

Green Construction: A Global Transformation

Discover how to build green today
and what to expect tomorrow



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Introduction

While the buildings and construction sector accounts for 30% of global energy use and 27% of emissions, the industry is seizing the moment to make positive change. Green building is a revolution and no construction company can afford to be left behind.

The impetus is real. To combat climate change and meet Net Zero emissions goals, and to cater to growing global population, we need radical change. Not only that, but the skills shortage and productivity challenges in construction also demand innovative solutions.

Sustainable construction helps to safeguard our planet, but it's also efficient construction. Smart green building methods reduce errors and waste, cut costs and lead to better buildings. It's time to transform how we build.



What is green construction?

Green construction is clean, sustainable construction. It involves minimising any negative effects of building projects on the environment and communities, while making the finished structure as environmentally friendly as possible.

This doesn't end when construction wraps up. With proper planning and design, a structure can be sustainable throughout its lifetime and even while it's being demolished.¹

“Our approach to sustainability is more than just thinking about a by-product, it's in everything we do every day. So, we approach it by thinking of how we are using the resources from the beginning to the end. We approach sustainability as life cycle thinking.”

–Gudrun Jonsdottir, Team Lead, EFLA

Construction's environmental impact

From simple single-family homes to the biggest infrastructure megaproject, building projects can affect the environment in multiple ways:

- Ecosystems destroyed due to mining, logging and other techniques for extracting raw materials
- Waste, water and air pollution, and high energy use in building material manufacturing
- Damage to local waterways and plant life due to erosion and runoff on construction sites
- Air pollution from heavy machinery that runs on diesel or gasoline engines
- High CO2 emissions because materials and equipment are transported long distances
- Soil, air and water being contaminated by toxic chemical spills or other accidents

In fact, carbon emissions from cement production alone have doubled in 20 years and accounted for more than 7% of all global CO2 emissions in 2021.² Moreover, the International Energy Agency says the industry is not on track to meet Net Zero emissions targets.³

These issues threaten the bottom line across the supply chain. But we can mitigate our impact. When building material manufacturers reduce waste, for example, they help the environment and can see increased profits by using every last scrap of raw material.



Essential components of green construction

1. Focus on energy efficiency

Green building methods use less energy during construction and result in energy-efficient structures. Site alignment, building layout, insulation and even the colour of the exterior materials can all improve energy efficiency.

2. Reduce waste

With sound planning and on-site waste reduction directives, it's possible to generate almost no waste when building a new structure.

3. Use low-impact materials

Construction firms can use building materials that generate less waste during manufacturing to help cut a project's environmental footprint significantly. Many low-impact building materials are standard products (such as timber for framing), simply manufactured to tighter criteria.

4. Protect indoor air quality

Selecting materials carefully reduces waste and improves profit margins. Moreover, interior finishing materials that release little to no volatile organic compounds (VOCs) lead to healthier environments for the people who end up using the building.

5. Minimise site impact

Careful site placement and preparation can help reduce erosion and water damage to foundations. Smart siting can also reduce a building's eventual energy use by harnessing natural light, and passive heating and cooling opportunities. Saving trees on-site enriches the local environment and can keep buildings cooler thanks to shading. Biodiversity regulations are also coming into play – all new construction projects in the UK must have a 10% gain in biodiversity.⁴

6. Limit water use

Using green building techniques can minimise water waste and control excess water outside the building. Buildings account for a large share of global freshwater consumption (14% of all potable water consumed in the US⁵, for example). Small adjustments save drinking water for more important uses than flushing and washing.

What is driving change?

There's no doubt the push to Net Zero carbon emissions along with increasing national and European regulatory insistence are key drivers of the shift to sustainable practices in architecture, engineering and construction (AEC).

Global goals and local regulations

The [UN Sustainable Development Goals](#)⁶ and the accompanying circular economy business model have been flowing into regional and national goals, meaning sustainability is at the top of everyone's agenda.

