Rise of the

PLYSCRAPERS

Timber buildings are reaching towards the skies, thanks to breakthroughs in super-strong wood. BY *Greg Callaghan*

IF THERE'S one way to get people talking, it's to draw up plans for a new skyscraper and plonk it smack in the middle of an iconic skyline like London's, overlooking majestic St Paul's Cathedral. Londoners have nifty nicknames for the crop of eccentrically shaped skyscrapers that have popped up over the last decade or so – the Gherkin, the Cheese Grater and the Walkie-Talkie – but if a small group of British architects and engineers has their way, the historic skyline may be welcoming a bold geometric addition with a new moniker: the Toothpick. This sleek, 80-storey tower will soar 300 metres above the Barbican Centre, a gloomy, grey concrete slab of residential and arts buildings that was opened by the Queen in 1982.

But there's something very different about this proposed tower, something pointing to the possible rebirth of the skyscraper itself: the Toothpick, as its name suggests, will be made almost entirely from wood. Thanks to significant breakthroughs in super-strong engineered timber products over the past decade, making them as tough as structural steel or concrete, the stage is now set for the construction – for the first time in human history – of tall timber buildings.

"Mass timber" is the collective term used to describe this new suite of structural materials, which include cross-laminated timber or "CLT" (multiple layers of wood glued together at right angles under extreme pressure to form giant wall, ceiling and floor panels) and "glulam" (layers of wood jointed together along the same grain for beams and posts). And here's another nickname for these woody high-rises: plyscrapers.

Just as steel, glass and concrete revolutionised super-tall construction in the 20th century, it's now likely that timber, which has been shown to be vastly kinder to the environment, faster to build with, with next-to-zero waste and far healthier to live with, will do the same as the new century marches on, leading to burgeoning new high-rise profiles in Europe, the US and parts of Asia. British architect Andrew Waugh, whose company Waugh Thistleton is building the largest timber housing development in the world in Hackney, London, goes as far as to call this "the beginning of the timber age".

At present, the tallest wooden building in the world is Treet ("the Tree"), a 14-storey apartment block in Bergen, Norway, which last year surpassed Australia's first trailblazing timber high-rise, the 10-storey Forté apartment building in Melbourne, built in 2012. But the Treet will soon be dwarfed by the 24-storey HoHo tower in Vienna, due for completion late next year, an 18-storey building at the University of British Columbia, which will open next year, and a 34-storey tower in Stockholm, earmarked for completion in 2023. Earlier this year French architect Jean-Paul Viguier won a design competition for Hypérion, a wooden-framed residential tower in Bordeaux featuring hanging gardens, to be finished in 2020. In Sydney there's International House, a striking timber office complex in Barangaroo, to open next year.

But if it's a super-tall, iconic skyscraper you're after, Michael Ramage, director of Cambridge University's Centre for Natural Material Innovation and an internationally recognised expert in building big with wood, is your man. He insists that the timing is right for projects like the Toothpick, which he designed with engineers from London's PLP Architecture. While the latest steel-and-concrete skyscrapers may look sleek and cutting-edge, most come with old-world energy bills, insists Ramage. "Timber has a very important place in the future construction of medium- and large-scale buildings," says Ramage, in his soft American accent (he grew up in New York state), in a phone interview from his office at Cambridge University. "It can be cost-effective, faster to build, and result in more attractive high-rises."

Timber is our only renewable construction material. Absorbing CO_2 from the air, forests – from wilderness to crop plantations – are huge carbon stores or "sinks", and a tree's wood continues to store carbon when it becomes a timber beam holding up a ceiling, a process known as carbon sequestration. It's been estimated that a timber beam of one cubic metre stores close to one tonne of CO_2. Compare that to steel, concrete or plastics: not only do their manufacturing processes require large quantities of electricity and water, but instead of storing carbon, steel and concrete *emit* it. For the equivalent one cubic metre beam, concrete releases two tonnes

An artist's impression of London's skyline with the proposed "Toothpick": "Timber has a very important place in the future construction of medium- and large-scale buildings," says co-designer Michael Ramage.

