



CLIMATE SOLUTIONS

## This old-school building material could take over city skylines

Architects are in a proof-of-concept race to construct sustainable wood high-rises.



By [William Booth](#)

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SKELLEFTEA, Sweden — It is right to say that the construction of one of the tallest timber buildings in the world — the Sara Cultural Center here — began when a pine seedling was planted in a nearby commercial forest almost a century ago.

People had no idea back then what role the little sapling might play beyond the sawmill. It could have become Ikea furniture. Or a cardboard box.

Instead, the tree grew to become part of a grand experiment in sustainable architecture — one that seeks to reduce greenhouse gas emissions and store carbon in revolutionary “mass timber” structures going up around the world.

Constructing shelter from logs — Abe Lincoln-style — is old-school. Alongside stone, mud brick and animal skin, wood has been humanity’s go-to building material for low-rise dwellings for thousands of years.

But this is a new dream for an old material.

In this sylvan vision, wooden skylines will be erected with glued lumber laminates that rival steel and concrete in strength and reliability. The architects designing tall timber structures say that, if desired, the Empire State Building could be replicated in wood.

Developers, regulators and the public aren’t yet sure what they think of this technology. Until recently, there were strict limits on how tall a wooden building could be.

But, now, building codes are being rewritten in Europe and the United States to accommodate big wooden structures. And trailblazing architects and engineers — and their early-adopter clients — are in a proof-of-concept race to erect ever-taller timber towers.



The engineered wood rivals the strength of steel and concrete. (Loulou d’Aki for The Washington Post)



Advocates want to show that the buildings will not fall over.

That they are not firetraps.

That they can be built quickly — at competitive prices.

The 20-story, \$110 million Sara center in subarctic Sweden was built almost entirely of prefabricated wood products, delivered from the sawmill to the construction site the day they were needed, and put together by a few dozen technicians with high-speed screwdrivers, working their way through boxes containing 550,000 steel screws.

The center incorporates a public library, exhibit spaces, banquet halls, three theaters and the 205-room Wood Hotel, which has a restaurant, pool and spa.

Standing inside the soaring lobby, one of the project's lead architects, Robert Schmitz, rubbed his hand on a wooden column that helps to hold his creation aloft. The solid pillars and beams in wooden towers are necessarily massive, but they are lighter than steel and concrete. And they have the added benefit of locking the carbon of a clear-cut forest into the built environment, "like a bank vault," Schmitz said.

The Sara center was designed to run on green power. But the project makes a further bold claim: over its lifetime, it will be "carbon negative." Specifically, the 5,631 tons of carbon dioxide emitted by the felling of the trees, their transport, their transformation into wood products, and the construction and operation of the building will be offset by the 9,095 tons of carbon sequestered in the timber.

"The municipality was asking for a 'brave building,'" Schmitz said, "and this is what we tried to do."

## Green, sturdy, safe

The world's tallest timber building today is Milwaukee's 25-story Asce a luxury apartment-and-retail tower completed last year. At 284 feet, it is about as high as New York's Flatiron Building.

Just below that are tall timber buildings in Asia, Canada and Europe, with some of the most ambitious projects rising in old timber and mining towns in Scandinavia, including Norway's 18-story, 280-foot Mjostarnet tower, opened in 2019, and the 246-foot Sara center, completed in 2021.

Approved for future construction: the 32-story, 328-foot Rocket & Tigerli tower in Winterthur, Switzerland, and the 50-story, 627-foot C in Perth, Australia — which would be the first timber building to meet the modern definition of a skyscraper.

The driver of all this ambition is climate change.

Buildings have a big carbon footprint. They are responsible for at least 39 percent of global emissions: 28 percent from the energy needed to heat, cool and power the structures, and the remaining 11 percent from materials and construction, according to calculations by the World Green Building Council.

The foundational materials of the past century are energy-intensive and polluting. The production of steel is responsible for 7 to 9 percent of global carbon emissions. The cement industry produces about 8 percent. Efforts are underway to make "green" steel and concrete, but a full transformation is still years away.

"The built environment — as it is built now — is not sustainable," said Michael Green, a Vancouver, B.C., architect and the author of the 2012 manifesto "The Case for Tall Wood Buildings."

"This is what we have: concrete, steel, masonry and wood. That's it. And the only path forward to get us to carbon-neutral buildings is timber," said Green, who designed the seven-story T3 building in Minneapolis, completed in 2016, using timber salvaged from trees killed by beetles.

When you hear "wooden skyscraper," you might think towering inferno — or collapsing garden shed, done in by rot and termites.

Green agreed: "It sounds scary — but it's not."

