CARBON CURE™

A Concrete Opportunity to Meet Tech Climate Goals

How one of the world's oldest industries can help one of the newest meet ambitious sustainability goals.

Introduction

The world emits around 50 billion tonnes of greenhouse gases each year. According to the Intergovernmental Panel on Climate Change (IPCC), these emissions must be halved by 2030 to keep the world on track to meet its climate goals of limiting global warming to 2.7°F (1.5°C) and avoiding the irreversible consequences of climate change.

The tech industry has an outsized ability to contribute to these climate goals. Although it is only responsible for 1.4% of the world's carbon emissions, the tech industry has significant sway in influencing the decisions of billions of consumers and voters through e-commerce, search, and social media.

The tech industry is perfectly positioned to lead the charge on climate change, given the large role it plays in the global economy, politics, and culture. Many tech players have already stepped up to the challenge, making zero-carbon commitments, investing in clean tech startups, and pushing for the use of data to encourage greater energy efficiency.

Amazon, Microsoft, Shopify, and Stripe are just some of the many tech giants that have made tangible commitments to not only reduce carbon and emissions along their supply chain, but also remove them from the atmosphere.

Since tech companies played a leading role in investing in and adopting renewable energy, many have already tackled their operational emissions and are now looking at reducing and removing sources of embodied carbon.

Embodied carbon is distinct from operational carbon (CO_2 generated from heating, cooling, lighting) as it is the CO_2 emissions associated with materials, manufacturing, and construction processes throughout the whole lifecycle of a product, building, or infrastructure.

One significant way to reduce embodied carbon in the tech sector is to examine the practices and materials used to construct the buildings that support the industry: data centers, technology campuses, and e-commerce fulfillment centers. With the world embracing digital habits in all areas of life, more and more of these buildings are required to keep up with the tech industry's seemingly endless growth trajectory.

Concrete is the perfect material for the construction of these buildings as it doesn't rust or rot and it's resistant to fire, wind, water, and earthquakes. Concrete also has incredible potential for carbon reduction.

This ebook explores how one of the world's oldest industries can help one of the newest ones move the needle on climate change.

The Race to Net-Zero

The atmospheric concentration of CO_2 reached about 410 parts per million (ppm) in 2020. To meet climate goals, the world needs to stabilize at around 350 ppm. Since there is already too much CO_2 in the atmosphere, we don't just have to reduce emissions—we also have to pull some CO_2 out of the atmosphere with so-called "negative emissions" in order to reach net-zero.

In other words, halting climate change will require human-created emissions of CO_2 to fall by 45% from 2010 levels by 2030 and reach 'net-zero' by 2050. According to the IPCC, this will require "rapid, far-reaching, and unprecedented changes in all aspects of our society" including land, energy, industry, buildings, transport, and cities.

The bottom line is that industries, governments, and individuals must drastically change the way they operate in order to have any hope of avoiding a number of severe climate change impacts including sea level rise, coral reef decline, shrinking ice caps, and extreme weather events.

In the same way that tech investment in—and adoption of—renewable energy sources like wind and solar led to a record surge in renewable energy usage globally, tech's investment in climate change will create momentum in all industries and government policy will evolve in parallel.

The tech industry is setting the pace in the race to net-zero.

The Role of Tech in Reaching net-zero

The tech industry's role in achieving net-zero emissions is fourfold:

1. Leading investment in clean tech innovation
2. Removing CO_2 emissions either directly or through carbon offset credits
3. Reducing operational carbon emissions
4. Reducing embodied emissions across its supply chains

Image courtesy of: GeekWire

1. Investment in Clean Tech

Tech firms have been leading investors into energy startups since 2016, according to the International Energy Agency. Since then, the industry has invested billions in clean tech innovation, particularly in the area of carbon dioxide removal.

For example, Breakthrough Energy Ventures—founded by Bill Gates in 2015—aims to accelerate innovation in sustainable energy and other clean tech and invests in a variety of startup companies that are attempting to commercialize new concepts such as nuclear fusion, large-capacity batteries to store renewable energy, concrete that mineralizes recycled CO_2, and microbe-generated biofuels.

