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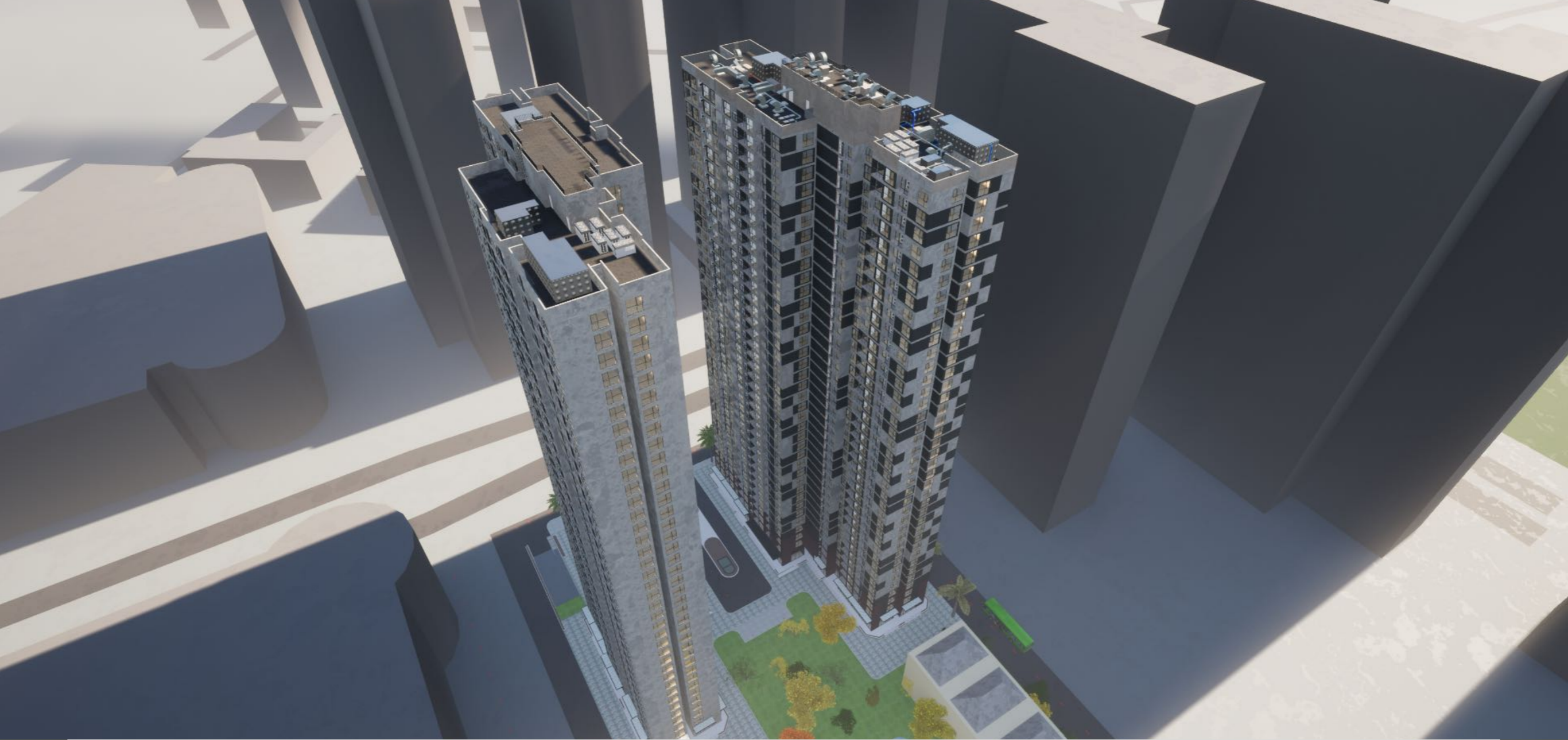
rim

wilo



VINGROUP  
VINHOMES

based on a decision of  
the German Bundestag



# SMART URBAN AREAS - SUA

BUILDING ENVELOPE AND ENERGY OPTIMISATION EVALUATIONS FOR URBAN AREAS IN VIETNAM: LEARNING FROM GLOBAL STANDARDS



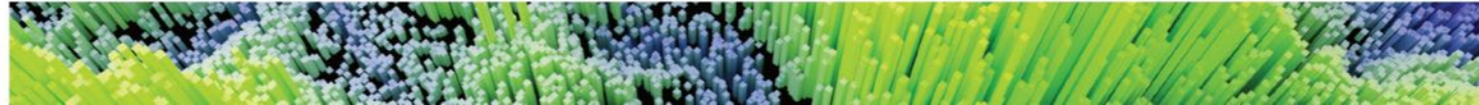
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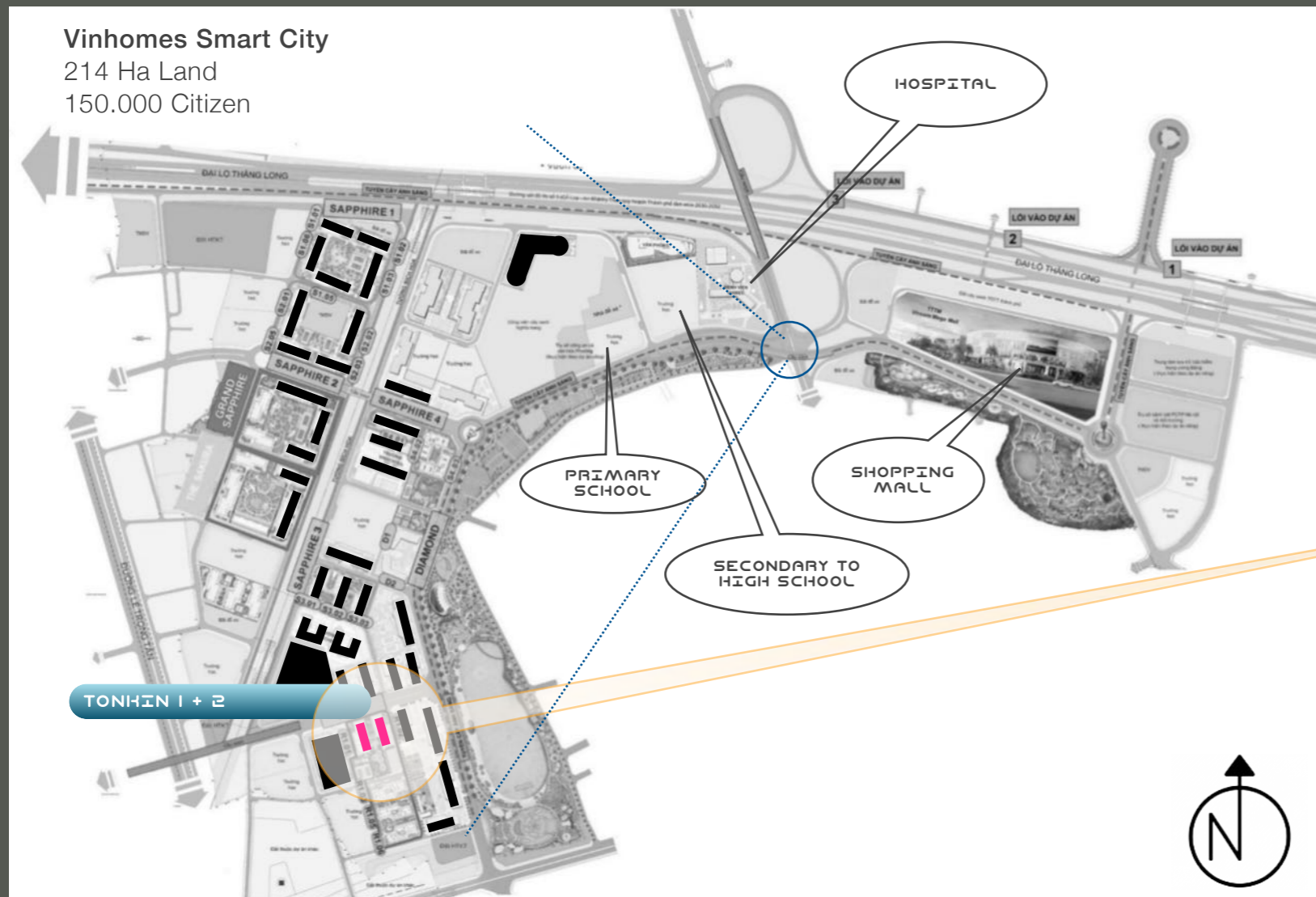


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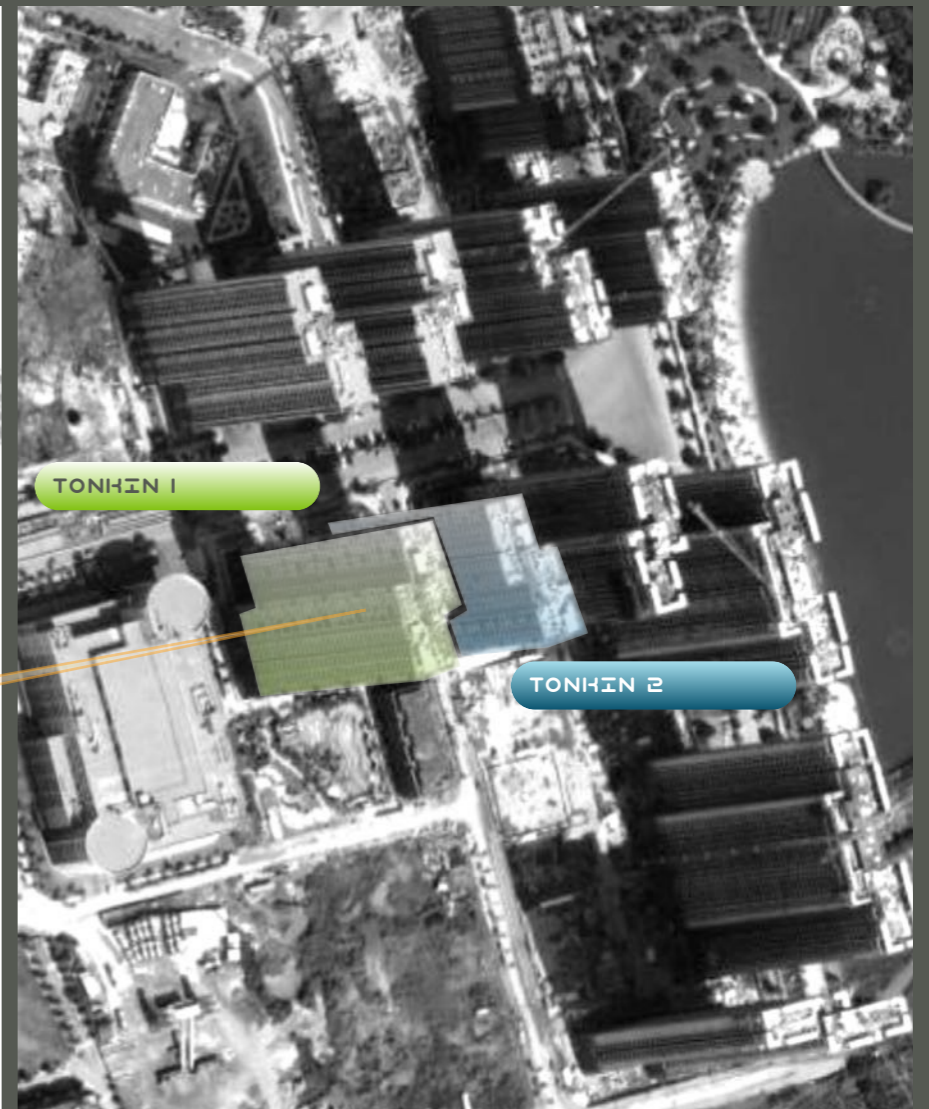