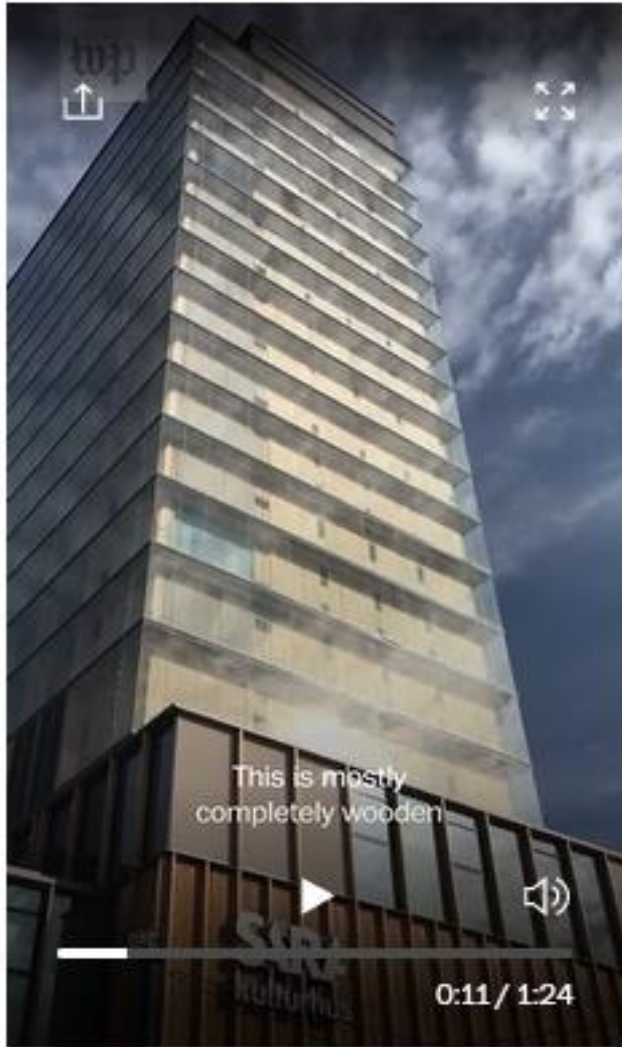
Just as protecting steel from water prevents rust, protecting wood from water prevents rot. There are 1,000-year-old wooden churches in England and 1,500-year-old wooden temples in Japan, Green noted.

In case of fire at a wooden high-rise? Damage would be contained by the requisite sprinkler systems and the fire-retardant coatings on the timber.

Advocates say that in the event of catastrophic fire, the thick beams would slowly char rather than combust, and that even then, the timber would burn at a steady, measurable rate — unlike steel, which melts and suddenly folds. New timber towers have all achieved the highest safety ratings.

## In the forest

From the spa on the top floor of the Sara center, you can almost see the area where the seedling doggedly grew for 90 years, through long summer days and long dark winters, visited by moose and wolf, mushroom hunter and berry picker, and finally the lumberjack.



London bureau chief William Booth toured one of the world's tallest timber buildings, which has a lower carbon footprint than one made of concrete and steel. (Joe Snell/The Washington Post)

[www.washingtonpost.com/video](http://www.washingtonpost.com/video)

Jan Ahlund is a veteran forester for Holmen, the huge Swedish wood, pulp and energy company that supplied most of the trees for the Sara center. He walked a Washington Post correspondent and photographer through a boggy, old-growth conservation area, which he called a “knowledge forest.” Then he took us to two “precision forests,” tree plantations certified as sustainable by the Forest Stewardship Council, based in Bonn, Germany. For every tree felled, three seedlings are planted. The forest floor is alive with mushrooms, lichens, moss and fox droppings.

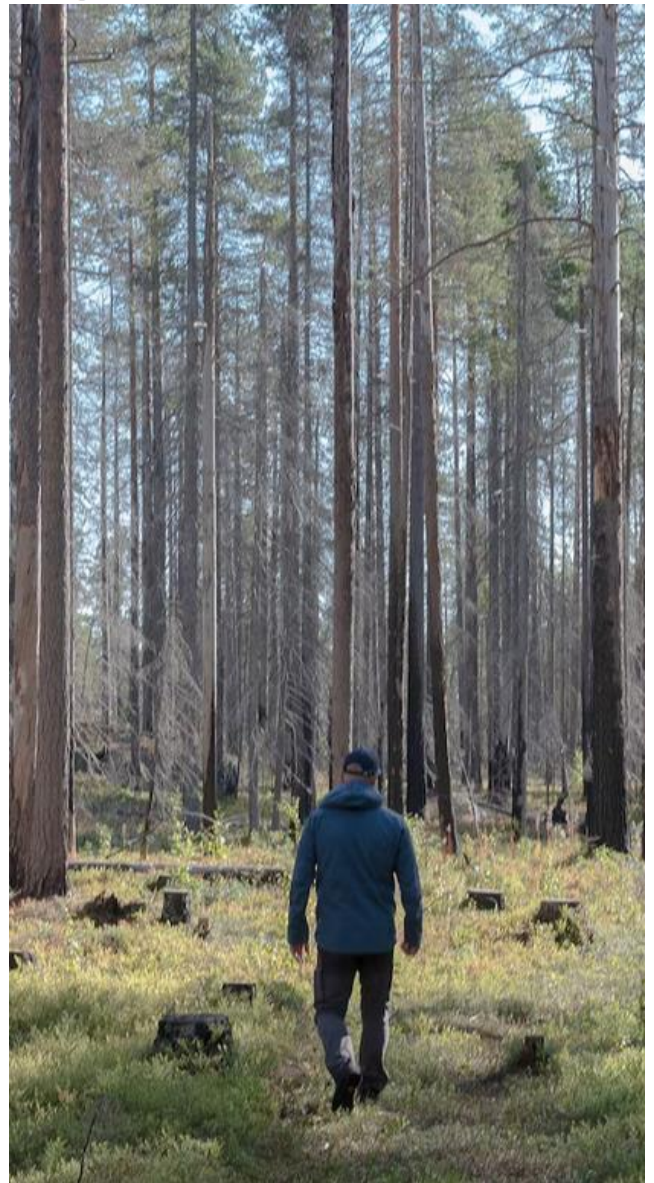
Here, foresters such as Ahlund are more likely to carry computer tablets than axes.