The European Green Deal is also helping to drive sustainability across society. Under the Green Deal, Europe aims to be the first climate-neutral continent by 2050 and to have cut greenhouse gas emissions by 55% over 1990 levels.⁷

To help meet the building and renovation goals set out in the European Green Deal, the construction industry in Europe must follow the relevant energy directives⁸ and ensure all new buildings are Net Zero Energy Buildings (nZEB).

The UK and the Nordics go green

All new homes and non-domestic buildings must be zero-carbon ready by 2025 in the UK, where building information modelling (BIM), a key element of green construction, is mandatory on public projects.

The [Nordic Sustainable Construction](#) programme aims to establish the Nordics as a global leader in green construction by implementing an integrated approach covering life cycle assessment, circular business models, sustainable materials, emission-free sites and much more.

The Middle East and Africa embrace sustainability

In the Middle East, meanwhile, green building regulations are now mandatory in multiple countries, including Abu Dhabi and Qatar, and strongly recommended in others, such as Saudi Arabia and the UAE. Likewise, South Africa has obligatory energy efficiency regulations for all new buildings and, across the region, organisations such as the African Alliance for Sustainable Cities and Built Environments⁹ are pushing for green construction to become standard.

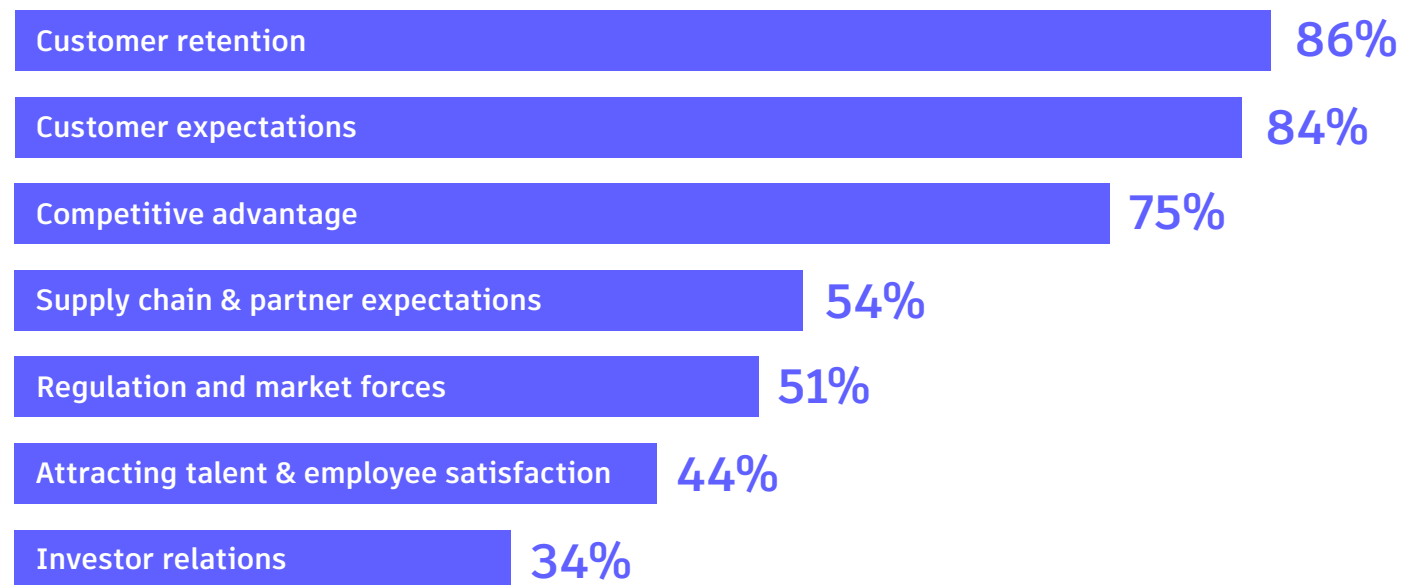


Customer needs and expectations

The drive for change isn't all about regulation, however. Our 2021 report with Frost & Sullivan, Digital Sustainability: The Path to Net Zero showed that across the Nordics, Benelux and UKI, the most powerful drivers of sustainable practices weren't just government regulations, but customer, partner and employee expectations.