# SMART CITY HANOI

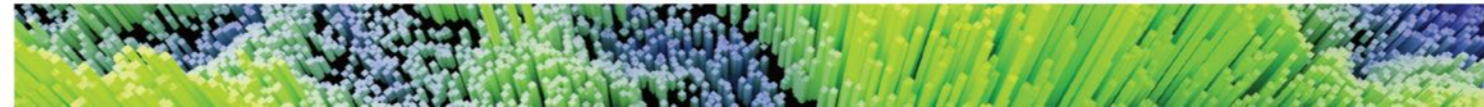
Site plan & Bird view



Source: Vinhomes



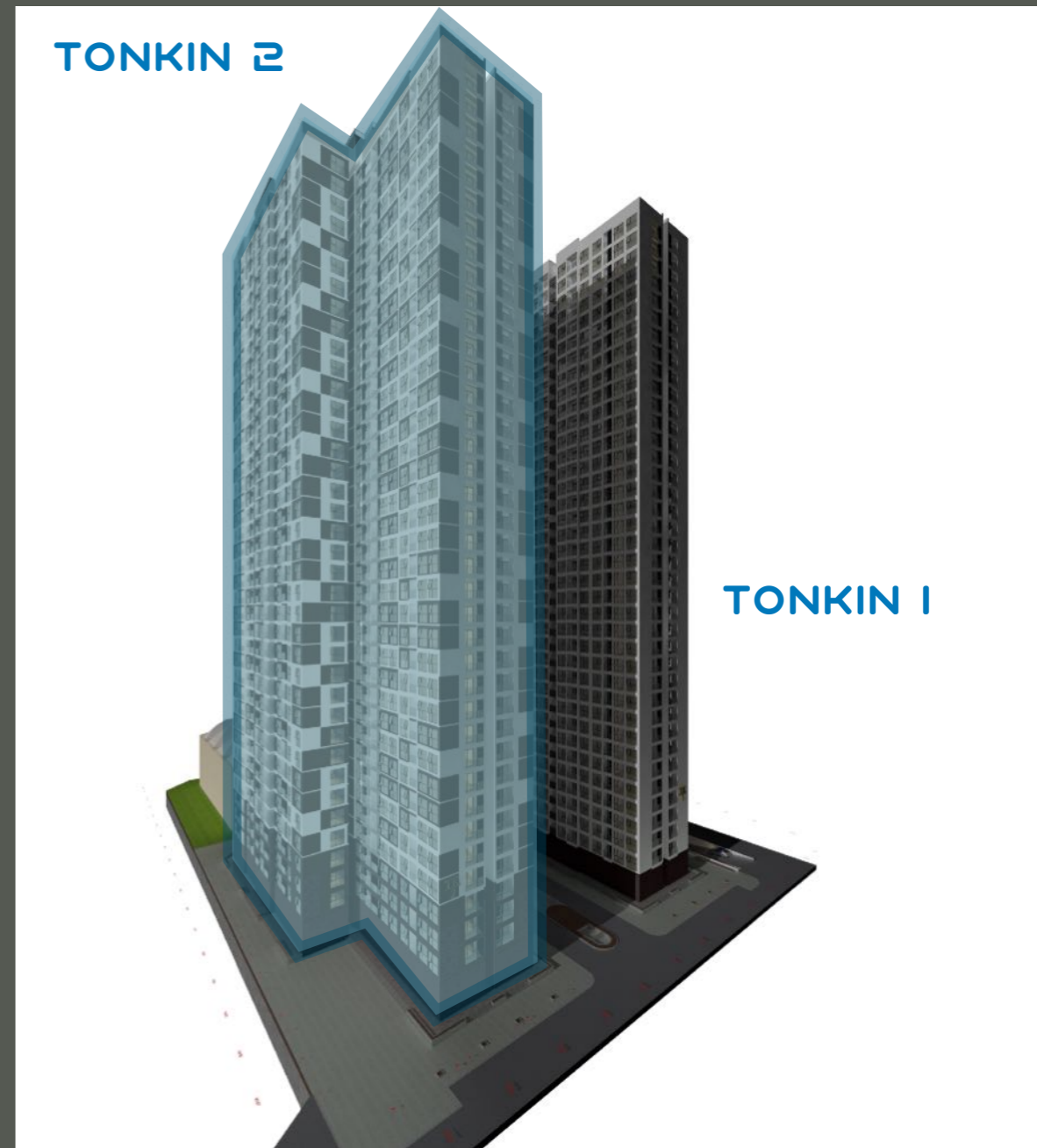
Source: Google Earth



# TONKIN 2

## Building Information Board:

- Length: 70,80 m
- Width: 37,35 m
- Height: 139,00 m
  
- Floor area: 1.217,90 m<sup>2</sup>
- Gross floor area: 46.279,80 m<sup>2</sup>
- Umbauter Raum: 160.870,99 m<sup>3</sup>
  
- Floors: **39** (incl. roof top)
- Residential floors: 38
- Retail floors: 1
  
- Apartments: **602**
  - Studios: 114
  - 1 Bed Apt: 112
  - 2 Bed Apt: 301
  - 3 Bed Apt: 75
  
- Residents (fix): **~1.917**
- Residents (flex): ~100 (Maid / Family / Service staff)
  
- Construction Material: Concrete, Bricks, Cement plaster, Ceramic, Stone, Metals, Glass, Paint, div. Plastics



Quelle: BIM Planung, RIM



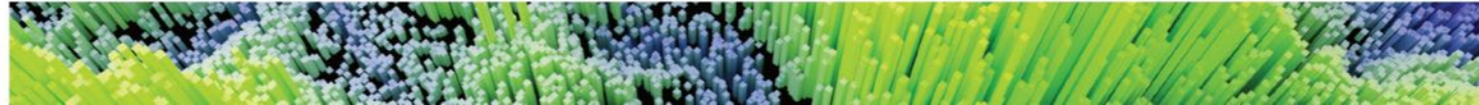
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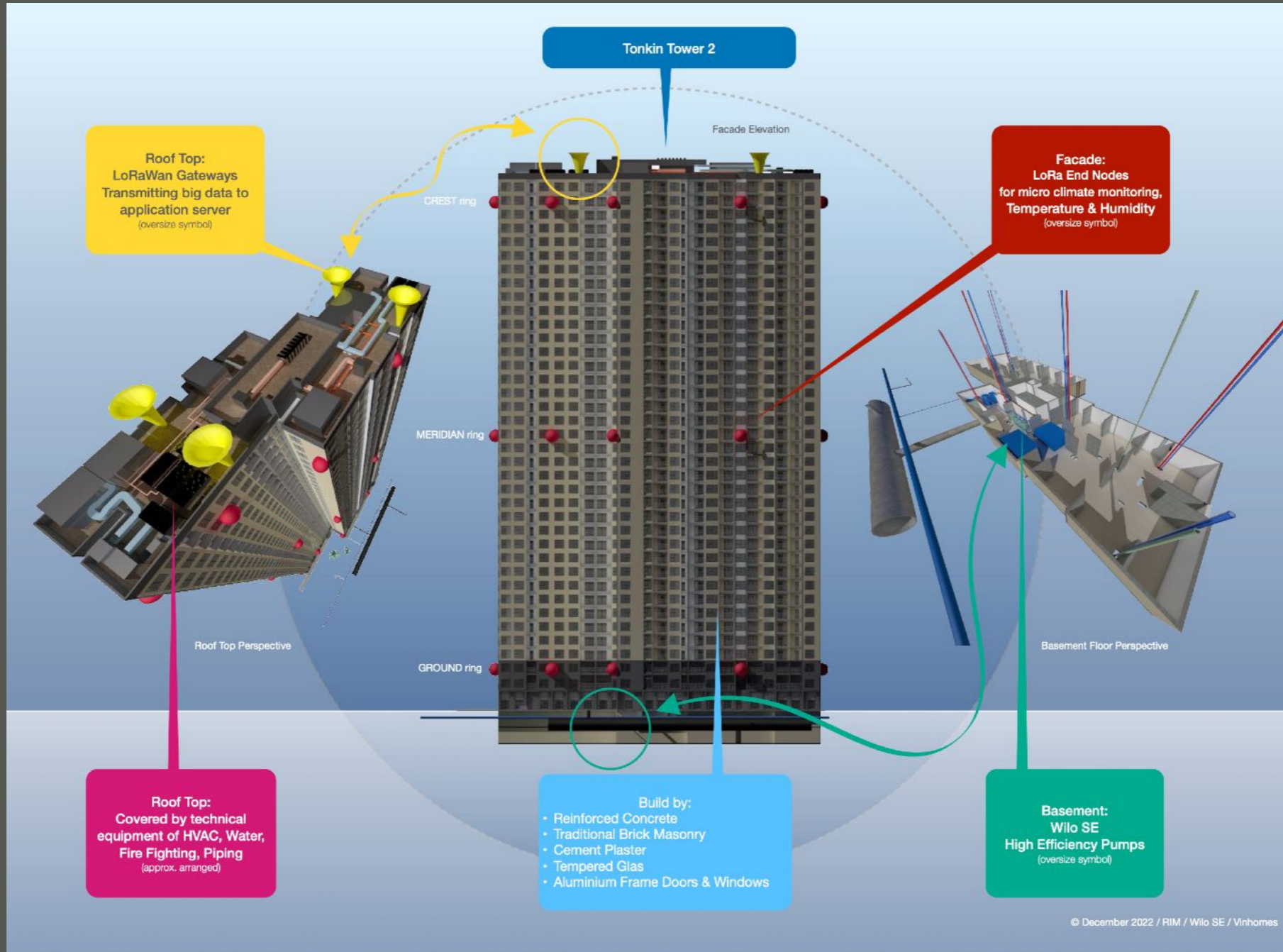
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# TONKIN 2 - RESEARCH BUILDING



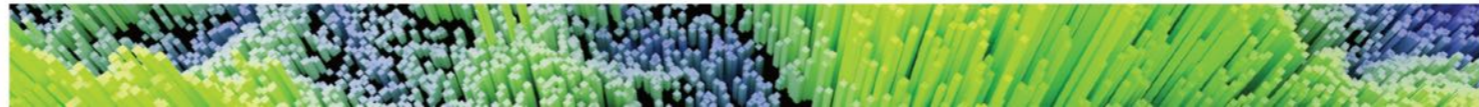
Source: RIM



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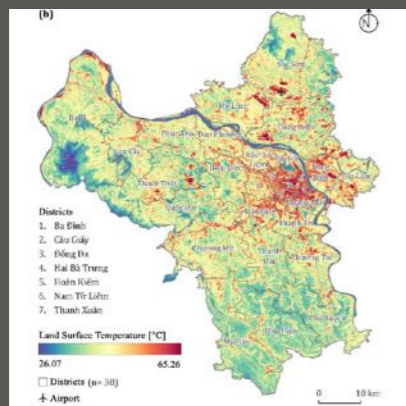
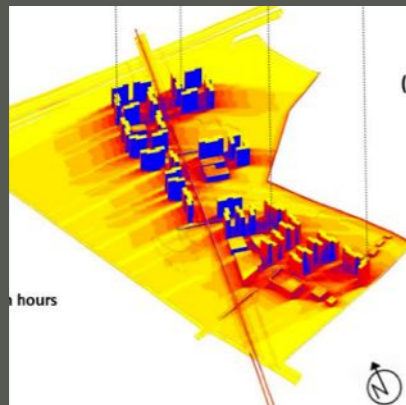
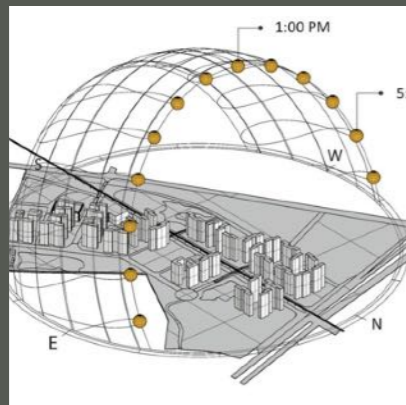


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# TONKIN 2 - FOCUS

Micro-Climate Dynamic:



Building Materials:



Energy - Water - Performance:



**LIVING COMFORT**

**BUILDING PERFORMANCE**

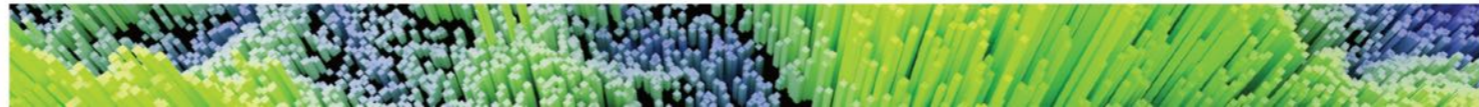
Source: RIM, WILO



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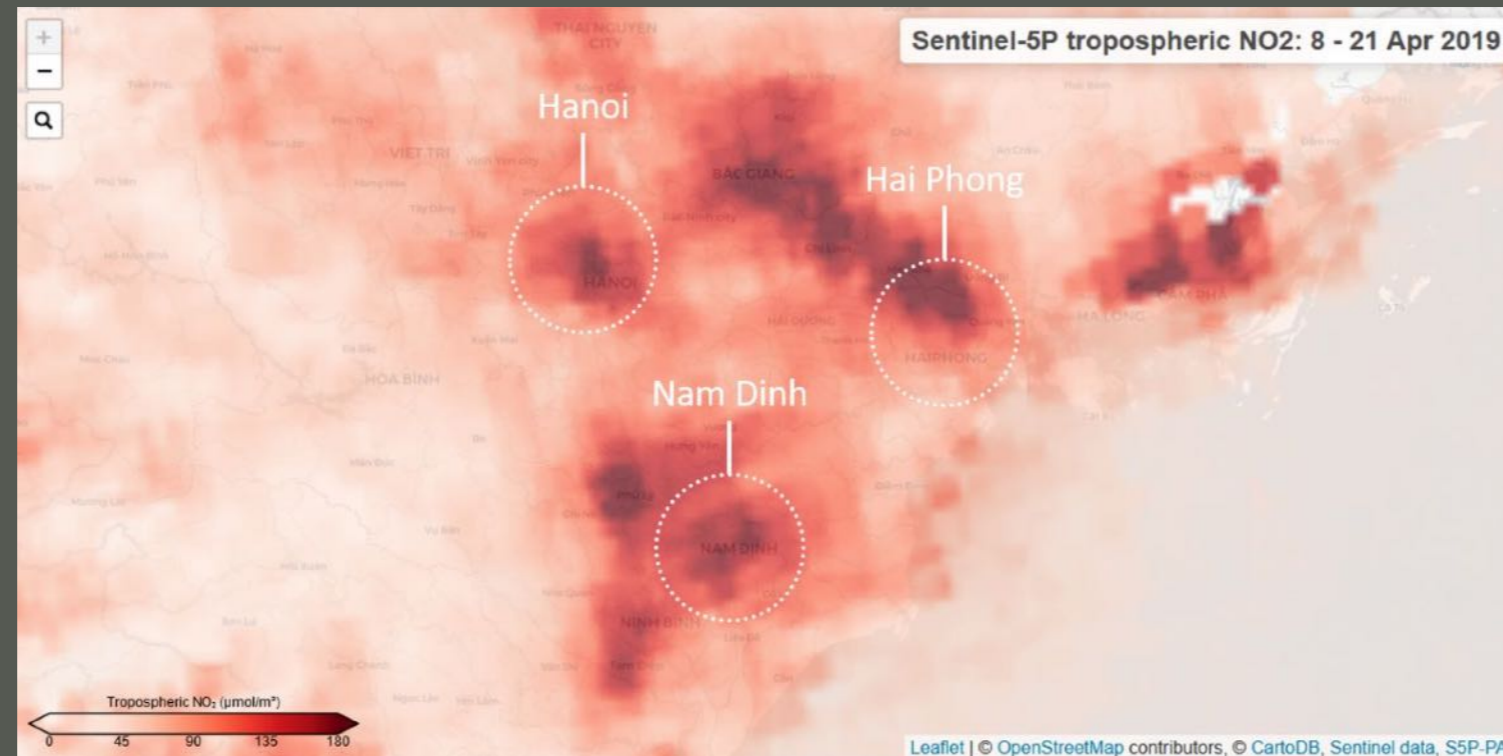
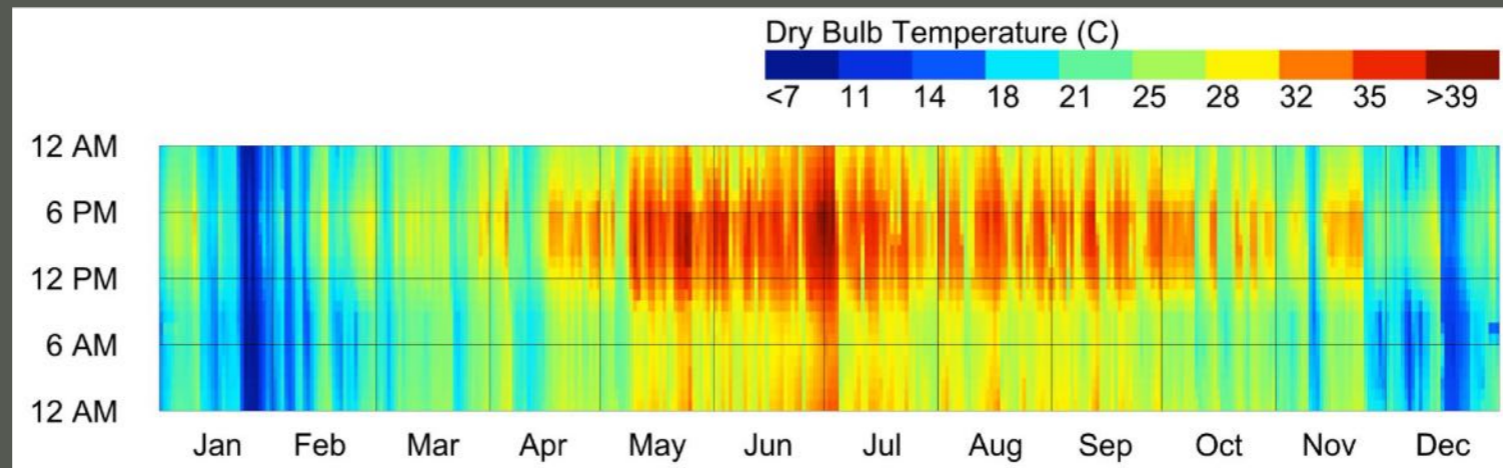


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# BIG PICTURE

## NO<sub>2</sub> - Nitrogen Dioxide concentration in northern Vietnam



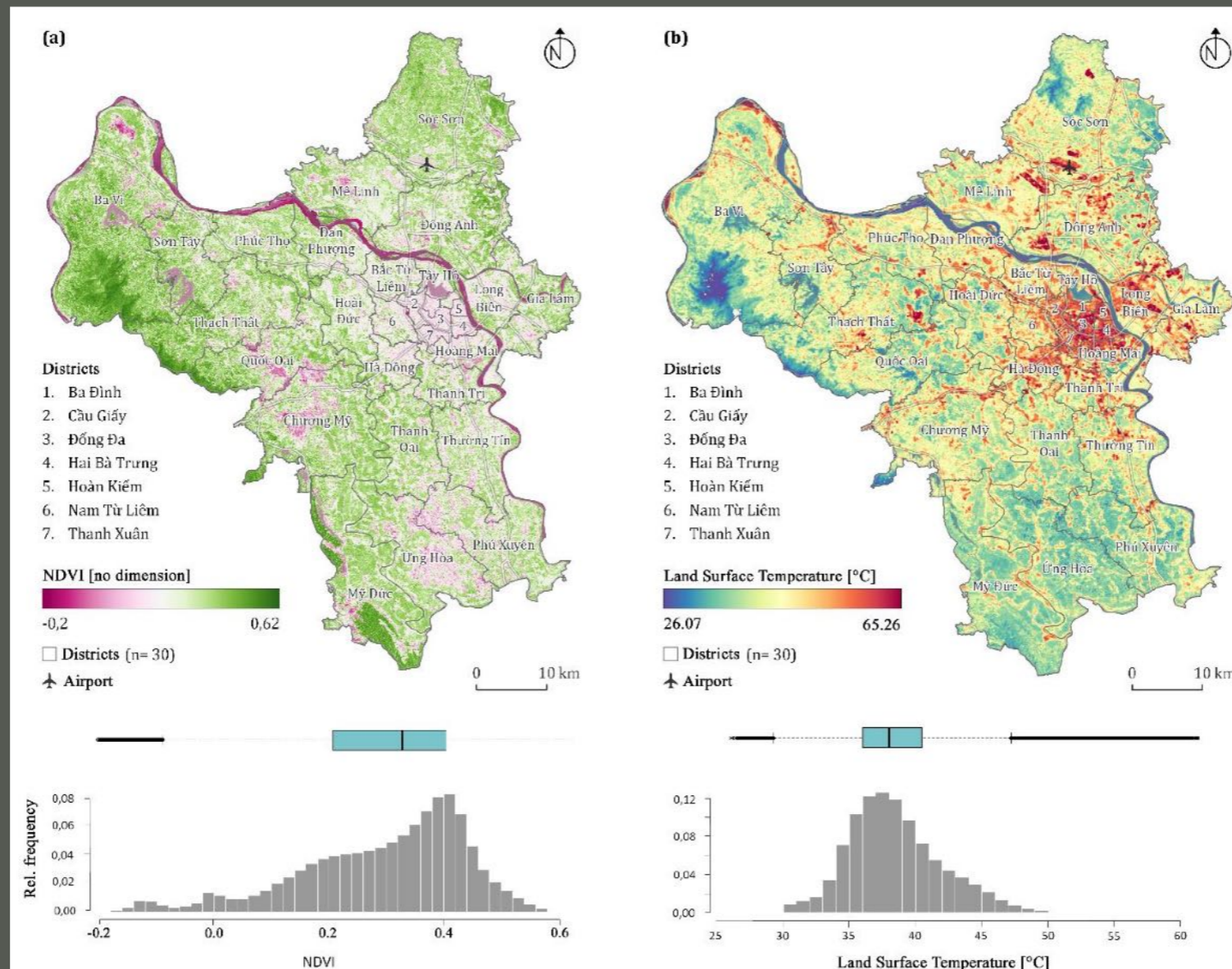
Source: RIM

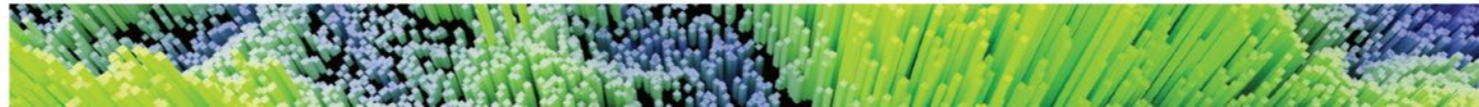




# CITY ENVIRONMENT

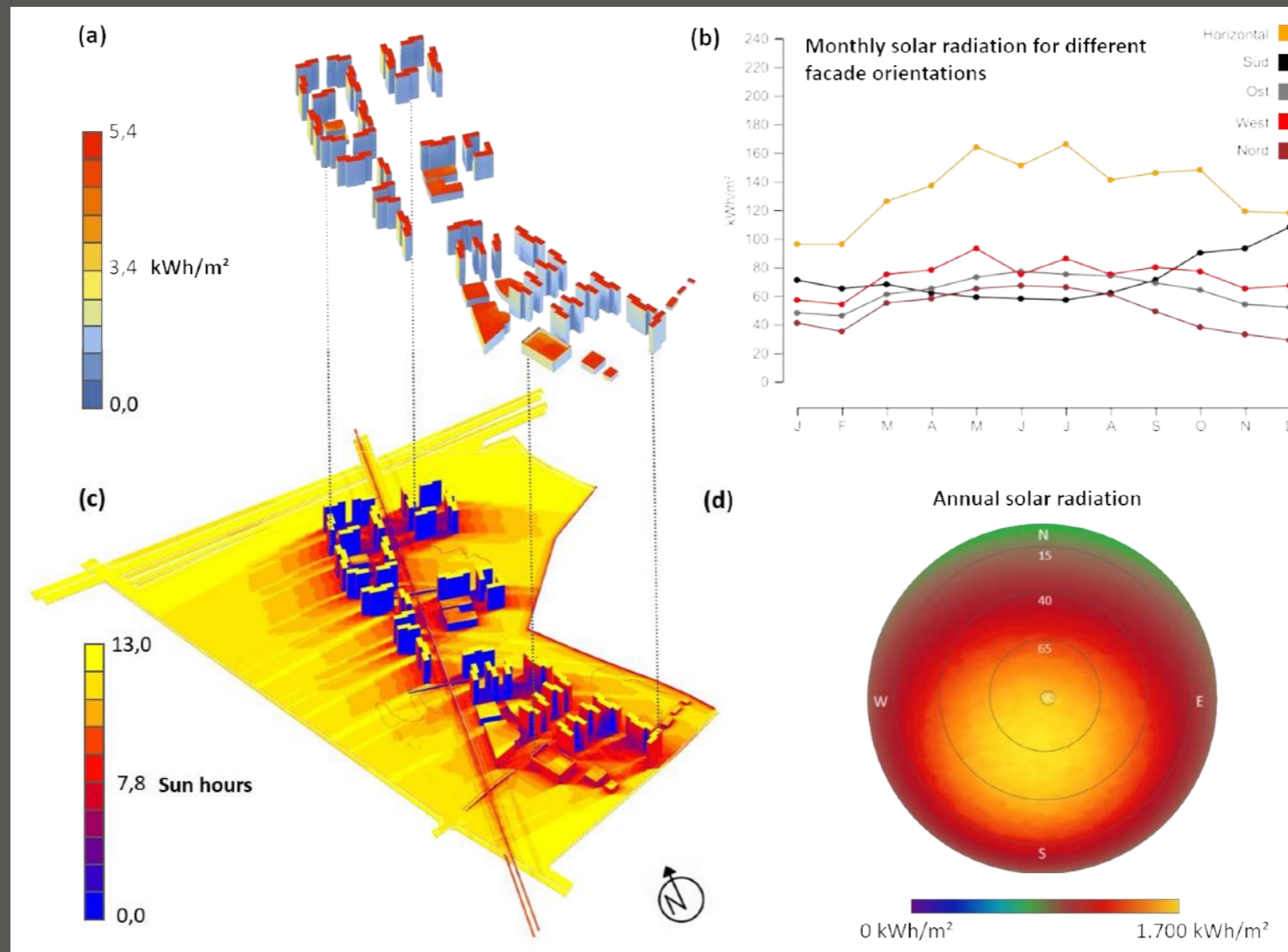
## Normalised Difference Vegetation Index (NDVI) vs. Land Surface Temperature



