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Building Toward Net Zero

Technology Solutions for Sustainability in the CRE Environment

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Executive Summary

The commercial real estate (CRE) sector is a significant contributor to global carbon emissions, making it crucial to implement sustainable practices. Buildings are a major source of greenhouse gas emissions, accounting for approximately 42% of global CO2 emissions.

A critical need exists for a holistic approach to decarbonization. Greater innovation and a wider adoption of new technologies are required to accelerate progress toward sustainability goals.

Digitalization can reduce existing buildings' carbon output, reducing the need to displace tenants or alter the façade and envelope.

Better methods and digital tools for planning can reduce waste and limit embodied carbon in new construction.

AI solutions can help property stakeholders leverage data-driven insights to improve green initiatives.

New technologies can overcome siloed operations to connect designers, engineers, suppliers, and construction teams for more holistic planning.

This white paper explores artificial intelligence solutions and targeted digital technologies that are emerging to help facilitate sustainability, improve collaboration across the building lifecycle, and create new opportunities within the CRE industry.

The Urgency of Sustainability in CRE

The global climate is becoming increasingly unstable. In 2024, the US saw unprecedented disasters fueled by climate change. Back-to-back hurricanes, tornado outbreaks, and wildfires destroyed entire communities.

Hurricane Helene alone caused an estimated **$30.5-$47.5 billion** in damages to residential and commercial properties across 16 states.

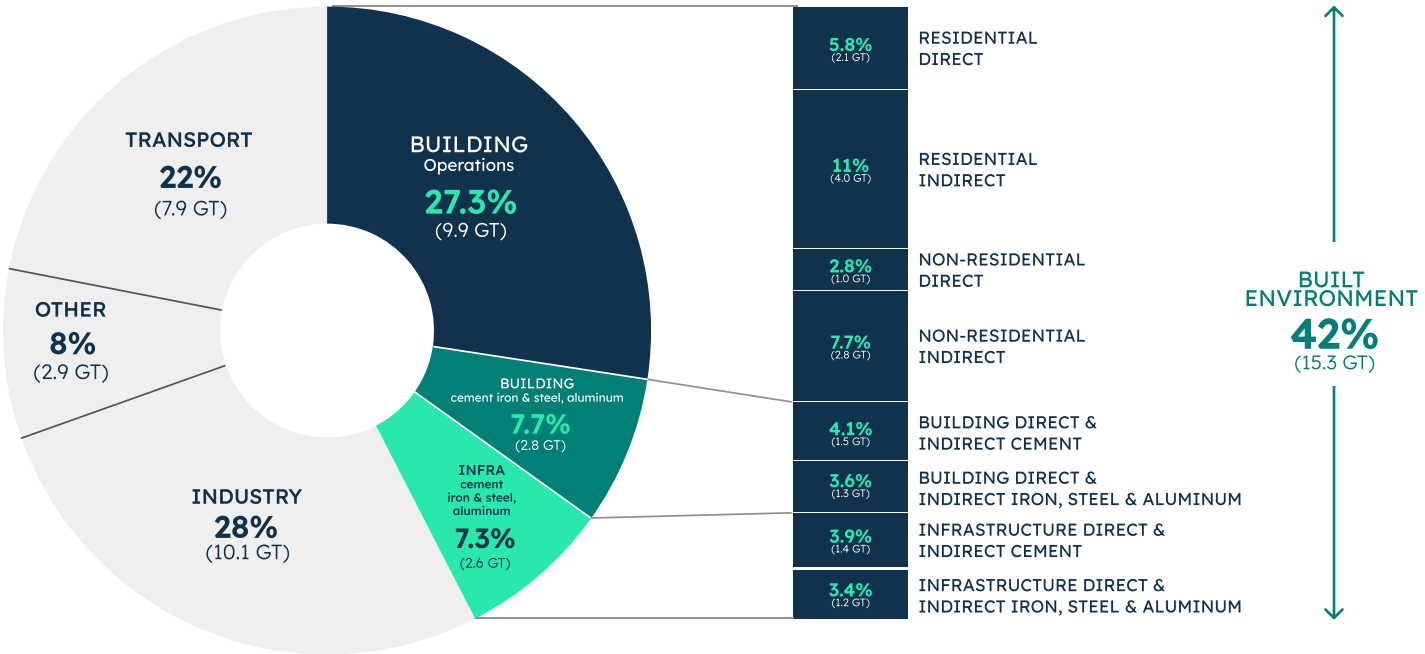
These disasters are the most visible impacts of climate instability. It also affects our **food security**, water supply, and air quality.