Construction firms overwhelmingly recognise that clear sustainability credentials are critical when it comes to attracting and retaining new customers. Not only that, customer and partner needs and expectations rank above regulation and market forces.

Why companies* are embracing sustainability



*Companies with a corporate focus on sustainability in the Nordics, Benelux region and UK and Ireland¹⁰

Best practices for implementing green construction

Committing to green construction practices is the first step. To achieve good results and attract new clients, your firm needs to follow best practices for green construction, regardless of its size or the sector in which it operates.

1. Go green internally

Turn a critical eye on internal business practices, and seek to switch to paperless filing system, energy-efficient lighting and low-flow water fixtures, while maximising opportunities to reduce, reuse and recycle. When your business goes green, it shows your commitment to sustainability goes beyond lip service.

2. Keep up with local and global developments

Green construction practices can quickly go out of style, be replaced, or be proven ineffective. Keeping abreast of green construction techniques takes work, but it's vital to stay competitive.

Ensure one of your teams is responsible for tracking the latest developments and determining which are right for your company. If that's not practical, assign at least one member of each major department to assessing which construction innovations are right to embrace.

Not sure where to start? The [World Green Building Council](#) (WorldGBC), with its network of over 75 Green Building Councils across the world, is a good resource for local, regional and global green construction leadership.



3. Choose a rating system

Green building rating systems set internationally recognised standards for sustainability and environmental performance. If you're still expanding into green construction, seek to understand and meet the requirements of one rating system before moving on to another.

In Europe, [BREEAM](#) (the Building Research Establishment Environmental Assessment Method conceived in the UK) and [LEED](#) (Leadership in Energy and Environmental Design, designed by the US Green Building Council) are among the most popular and recognised rating systems.

Excellence in Design for Greater Efficiencies (EDGE), meanwhile, is a green building standard and certification system for emerging markets, used in over 100 countries. It was created by the International Finance Corporation (IFC), a member of the World Bank Group.

4. Invest in training

Embracing truly green construction methods can demand hundreds or even thousands of small adjustments to the building process. That means construction workers may need comprehensive training to become familiar with current techniques. Simply specifying new methods without training workers on them only leads to low adoption rates. All the design improvements in the world can't make a structure green if the people building don't believe green methods have value and don't follow the specifications.

Embracing construction innovation

Safe, efficient green building demands the use of the latest technology. Using 3D printing or design for manufacture and assembly (DFMA), for example, can be smart ways to construct prefab homes and other modular buildings.

On any construction project, a common data environment for shared project data not only means improved productivity, fewer errors, less rework, lower costs and less waste, but it also brings true transparency to the process.

“Using construction management software means we can make our environmental footprint transparent. This also allows us to convince our clients and partners to take sustainable steps too.”

–Thom Dirks, BIM Lead, Dura Vermeer

“We plan to power our buildings using sustainable energy methods so that we have an entirely circular energy system. We know we need to evolve from working with carbon and remove this from the building phase entirely too. Connecting our off-site manufacturing practices into our BIM models mean we can use technology to track, monitor and manage our sustainability plans on our projects”

–Koenraad Belsack, co-CEO and Founder of Upgrade Estate



Adopt BIM and Digital Twins

Building information modelling (BIM) is the holistic process of creating and managing information for any built asset. Twelve European countries already have a BIM mandate or active BIM programme for public sector projects, and 21 countries took part in the European Commission-funded EU BIM Task Group.

Meeting the highest green building standards

By connecting teams, data, and workflows at every stage of a project, BIM enables better project outcomes while helping to drive sustainability.

It not only allows design and construction teams to work more efficiently, but also enables them to capture the data that can ultimately be used for operations and maintenance.

Furthermore, digital twins replace physical prototypes, allowing for a less resource-intensive, more flexible approach to planning and design. Also used to monitor, measure and manage building processes, operations and maintenance, they help to maximise efficiency and optimise energy use.

Tools such as Autodesk Green Building Studio enable you to run building performance simulations to optimise energy efficiency and to work toward carbon neutrality earlier in the design process.

