CONSTRUCTION INDUSTRY COUNCIL
建 造 業 議 會

CIC – Zero Carbon Building

Microclimate – Building Design Considerations and Future Development

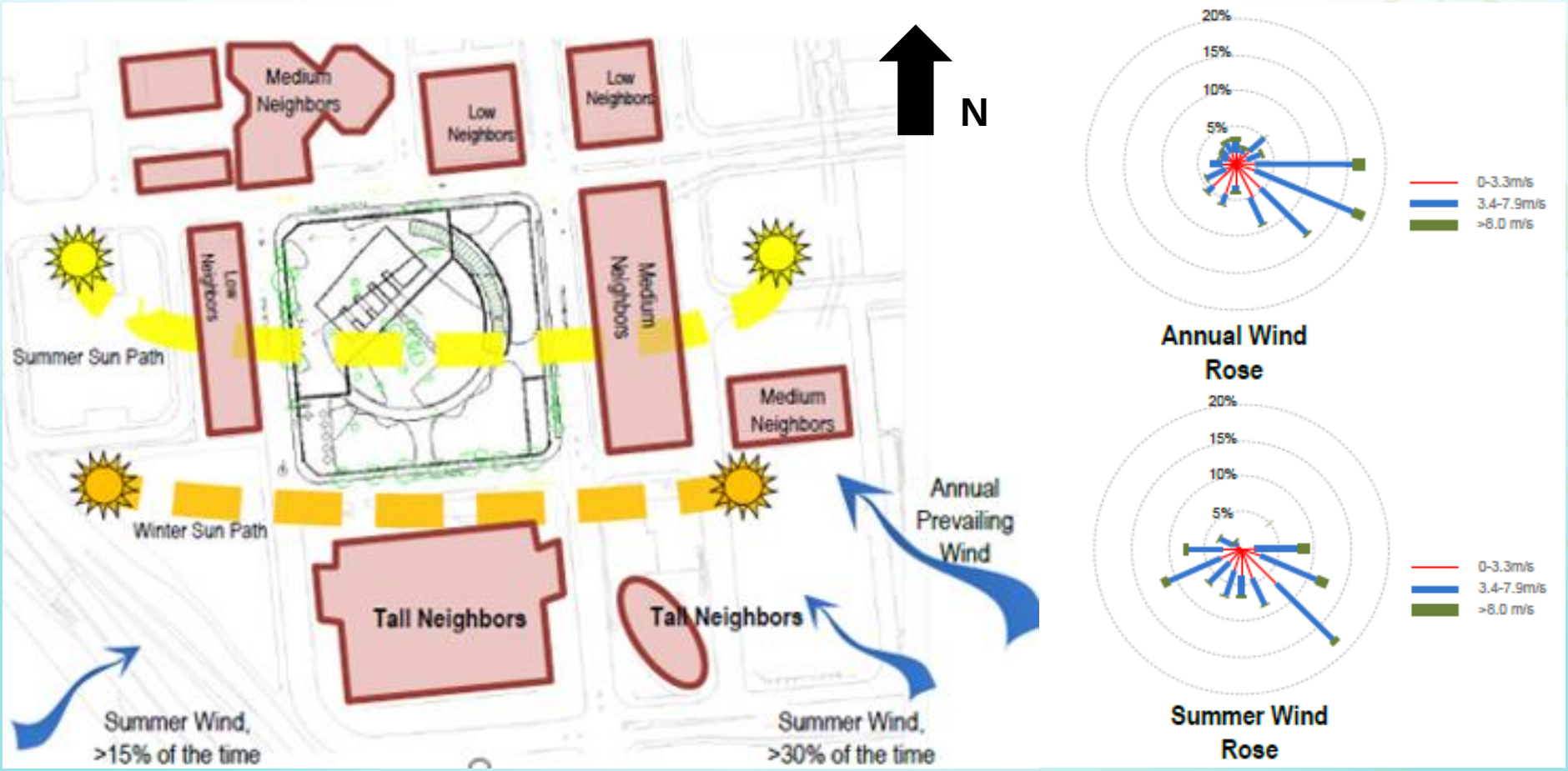
Ir. LM CHOW
Chief Executive Officer

16 January 2018

CIC – Zero Carbon Building

Wind

