



ZERO CARBON. HYBRID WOOD. SUPERTALL.

A prototype for a zero carbon sustainable future

DIALOG

Scaling new heights

The “supertall” wood tower is a dream many have chased. Supertalls are among the most technically challenging structures to design, but they’re also a perfect typology for testing the limits of sustainable mass timber design, and zero carbon design.

DIALOG’s team of architects, structural, mechanical and electrical engineers, interior designers, and landscape architects, in collaboration with EllisDon and RWDI, came together to ask: is it possible to design a zero carbon, hybrid timber supertall tower?

OUR ANSWER?

ZERO CARBON: Designed to be zero carbon (operations) by leveraging energy efficiency, smart technologies, façade-integrated photovoltaics, and a district energy cogeneration plant that eliminates CO₂ and NO_x and SO_x emissions using an integrated algae bioreactor to make it the tallest zero carbon tower in the world.

HYBRID TIMBER: DIALOG has developed a patent-pending, revolutionary Hybrid Timber Floor System (HTFS) that includes a prefabricated composite floor panel that allows for an unprecedented 12-meter column-free floorspan.

SUPERTALL: A 105 storey supertall hybrid mass timber structural system that maximizes the overall use of sustainably harvested wood in a highly cost efficient, energy efficient, and elegant tower.



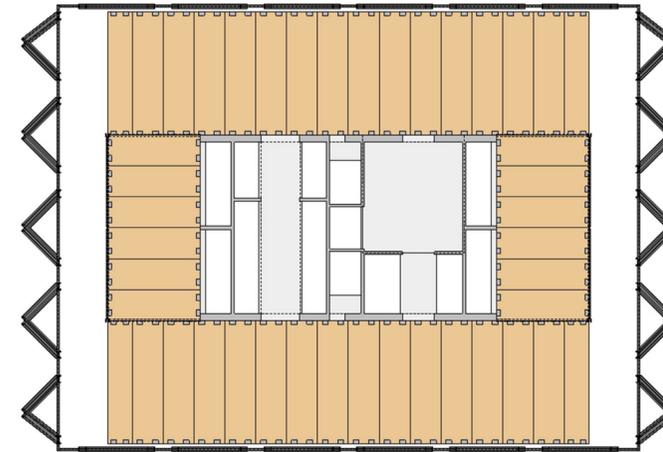
Hybrid Timber Floor System

Tall timber buildings are a critical part of the solution to climate change. However, the race to design the tallest all-timber building obscures the most important goal of using mass timber: to make significant reductions in carbon emissions by maximizing the overall use of sustainable harvested wood. Moreover, tall and supertall buildings of all shapes and forms have been extensively explored by architects and engineers. **The DIALOG structural team responded with an innovative idea: the patent-pending Hybrid Wood Floor System (HTFS).** The HTFS can be deployed in buildings of any size, form, or height, and the 105 storey prototype is a good example of how the HTFS can be deployed in a mixed-use supertall building form.

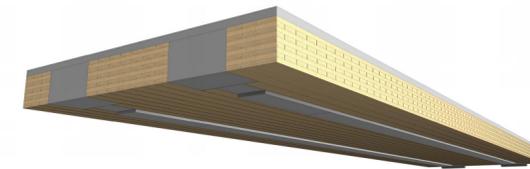
The HTFS is a pre-fabricated composite floor panel that leverages the properties of concrete and steel to reinforce engineered timber. The system is elegant in its simplicity: post-tensioning steel cables and steel cages are encased in a concrete band and recessed into a cross-laminated (CLT) wood panel. The HTFS will make it possible to build taller hybrid wood structures than ever imaged before.

HTFS offers the following characteristics:

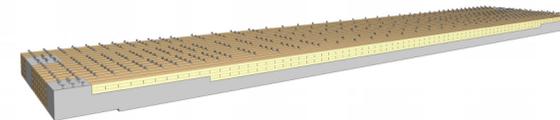
- 12 meter clear floor span
- Minimized structural floor thickness that allowing lower floor to floor height
- Non combustible concrete band offering additional fire safety
- More exposed wood and superior sustainability attributes
- Prefabrication offers higher and more consistent quality
- Prefabrication help to reduce construction time



