

Wood replaces steel as Japan builders fight climate change

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New fire-resistant materials help multistorey buildings go green



About 90% of this 11-story high-rise built by Obayashi is made from wood. (Photo by Shugo Tamura)
SHUGO TAMURA, Nikkei staff writer August 15, 2022, 02:04 JST

TOKYO -- With its sleek modern design, the 44-meter, 11-story Port Plus building stands out even in Yokohama's posh Naka Ward. But what really sets it apart from other buildings in the neighbourhood is that 90% of its structural elements are made with wood.

Built by engineering group Obayashi, the building is an example of how Japan's leading builders exploring wood as an alternative to steel and concrete -- two of the most carbon-intensive materials -- as nations look to cut greenhouse gas emissions.

Carbon dioxide emissions over the entire life span of the building, from producing the materials to tearing it down, will total about 60% as much as for a steel-frame building of a similar size, Obayashi says. After accounting for the amount of CO₂ absorbed by trees used to make the lumber, that footprint shrinks to around a quarter, the company estimates.

Obayashi has developed a new laminate material that can resist fire for at least two hours -- a legal requirement for use in high-rises -- for the building's pillars and beams. It avoided welding or bolting joints together and used cross-laminated timber for the floors and walls. This in turn eliminated the need to cure concrete, which Obayashi hopes will cut down on the amount of labour necessary for future projects.

"It cost around 30% to 40% more than a steel-frame building of a similar size," said Mitsutoshi Nakamura, a wood construction project team member at Obayashi. Still, many clients have expressed interest in wooden buildings as a way to signal their commitment to decarbonization.

Other builders are using hybrid constructions that are cheaper and more resistant to fire. Takenaka and property developer Mitsui Fudosan are planning a 17-story building in central Tokyo's Nihonbashi neighborhood. By using laminates and other lumber products in 20% to 30% of structural elements, they aim to keep costs at 10% to 15% above that of a conventional steel-frame building.

"We plan to achieve materials that can resist fire for three hours, meaning it can be used in all types of high-rise construction, by the end of fiscal 2022," said Hiroyuki Matsuzaki, head of wooden construction at Takenaka.

Mitsubishi Estate opened a hybrid high-rise hotel in Sapporo in October. Of the 11 floors above ground, the first seven are made of reinforced concrete, the eighth has a hybrid structure, and the ninth to eleventh are built entirely of wood.



The Royal Park Canvas Sapporo Odori Park hotel was built with locally harvested wood. (Photo by Shugo Tamura)

Meanwhile, Sumitomo Forestry plans to build a 350-meter-tall ultrahigh-rise made of wood in 2041 under its "W350 Plan." It has an early project overseas, working with NTT Urban Development and U.S. developer Hines on a 15-floor hybrid building in Melbourne.

Fire-resistant materials are essential to expanding the use of wood construction in multistorey buildings. But few suppliers are capable of producing the necessary laminates. There were 15 facilities that produce laminated veneer lumber and 11 that made cross-laminated timber in Japan in 2021, according to Japan's Ministry of Agriculture, Forestry and Fisheries.

Combined with technical hurdles, such as compliance with fire resistance standards, production capacity is extremely limited.

Some suppliers have started to bolster capacity with an eye on future demand. Sumitomo Forestry plans to establish three to four new complexes in Japan capable of producing a range of products, from logs to plywood to wood chips.

The company will invest 20 billion yen (\$148 million) through 2024, and the production complexes will include biomass power generating units. Sumitomo Forestry has already acquired an 88,000 square-meter plot of land in Shibushi, a city in southwestern Japan, with plans to start operations of the future plant in 2025.

"We can't buy overseas-made materials because of the weak yen, and we have seen our competitiveness decline," said Sumitomo Forestry President Toshiro Mitsuyoshi, outlining the need for a domestic supply chain. The company aims to have the capacity to process 1 million cubic meters of logs a year in 2030.

Other companies in Japan are joining the bandwagon. Shelter has won government certification that wood building material developed in-house can be fireproof for three hours, which meets the standards for a variety of tall buildings.

Meiken Lamwood, which makes cross-laminated timber, will start building a logistics centre beside its production hub next year. Last year, the company spent 700 million yen to start a production line for laminated wood, used in posts and beams. With the new distribution centre, 14-meter wood can be shipped in as little as 10 days.

Chugoku Mokuzai will expand factory space as soon as 2023 in a bid to lift manufacturing capacity. The project is expected to require an investment of around 20 billion yen.



Meiken Lamwood, a major supplier of cross-laminated timber, is ramping up production. (Photo by Masahiro Tamura)

With bigger buildings, the construction material will get larger as well. Makers of wood processing equipment are rolling out new machines that can handle larger cuts. German supplier Hundegger has started selling saws in Japan capable of cutting up to 610-by-1,300-millimeter sections, compared with an earlier range of up to 300 by 1,300 mm.

Miyagawa Koki, headquartered in near Nagoya in Toyohashi, sells saws that can cut 450-by-1,250-mm sections. The company has delivered three of the machines to date.

In the fiscal year that ended March 2021, 13.9% of Japan's public building starts were made of wood, according to government data. About 30% of low-rise buildings are made of wood.

But overall, wood accounted for hardly any construction starts for structures four stories or higher in 2020.

That is starting to change. Insurance group Tokio Marine Holdings announced this month that the new headquarters building will be made of wood or hybrid material. The building will be one of the world's biggest in terms of the amount of wood used, the company said.

"There's potential for wood materials to become more prevalent, especially for mid-to-high rise buildings and non-residential buildings," said Hiroaki Kojima, director of the wood promotion division at Japan's Forestry Agency.