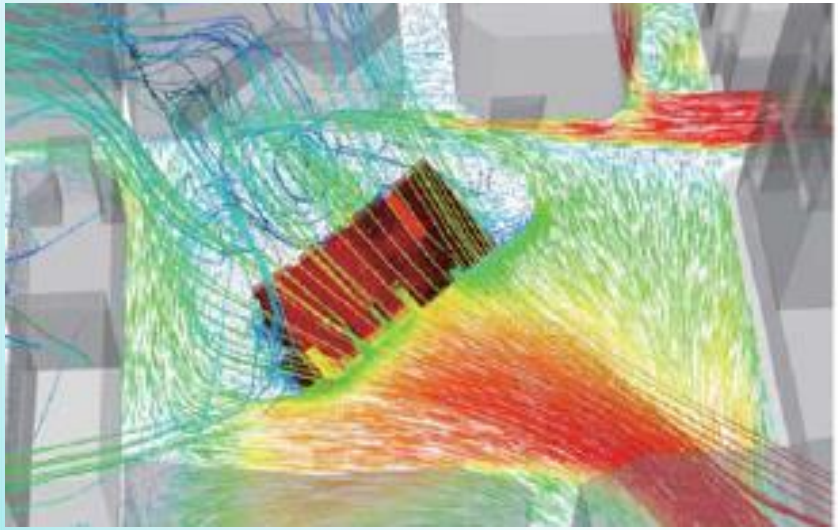
Microclimate Assessment for Site Planning

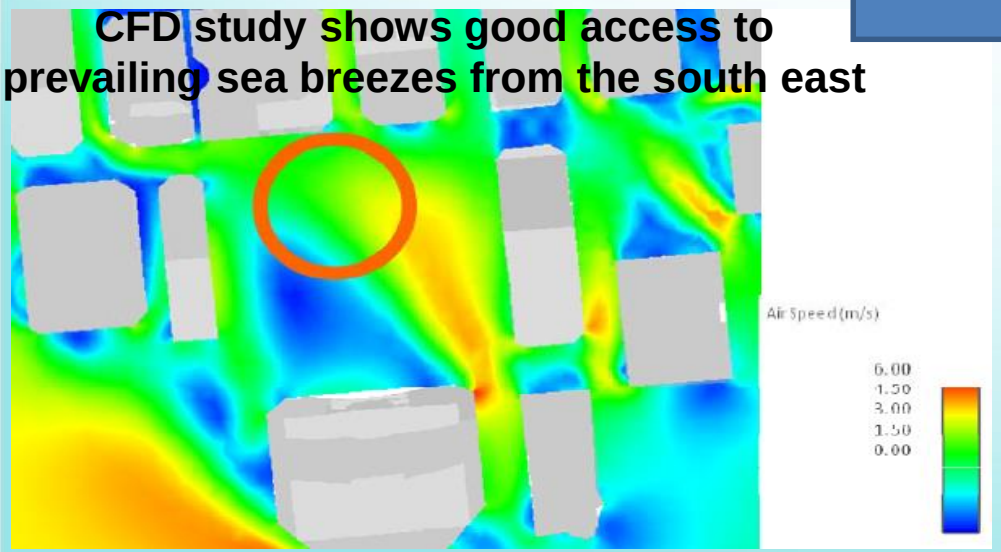


Microclimate positive site planning maximizes the use of wind and solar resources

Wind

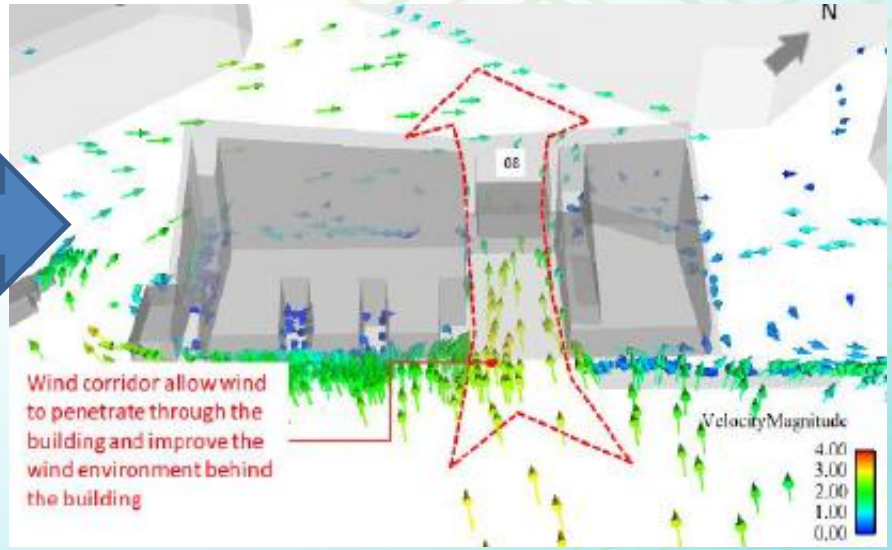
Air Ventilation Assessment for Site Planning