Sydney's first timber office block, International House at Barangaroo, due to open next year.

rial emissions (steel releases even the time a concrete skyscraper has ted, it has produced tens of thousands of CO_2; it has been estimated that as a e concrete industry has five times the otprint of the world's airline industry. re's the scary part: more than 70 per nergy-related carbon dioxide emis- s *Scientific American*, come from the ast new mega-cities. It's estimated has poured more concrete in the past than the US has in its entire history. ncrete and steel buildings have be- nore energy-efficient in recent years, better insulation, solar panelling, roofs, waste-water recycling and lighting, but in the battle for green y, nothing touches timber. Masses of le buildings sourced from timber s would provide a carbon sink in any veloped city.

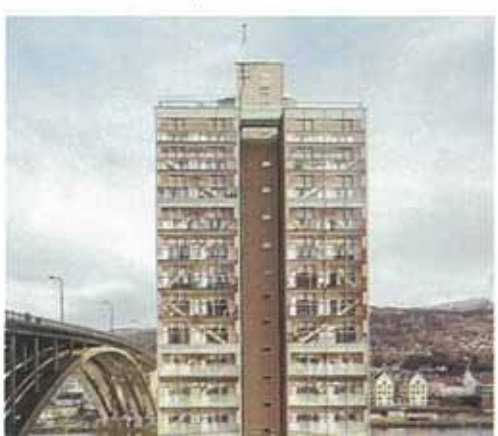
ow, agroforestry may not form a rt of international climate-change t that's likely to change in the next so, says Vancouver architect Michael internationally-recognised expert in ig with wood. While timber planta- o substitute for continued deforesta- rgin rainforests have irreplaceable value – it's one way to reduce man- enhouse gases.

ean crop forests are expanding, while f trees is declining because we're paper," explains Michael Ramage. tually cutting down far less than we ng, at a time when timber as a struc- erial is achieving a higher value. lantations would also provide strug-

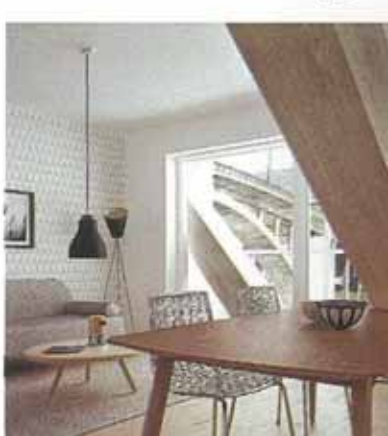
gether with more trees, parks, green roofs and vertical gardens – will also reduce the urban heat island effect: the phenomenon of higher temperatures experienced in cities due to concrete and tar soaking up thermal energy and radiating it back into the atmosphere.

More timber buildings and large, shade-bearing trees would mean a lower gauge on the thermometer – and cleaner air in cities (a mature tree removes 60 to 70 times the pollution of a sapling). A report by the UN Food and Agriculture Organisation released in July called for more wood and wood-based materials to be used in construction instead of non-renewable materials like concrete, brick and steel.

Wooden buildings are, of course, nothing new. Japan's five-storey Horyuji Buddhist temple in Nara, built more than 1400 years ago, has survived earthquakes, fires and floods. But in most countries, timber lost its allure – especially for the construction of monumental buildings – once the art of stonemasonry and, later, bricklaying took hold. Even today, there is a resistance to large-scale timber construction



The 14-storey Treet building in Bergen, Norway, currently the world's tallest wooden building.



A view inside a Treet apartment, with timber beams

for three age-old, common-sense r rots. It's a fire risk. It's not rigid or hea for high-rise construction. The chal certainly real, but those at the forefro neered wood construction insist mos swiftly overcome – if they haven't alr

Many are betting their careers and a big future for high-rise "big timber good news is that some of those at t edge of this new timber wave are in

ON A CRISP, SUNNY morning i as droves of office workers scu Sydney's new City Walk Bridge to th Barangaroo's gigantic glass towers architect Jonathan Evans grabs my ping me in my tracks. We're only 50 m the site of Evans' latest project, Int House Sydney, a seven-storey tim building now under construction at th of Barangaroo. Evans is keen for m first glimpse – from this elevated van – of a design flourish on its façade.