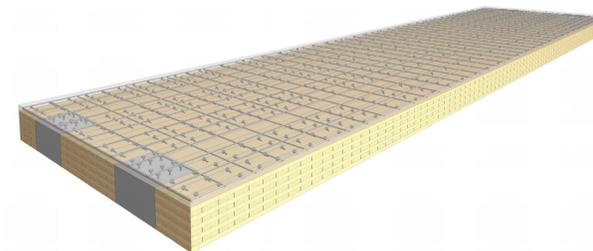
HTFS Panel Arrangement



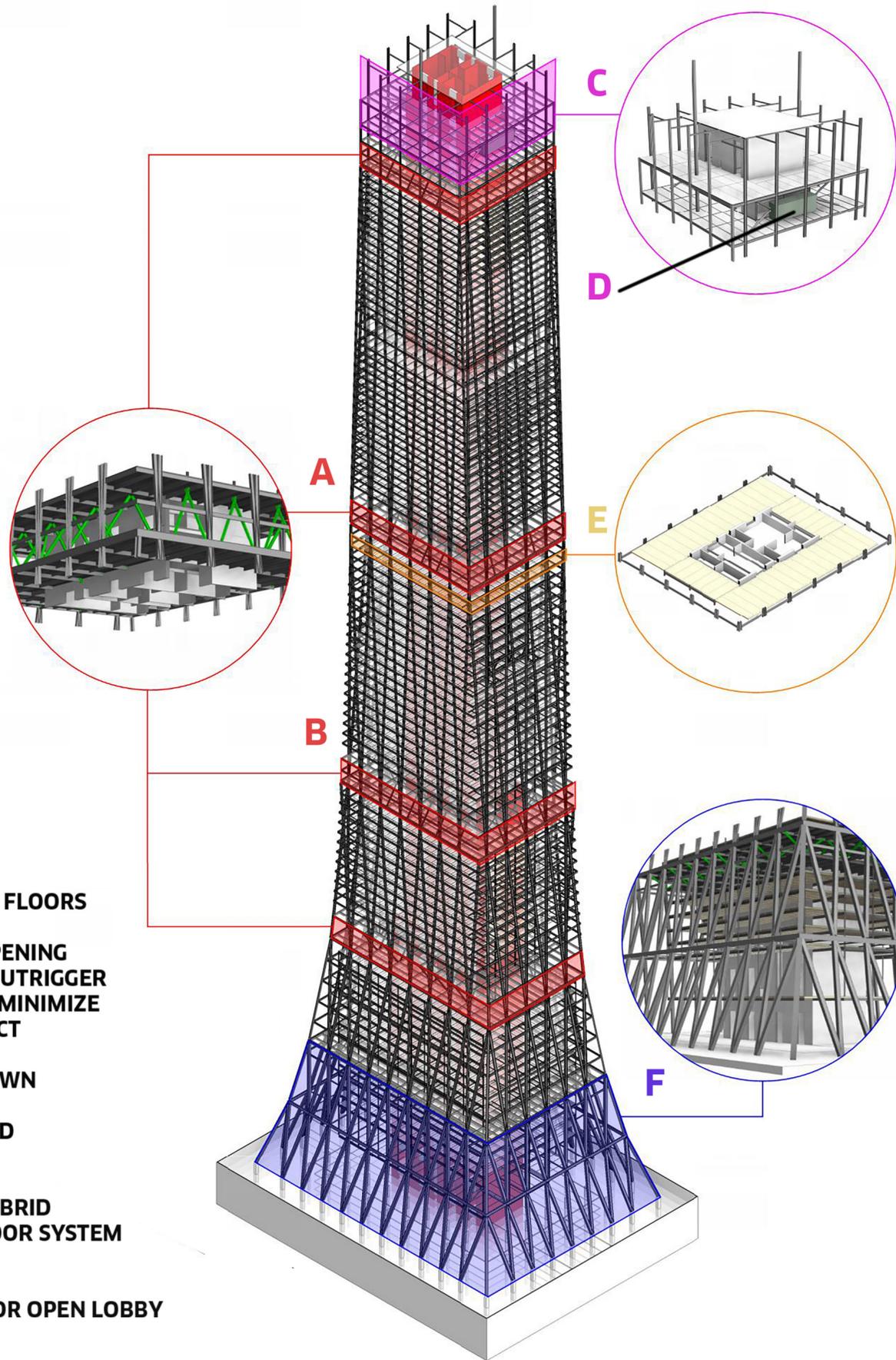
HTFS - CLT, reinforced concrete bands and concrete topping composite



Reinforced concrete band recessed and bonded with the CLT, and shear studs prefabricated from factory.