CFD study shows good access to prevailing sea breezes from the south east

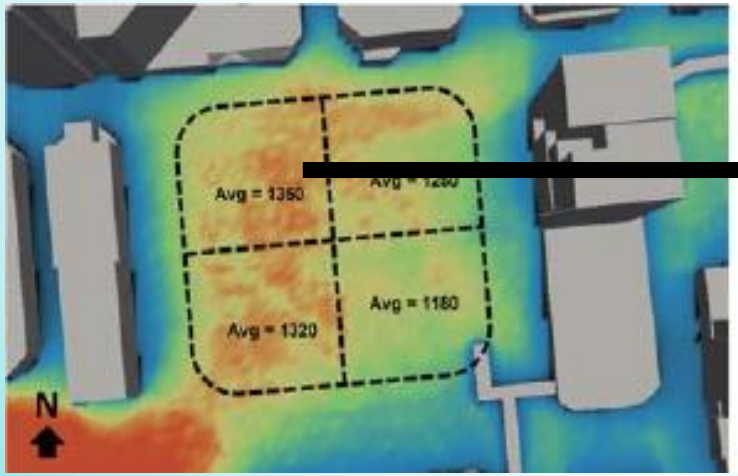
- Understand local wind environment
- Identify general ventilation performance
- Identify important factors for conceptual design



Wind corridor aligns with prevailing wind maximizing ventilation

Wind

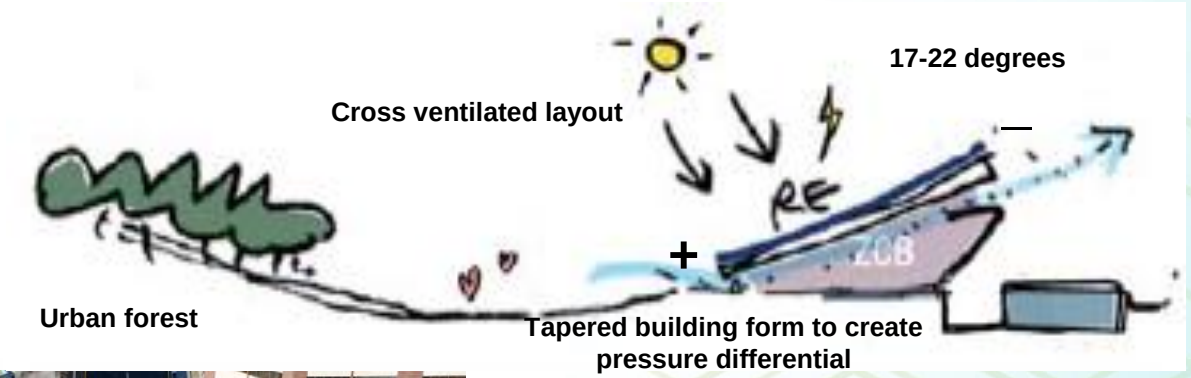
Solar Irradiance Study to Maximise Solar Access



- With maximum solar radiation and the constraint of the drainage reserve, optimal building position is towards the north west of the site

Wind

Integrate Microclimate and Building Passive Design



- Building massing creates pressure difference that drives natural ventilation
- Building setback from boundary enhances wind environment of surrounding areas