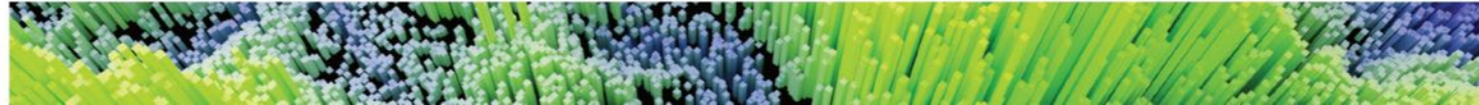


# SOLAR RADIATION ANALYSE

Solar potential, Monthly solar radiation, 24hrs absolut Sunshine in June and annual solar radiation Hanoi







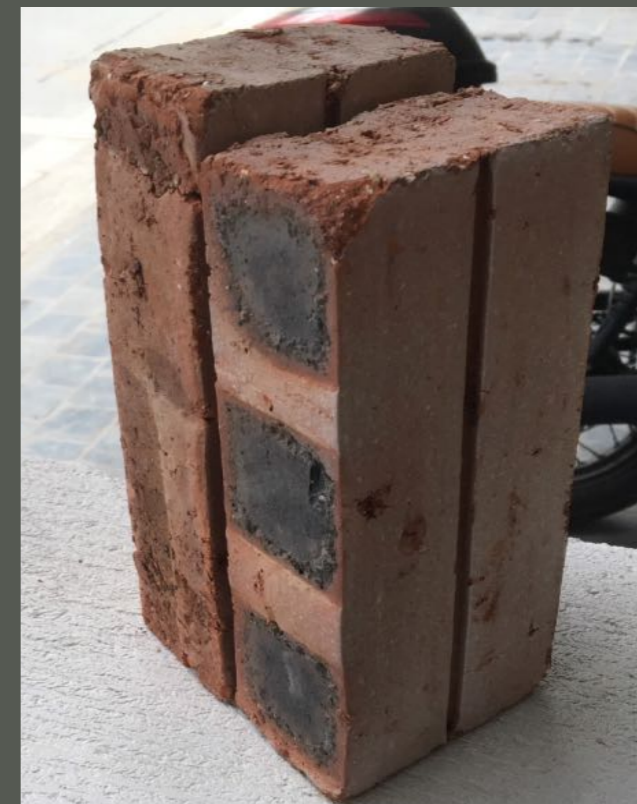
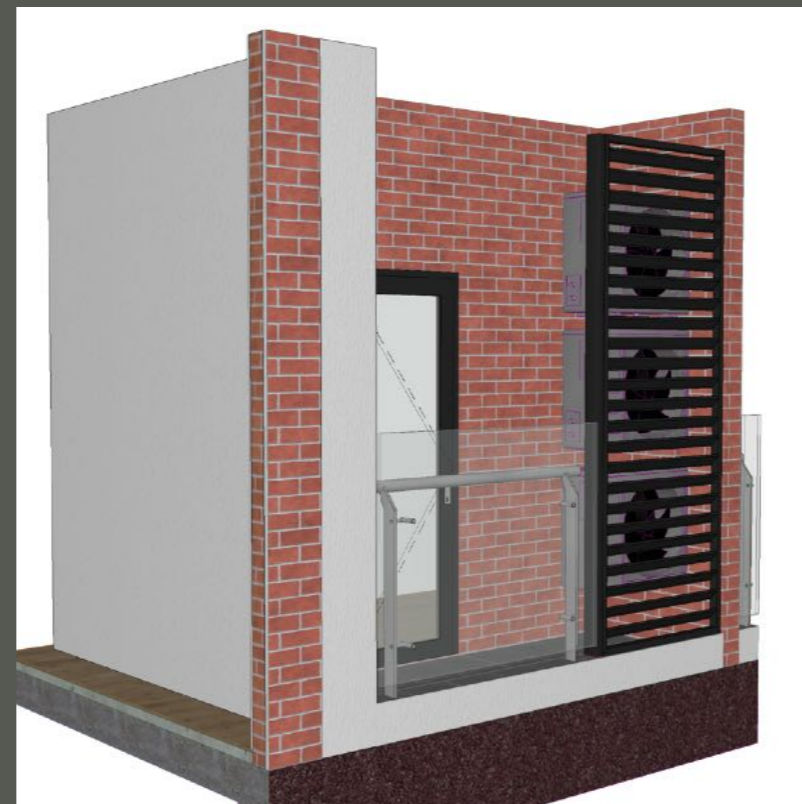
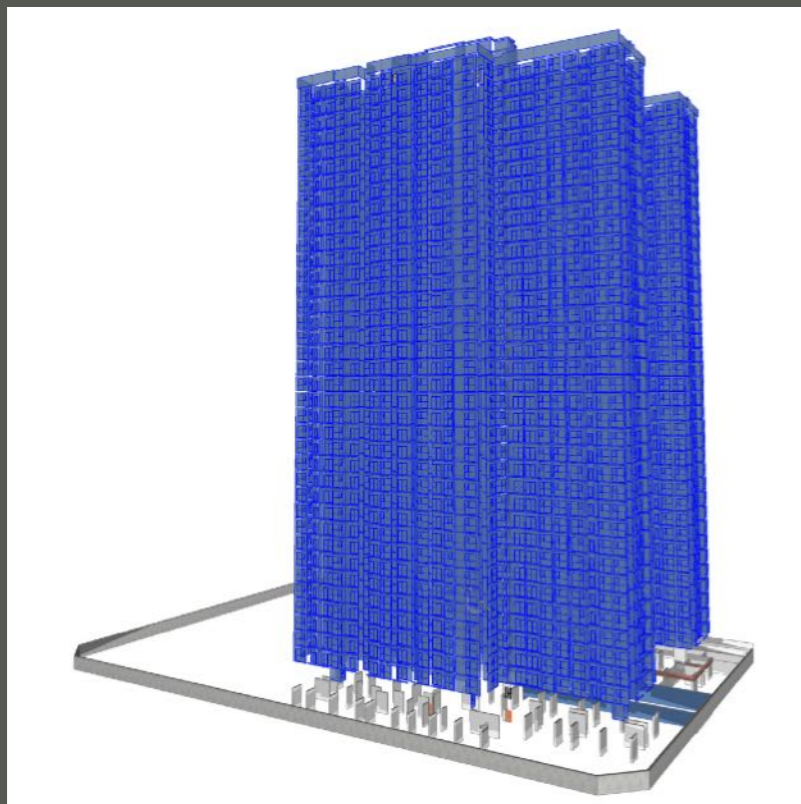
# ENVELOPE SURFACE

## Brick Masonry w/ cement plaster - 150mm

- Bricks: 1,0 m<sup>3</sup> = 1.000 pcs. = 1,5 mt
- 5.000 m<sup>3</sup> = 5.000.000 pcs.
- 5.000m<sup>3</sup> = 7.500 mt
- 1,0 Stk. = 0,000514 metric ton CO<sub>2eq</sub>



5.000.000 pcs. = 2.570 metric tons CO<sub>2eq</sub> / year



Wall surfaces

Source: RIM

Source: <https://www.ccacoalition.org/en/resources/emissions-brick-manufacturing-industry-book-chapter>





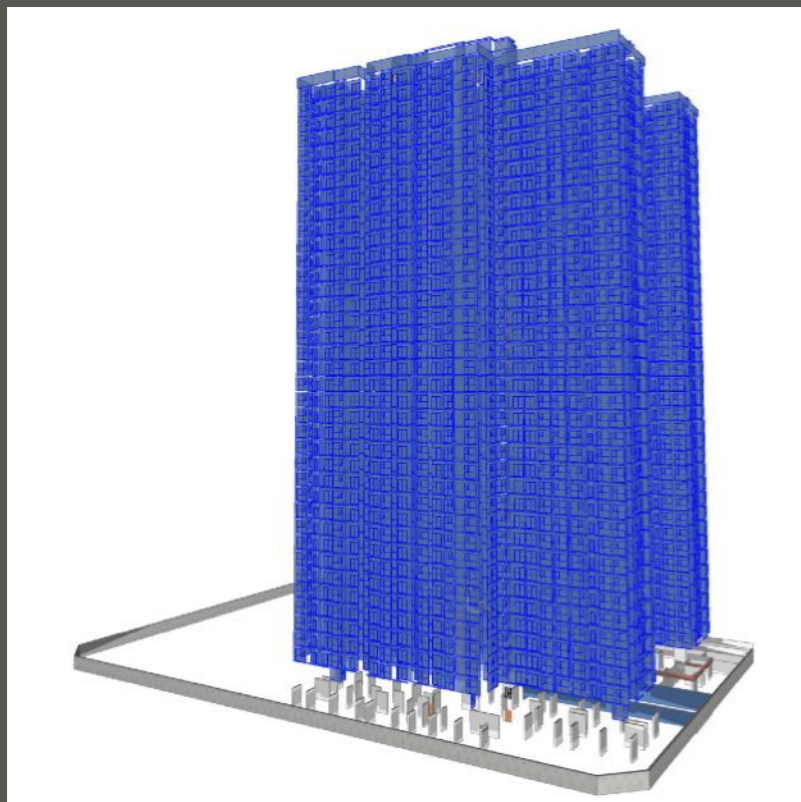
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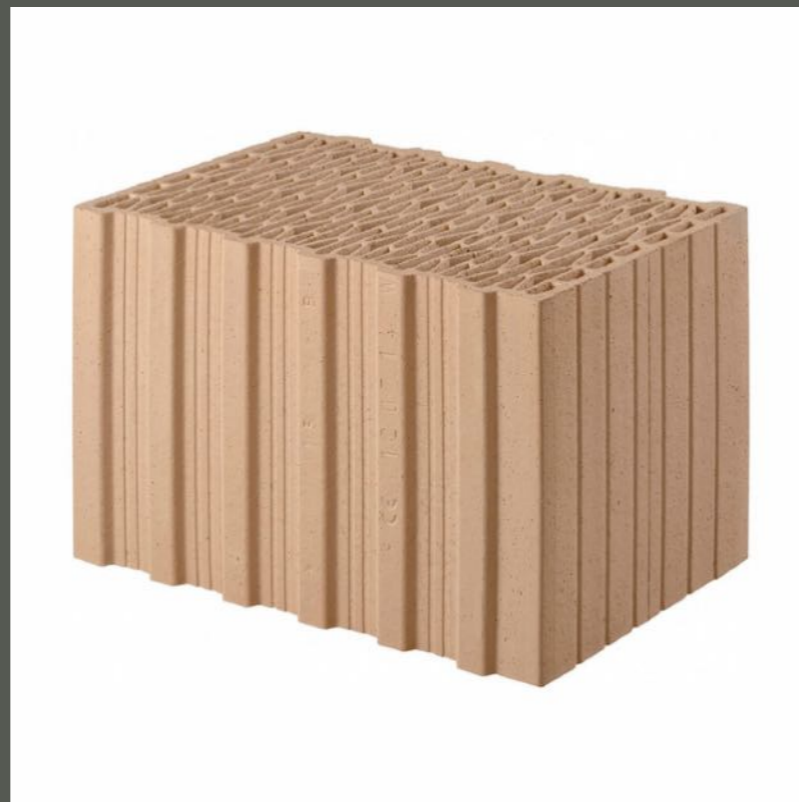
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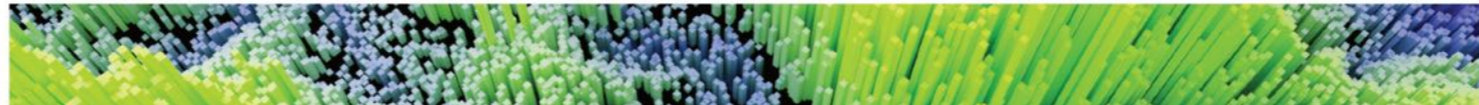
Wall surface material