Concrete topping poured on site, with reinforcing steel mat, complete the Hybrid Tower Floor System (HTFS)



A - OUTRIGGER FLOORS

B - PARTIAL OPENING THROUGH OUTRIGGER FLOORS TO MINIMIZE WIND IMPACT

C - TOWER CROWN

D - MASS TUNED DAMPERS

E - TYPICAL HYBRID TIMBER FLOOR SYSTEM (HTFS)

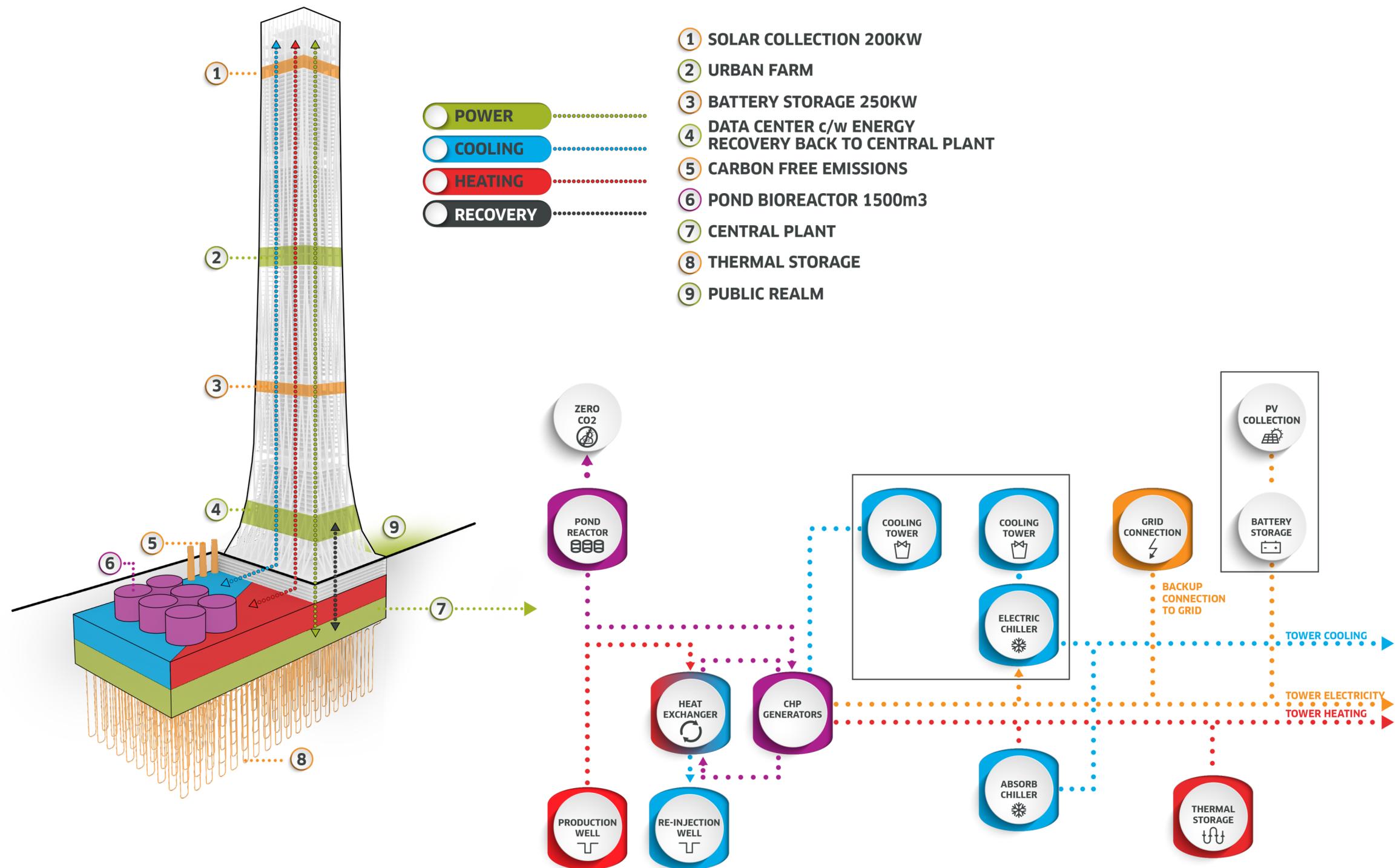