Wind

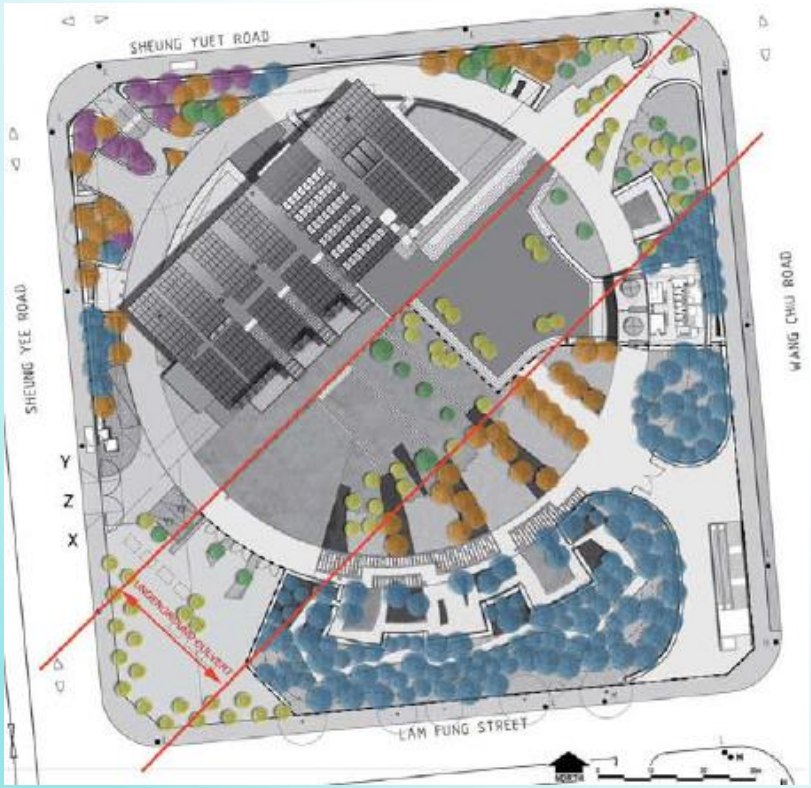
Building Permeability Enhances Ventilation

Building permeability enhances cross ventilation and urban climate in terms of air ventilation in the surroundings

Ventilation voids channel breezes through the building

Thermal Radiation

Reduce Direct Solar Radiation through Landscape Design



Existing Retained & Transplanted Trees

Canopy Trees

Small Trees on Drainage Reserve

Ornamental Trees

Woodland Trees

- Extensive greenery in the landscape area (approximately 49% of the site) contributes to improvement of the microclimate and thermal comfort of the open space.

Thermal Radiation

Reduce Surface Temperature with Green Walls

Greenery and shading reduce thermal mass heat storage of building materials

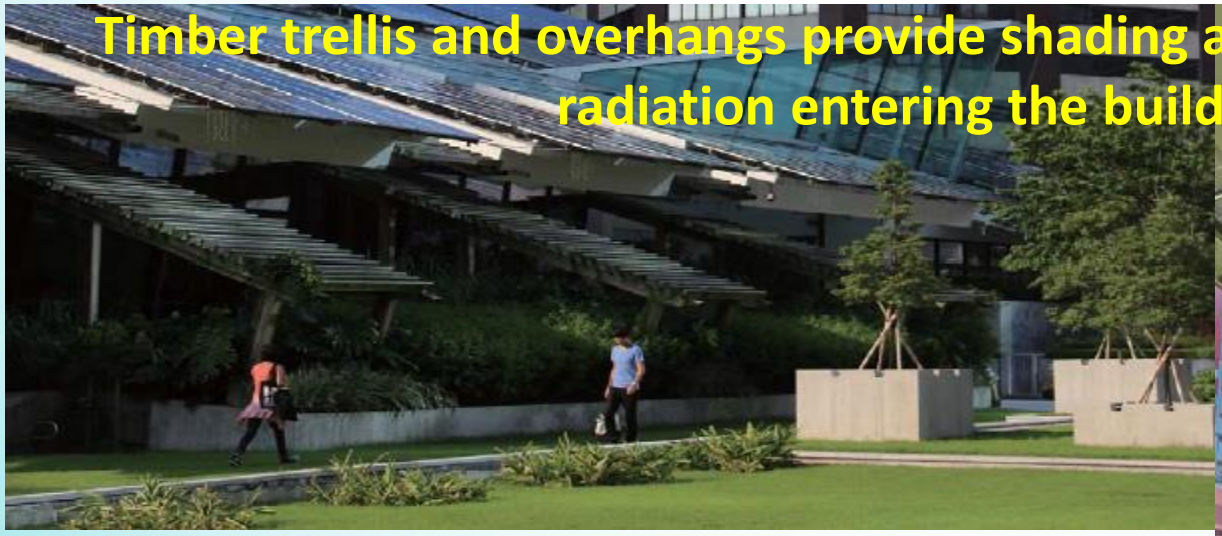
Reduce anthropogenic heat discharge near pedestrian area