It turns out to be a dazzlingly ele

gth of the building; it will be the first
destrians see as they cross into
oo from the city side. "The colonnade
of Barangaroo from north to south,"
tall, soft-spoken Evans, eyeing his
k, which he designed with veteran ar-
lec Tzannes. "If you have a front door,
it to be inviting and attractive, right?"
trikes me first as we enter the site of
nal House, fitted out in our regulation
jackets, hard-hats and steel-capped
he faint woodsy smell of the three sto-
dy completed. Not only do the exposed
ngs and walls, made from pine and
el warm and inviting, but they exude
t resinous scent (a change from the
ll of freshly poured concrete). But it's
see the core of the construction – the
shaft and load-bearing walls – that you
is is a building (apart from its concrete
ns) built entirely of CLT (for floors, ceil-
walls), and glulam (for beams and posts).
first journalist to visit the site, and I
mething else besides the absence of
odour: no thundering din. Because
s timber panels, prefabricated in
are craned, slotted and screwed into
with next to no waste, there's far less
ion noise – and, I'm told, much less
-forth of cement trucks and other
hicles, thus lightening traffic conges-
al streets and reducing noise.
d glulam structures of this size typi-
uire only a handful of "timber install-
build and are completed within a
me. International House Sydney will
ed next May, three months earlier
equivalent concrete building. What's
ernational House will have superior
nd acoustic properties compared to
s neighbours.
s among a small club of architects in
who love designing with timber, es-
n large-scale projects. He just loves
nd feel. In his inner-city Chippendale
w weeks earlier, he lifted up a piece of
ize of at least two bread bins. "As ar-
ve like to touch and feel the materials,"
ned. "Timber has a tactile quality like
Not all of the new generation of tim-
rises wear their wood-grain on their
he exterior of Melbourne's Forté, for
is covered in cladding; International
wever, celebrates its timber structure
olonnade to its roof.

NS OUT that timber buildings aren't
lthier for the environment but for the
who live in them, producing benefits
those of being out in nature: lower
ssure and heart rate. A 2009 study by
Human Research Institute shows
ren taught in timber buildings experi-
stress and concentrate better; timber-
ement villages promote tranquillity,
to studies in the UK and Finland;
an, positive benefits have been noted
gical clinics constructed from wood.
are "innately drawn towards wood,
its feelings of warmth, comfort and
..." concludes a study by Planet Ark
last year.
n Evans says there is now a push in
nd Germany for homes for the elderly

A proposed 34-storey tower in Stockholm.

turning into a towering inferno if a
out? Not with mass timber technolo
ing to José Torero Cullen, a profes
safety engineering at the Uni
Queensland. He has been testing fi
in wooden buildings, including a pro
small apartment in which the furni
consumed by flame, but the walls a
are not. "If a fire begins in the outc
the CLT, panels will only char, pro
core," he says. This means that i
high-rise did ignite, the structural i
the building should be maintained
buckles under extreme heat, turni
ghetti at about 260°C).

A construction challenge for all sk
but particularly lighter, timber ones,
Wind pushes against structures ar
ates upward in what's known as the s
One solution to reduce sway is to ad
elements in the middle storeys and r

"A timber high-rise of 25 storeys
able and feasible," says Andrew N
architect with Lend Lease, the comp
Melbourne's Forté and Sydney's In
House. "Beyond that, you need a hybr
one with concrete or steel inclusion
you'll still save an enormous amoun
emissions if the bulk of the building

The beauty of timber is that it ca
multiple design languages, adds I
structure can be given curves, roun
and virtually any form of embe
"Timber is a traditional building ma
can be used in a 21st-century way,"

That very lightness of timber can
vantage in seismically active areas i
ings are well constructed (in Haiti,
Japan, many timber buildings remai
ing amid a sea of grey rubble in th
major earthquakes). And timber high
have a role to play in areas of soft soils
for example, has sunk 40 centimetres
50 years, a legacy of its soft soils
warming, possibly made worse by th
its vast mountain of skyscrapers).

"Timber buildings have the resilien
they can creak and move. Concrete
have a cracking point; once they star
ble, they have to be rebuilt," obser
Brady, chief architect with Decibel Ar
in Victoria. Brady has designed an e
CLT building in Punt Road, Melbou
he describes as "townhouses in the s

The other value of a timber high
Brady, is that its materials can be r
the end of its lifespan (estimated at 1
least). "Timber buildings and timber
at the cutting edge, but it's importan
over-zealous," he cautions. "They are
a growing number of – but not all – s

Cambridge's Michael Ramage be
most likely roadblock ahead for ta
towers is not engineering, but publi
He admits the idea of living in a ti
scraper takes some getting used to.
cult to get people out of the mindset
or concrete are intrinsically more s
says. "But isn't it great that the build
rial showing the most promise in
today is the one that humans have ha
ity with since we started looking
beyond the caves?" ■