F - FRAMING FOR OPEN LOBBY

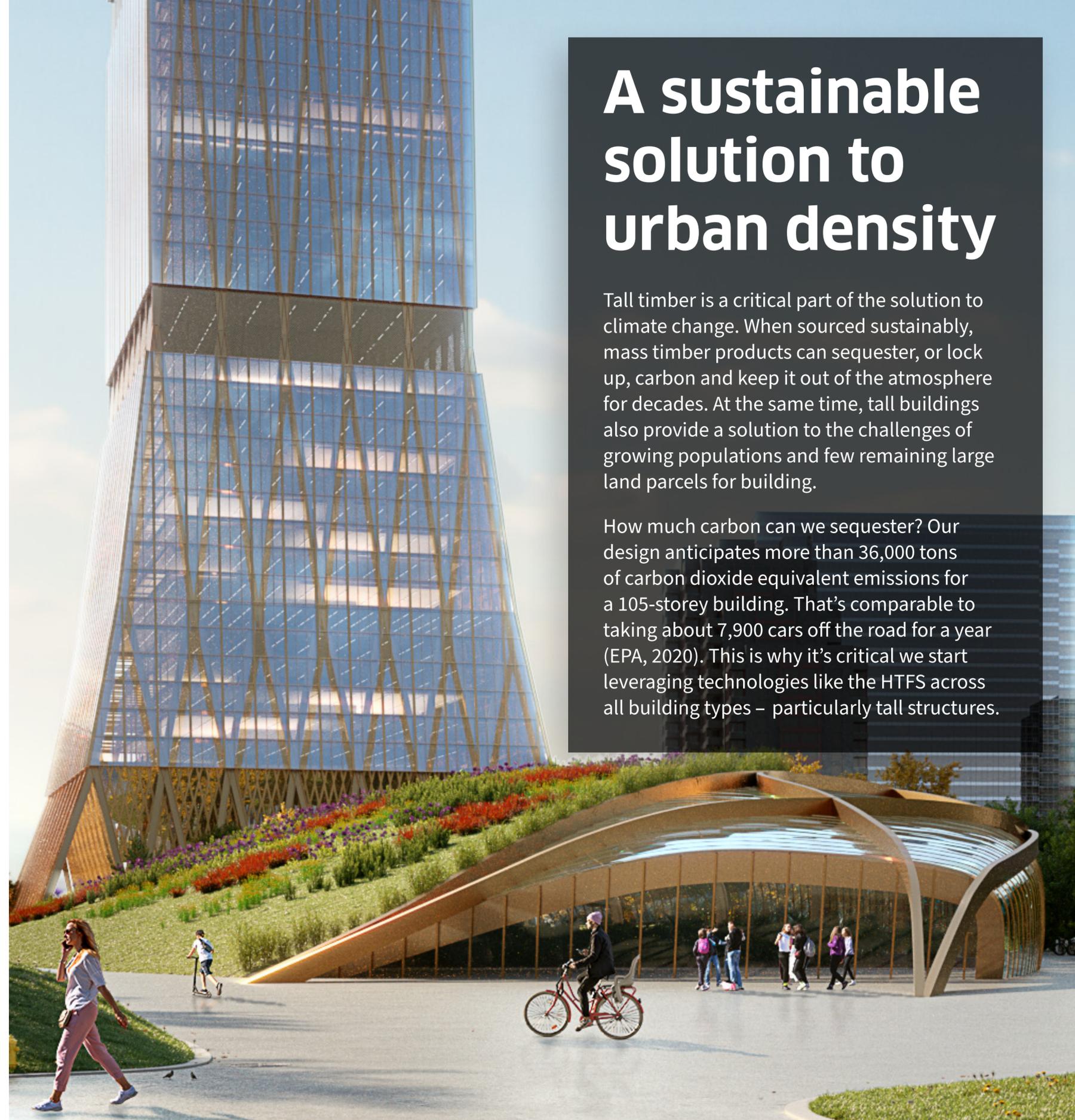
Zero carbon from within

The supertall, hybrid timber tower prototype aims to achieve zero carbon entirely within the building itself. In fact, we have gone one step further by designing the building to be entirely independent of the grid.