Source: RIM, Wienerberger, Viglacera

Source: <https://www.ccacoalition.org/en/resources/emissions-brick-manufacturing-industry-book-chapter>





# CONSTRUCTION MATERIAL

## Building framework

● Evaluation

16.932m<sup>3</sup>  
33.864t

= 42.330 mt concrete (one tower)  
= cement share  
= 20.318.400 kg CO<sub>2eq</sub> / year  
= Bubble Deck, UBoot, Unidome

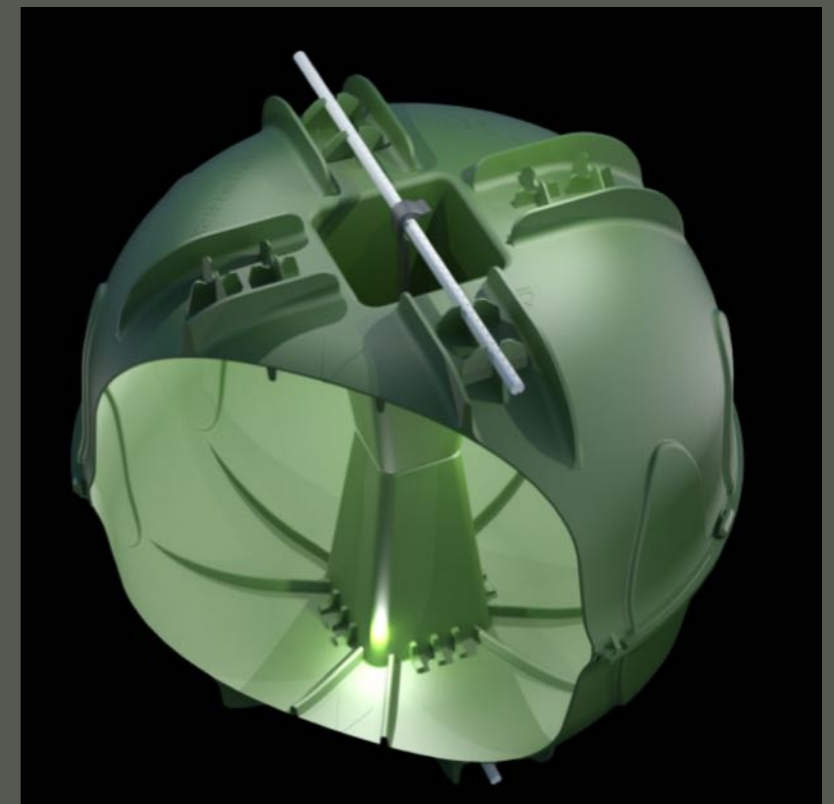
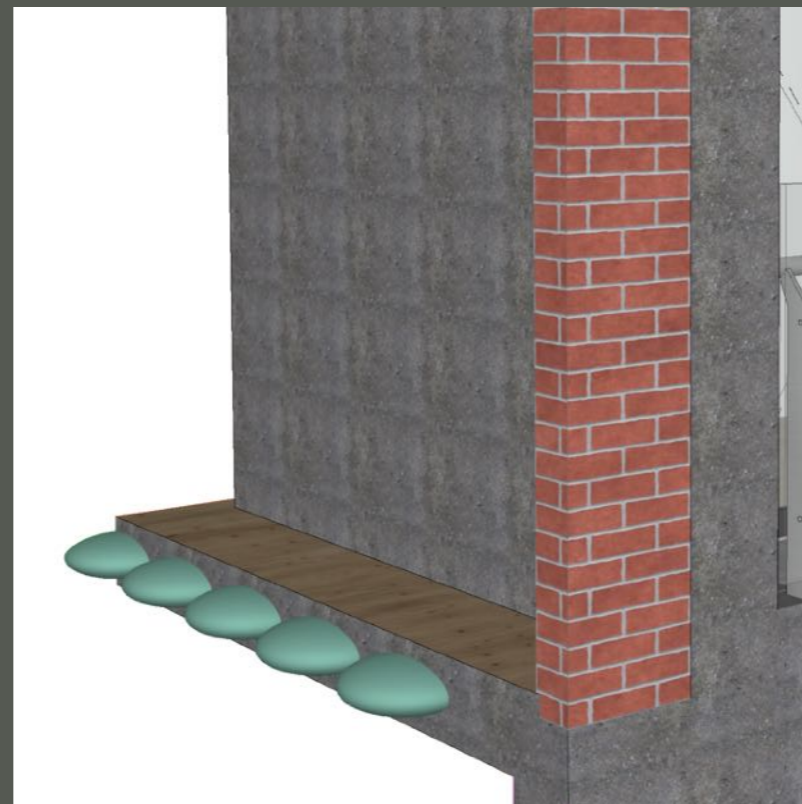
●



- up to 30% - 40% cement reduction in slabs, floors, foundations and basement walls.
- Higher stability and durability
- Less Building load (earth pressure)
- Faster construction



Concrete Frame Work



Source: RIM, Unidome

Source: <https://baustoffbeton.at/faq/wie-viel-co2-entsteht-durch-beton/>

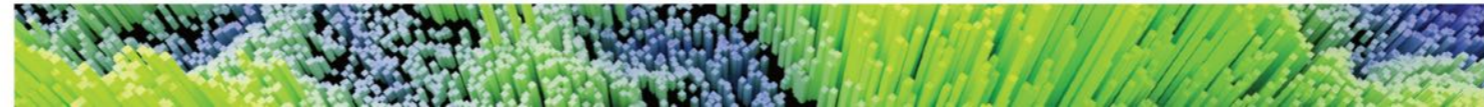
Source: <https://gccassociation.org/sustainability-innovation/gnr-gcca-in-numbers/>

Source: <https://www.baunetzwissen.de/beton/fachwissen/herstellung/betonherstellung-und-klimaschutz-7229519>

Source: [https://www.researchgate.net/publication/350823893\\_CO2\\_EMISSION\\_ASSESSMENT\\_FOR\\_RICE\\_HUSK\\_ASH\\_IN\\_CONCRETE\\_ON\\_ENVIRONMENTAL\\_APPROACH](https://www.researchgate.net/publication/350823893_CO2_EMISSION_ASSESSMENT_FOR_RICE_HUSK_ASH_IN_CONCRETE_ON_ENVIRONMENTAL_APPROACH)

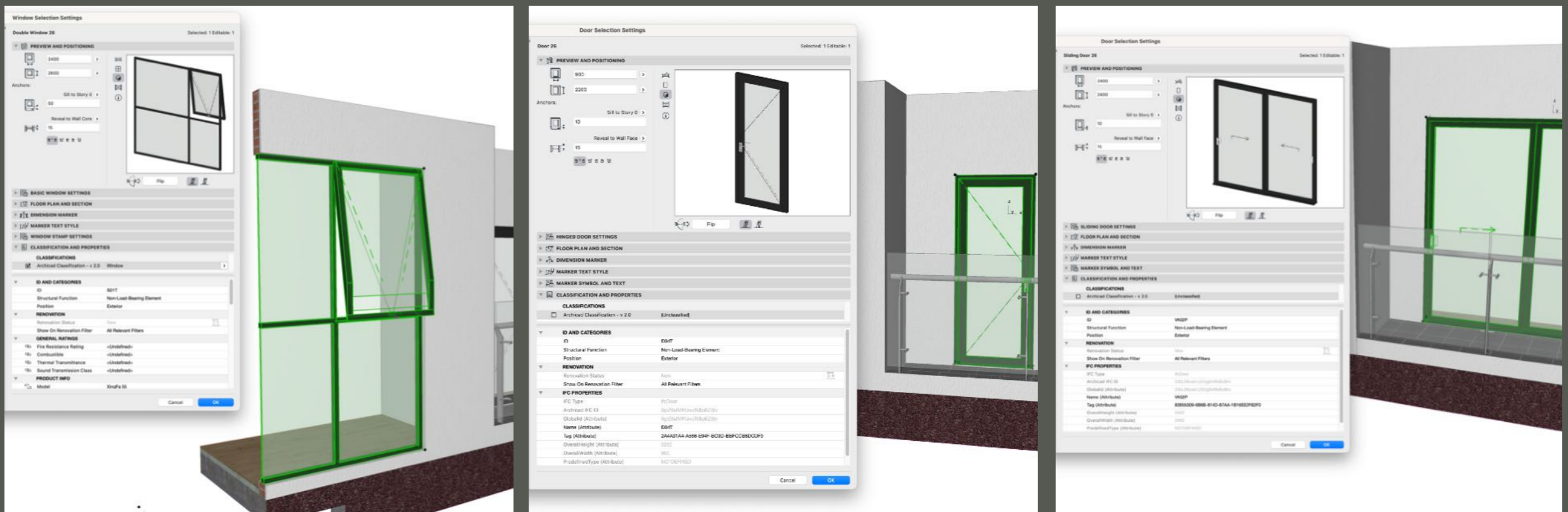
350823893\_CO2\_EMISSION\_ASSESSMENT\_FOR\_RICE\_HUSK\_ASH\_IN\_CONCRETE\_ON\_ENVIRONMENTAL\_APPROACH





# WINDOWS & FRAMES

- Quantity: 1175 pcs.
- Window frame: Aluminium, dark grey, powder coated (Jotun Grey 1301), NOT insulated
- Glass: 2-layer 4mm Tempered Glass with film (Safety glass), total thickness 8,38 mm, NOT insulation glass
- Manufacturer Xing Fa (China)