Similarly, Amazon established The Climate Pledge Fund, which supports the development of sustainable and decarbonizing technologies and services. The investment program launched in June 2020 with an initial USD $2 billion in funding and invests in visionary companies whose products and solutions will facilitate the transition to a low-carbon economy and help preserve the natural world. As of February 2021, 53 companies including IBM, Microsoft, Uber, Verizon, and Infosys had joined Amazon's Climate Pledge.

There is a range of other venture capital funds solely focused on clean tech including CleanTech Capital and Asia Cleantech Capital. CleanTech Capital is based in Germany but operates across Europe, North America, and South America where it invests in renewable energy, energy efficiency, energy storage, water, transport, smart cities, and infrastructure. Asia Cleantech Capital is based in Singapore and has raised S$50 million for its portfolio companies from institutional investors since 2007.

These companies must be laser-focused on delivering meaningful climate benefits—but they must also be commercially viable. The startups that receive funding from Breakthrough Energy Ventures, for example, must be able to scale up to cut at least 500 million metric tonnes of annual CO_2 emissions—that's about 1% of global emissions.

2. Purchasing Carbon Offsets

Many tech companies have made commitments to get to net-zero. This means a company actually removes as much carbon as it emits. The reason the phrase is “net-zero” and not simply “zero” is that there are still carbon emissions, but these are offset by carbon removal.

Companies that can’t physically remove carbon from their own operations will purchase carbon offsets instead. Carbon offsetting involves the reduction or removal of emissions by one party which can be sold to another party who is unable to reduce or remove enough of their own emissions. The tradable assets are known as carbon credits.

Voluntary carbon offsets have seen a surge of interest from companies across industries and geographies over the past few years as companies like Microsoft, Amazon, Stripe, and Shopify place carbon reduction and carbon removal at the center of their climate strategies.

The cost of carbon credits are rising with demand. In Europe, home to the world’s largest emissions-trading system, prices have increased by 60% from November 2020 to February 2021 when they hit a record high of nearly €40 (USD $49) per tonne of carbon dioxide equivalent.

This bodes well for clean tech and other companies that can reduce or remove significant emissions from the atmosphere to partake in carbon credit marketplaces.

3. Reducing Operational Emissions

The tech industry has already made significant improvements in operational emissions reductions and is striving for more.

Across the entire sector—including the data centers that store and compute data, the transmission networks that transfer data, and the connected computers and smartphones that exchange information—tech accounts for about 4% of all global electricity consumption. Data centers' share of total energy consumption is growing significantly as the world continues to create more and more data.

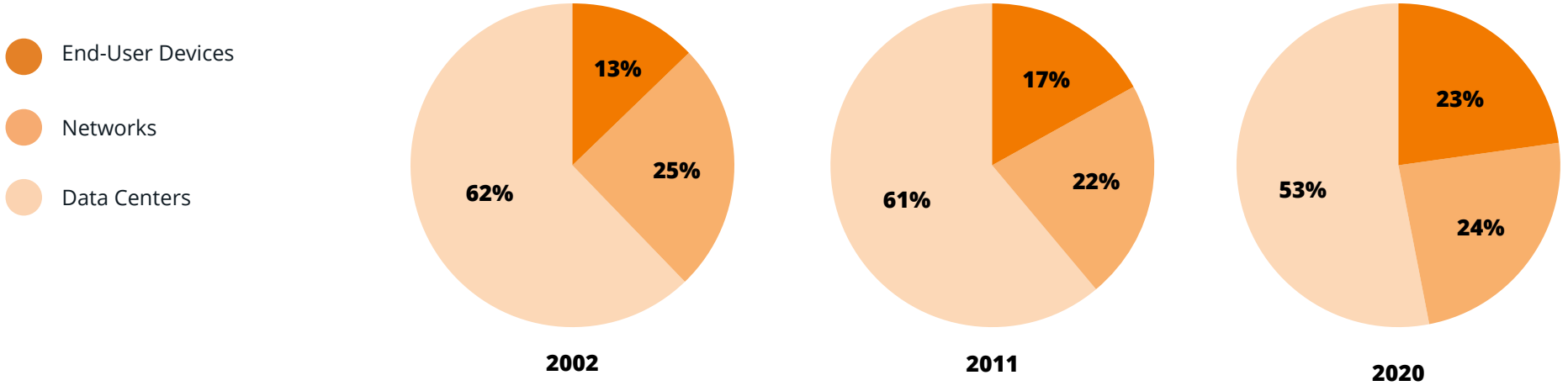
However, most tech companies are champions of renewable energy:

Cisco achieved 100% renewable energy for its U.S. operations this fiscal year.

Amazon is on track to power its operations with 100% renewable energy by 2025 and was the biggest corporate buyer of renewable energy in 2020.

Google pledged to run all its data centers and corporate campuses on 100% carbon-free power by 2030. It also launched a new carbon-intelligent computing platform, which optimizes the scheduling of compute tasks to run when low-carbon power sources, like wind and solar, are most plentiful.

Since most tech companies have already reduced—or have plans to reduce—operational CO_2 emissions sufficiently to meet sustainability goals, the industry is turning its focus to embodied carbon.

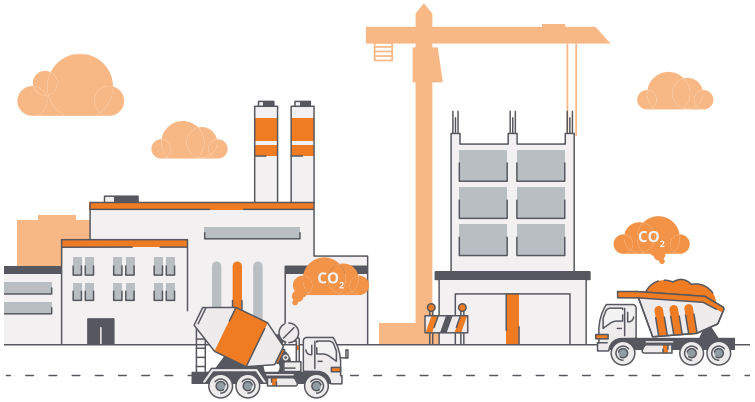


4. Reducing Embodied Emissions

Embodied carbon is the CO_2 emissions associated with materials, manufacturing, and construction processes throughout the whole lifecycle of a product, building, or infrastructure.

In construction, for example, it includes any CO_2 created during the manufacturing of building materials (material extraction, transport to manufacturer, manufacturing), the transport of those materials to the job site, and the construction practices used. Put simply, embodied carbon is the carbon footprint of a building or infrastructure project before it becomes operational.

To address embodied carbon in the buildings that keep tech companies in business, tech project managers are specifying sustainable materials in building projects.



Embodied Carbon
The emissions from manufacturing, transportation, and installation of building materials through to the construction of the building.