“Quality, cost and environmental impact are at the forefront of our minds on our projects. We can work much more collaboratively in an open and transparent way with building owners using construction management software. This means we’re always working in the most environmentally-friendly way that still allows us to deliver the best outcomes for our client and the end users of the buildings we deliver.”

–Hannes Ellert Reynisson, BIM Manager at EFLA

Aim for zero waste with lean construction

By reducing errors, minimising waste and increasing quality, lean and modern methods of construction can support sustainability, save money and deliver better outcomes for clients.

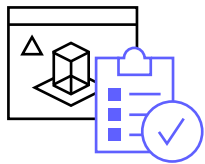
Nearly half of construction companies that participated in our Digital Sustainability research¹⁰ use collaborative, hands-on lean construction methods and most see its role growing in the future.

Make the most of a common data environment

Creating a more sustainable construction industry must start with data. After all, any construction project generates thousands if not millions of data points.

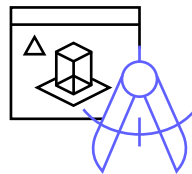
A common data environment¹¹ gives teams access to a single source of real-time information, streamlining design and construction, and making projects more efficient. It enables collaboration and helps to avoid errors and waste.

This digital project hub not only encompasses BIM data and workflows, but can also include anything from project contracts, schedule, change orders and more.



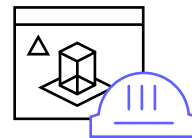
BIM Planning

Inform project planning by using real-world data to generate context models of the existing built and natural environment.



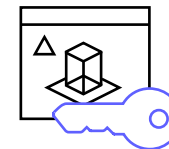
BIM Design

Understand how the building will look and function before construction starts. Perform conceptual design, analysis, detailing and documentation, and make changes as needed to improve sustainability. Start the preconstruction process using BIM data to inform scheduling and logistics.



BIM Building

Start construction using BIM specifications, including use of prefabrication and robotic tools as appropriate. Share the build logistics with suppliers, trades and contractors to ensure optimum timing and efficiency, and to reduce deliveries and waste.



BIM Operating

Make use of BIM data to maximise the success of the operations and maintenance of the finished buildings. Remember, BIM data can be used down the road for cost-effective renovation or efficient deconstruction too.



Understand and use alternative materials

Concrete and steel are the two biggest emitters in construction's carbon footprint. As an industry, we need to embrace more sustainable alternative materials. Engineered timber, for example, offers a carbon-negative option, while bamboo is being used for scaffolding in some regions.¹²

Meanwhile, it's also worth keeping abreast of innovations in materials science. The University of Manchester and Nationwide Engineering in the UK, for example, have developed a graphene-enhanced 'concretene', which means significantly less concrete is needed to achieve the same standard of structural performance.

Again, data has a crucial role to play when it comes to making informed decisions about the materials to use, including their potential for reuse down the line. With more than half of demolition materials going to landfill, we need to consider the end game at the outset.¹³

Consider prefabrication and DfMA

Our Digital Sustainability research found 53% of construction professionals believe prefabrication is the approach with the greatest potential to reduce the industry's carbon emissions.

Not only does offsite prefabrication mean virtually no waste and excellence in quality assurance, as components are made to exact specifications, it also enables precise planning keeps projects on schedule due to its predictable nature.

“Just this year at the Forge in Southwark, London, we've designed a building for it to be assembled as if out of a kit of parts. In doing that, we also happen to optimise and reduce the amount of materials we need. So for that building, we've shown a reduction of about 20% in embodied carbon compared to the same product being built traditionally.”

–Nils Rage, Sustainable Design and Innovation Manager, Landsec¹⁵

This has further positive knock-on effects as this carefully controlled production process leads to fewer construction teams working fewer shifts, ultimately helping to enhance on-site safety. Prefabrication in dry, clean environments also reduces risks and problems linked to moisture, dirt and other hazards.

Furthermore, the 4D integration BIM tools offer have increased the potential power of design for manufacture and assembly (DfMA), which is an engineering methodology focused on end-to-end simplification.¹⁴

The future of green construction

The future of green construction is that it becomes known simply as construction. As an industry, we can only seek to make sustainable building methods the default as we seek to safeguard the environment and the communities in which we work.