HOW?

- The building will be constructed with façade integrated photovoltaics (PVs) on the east, south, and west façades
- A natural gas-powered district energy cogeneration (cogen) plant will deliver the power and heat not provided by the PVs
- Combustion emissions from the plant, including carbon dioxide (CO₂), nitrogen oxides (NO_x), and sulphur oxides (SO_x), will be captured and sequestered by an innovative algae bioreactor
- The efficient use of the HTFS and sustainably harvested timber to sequester carbon





A sustainable solution to urban density

Tall timber is a critical part of the solution to climate change. When sourced sustainably, mass timber products can sequester, or lock up, carbon and keep it out of the atmosphere for decades. At the same time, tall buildings also provide a solution to the challenges of growing populations and few remaining large land parcels for building.

How much carbon can we sequester? Our design anticipates more than 36,000 tons of carbon dioxide equivalent emissions for a 105-storey building. That's comparable to taking about 7,900 cars off the road for a year (EPA, 2020). This is why it's critical we start leveraging technologies like the HTFS across all building types – particularly tall structures.



Fast facts that make a difference

- Buildings and construction account for ~39% of energy-related emissions
- 36,649 m³ + of sustainably-harvested wood
- HTFS = 12 m open spans
- 1 m³ of wood product can potentially store 1.9 tons CO₂ emissions
- Equals 7,900 cars off the road for a year
- Is equipped with 5G antennae

Managing wind like a tree

Wind plays a significant role in the design of tall structures. Our prototype is shaped orthogonally, gently curving out to meet the ground, conveying how the load is carried down to the ground. This is reminiscent of the way that a tree trunk performs the same task as it meets the earth.

This building form offers many benefits:

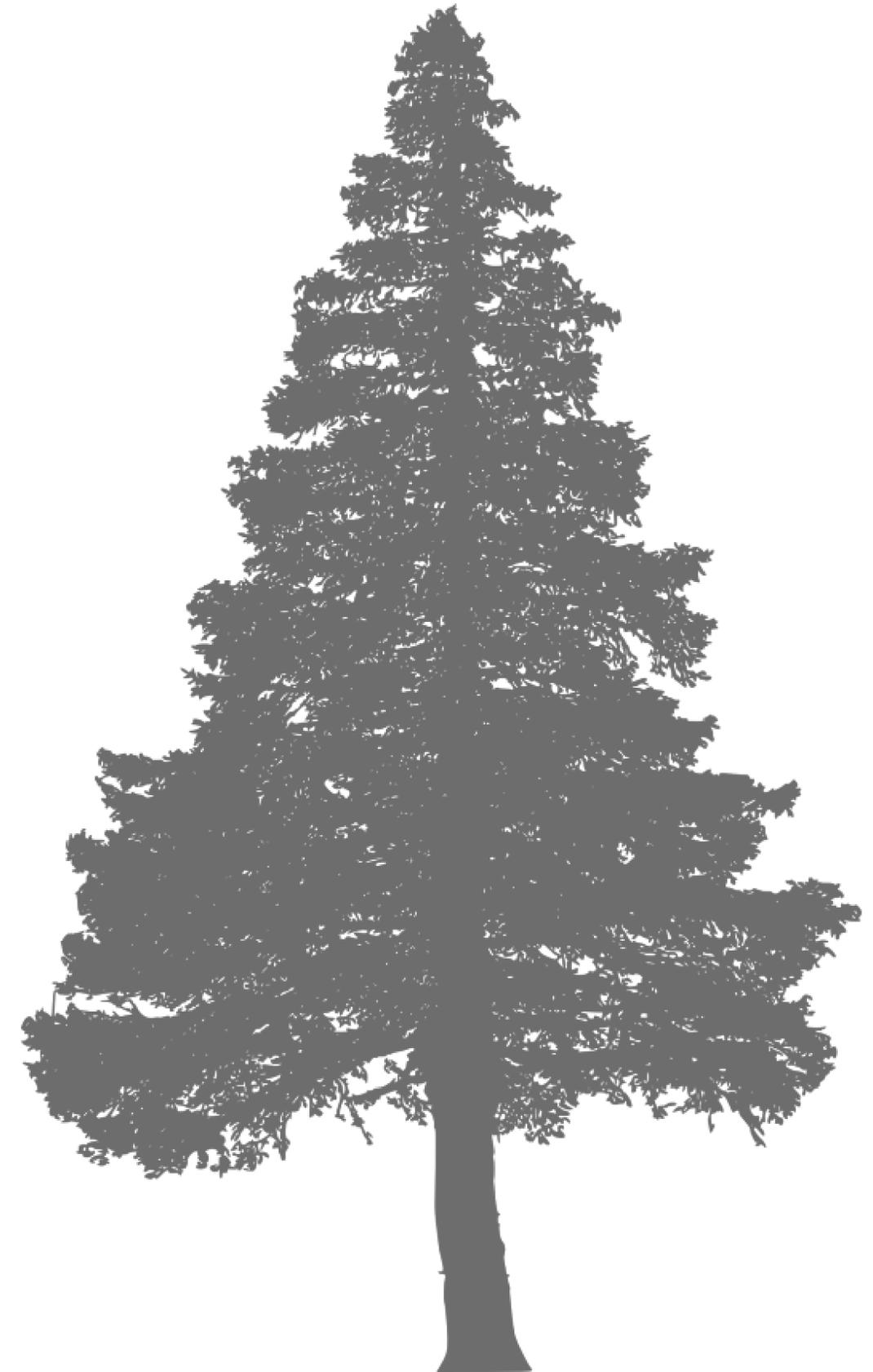
- It maximizes the efficient use of mass timber with rectangular HTFS
- A rectangular floorplate provides greater usable and efficient column-free floor space for office planning
- The shape better integrates into Toronto's existing rectangular street grid
- It's more cost effective to deal with wind loading by introducing intermediary open service floors that allow the load to move through the building than to curve floorplates