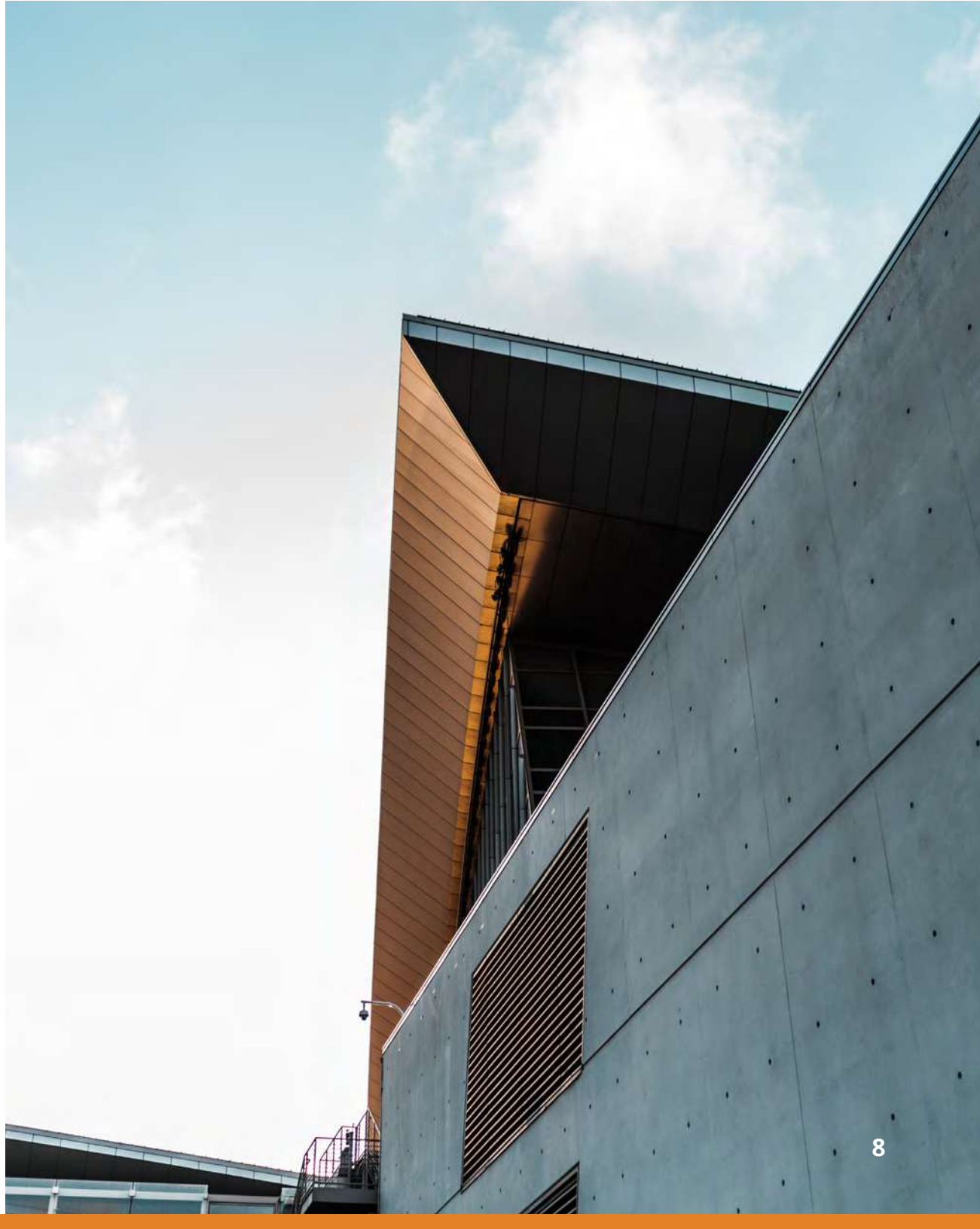
The Concrete Opportunity in Tech

Concrete is one of the world's oldest industries. Dating back to 6500BC, its earliest use was recorded in structures in Syria and Jordan.

Concrete shapes the built environment around us—from schools, hospitals, and housing to roads, bridges, and tunnels. In the tech industry, concrete houses expensive data centers, creates state-of-the-art tech campuses, and effective e-commerce fulfillment and distribution centers. Concrete's prevalence is a testament to its efficacy. Concrete is simply the most resilient building material in the world.

Because of its ubiquity, cement—the key ingredient that gives concrete its strength—is one of the largest emitters of CO_2 in the built environment and represents the largest opportunity for embodied carbon reduction by tech construction project owners.

In this way, one of the world's oldest industries can help the world's most cutting-edge industry to modernize its construction processes and contribute to strategic sustainability mandates.



The Green Distribution Center Opportunity

According to McKinsey and Co., the U.S. e-commerce industry experienced 10 years of growth in just three months from March to June 2020 due to the changing consumer behavior created by the global pandemic. This surge in e-commerce created a 51% increase in large fulfillment and distribution center demand.