Scientific studies show that the global temperature increase must be limited to 1.5°C above pre-industrial levels to prevent the worsening impacts of climate change and preserve a livable planet. To achieve that, global greenhouse gas (GHG) emissions must fall **45%** by 2030 to reach net-zero targets by 2050.

The built environment (i.e., the buildings, water and electricity distribution systems, roads, bridges, and transportation systems) generates about **42%** of those CO2-related emissions, so it needs to be part of the solution. According to **McKinsey and Company**, the built environment accounts for 14.4 metric gigatons of CO2 emissions globally each year. Approximately 26% of all GHG emissions and 37% of combustion-related emissions come from construction and building operations.

TOTAL ANNUAL GLOBAL CO_2 EMISSIONS

Direct & Indirect Energy & Process Emissions (36.3 GT)

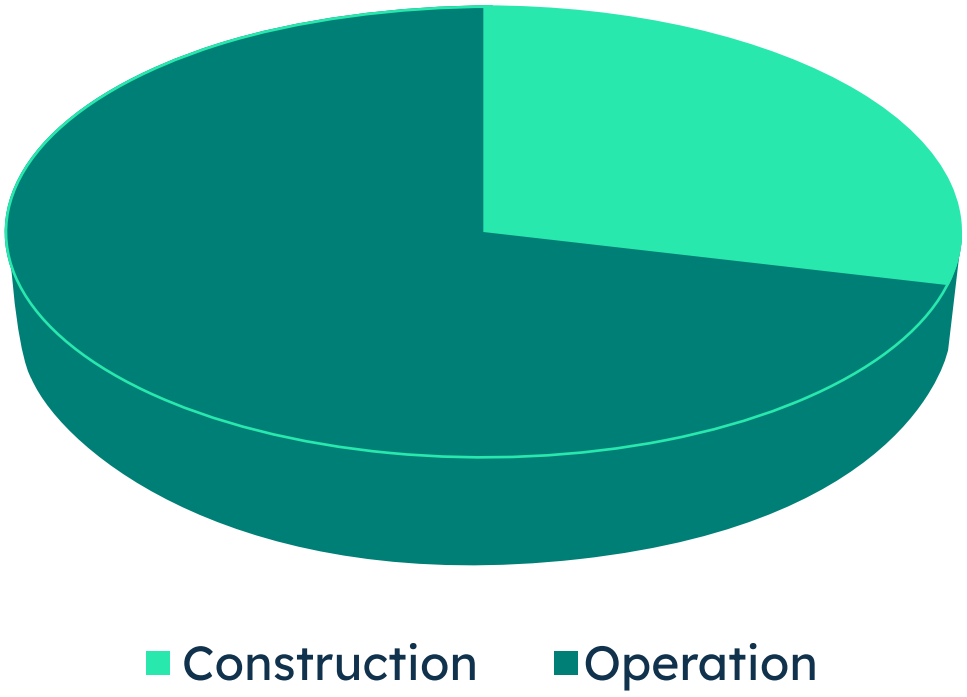


Analysis & Aggregation by Architecture 2030 using data sources from IEA & Statista.

When broken down into construction vs. operation, it's a 30-70 split. In other words, 30% comes from embodied carbon in the construction process—any CO2 created while manufacturing the building materials (extracting raw materials, transporting them to the manufacturer, and the manufacturing process), transporting those materials to the job site, and constructing a new building.

The larger 70% portion of carbon emissions comes from building operations. These emissions are caused by the fossil fuels used to power commercial buildings, the low rate of electrification, and inefficiencies in building operations, including energy use.

Sources of Embodied Carbon



Sustainable Design & Construction

To reach net-zero targets by 2050, the construction industry is exploring sustainable design and build practices aimed at reducing emissions across the entire building lifecycle.

Traditional design and construction methods are increasingly problematic. They fail to account for areas of growing concern, such as sustainability, carbon accounting, and the longer-term goals and ambitions of most organizations.

As the Architectural Engineering and Construction (AEC) industry adapts to new embodied carbon requirements, technology is helping builders meet their goals in reducing waste and designing for greater sustainability.

Reducing Waste

A 2018 Environmental Protection Agency (EPA) **study** found that construction and demolition (C&D) in the US generated 600 million tons of debris—more than twice the amount of municipal solid waste.

A great deal of C&D waste results from overbuying materials. As much as **30%** of all building materials delivered to a typical construction site can end up as waste. Although some of that waste is damaged or scrapped materials, much of it is due to overestimating in the planning stage.