EMBRACING THE SUNSHINE

The building's skin has been designed for both energy conservation and energy production.

The façade responds to the structure, working on a storey-by-storey basis. As the building rises in height, it will react optimally to its orientation and climate conditions.

The box frame double-skin curtain wall system provides an ultra-high-performance building façade that enhances natural daylight penetration and promotes natural ventilation through manual controls. A building automation-controlled active solar shading system complete with integrated PVs regulates building temperatures while also capturing solar energy.



Soaring interior heights, sustainable materials

Our prototype offers occupants expansive, unobstructed views from floor-to-floor with its multiple interior atriums up through the height of the building. While the HTFS is comprised entirely of sustainably harvested wood, the interior spaces also offer an unprecedented opportunity to incorporate sustainably harvested wood both as an aesthetic element as well as excellent structural material.

Our strategic use of wood as a prominent structural element, and as an interior finish material, adds a sense of drama to increase its wonderful biophilic effect – satisfying our innate love of natural materials. Our commitment is to create exceptional spaces and extraordinary experiences for the people who will occupy and use the building every day.

Sustainable wood construction and beautiful interiors go hand-in-hand: Our prototype is another demonstration of our commitment to the American Institute of Architects (AIA) 2030 Commitment; a carbon-neutral future.



A new vertical landscape



TYPICAL OFFICE SECTION

- ① Vented box type double skin facade with integrated photovoltaic louvers
- ② Landscaped interstitial space
- ③ Interior office partition with operable windows into interstitial space
- ④ Exposed hybrid CLT floor slab
- ⑤ Raised access floor system with building services



TYPICAL HOTEL / RESIDENTIAL SECTION

- ⑥ Vented box type double skin facade unit
- ⑦ Insulated panel with integrated photovoltaic
- ⑧ Fire protected hybrid CLT floor slab and drop ceiling with building services

About DIALOG

We are passionate about design. We believe it can, and should, meaningfully improve the wellbeing of our communities and the environment we all share.

We've come together because we see the important challenges facing communities becoming increasingly complex and therefore best engaged through the collaboration of diverse perspectives and expertise. DIALOG has been consciously created as a multidisciplinary collaborative to tackle these challenges.

Our multidisciplinary team includes architects, urban planners, interior designers, structural, mechanical and electrical engineers, and landscape architects. We practice across Canada and the US from studios in San Francisco, Vancouver, Calgary, Edmonton, and Toronto. Our work includes designing for urban vibrancy, health and wellness, transportation, education, arts and culture, residential, retail, and commercial, as well as mixed-use solutions which incorporate an increasing number of these.

