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Building Better Buildings

Homes and offices have huge climate footprints. There are many ways to fix that.

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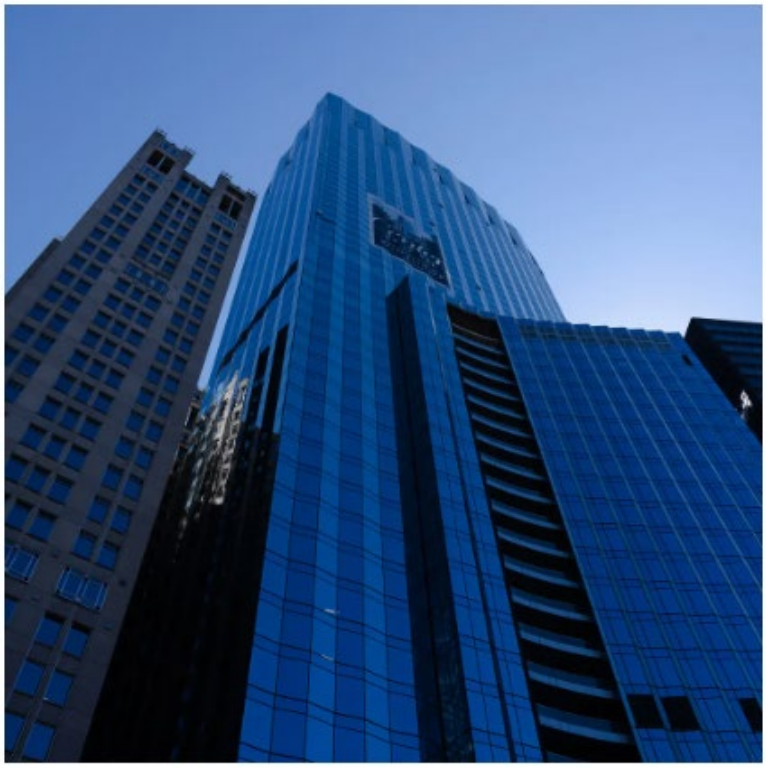

The Winthrop Center under construction in Boston. Sophie Park for The New York Times

Here's something we know we have to fix, and we mostly know how to fix it.

I'm talking about the buildings in which we live and work. They play a big role in heating the planet. In some cities, they're the biggest single source of planet-warming greenhouse gas emissions.

New laws in a handful of cities, including mine, New York, now compel building owners to reduce those emissions or face fines. The European Union recently enacted a law that requires all buildings to be zero-emissions by the middle of the century.

I wanted to learn more about all this. So I reached out to John E. Fernandez, an architect and professor at the Massachusetts Institute of Technology.

Airtight equals efficiency

Not long ago, I went to see an office building under construction in downtown Boston. On what was once a city-owned parking lot, Millennium Partners Boston, a developer, had erected a 21-story, 800,000-square-foot tower called the Winthrop Center. Fernandez was a consultant on the project.

Its 10-foot, floor-to-ceiling windows were triple-pane, oriented to let in sunlight. The walls had a 4-inch layer of insulation. On each floor, a door opened to a balcony, though, as in a lot of offices, none of the windows opened. Any chance of fresh air? Yes, said Brad Mahoney, the company's director of sustainable development. From the ventilation system.

Winthrop Center was built on Passive House principles, a concept that sprang up in Germany in the 1980s, based on the idea that the cheapest energy is the energy you don't use. So the emphasis is on creating an airtight envelope for the building. Don't let unwanted air leak in or out. Insulate. Take advantage of the heat produced inside by circulating it. Our bodies and our computers generate a lot of heat, it turns out.

Insulation, left, lines the windows of the Winthrop Center. Sophie Park for The New York Times

Upfront construction costs are higher than for a conventional building. In the case of this building, Mahoney estimated, the cost was about 2 percent to 3 percent higher.

(Luxury condominiums sit on top of the office tower, but they're not, strictly speaking, built to Passive House standards.)

The heating source is key

The Winthrop Center is still heated by a gas boiler. Because of the energy efficiency hacks, Mahoney was quick to point out, it will use less gas than a conventional building of the same size. He said that when construction began, in 2017, electric heat pumps weren't "commercially viable."

There was no incentive, either. Now, there is. Boston in 2021 passed an ordinance requiring large buildings to neutralize their greenhouse gas emissions by 2050. Between now and then,

building owners are required to report their emissions numbers. In March, Mayor Michelle Wu proposed that new constructions be fully electric; the City Council has yet to vote on the proposal.

Nearly 70 percent of Boston's emissions come from buildings.

Building materials matter, too

Passive House principles don't take into account the stuff buildings are made of, like concrete and steel, which are huge polluters. How can that be reduced?

Fernandez said steel would become less carbon-intensive if its production could be fueled by green hydrogen, which is derived from water.

Concrete is more complicated. It can be used to store planet-warming carbon. My colleague Brad Plumer wrote about a building in Manhattan that captures the carbon dioxide emissions produced by its gas heating boilers, converts it to liquid and mixes it with cement, to be socked away for a long time in concrete blocks.

Likewise, coal ash from power plants can go into cement and then concrete, rather than be released into the atmosphere. But, for the most part, making conventional concrete and steel still produces a lot of pollution, and that's embodied in every concrete-and-steel building.

The United States is catching up

There are many such airtight buildings in Europe and China, including a hospital in Germany. The Winthrop Center is among the largest such office constructions in the United States, but there are airtight housing developments. Cornell Tech has built a 26-story apartment tower for its students and faculty on Roosevelt Island in New York City. An affordable housing project in Brooklyn is built with Passive House principles in mind, as is a 61-unit housing development for seniors in Allentown, Pa.

It's easier to build an airtight building in a cold or temperate climate, Fernandez said, than in a hot tropical climate, where you have to worry about humidity.

What about older buildings?

A lot can be done to retrofit existing homes and offices. To Fernandez, they are the quickest, most cost-effective ways to reduce a city's emissions. Windows can be replaced. Walls can be insulated. Heat can be kept inside in winter. Hot air can be kept out in summer

"The smartest dollar spent is to repair a leaky wall," he said.

For individual apartment buildings, that's still a considerable expense. But as Fernandez pointed out, those expenses are small compared with many other things needed to quickly reduce climate pollution, like retooling the electricity grid or building a network of electric vehicle chargers.

"It's going to be a lot easier to reduce carbon emissions in the built environment than almost everything else," he said.