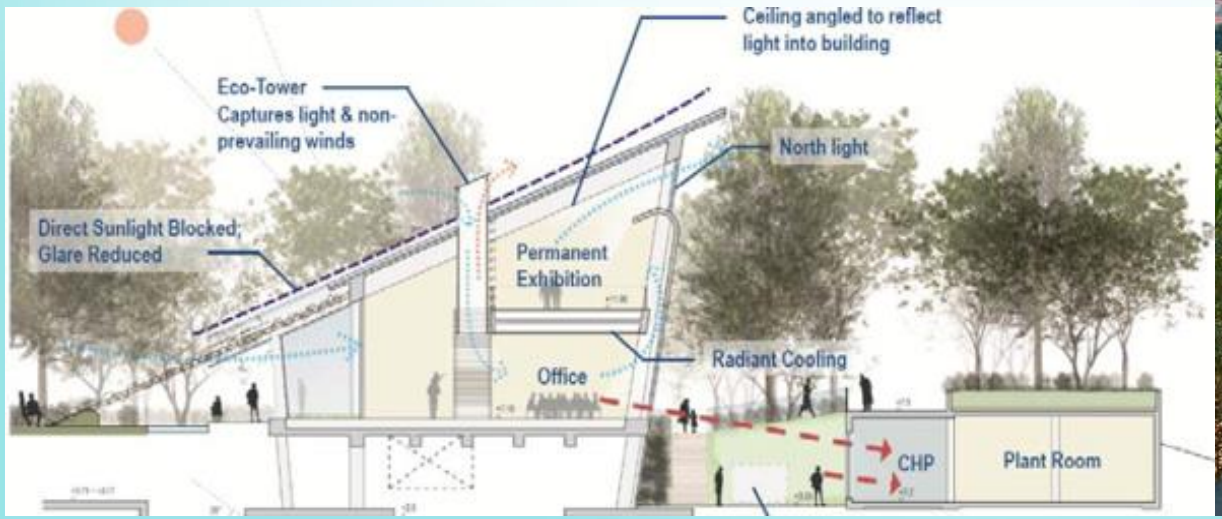
Green walls at various locations reduce façade surface temperatures and increase evapotranspiration. Rise in ambient temperature near the green wall from the UHI effect can be reduced

Thermal Radiation

Manipulating the Building Façade to Reduce Direct Solar Radiation into the Building

Timber trellis and overhangs provide shading and reduce direct solar radiation entering the building