KP Reddy, Founder and CEO of **Shadow Ventures,** believes this amount of waste doesn't make sense. Reddy is the author of *BIM for Building Owners and Developers,* the definitive guide to Building Information Management.

"When I started my investment firm about five years ago, there was this idea that 30% of a building ends up in the dumpster," he said in a recent **proptech panel discussion.** "That makes zero sense to anyone."

Reddy also disagrees that sustainability efforts and better construction pre-planning drive up costs. "Getting rid of waste in this system does not cost more," he said. "It actually saves you a lot of money."

Sara Neff, Head of Sustainability at **Lendlease Americas,** agreed. "We find that you can get about 30% of the embodied carbon out of your materials just by being a little smarter with how you procure."

Builders can reduce embodied carbon by 30% with smarter procurement practices.	**30%**

Resolving this challenge requires tools that allow building architects and designers to talk to the construction side of the fence. The industry is beginning to see innovations that are breaking down the silos that separate these two vital parts of the build process, but more progress needs to be made.

For example, building product manufacturers are pushing to be included in the design phase rather than just being handed a list of supplies once the planning is complete. This would help reduce overage waste, mitigate supply chain issues, and improve sustainability efforts.

Designing for Sustainability

Exposing designers to valuable data on specific product performance metrics and embodied carbon aspects can help them better understand how to reduce a building's carbon footprint.

"It's very hard right now for companies to design for embodied carbon," Neff said. Embodied carbon is typically measured by a lifecycle assessment (LCA) at the end of the job, which is way too late to affect any change. "Actually designing for embodied carbon—and ideally, holistically, so that if you make a bad design decision, you know that you're going to have to really make it up in the materials—that kind of synergy happens rarely."

The technology exists to help builders perform whole-building LCAs (WBLCAs), according to **Embodied Carbon Reduction in New Construction,** a reference guide published by the US Department of Energy.

"However, the largest gap in the knowledge infrastructure of embodied carbon is at the whole building level because of the lack of projects completing WBLCAs in the United States," the guide says. "Most available data are for single building case studies, which makes it challenging to establish benchmarks for whole building embodied carbon."

Technology Solutions for Design & Construction

Whether utilizing data to reduce waste or leveraging data from suppliers, engineers, and construction teams to improve building design, data-driven decision-making is central to improving sustainability.

“We’re working with startups to help create this data,” said Jonson Berman, VP of Investment at **Suffolk Technologies.** “People in the material supply chain have never produced this embodied carbon data before, but now it’s required. So, how do we make it easy for people to access that information? And when you’re starting to auctioneer on different options throughout the building lifecycle, what are the choices you can make?”

The Potential of AI

Reddy sees the promise in AI for crunching this data and making it visible. “Colin Powell said that, in making wartime decisions, you generally have about 30% of the data you need. By the time you get 70%, it’s too late. And I feel like that applies to how we think about the data around design planning. By the time we can get all the information together, concrete is being poured.”

He believes AI can change that. “With the advent of AI on the design side, you’re just seeing the ability to get better data faster. The best use case I’m seeing of AI is taking droves of unstructured data, structuring it, and getting great information out a lot earlier in the process.”

The CRE sector increasingly uses AI and machine learning to gather and utilize real-time data, including embodied carbon data, to optimize building design and performance. With the advent of smart technologies, accurate, real-time data can be gathered to address specific sustainability challenges in CRE.

One example is **Green Badger,** a construction software platform that automates sustainability and facilitates LEED compliance. Another is **Good.Lab**, which helps CRE businesses measure Scope 1, 2, and 3 greenhouse gas emissions.

Leveraging Historical Data

Performance improvements can only happen with access to quality data. A significant benefit of AI solutions for general contractors and engineering firms is that they analyze and pull actionable insights from unstructured pools of big data.

Accounting for embodied carbon is relatively new, which makes lifecycle assessments difficult to complete accurately. Leveraging data from previous projects will help make LCAs more accurate and allow teams to identify potential problems earlier in the planning stages.

“People want to compare [construction] to manufacturing,” Reddy said. “We’re more like the movie industry. We all kind of show up and we’ve maybe worked on another project together, but the minute we’re done with the project, we just leave all that IP, all that knowledge, all that experience right there at the project. And we go on to the next project and act like we’ve never built anything before all over again.”

Berman agrees that there's a critical need for a way to continuously capture and repurpose project information and use it for future process improvements. "Part of the reason each project is individualized and we don't have these compounded learnings is because the data is so hard to capture. It's very hard at the end of the project to close the loop."