DIALOG has been designing positive change in communities since 1960. Although our work has attracted many awards over this span, we consider a project truly successful when it is embraced by its end users and its community.

2150 Keith Drive Office Tower | Vancouver, BC



Centennial College - A Block Expansion | Scarborough, ON



Shangri-La Hotel | Vancouver, BC

Renderings

To acquire full sized versions of these images, please reach out to DIALOG's media contact.



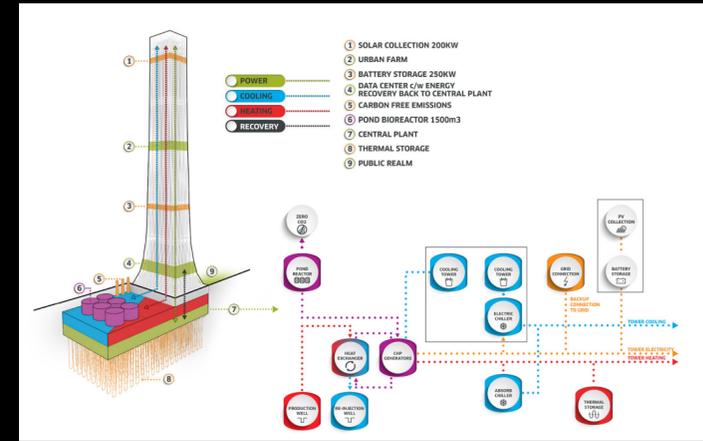
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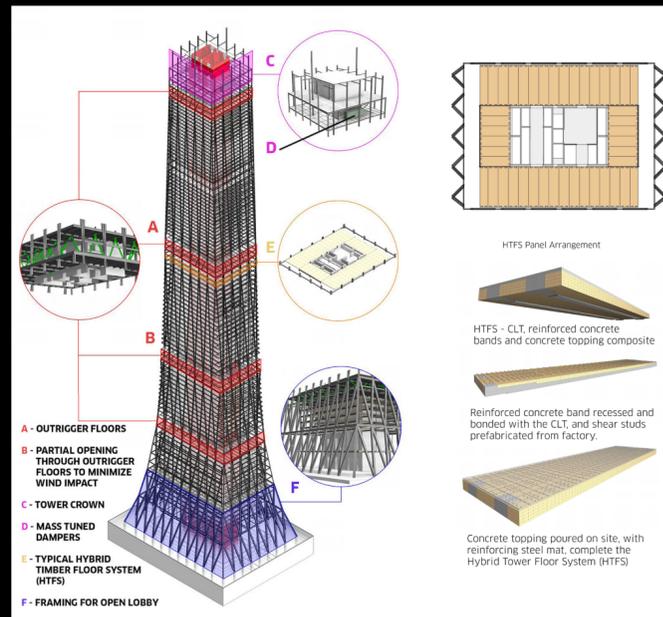
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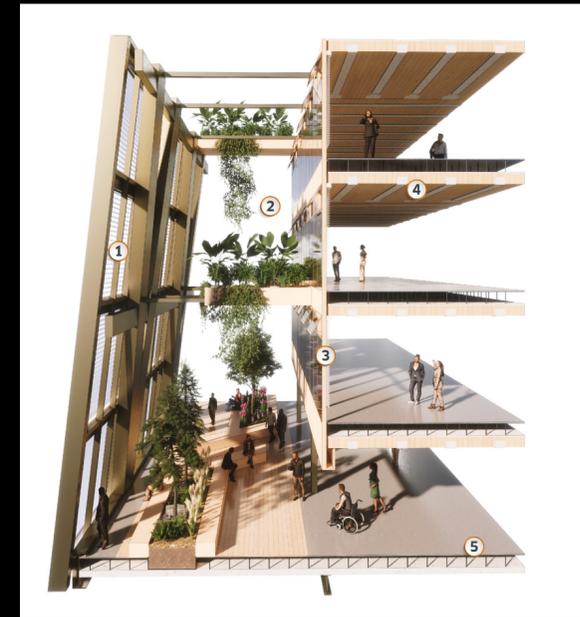
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