Gaia •
Graphical look at NTU's wooden building | **A18**

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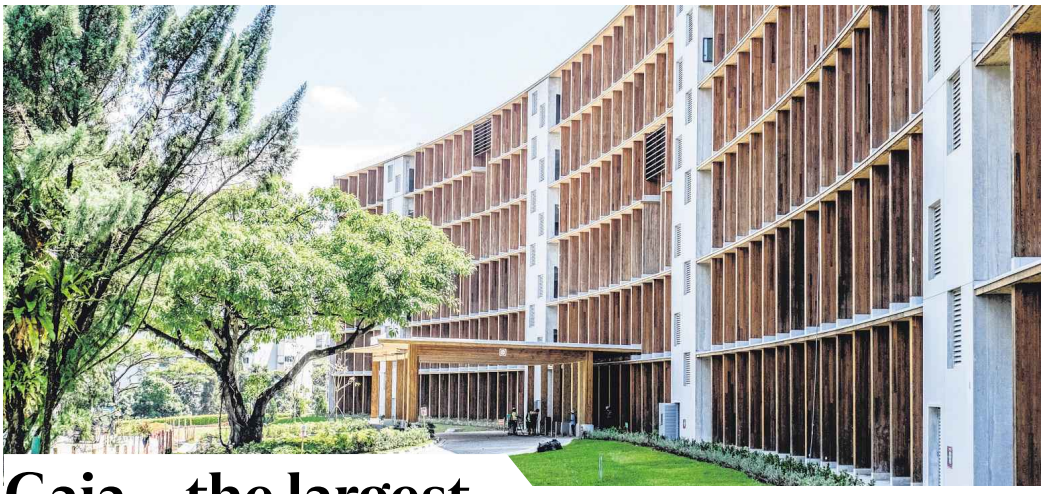
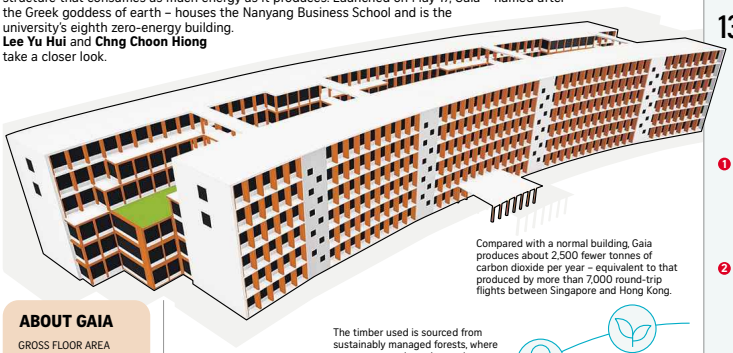


Gaia – the largest wooden building in Asia

Nanyang Technological University (NTU) is home to Asia's largest wooden building, which is also a zero-energy structure that consumes as much energy as it produces. Launched on May 17, Gaia – named after the Greek goddess of earth – houses the Nanyang Business School and is the university's eighth zero-energy building.
Lee Yu Hui and **Chng Choon Hiong** take a closer look.



Compared with a normal building, Gaia produces about 2,500 fewer tonnes of carbon dioxide per year – equivalent to that produced by more than 7,000 round-trip flights between Singapore and Hong Kong.