Of course, it's also how we can meet the skyrocketing demand from the public and private sectors for green buildings. In fact, the value of the global green construction market should top \$774 billion by 2030, meaning it will increase by close to 12% a year in the meantime.

By understanding the potential of emerging green construction technologies and approaches, your firm can be strategic as it plans its sustainable future.

“We must still optimise digitalisation of the execution phase of projects to increase the level of detail in our BIM models and make the construction cycle even more smooth.”

–Frédéric Gal
Director of Digital Project Management
Strategy, Bouygues Construction

Shifting the emphasis to whole-life emissions

When considering a large-scale project's emissions, it's time to think past handover. At the design stage, consider emissions over the lifetime of a built asset, taking into account every stage up to and including its eventual demolition.

“The construction of a building only accounts for 20% of its whole life costs. If you make it 20% more operationally efficient over its lifetime, you effectively get the building for free.”¹³

–Dale Sinclair
Director of Innovation, EMEA, AECOM



Increasing use of robotics and 3D printing

Robotics can hugely enhance the green credentials of any build. For example, it can reduce concrete consumption on-site by more than two-thirds, ultimately meaning fewer emissions. It can also help to reduce use of timber and other carbon-intensive materials, and help to reduce risk on-site.

Likewise, 3D printing is likely to become a more and more prominent approach to construction. Dubai, for example, plans to have a quarter of its state-built buildings 3D printed by 2025, and firms in many other countries, including the UK, the Netherlands, Italy, China and the US, are working to 3D print housing estates and bridges.¹⁷

Creating smart cities and integrated buildings

While cities have developed organically for thousands of years, we are entering the age of smart cities, designed and integrated to meet the needs of those who live and work in them.

Sensors in smart cities and buildings can detect and monitor everything from occupancy and traffic to air quality, infectious disease risk and many other metrics. AI-powered analysis of data enables city and facility managers to make more informed decisions in real time, ultimately helping to improve reliability, reduce costs and boost sustainability.

Not only that, but architects and planners can harness the data from existing buildings and urban areas as they plan future developments. Embracing big data will empower and streamline green construction in a myriad of ways over the coming decades.

For the construction industry, it's all about being ready and willing to meet the needs of smart city planners and building owners and operators.

Rising demand for renovation and retrofitting

Not only does renovating older buildings typically require less new material than new builds, but many older structures were also built with high-quality, climate-responsive materials.

While renovation projects were often seen as less profitable for construction firms in the past, increased budgets and public sector grants render them more appealing.

In 2020, the European Commission adopted a Renovation Wave¹⁸ strategy, which aims to provide funding and expertise to help double EU building renovation rates over 10 years, meaning 35 million buildings would be renovated this decade. The strategy is prioritising:

- the renovation of public buildings
- the decarbonisation of heating and cooling
- tackling energy poverty and the worst-performing buildings

Particularly for older buildings, plans can be incomplete, outdated or lack key detail on the structure as it stands today. Creating accurate digital plans, such as a data-rich BIM models, can enable owners to plan retrofits more effectively.¹⁷

Conclusion: The time for change is now

Construction is becoming green construction, in every country and in every sector. That means it's time for every construction firm to embrace it. As much of the world aims for net zero carbon emissions by 2050, we need to remember the assets we build today will still operate then.

As powerful construction technology and digital tools continue to grow and evolve, green construction will transform and thrive too. When we put data at the heart of every project, we find the call for sustainability is no longer a barrier but becomes an enabler of progress and profits.