Thermal Radiation

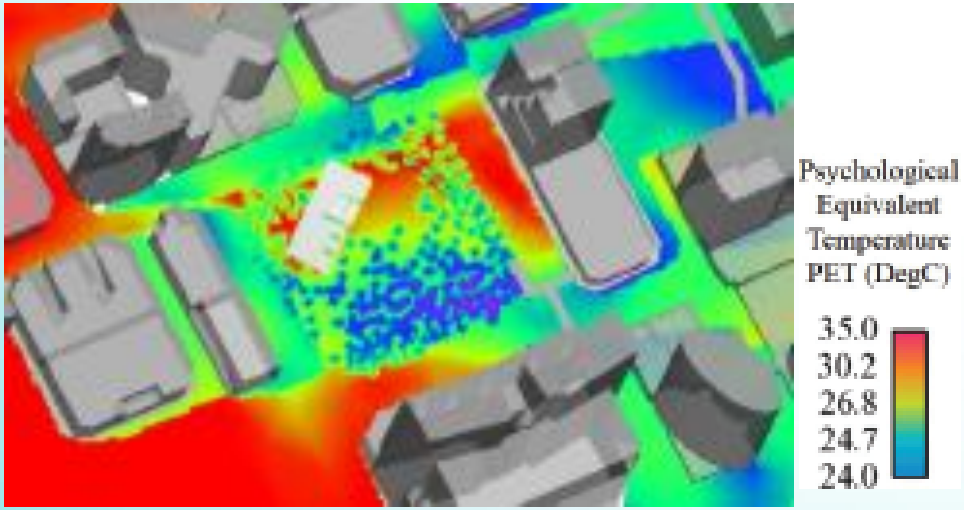
Increase Albedo of Building Surface

White colour used on building façade reduces heat absorption

Temperature

Thermal Comfort Assessment of the Outdoor Environment

Physiological Equivalent Temperature (PET) Analysis

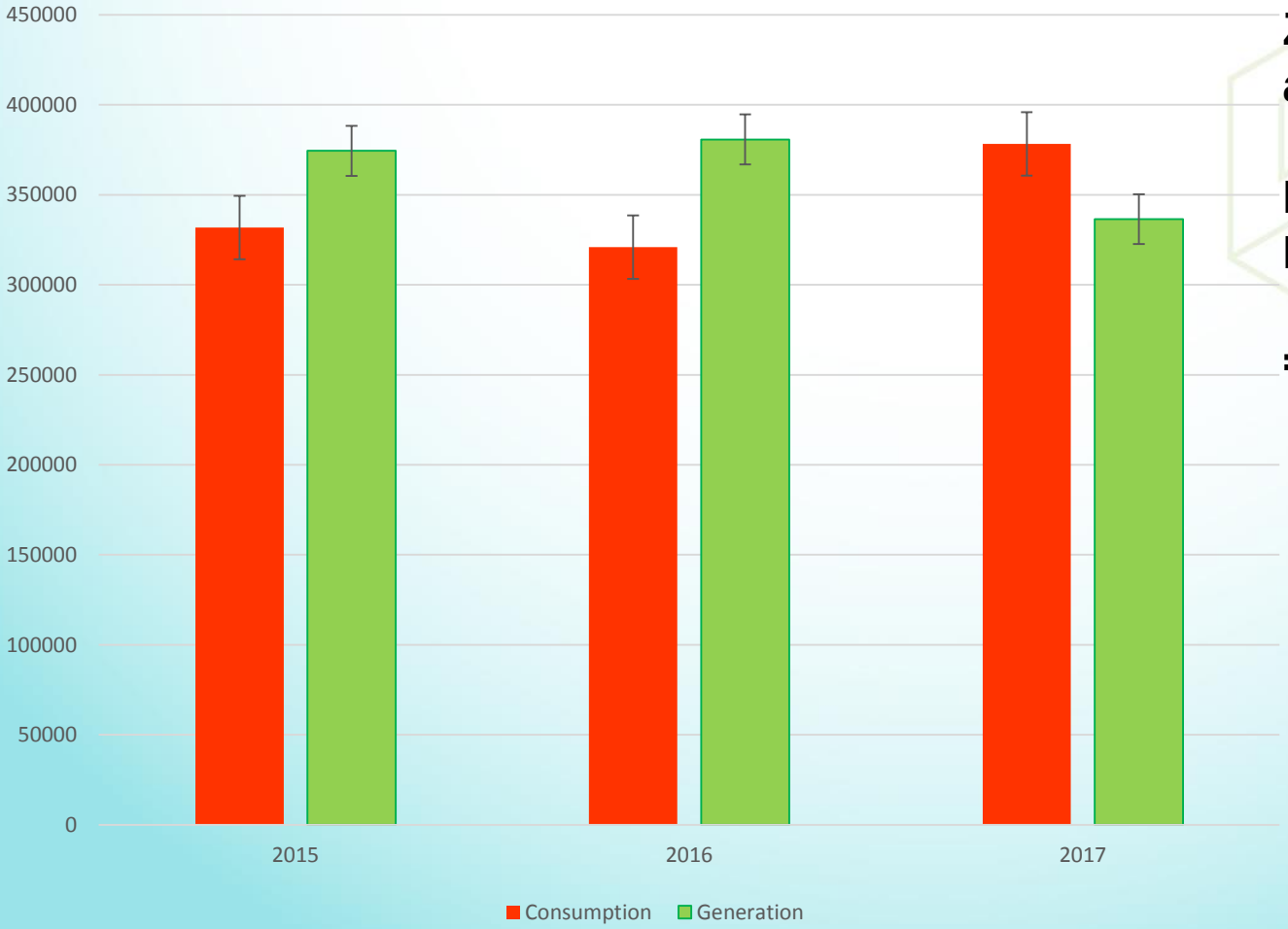


Temperature

Permeable Paving to Enhance Evaporative Cooling

Permeable paving reduces stormwater runoff by retaining water in the pavement and increases evaporative cooling

Energy Consumption & Generation (kWh)