Windows, Doors and Sliding Doors

Source: BIM Planung, RIM



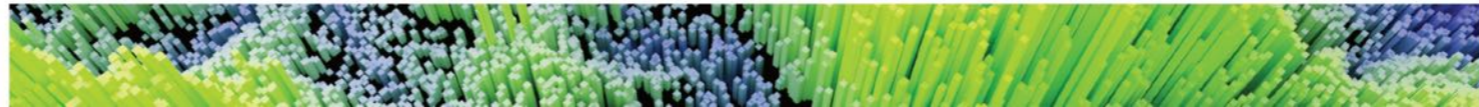
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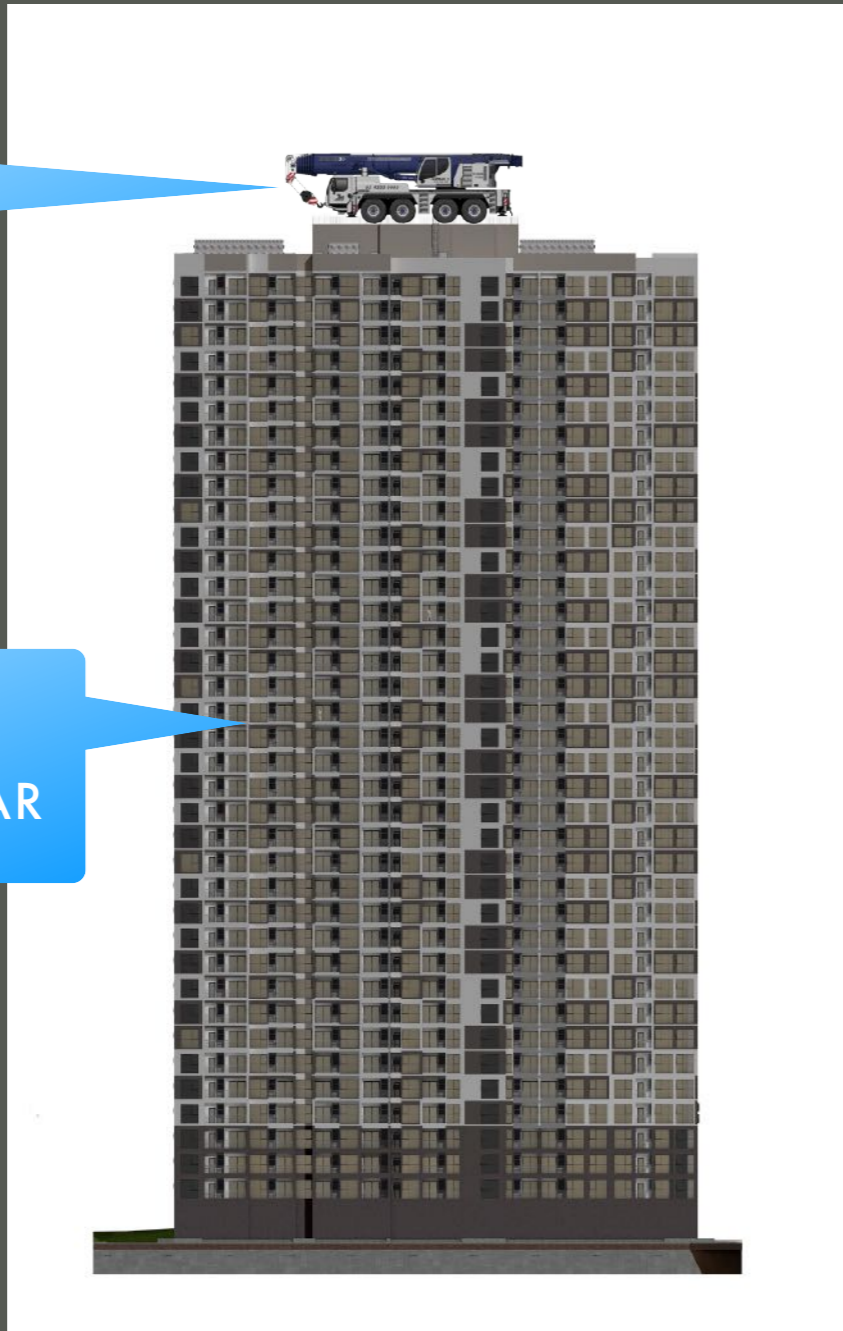


# COOLING HVAC



100T  
LOAD

1540 UNITS  
18.MIO KW/YEAR



3,5KW Geräte / 18.000 - 24.000 BTU



Source: daikin.com



60KW outdoor unit

Source: midea.com



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# WATER & HEATING



**355T  
LOAD**



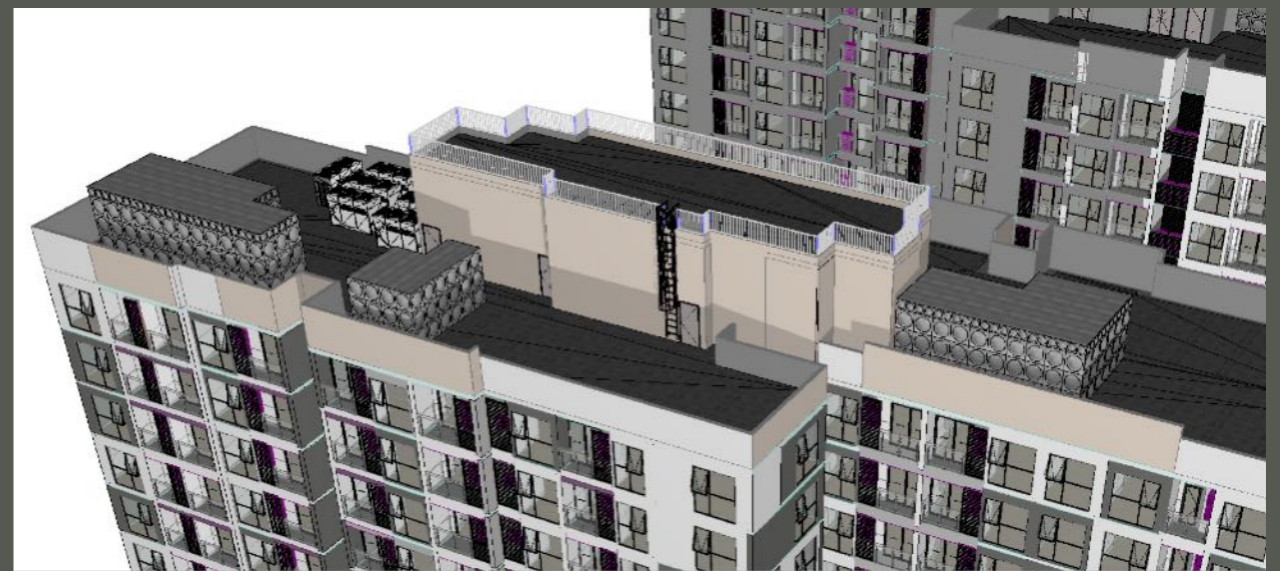
**COOL WATER  
WARM WATER  
FIRE FIGHTING  
DRINKING WATER**

**NO  
RAIN WATER USAGE  
GREY WATER USAGE**



~ 500KW Heat Pump Water Heater

Source: RIM



Water tanks on roof

Source: RIM



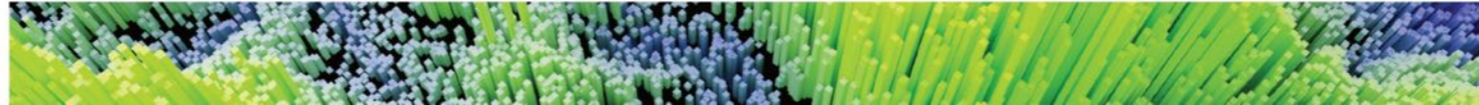
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# SUA - HOLISTIC APPROACH - WHY?