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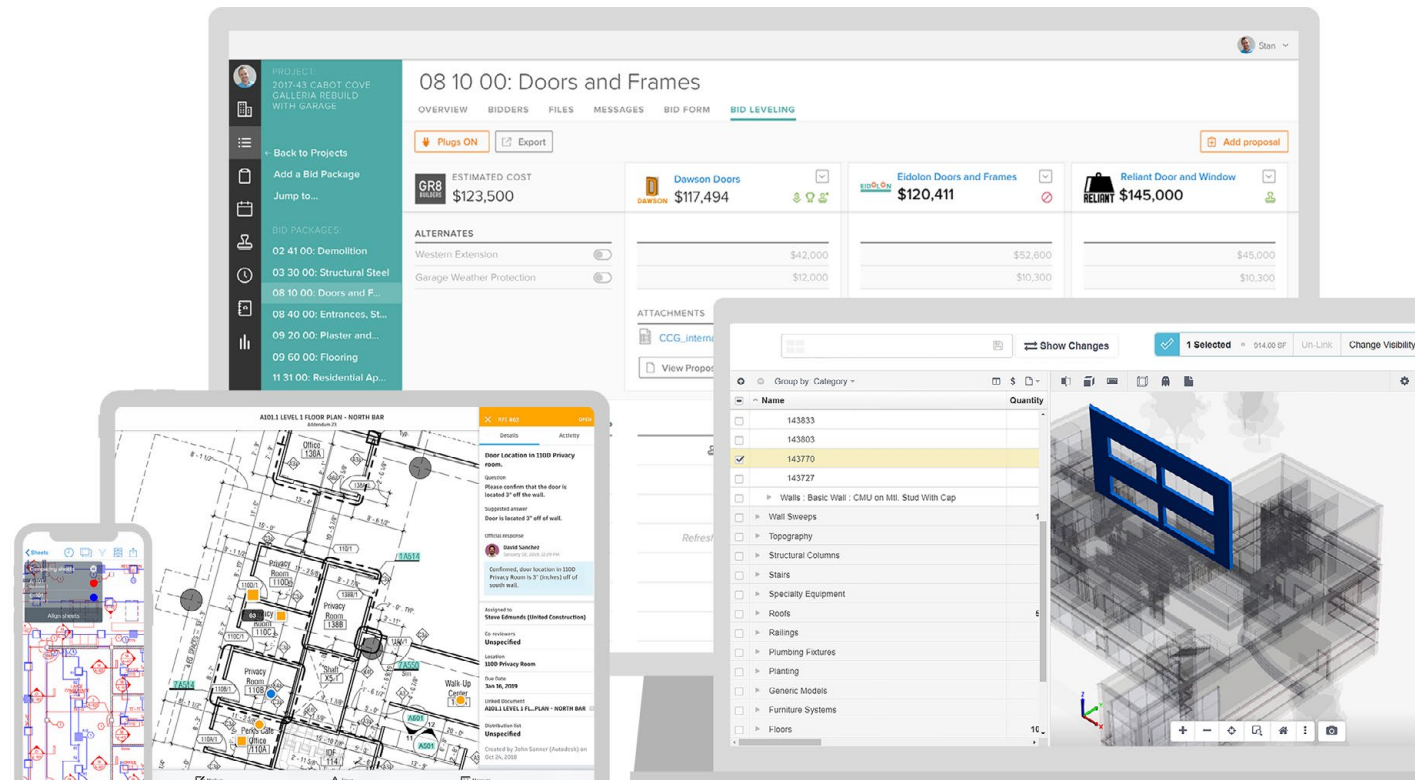
See the Future of Connected Construction

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Our industry requires solutions that connect their information, teams, and technology –breaking down data silos and disconnected processes that hinder true transformation. As we navigate the ever-present push to do more with less, we need to uncover new ways of working, enhance connected digital workflows, and incorporate advanced analytics. To support us on this journey of transformation, we must lean into tools that connect construction – from design to plan, build, handover, and operations.

Built on a unified platform and common data environment, Autodesk Construction Cloud is a powerful and complete portfolio of construction management products that empowers general contractors, specialty trades, designers and owners to drive better business outcomes. Autodesk Construction Cloud combines advanced technology, a unique builders network and predictive insights to connect teams, workflows and data across the entire building lifecycle.

While the industry experiences unprecedented transformation, our mission remains the same: to help construction teams meet the world's rapidly expanding building and infrastructure needs while making construction more predictable, safe, and sustainable. And we've remained steadfast in our promise to deliver the industry's most compelling solutions, connecting data, teams and workflows from the site. This is our commitment to connected construction.





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