ABOUT GAIA

GROSS FLOOR AREA
43,500 sq m

BUILDING HEIGHT
Six storeys

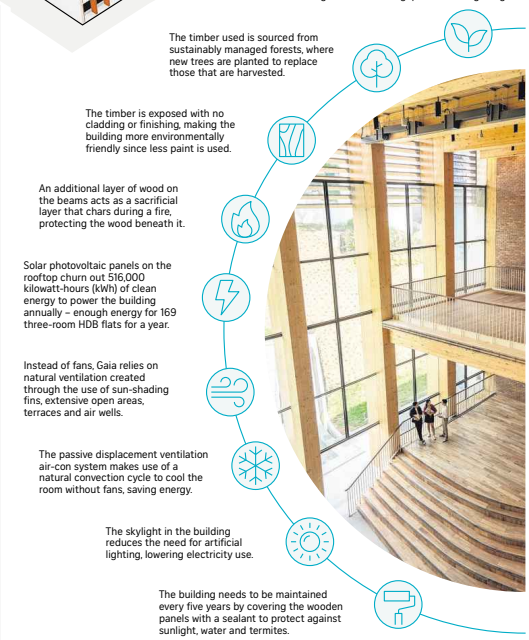
IN THE BUILDING

1	auditorium (120 seats)
12	lecture theatres
15	seminar rooms
78	study rooms

GREEN MARK PLATINUM (ZERO ENERGY)

Gaia is the eighth building on the NTU campus with the highest award issued by the Building and Construction Authority of Singapore.

There are currently 16 certified zero-energy buildings in the city.



The timber used is sourced from sustainably managed forests, where new trees are planted to replace those that are harvested.

The timber is exposed with no cladding or finishing, making the building more environmentally friendly since less paint is used.

An additional layer of wood on the beams acts as a sacrificial layer that chars during a fire, protecting the wood beneath it.

Solar photovoltaic panels on the rooftop churn out 516,000 kilowatt-hours (kWh) of clean energy to power the building annually – enough energy for 169 three-room HDB flats for a year.

Instead of fans, Gaia relies on natural ventilation created through the use of sun-shading fins, extensive open areas, terraces and air wells.

The passive displacement ventilation air-con system makes use of a natural convection cycle to cool the room without fans, saving energy.

The skylight in the building reduces the need for artificial lighting, lowering electricity use.

The building needs to be maintained every five years by covering the wooden panels with a sealant to protect against sunlight, water and termites.

MASS-ENGINEERED TIMBER

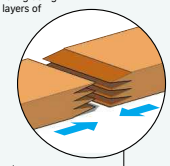
Gaia is built using mass-engineered timber, a sustainable building material made from engineered wood products prefabricated off-site.

It was first used by NTU in the construction of its mega sports hall, The Wave. The two buildings are the works of Japanese architect Toyo Ito, a recipient of the Pritzker Prize, known as the Nobel Prize of architecture.

13,000 cubic m of glue-laminated timber and cross-laminated timber (CLT) was used in the construction of Gaia.

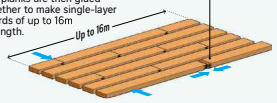
How cross-laminated timber is made

CLT, a subcategory of engineered wood, is a panel product made from glueing together at least three layers of solid-sawn lumber.

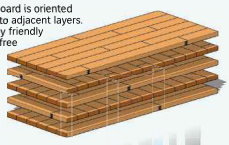


1 A wooden plank of the required length is created by finger jointing.

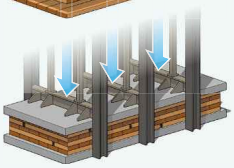
2 The planks are then glued together to make single-layer boards of up to 16m in length.



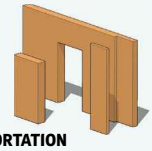
3 Each layer of board is oriented perpendicular to adjacent layers. Environmentally friendly formaldehyde-free adhesives are applied on the wide faces of each board.



4 They are then bonded together with a hydraulic press.



5 The wooden element is cut with millimetre precision to the exact specifications required for the final build.



EFFICIENT TRANSPORTATION AND CONSTRUCTION

CLT walls, floors, roofs and stairs were flat-packed into 29 shipments, equivalent to the size of three Olympic-size swimming pools. The parts were loaded in sequence and ready to be assembled on-site, ensuring minimum exposure to moisture.

The delivery from Altheim, Austria took 639 days between September 2019 and June 2021.

Sources: NTU SINGAPORE, WIEHAG, STORAENSO PHOTOS: NTU SINGAPORE, STORAENSO
STRAITS TIMES GRAPHICS: LEE YU HUI, CHNG CHOON HIONG