however, requires building up its sustainable practices. And, according to Lim, those efforts come down to uncovering the answers to these three questions:**

- 1 Do we have the right information?
- 2 What's that information telling us about how we're performing right now?
- 3 With that information, how can we bolster what we're doing now?

In 2011, Chandos launched a waste diversion policy, building software that tracks how much waste its projects create. That data has helped the firm identify sites that struggle because, for example, there are no recycling facilities. And it's allowed the firm to seek out other ways to reduce waste, including through more precise ordering or repurposing. Internal competition between teams helps to bolster efforts.

Now, on its operational side, Chandos is focusing on greenhouse gas emissions. 'But what we've realised is we need to do a bit better at collecting our data,' Lim said. It's still a work in progress, but Chandos is using AI to help collect volumes of data, scrub invoices for fuel and electricity purchases and pull out the relevant information. Chandos collaborates with BMO Radicle to verify and validate the data and produce more sustainability targets.

When working with project owners, encouraging green building practices often comes down to simply asking and educating, Lim said, like suggesting a greener concrete option.

'A lot of it is down to baselining and education. Finding ways to say, "OK, this is still what makes sense, but we could do this other thing here that helps advance sustainable incentives,"' Lim said.





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