CNBC Retail said in July 2020 that the "U.S. may need another 1 billion square feet (92,903 square metres) of warehouse space by 2025 as e-commerce booms." Similarly, according to the Australian Construction Industry Forum, the pandemic "has accelerated surging e-commerce and supply chains are being reconfigured and rebuilt."

With more new distribution center construction on the horizon, there is a great opportunity for tech companies to choose low-carbon concrete and contribute to their embodied carbon reduction goals.

Sunbeam Development Corporation recently constructed a new distribution center using low-carbon concrete to meet its sustainability goals. In total, 507,500 pounds (230,198 kilograms) of CO_2 were saved from both the sequestration of recycled CO_2 into the concrete and the reduction of carbon-intensive cement in the concrete mix. This is equivalent to 301 acres (122 hectares) of U.S. forest absorbing CO_2 for a year.

The Green Tech Campus Opportunity

Tech campuses like the Salesforce Tower and Googleplex are architectural wonders in their own right. The development of new campuses offer a great opportunity for low carbon construction.

LinkedIn began its low embodied carbon concrete journey at the LinkedIn Middlefield Campus in Mountain View, California. In a recent webinar, LinkedIn's Senior Manager of Design Build Workplace, Jennifer Mitchell shared her experience working on a project where sustainability was an uncompromisable requirement.

LinkedIn's Jennifer Mitchell at the LinkedIn Middlefield Campus construction site, which achieved significant embodied carbon reductions via concrete mix design strategies.

As part of LinkedIn's Carbon Negative commitment, the company is investing in carbon removal and innovation. Through clever design, performance-based specifications, and great partnerships with the architects, engineers, general contractors, and concrete producers, the project saved 4.8 million pounds (2.2 million kilograms) of CO_2 through innovation in concrete mix design.

The Green Data Center Opportunity

According to a 2020 IDC study, the world will create more data over the next three years than it created over the past 30 years. That means more and more data centers are required to meet the insatiable demand for data.

New data center designers are striving to minimize the embodied carbon footprint of new buildings by using low-carbon building materials. One of the simplest ways to make an impact on the embodied carbon in a new building is to use low-carbon concrete.

In a recent webinar, Compass Datacenters' Chief Innovation Officer, Nancy Novak said, "For us, concrete is the most resilient, safest, and fastest way to erect the facilities that our clients desperately need in order to keep expanding...we love the fact that we can be dried in a month [to deliver] six megawatts worth of space."

> "Concrete is the most resilient, safest, and fastest way to erect the facilities that our clients desperately need in order to keep expanding."
>
> *Nancy Novak,*
> *Chief Innovation Officer, Compass Datacenters*

There's another reason tech companies favor concrete as a building material: its low-carbon innovation potential. Compass Datacenters builds the construction and technology infrastructure to serve its market of data-hungry tech clients—clients that have very ambitious sustainability goals. All their suppliers today must be able to meet their requirements for low-carbon concrete.

"The exciting part for us now is making concrete a more environmentally-friendly product to go along with all of its other benefits," said Nancy. To date, Compass has saved an average of 1,800 tonnes of CO_2 per campus, which is equal to 2,100 acres (850 hectares) of U.S. forest absorbing CO_2 for a year.

Data center locations worldwide according to Datacenters World Map.

Key Takeaways

Tech giants like Amazon and Apple disrupt entire industries and influence the decisions of four billion consumers every day. If they turn their focus to tackling embodied carbon in a meaningful way, other tech companies, industries, and consumers will follow suit.

Here are two small changes they could make to make a difference:

1. Consider Embodied Carbon in Tech Construction Design

With tech's increased focus on carbon neutrality and carbon negativity, low-carbon concrete offers an excellent opportunity to significantly reduce the embodied carbon in new tech construction projects like data centers, e-commerce fulfillment centers, and tech campuses.

Partner with contractors and concrete producers to discover ways to integrate sustainable solutions into new building projects. A partnership approach from the design stage will result in more sustainable, performance-based material specifications.

> "I think project owners have a huge responsibility here. They also have a great opportunity to help drive the change that the industry needs. We want to stop talking about the problem of cement. The industry is really doing a great job developing solutions to address that. Once people fully understand it, we can stop talking about concrete as the problem and start talking about concrete as the solution."