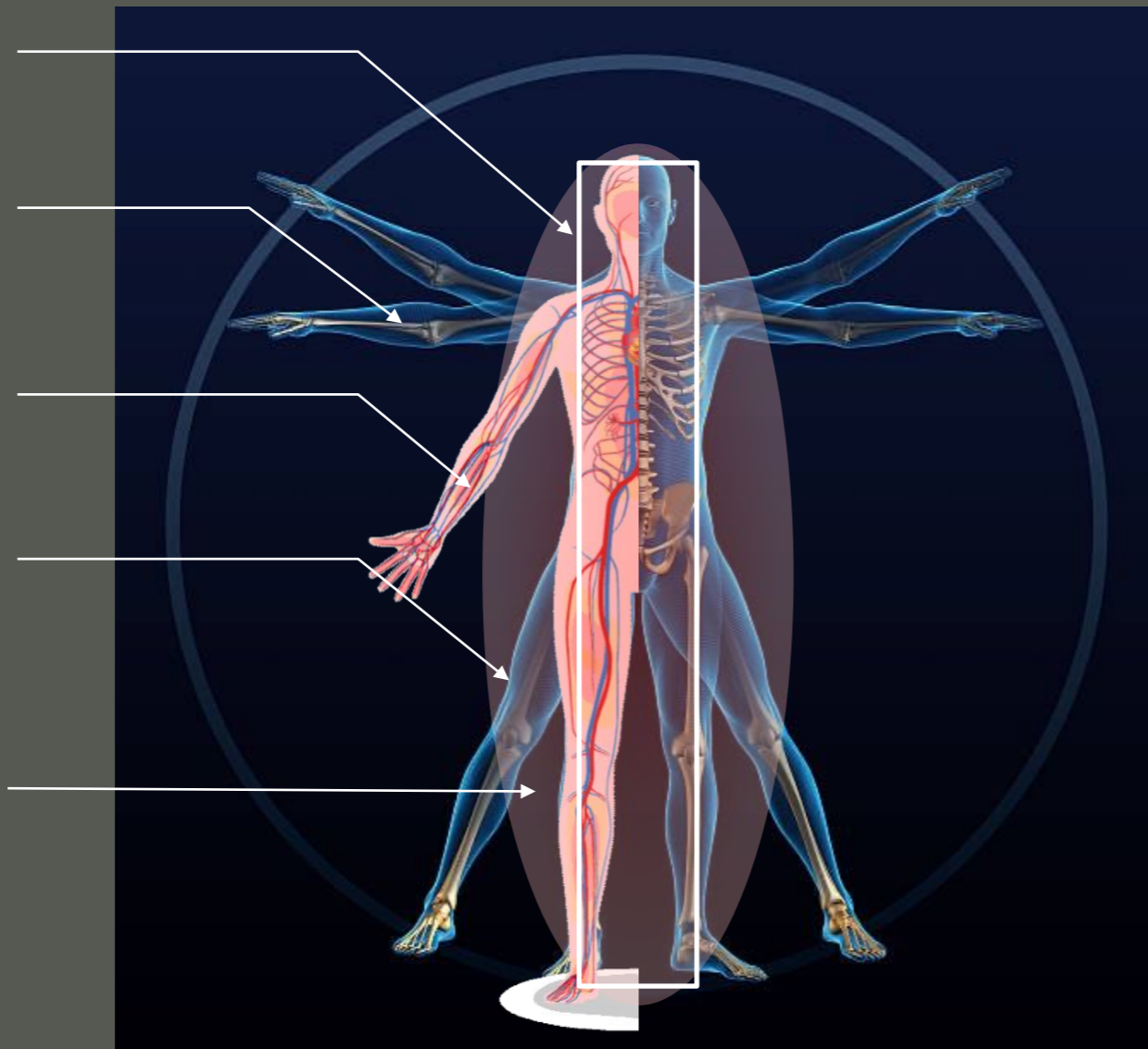
TONKIN 2

Skeleton System =  
Reinforced Concrete

Vascular System =  
WILO SE

Skin =  
Building Envelope

Micro Climate =  
Comfort Zone

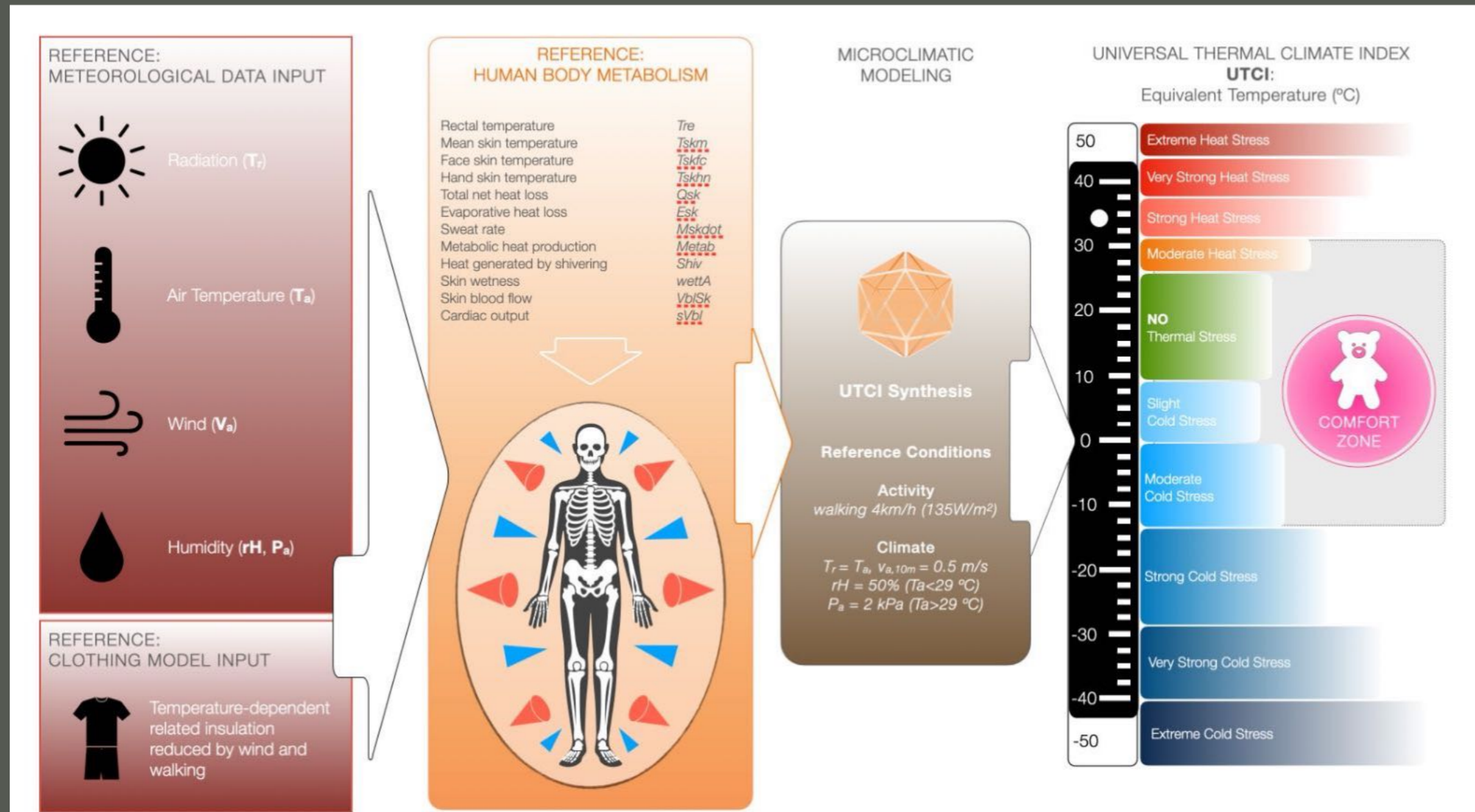


Source: Getty Images, St. Joseph Hospital



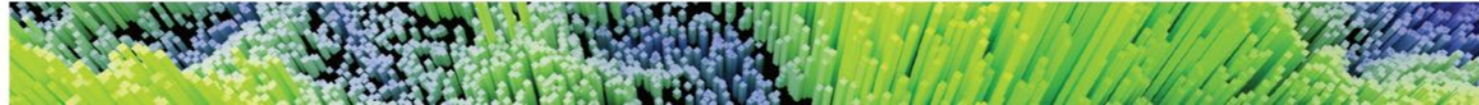
# UNIVERSAL THERMAL CLIMATE INDEX

our thermal comfort, what is within the acceptable



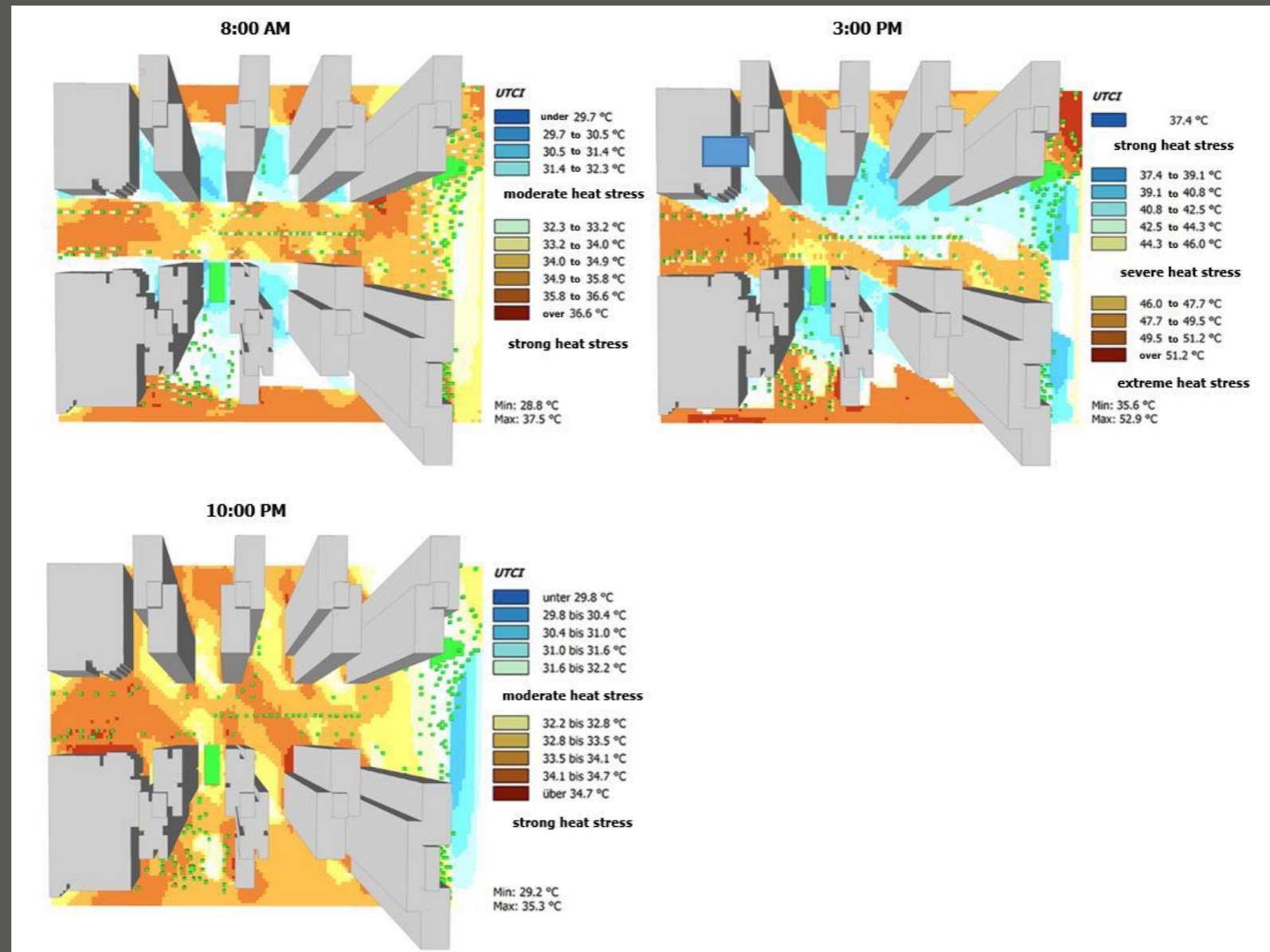
Source: RIM





# AMBIENT TEMPERATURE SIMULATIONS

UTCI on 1,4 m above ground



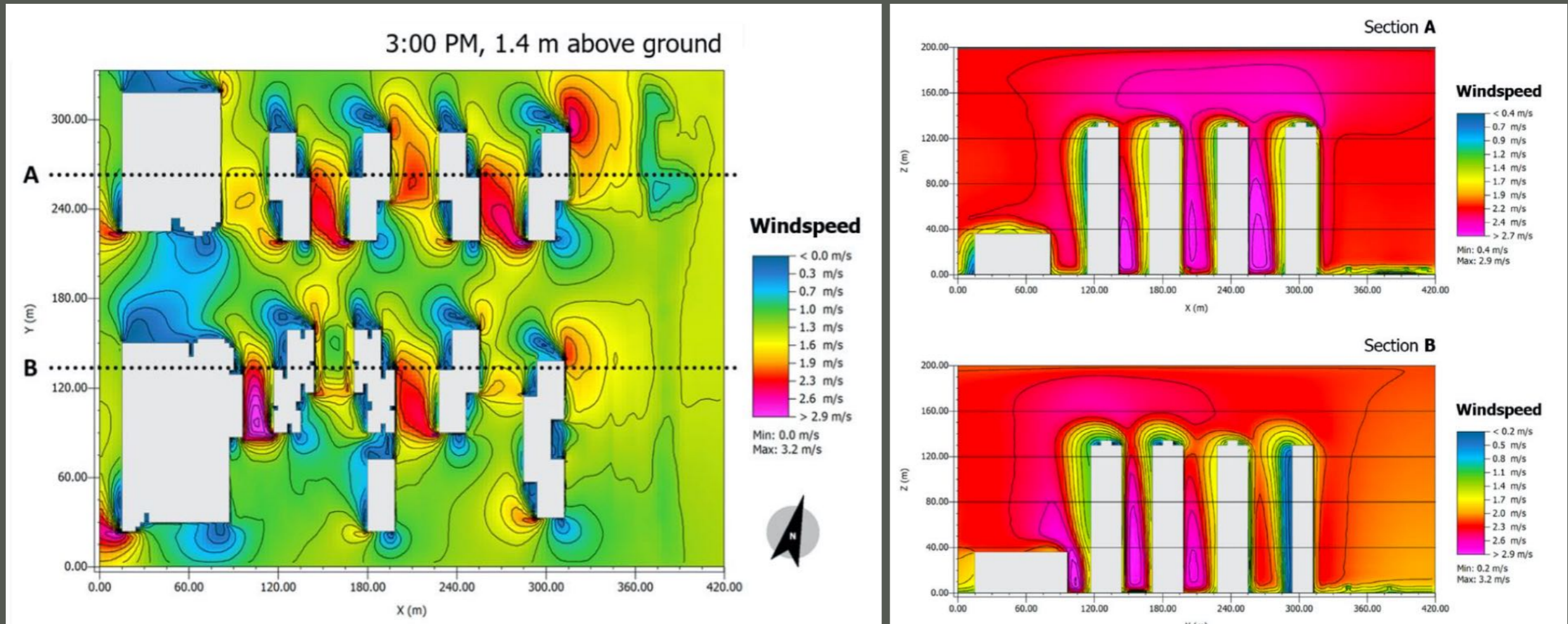
Source: RIM





# WIND SIMULATION

ENVl-met simulations 1,4 m and around research buildings



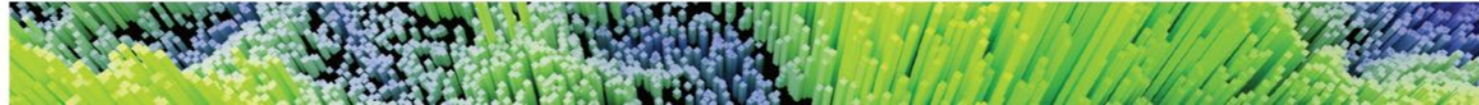
Source: RIM



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# SCENARIOS - WHAT IF...