New technologies and ways of leveraging and cleaning data are changing that. "We're finally in a position where we can really start to learn from our past projects and get better over time in a way that's been too intensive in the past to close that loop and gather that data and learn from it."

Leveraging Operational Data

A primary challenge in designing a building for performance is the communication gap between the design and operation phases. A building's designers might expect a certain level of efficiency that the finished building fails to reach.

"It's standard practice in Class A property across a number of property types to bake in a measurement and verification program into the software," said Neff. "You're coming back after six months and 12 months to see what's going on, because it's never operating like it's supposed to."

She said it's a reasonably mature process for reporting purposes, but few building designers ask for the data once their part of the project is finished. "In my 14 years doing this, I've had maybe three architects even ask if they could find out how the building was operating later. I don't think I've ever had an engineer ask."

Technology Solutions for Existing Buildings

According to the **World Economic Forum,** roughly 80% of existing buildings will still be in use in 2050. Therefore, the future of sustainable real estate lies less in optimizing new construction and more in successfully implementing sustainability initiatives in existing building stock and retrofitting assets.

“There’s a huge opportunity to start reducing the emissions of those buildings today,” said Mike Kazmierczak, CMO, Digital Energy Division of **Schneider Electric.** “Retrofitting existing builds allows us to reduce the operational carbon emissions while limiting the amount of embodied carbon because we’re not tearing down and constructing new. We need to start to prioritize that.”

Kazmierczak believes that using a digital-first approach to retrofitting is the best pathway to decarbonization. According to Schneider Electric’s research, transforming existing building stock into energy-efficient, fully electrified, digitized assets can significantly reduce carbon emissions without displacing a building’s tenants.

Digital Retrofits

Kazmierczak said that implementing modern, automated building management and power management systems can shrink energy consumption and increase building efficiency. “It helps reduce the building’s carbon emissions up to 42%, which is staggering.”

Building owners can drive efficiency even higher by leveraging electrification and onsite renewables like microgrids. “You can get up to about 77% of emissions reduction on an existing building,” he said.

Digital retrofits can reduce a building's carbon emissions by 42% to 77%.	**42% to 77%**

Digital retrofits also allow building owners to continue receiving revenue without disruption. Tenants often don't need to vacate while digital technologies are installed, and implementation is frequently completed in months.

Additionally, CRE stakeholders see a rapid return on investment from digital retrofits. "You're talking about a one to three-year return on investment for implementing building management or power management systems," Kazmierczak said. "Versus 20 to 25 years for a deep renovation that involves the shell and everything around it."

With the inclusion of AI, building management tools can deliver greater efficiency improvements and faster ROIs. For example, some technology employs machine learning to regulate a building's HVAC systems.

Digital Twins

Engineers likewise leverage AI to run scenarios and obtain better data for design decisions, especially for retrofitting and optimizing existing buildings. AI can autonomously conduct a comprehensive system audit by creating a digital replica or "twin" of the building.

Digital twin technology is transforming the approach to building design, construction, and management. It involves creating a virtual replica of a physical asset that reflects its current state, performance, and characteristics.

Digital twins hold significant potential for improving the performance and energy efficiency of new and retrofitted buildings. By combining data from sensors, building management systems (BMS), IoT devices, and other such sources, building operators can create accurate, real-time models of a facility.

These models can simulate different approaches to a retrofit, allowing the building's owners and stakeholders to see the potential impact on energy efficiency, performance, and occupant comfort.

Digital twins can be used to optimize building performance to specific requirements, leading to significant energy savings over the building's lifetime.

Digital Is Key to Net Zero

Achieving sustainability in the CRE sector requires a multifaceted approach. CRE stakeholders can accelerate their progress toward carbon reduction goals by leveraging digital technologies for sustainable design and construction, building retrofits, and waste reduction.

The future of the built environment depends on digital solutions to sustainability challenges. CRE stakeholders need to break down silos, allowing greater cross-team accessibility to data. It also requires buy-in and the integration of sustainable thinking at every stage of a project lifecycle.

Bringing these factors together will allow for the implementation of both innovative and practical digital strategies to reduce carbon emissions, improve building performance, and get us to our net-zero goals.

About Taazaa

Taazaa develops custom solutions for energy management, tenant management, facilities maintenance, and other proptech solutions for the commercial real estate industry. We follow design-based development practices that promote rapid delivery and a tailored fit to your business.

Leveraging the latest AI and software technologies, we can either augment your internal team or fulfill your complete development needs. We're agile. We're high-empathy and low-friction. And we make great software.

For more information about Taazaa, visit **Taazaa.com.**