

Digital Twins Could Help CRE Reduce Emissions In A Big Way – But First, The Technology Needs To Become More Accessible

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The push for greener, more sustainable buildings (<https://www.bisnow.com/tags/sustainable-buildings>) and cities has been around for years, but that enthusiasm does not appear to have made a dent in global carbon emissions (<https://www.bisnow.com/tags/carbon-emissions>).

Energy agencies agree that residential and commercial real estate account for about 40% of global energy consumption (<https://www.bisnow.com/tags/energy-consumption>) and emissions. Advocates of digital twin (<https://www.bisnow.com/tags/digital-twin>) technology say that by increasing the efficiency of the built environment through real-time, comprehensive monitoring, that number could come down.

New flagship office towers and corporate HQs are more likely to take advantage of the efficiencies that could be achieved using a digital twin. But the greater challenge is posed by the sheer volume of aging building stock, which requires significant and costly repositioning to be able to achieve the same efficiencies.

“If you're doing it with an older building, this could be a far more costly undertaking,” Massachusetts Institute of Technology (<https://www.bisnow.com/tags/massachusetts-institute-of-technology>) Real Estate Innovation Lab Lead Researcher James Scott told *Bisnow*.

“That's why the rollout of this isn't going to happen as quickly as people would hope for.”



Climate change is back in the spotlight now that President Joe Biden has taken the helm. One of Biden's very first executive orders was to rejoin the Paris Agreement (<https://www.bisnow.com/national/news/economy/how-bidens-first-executive-orders-will-impact-cre-107445>), where participating countries must commit to reducing their greenhouse emissions.

That could increase demand for digital twin technology, which was already being met with a fair amount of enthusiasm (<https://www.bisnow.com/houston/news/technology/one-is-a-lonely-number-is-it-time-to-get-your-building-a-digital-twin-104742>), and investors are starting to put their money where their mouths are. The global digital twin market size was valued at \$3.1B in 2020, and it is projected to reach \$48.2B by 2026, according to Markets and Markets (https://www.marketsandmarkets.com/Market-Reports/digital-twin-market-225269522.html?gclid=CjwKCAjw5vz2BRAtEiwAbcVIL5TxGwZEoYA4kh6vI5yV_LGlcegnGaoJDTa6dBUi3Jcj7ndkNP89RBoChg8Q)

Digital twins have all sorts of applications. In commercial real estate, a digital twin is a virtual replica of a building and is connected to real-time data flowing from sensors, meters and systems throughout the property, tracking metrics like air quality, temperature and electricity usage.

Building owners and operators are most likely to consider using a digital twin for long-term cost savings. The technology makes it easier to maintain an asset, improve overall performance and reduce unnecessary use of energy and water. In particular, by using less energy, buildings can reduce their carbon footprint.

The positive environmental outcomes of using digital twins have also become a popular selling point for the growing number of companies that offer the technology.

Buildings and construction together accounted for 36% of global energy use and 39% of energy-related carbon dioxide emissions when upstream power generation is included, according to a joint report (https://www.worldgbc.org/sites/default/files/UNEP%20188_GABC_en%20%28web%29.pdf) published by the International Energy Agency (<https://www.bisnow.com/tags/international-energy-agency>) and the Global Alliance for Buildings and Construction in 2017.

In the U.S., the residential and commercial real estate sectors accounted for a combined 39% of total energy consumption (<https://www.eia.gov/tools/faqs/faq.php?id=86&t=1>) in 2019, according to the U.S. Energy Information Administration.

So far, the adoption of digital twin technology in commercial buildings has been slow, owing to its relatively new development and high price point. Annual subscriptions can cost tens of thousands of dollars, and that's not including the expense of installing sensors and upgrading connectivity (<https://www.bisnow.com/tags/connectivity>) to feed data to the digital twin software.

That expense can be a particularly tough pill to swallow for the owners and operators of older building stock. More than half of U.S. commercial buildings were built between 1960 and 1999, while only 25% have been built since 2000, according to the EIA's most recent Commercial Building Energy Consumption Survey (<https://www.eia.gov/consumption/commercial/>), which was conducted in 2018.

“When investors acquire a building, it is usually based on a 10- to 12-year time frame, and they build into it a certain amount of capital expenditure,” Scott said. “The retrofitting or the renovation costs of a building with the new hardware and new sensors that will be required to create a digital twin are probably not costs that will have been taken into account when an original investment is made.”

To Scott, the adoption of digital twins within the next two years is more likely to occur at large CRE firms, such as REITs. But for the majority of U.S. real estate stock, the time frame will be much longer, as owners will need the technology to come down to a manageable price point and will need time to reposition their buildings and install complex hardware.