Three scenarios designed on feasibility



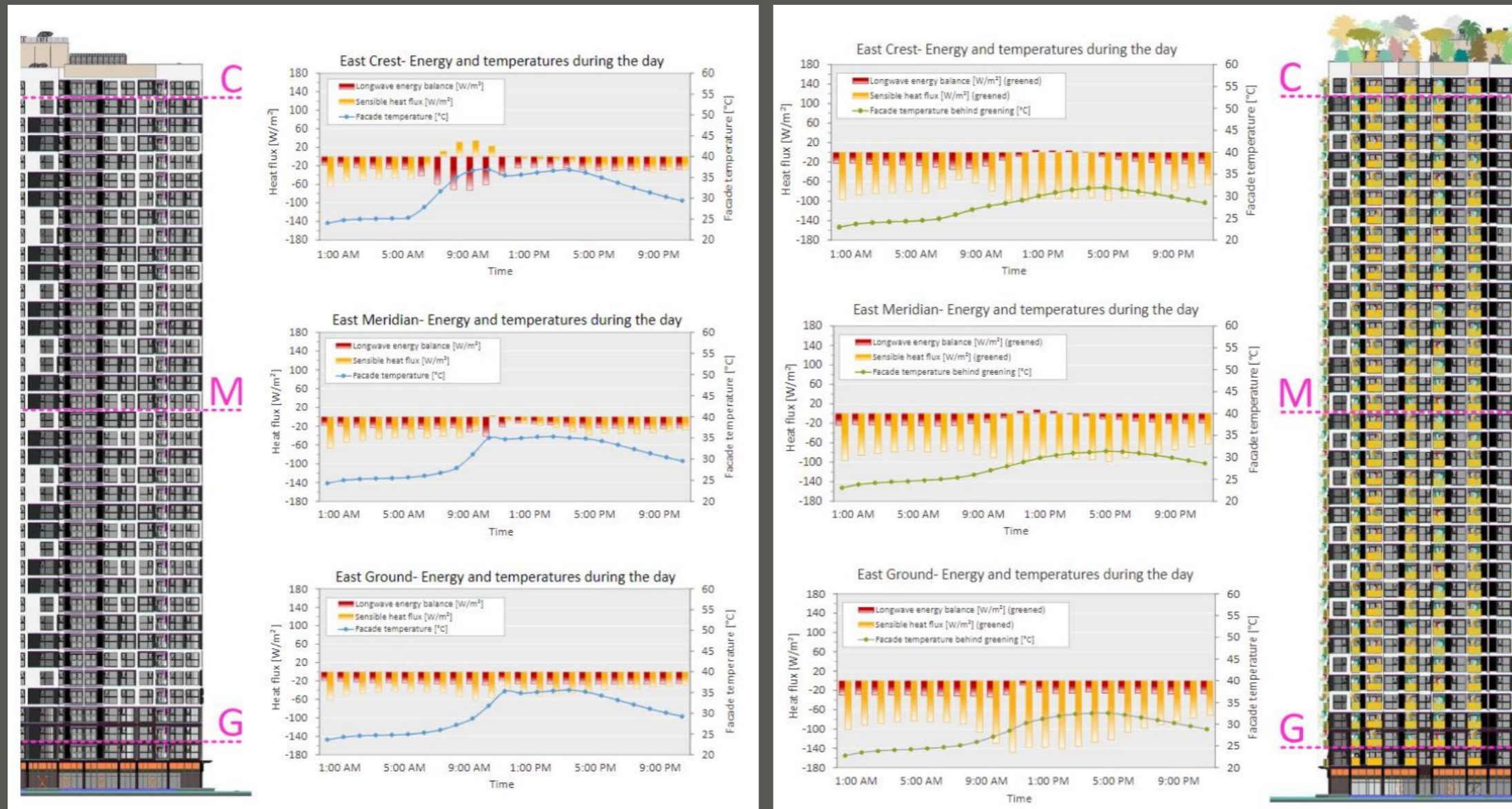
Source: RIM





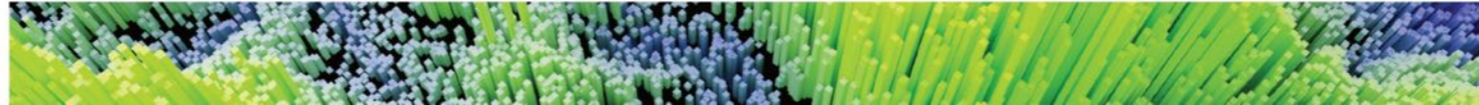
# ENERGY AND TEMPERATURE

climate simulations on three level at the facade (Ground, Meridian, Crest)



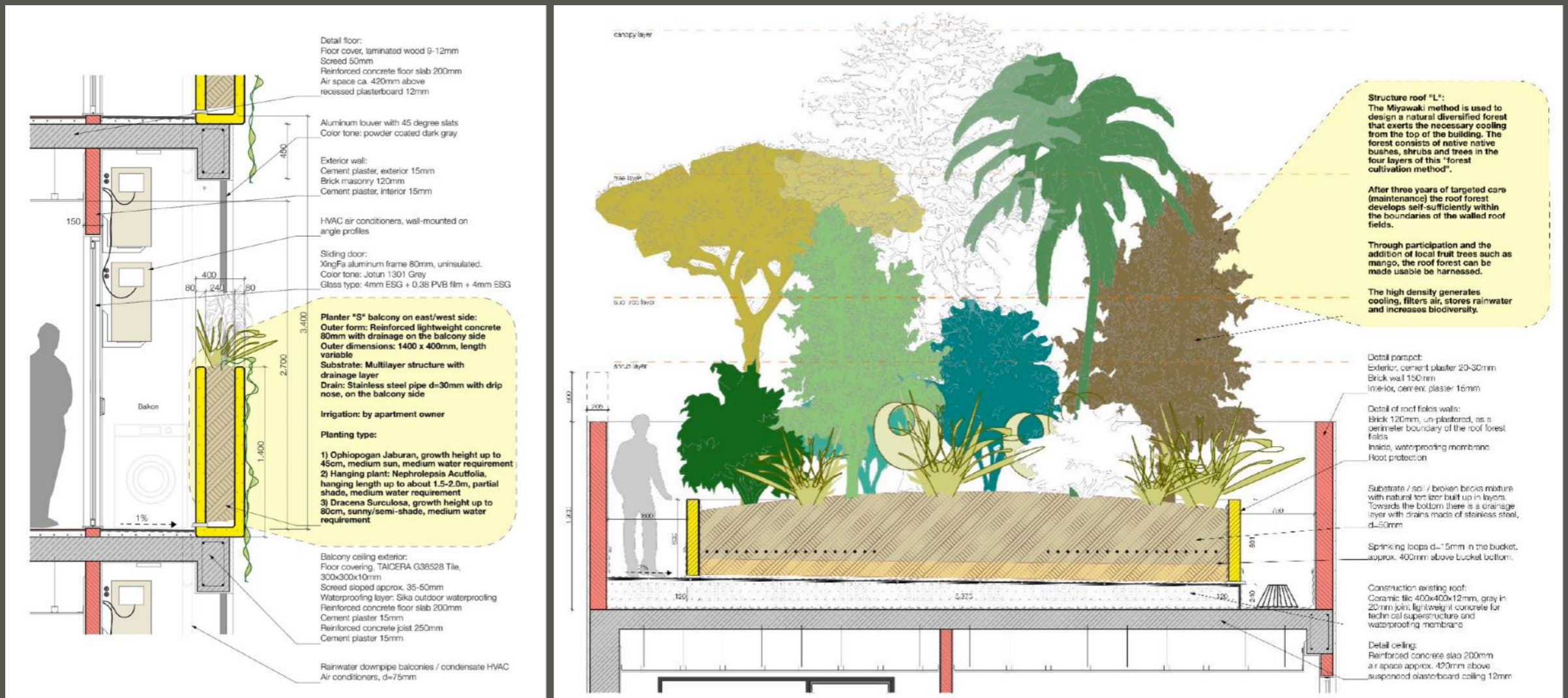
Source: RIM





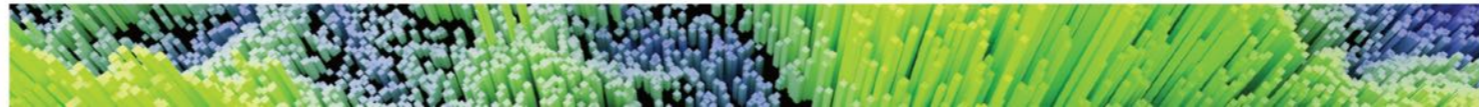
# SHADING SOLUTIONS FOR COOLING

What can be replaced? Where shading does make sense?



Source: RIM





# 2024 YEAR OF MAKING

## TestBed 01 - Planning & Engineering

Architectural renderings showing the building facade and balcony areas. Technical drawings include a table of contents and a 'DRAFT' label.

Floor plans for the 1st, 2nd, 3rd, and 4th floors, along with a roof top plan. Technical drawings include a table of contents and a 'DRAFT' label.

Technical drawings showing facade sections (S-01, B-03) and plant selection details (A, B, C). Includes a table of contents and a 'DRAFT' label.

Irrigation system schematic showing planter rings (A, B, C) and technical drawings. Includes a table of contents and a 'DRAFT' label.

Plant system schematic showing plant pots (A, B, C) and technical drawings. Includes a table of contents and a 'DRAFT' label.

Sensor system schematic showing planter and sensors, and technical drawings. Includes a table of contents and a 'DRAFT' label.



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# 2024 YEAR OF MAKING

## TestBed 01 - Pilot Green Roof and Facade



Source: RIM



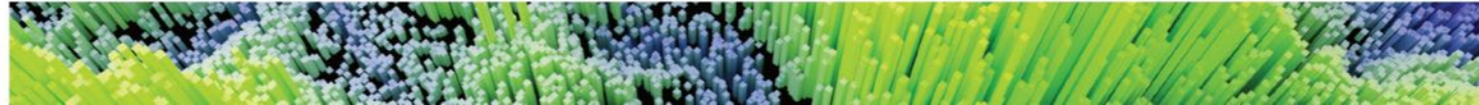
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# 2024 YEAR OF MAKING

TestBed 01 - Automated Irrigation System + DAVIS Weather station



Source: RIM



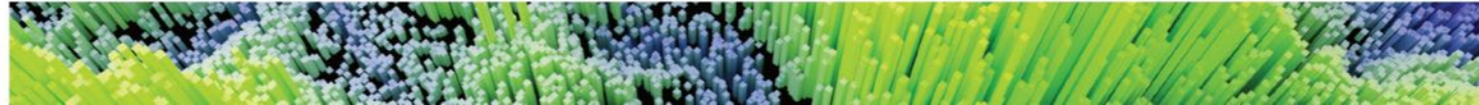
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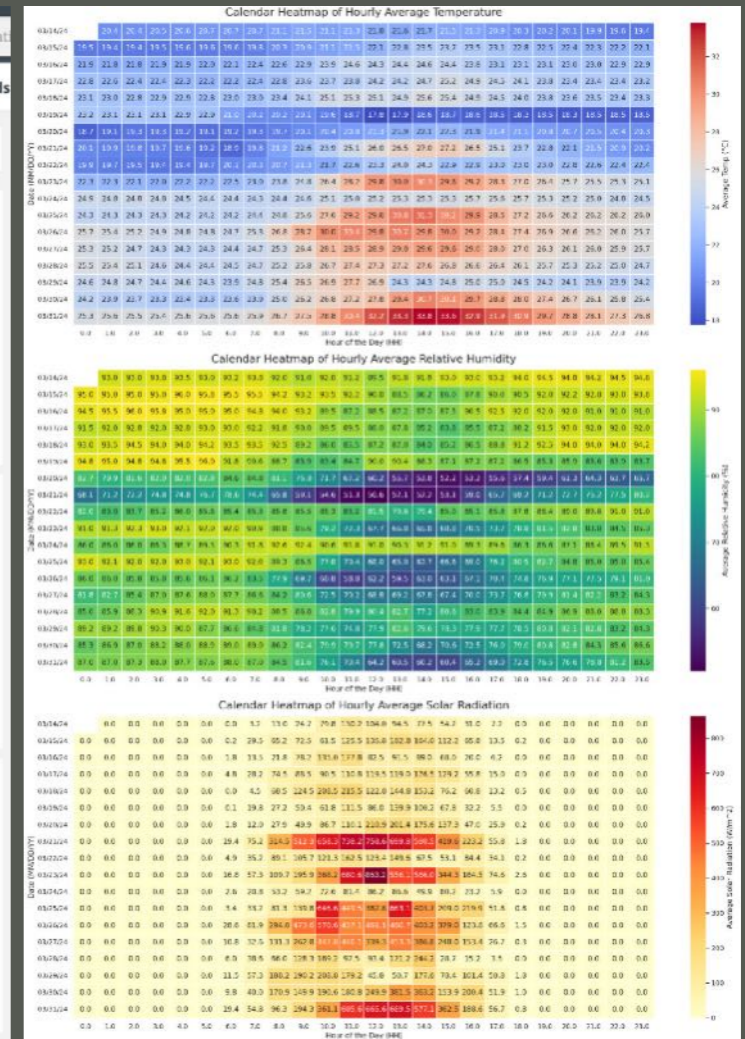


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# 2024 YEAR OF MAKING

## TestBed 01 - DAVIS Weather station - data mining



Source: RIM



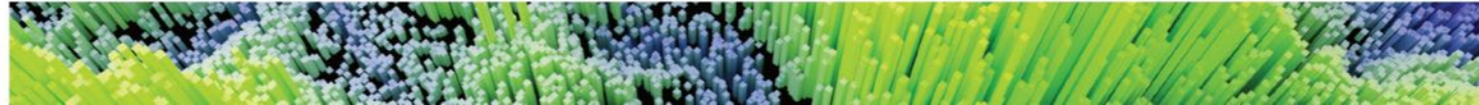
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# 2024 YEAR OF MAKING

TONKIN 2 - LoRaWAN System of 26 sensors for relative air humidity & temperature



Source: RIM



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# THANK YOU!