Satellites and drones look down on the canopy, keeping track of the inventory, temperature, dryness, and fire or storm damage. The industry is developing remote-controlled forest machinery that soon may do much of the physical labor, including thinning and harvesting.

Trees cover more than two-thirds of Sweden's landscape, making the country more suited to timber construction than, say, the tree-sparse Middle East. Holmen is one of the largest landowners. But alongside the timber companies are more than 330,000 private owners of forestland. Ahlund said many locals are proud to have contributed trees to the Sara center.

“The forest is a very efficient vacuum cleaner for carbon,” he said, with trees trapping greenhouse gas in their trunks, leaves and roots. But he pointed out that spruce and pine trees soak up the most carbon when they are 10 to 80 years old. After that, the trees still grow, but much more slowly, and in terms of carbon capture, they “reach a kind of equilibrium.”

“That is why we believe a managed forest is better,” Ahlund said. It is better to cut down the trees, he said, and store their carbon in buildings — and plant another forest.



The seedlings arrive from high-tech nurseries, where they have been grown under optimal conditions — fed with fertilizers, guarded by fungicides, subjected to artificial cold in refrigerators and to “long-night treatment,” or low light, that makes each seedling more robust, with double the needles and a thicker base.

Before they are planted, the seedlings are coated in wax — to foil voracious beetles.

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## At the sawmill

Most single-family homes in North America are wood-frame construction featuring the ubiquitous two-by-four.

But the materials that go into wooden high-rises are different.



Olov Martinson is the site manager of the Martinson sawmill. He and his family owned the place for generations before recently selling to Holmen. He said the trees used for the Sara center were cut down in forests within a 30-mile drive, limiting the emissions produced in their transport.

Martinson stood with us on a gangway, watching as logs trundled along conveyor belts and into the blades that cut them into long planks, which are then treated, kiln-dried and stress-tested.

Some of the planks are stacked and glued together to make glued laminate timber, or "glulam," in a process patented in Switzerland in 1901. In another part of the mill, planks are made into cross-laminate timber, or CLT, a newer technique. It is the pancaking of the planks that gives them their tremendous strength.

Martinson said he has been amazed at what wood can now do. "We are not ashamed of our business. It's a good business. We have a lot of forest in Sweden. We have a sawmill. Maybe we can help with the climate. That would be a good thing, too."



Logs move along a conveyor belt and are sawed into planks. (Loulou d'Aki for The Washington Post)

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## At the building site

The Sara center incorporated 10,000 cubic meters of CLT and 2,200 cubic meters of glulam — which were delivered in custom-cut, numbered units. This meant the building was erected much faster than a steel-and-concrete structure would have been — and more quietly.

“Like a big puzzle box,” Martinson said. “Ready for assembly.”

Schmitz, the architect, estimated that the building consumed roughly 100,000 trees.

Outside, the timber is protected by a thermal sheath of glass, but it is developing a patina, turning from sunny honey to icy silver.

It also is contracting. Over time, the organic building will shrink by about five inches in height, but it will do so at a consistent rate, so everything will remain level and plumb, theoretically.

[Andrew Lawrence](#), a timber specialist with Arup, a global engineering and sustainability consultancy headquartered in London, is a fan of mass timber construction but said the emphasis on soaring towers might be missing the point.

“Each of these tall buildings is like its own research-and-development project,” he cautioned.

The sweet spot for mass timber, he argued, is not a showy high-rise but the vast number of mid-rise buildings: schools, apartment blocks, auditoriums, sports arenas, warehouses, bus depots and office parks.

“That’s where wood could really work,” he said.

Saplings are growing now for those future projects, too.

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