Jennifer Mitchell,
Senior Manager of Design Build Workplace, LinkedIn

2. Use Performance-Based Specs on New Tech Construction Projects

Push for performance-based specifications so to allow for the implementation of innovative new technologies that will help meet sustainability goals.

Prescriptive specifications hinder innovation as they include clauses for methods of construction and impose restrictions on the compositional parameters of concrete mix and may entirely disallow certain ingredients that can help improve sustainability.

Performance specifications, on the other hand, are based on performance indicators like strength, permeability, shrinkage, sulfate resistance, resistance to alkali silica reaction, etc. These indicators are measured by standard test methods with defined acceptance criteria.

Compass Datacenters exclusively uses performance specs for its projects. "I've always wondered why we have prescriptive specs...I thought it was a kind of a lazy way of designing concrete to assure you're going to get a certain amount of strength, but it was wasteful because it required way more cement than was really needed. Performance specs allows the suppliers to fine tune mix designs to get the desired strengths while also meeting sustainability goals," said Nancy.

Similarly, LinkedIn partnered from the pre-construction stage with the AEC team to set the priorities for the project rather than the project team following old standard specifications.

The tech industry disrupts the status quo—and it can—and should—disrupt prescriptive specification practices in its construction projects.

About CarbonCure

Architects, structural engineers, owners, and developers are seeking proven ways to reduce the embodied carbon of their building projects. Recognizing concrete as a solution, CarbonCure Technologies, a fast-growing, clean tech company, has developed an easy-to-adopt carbon removal technology that enables concrete producers to use captured CO_2 to produce reliable, low-carbon concrete mixes and achieve market differentiation.

CarbonCure's Technology: A Closer Look

CarbonCure offers a concrete solution to reducing embodied carbon. CarbonCure's technology works by injecting recycled carbon dioxide (CO_2) into fresh concrete during mixing.

Once injected, the CO_2 undergoes a chemical reaction known as CO_2 mineralization, where the CO_2 converts into a nano-sized mineral. What was once CO_2 is now eliminated, never to be re-released into the atmosphere.

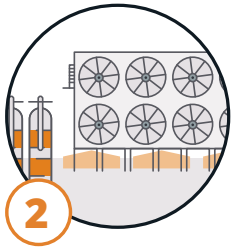
Mineralized CO_2 improves the concrete's compressive strength, which then enables the reduction of cement content in mix designs without impacting strength or performance.

Every cubic metre of concrete produced with CarbonCure's technology saves an average of 25 pounds (15 kilograms) of CO_2 emissions from entering the atmosphere, and provides a 4-6% reduction to Global Warming Potential.

An average building built with CO_2 mineralized concrete would save approximately 1.5 million pounds (680,000 kilograms) of embodied carbon, which is equivalent to the carbon absorbed by 888 acres (360 hectares) of U.S. forest in a year!

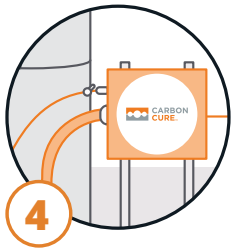
How it Works

CarbonCure's technology is retrofitted to an existing concrete plant in one visit.



Carbon dioxide (CO_2) gas is sourced as a by-product from industrial processes.

The purified CO_2 gas is delivered in pressurized vessels by commercial gas suppliers.



CarbonCure's proprietary delivery system precisely injects the CO_2 into the concrete mix.

Batching is controlled by a simple interface integrated with the batch computer.

Once injected, the CO_2 converts into a nano-sized mineral that becomes permanently embedded in the concrete.

CARBON CURE

Build for the Future.
Build with CarbonCure.

CarbonCure has been used on thousands of projects ranging from healthcare to higher education, home developments, and corporate campuses.

For more information about building with CarbonCure concrete, visit **carboncure.com** or please contact a CarbonCure representative at the toll-free number **+1 (844) 407-0032** (North America) or send us an email at **info@carboncure.com**.