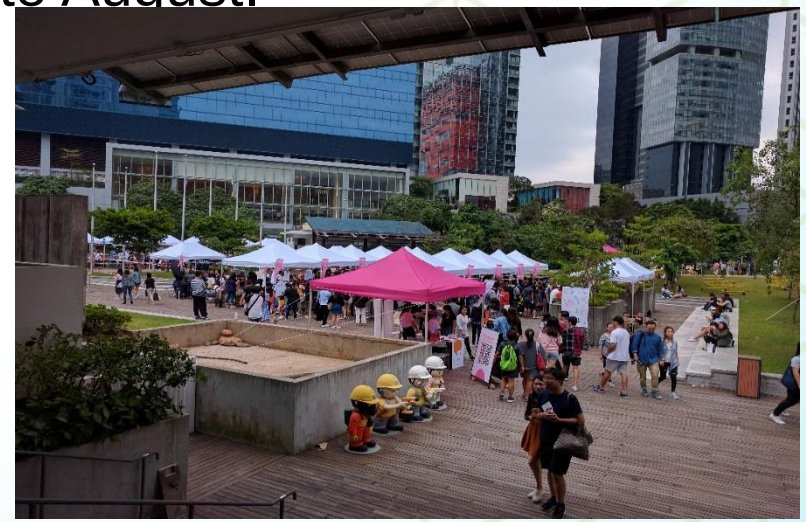
ZCB Carbon Footprint as at 31 December 2017

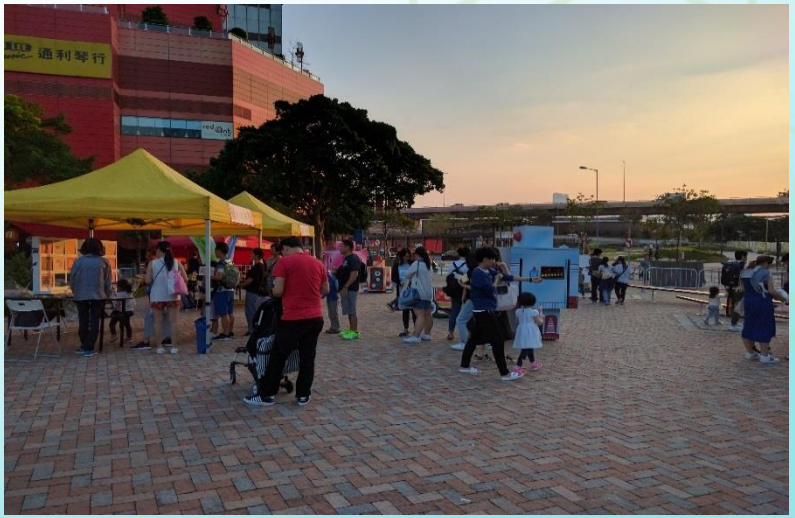
Energy generation > Energy consumption

= –12 tonnes CO_2e

Landscape Area Usage

Outdoor landscape area more heavily utilised from September to May. The area is less utilised from June to August.





Further Improvements

- ZCB Micro Climate Project:

  - Collect & share climate data under various site conditions with the community to enable better building designs

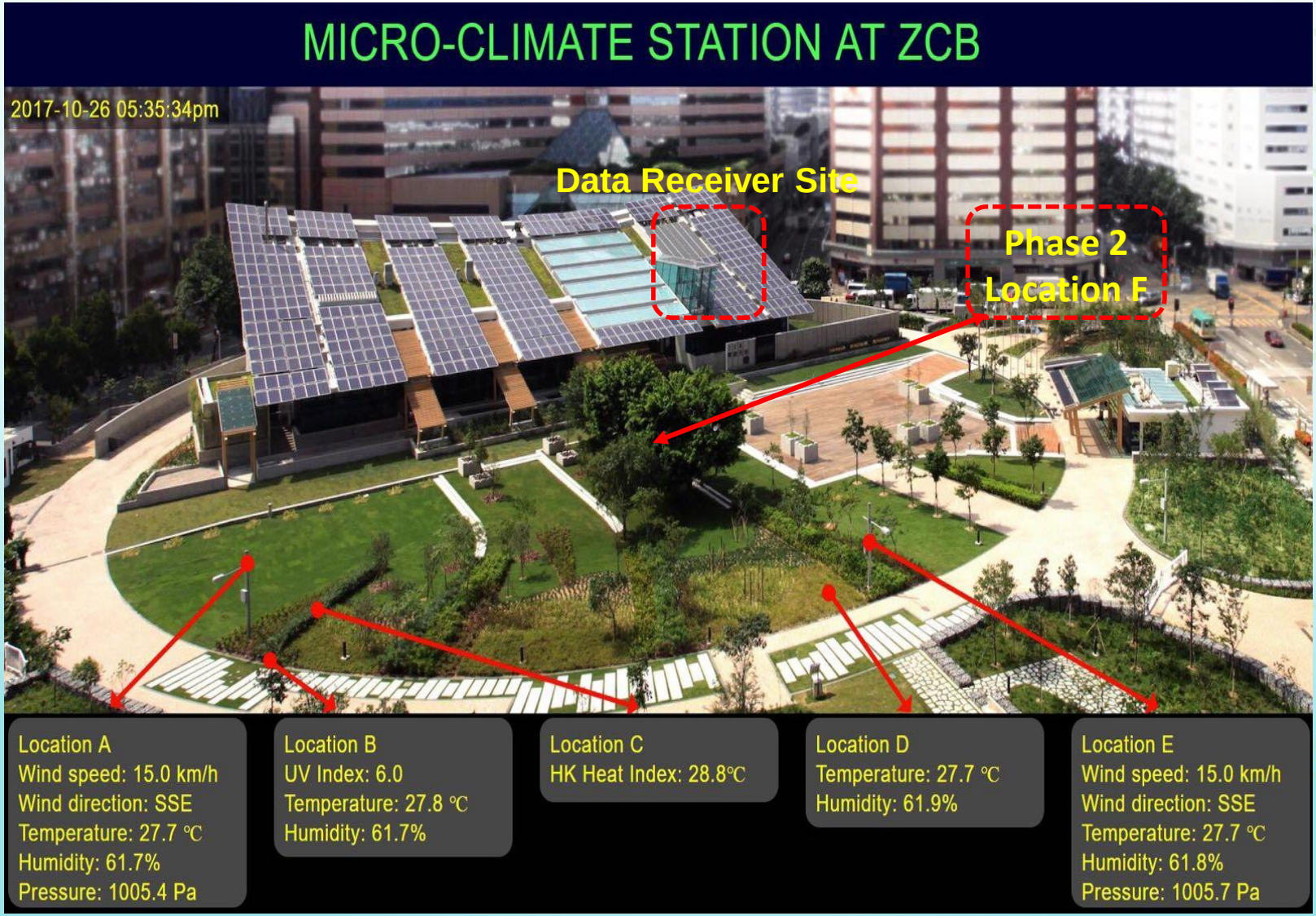
  - Engage public to understand impacts of Micro Climate on their health & living style