The pandemic could prompt some companies to adopt digital twins more quickly, according to Deloitte Consulting (<https://www.bisnow.com/tags/deloitte-consulting>) Managing Director John D'Angelo, who leads the firm's U.S. real estate offerings.

D'Angelo said he anticipates that occupants of all kinds of commercial buildings are going to demand evidence that those buildings are safe. To that end, the ability to monitor air quality and other factors in real time will be extremely valuable.

“I suspect that we're going to look back on this time as a period of big disruption, or much more traction in understanding what digital twins are, and applying them,” D’Angelo said.

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Because of their complexity, digital twins are most commonly used at the building level. However, if adopted on a district or city-level scale, the efficiencies and environmental outcomes could be much greater.

Chicago-based software company Cityzenith (<https://www.bisnow.com/tags/cityzenith>) launched its global “Clean Cities – Clean Future” campaign (<https://www.prnewswire.com/news-releases/digital-twin-technology-leader-cityzenith-pledges-to-reverse-carbon-emissions-in-our-most-polluted-cities-301138524.html>) in September, where it started offering the platform to cities for free, with the goal of helping them become carbon neutral (<https://www.bisnow.com/tags/carbon-neutral>).

In theory, a participating city would become a high-level steward of the digital twin platform, while individual building owners would become paying customers in order to achieve their net-zero carbon goals. CEO Michael Jansen said that in this way, cities could monitor performance but would not have to pay for it.

“There's no other money in American cities for good technology. They get what they need, max, and that's it, because they're firing police officers and teachers,” Jansen said.

The firm has been overwhelmed with interest since the launch of the campaign, Jansen said. Cityzenith is in the process of evaluating more than 50 proposals that have been submitted, and Jansen said the company has already identified one project that will move forward. There’s also the potential for the program to expand into the world of carbon offsets and carbon credits, which can be commercially traded.

“I can't say right now that this is been widely adopted, because it's at the pilot phase. 'Clean Cities – Clean Future' is a test project. It's an exploration that will see 10 cities come together to create the beginning of a carbon trading platform, based upon commercial real estate,” Jansen said.

Cityzenith's goals may seem lofty, but digital twin technology has been successfully rolled out on a large scale before, with significant environmental outcomes. Several of the more well-publicized examples have occurred in Asia or Europe, where fast-moving innovation in commercial real estate is more common, according to Scott.

"The implementation of this technology will most likely take place in Asia first. The real estate industry in the U.S. market tends to require a proof of concept and is generally a second mover when it comes to the application of new technologies," Scott said.

In terms of digital twins delivering measurable environmental and cost improvements on a large scale, Scott pointed to Nanyang Technological University's 250-hectare flagship Ecocampus (<https://www.iesve.com/ntu-singapore>) in Singapore as one of the best examples.

NTU used digital twin technology from UK-based software company Integrated Environmental Solutions to model, simulate and analyze systems and buildings across the campus.

Phase 1 of the project, which created a master plan model of the campus and involved simulations, found an energy savings potential of 10%, 8.2 kilotons in carbon savings and SGD \$3.9M (USD \$2.9M) in cost savings. Phase 2 modeling and simulations built on the findings of the first phase, and found 31% in energy savings potential, SGD \$4.7M (USD \$3.5M) in cost savings, and 9.6 kilotons in carbon savings.

The results highlight the potential impact digital twin technology could have on global carbon emissions – if it can be rolled out on a large scale, and at an accessible price.

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There are holdbacks beyond the price point. Scott said that in some cases, digital twin technology may not be quite as advanced as providers claim. The success of digital twins in the future will also depend on the speed of the rollout of 5G (<https://www.bisnow.com/tags/5g>), which allows for more devices and sensors to connect to the network at a faster speed.

The widespread adoption of digital twins, especially in the U.S., could be hindered by public pushback over concerns about privacy or property rights, Scott added.

Despite the challenges, D'Angelo said Deloitte has seen an uptick in interest from clients about implementing the technology, especially in light of good examples of case studies like NTU in Singapore.

“The case studies that are out there, it's not like there are hundreds of them. But there's some really good ones,” D'Angelo said.

For some real estate investors, it will come down to keeping an asset relevant and competitive in the marketplace. And there are clear financial and environmental benefits to using digital twins.

“Whatever your reasoning is, be it for an environmental purpose, or be it for an economic purpose, or a cost-saving initiative — this technology makes sense. You're going to have to get it, and you're going to need to get it,” Scott said. “But it's the time frame of when this technology is going to be available to you, and when it is at a price that makes sense for your organization to implement it.”

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See Also: 'A Sobering Picture Of Stagnation': CREW Finds Gender Wage Gap Is Much Worse Than 2015 (</national/news/commercial-real-estate/a-sobering-picture-of-stagnation-women-are-earning-even-less-than-men-in-2020-remain-underrepresented-in-cre-study-finds-105813>)

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