- ZCB Tree Management Project:

  - Smart technologies to monitor tree health

  - Public education on tree information & interesting stories

ZCB Microclimate Project



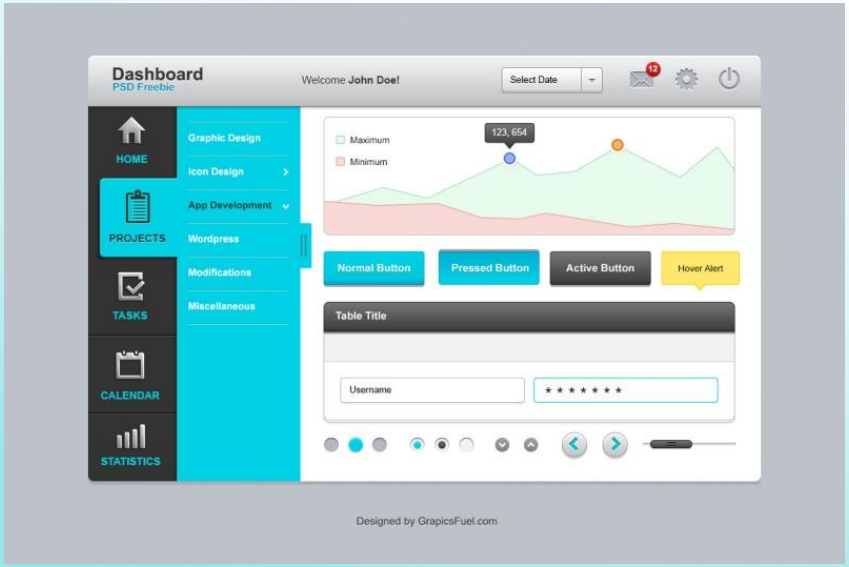
ZCB Microclimate Project

- Install sensors on grass surface, under trees and above concrete surface
  - To measure temperature, relative humidity, wind direction, wind speed, pressure, UV and heat stress, rainfall, critical pollutants (No_x Ozone, PM2.5, SO_2, CO_2, CO)
- Share the data with architects & other engineering professionals to enable more effective building designs

Location A - A set of sensors for measuring wind, temperature and humidity

ZCB Microclimate Project

- Data prediction and weather forecast
  - Partner up with HKO & Microsoft
- Engage public by delivering lifestyle messages and advice related to HEALTH, SPORTS and SKIN CARE to via a dashboard



Location B – Measure UV Index, temperature and humidity

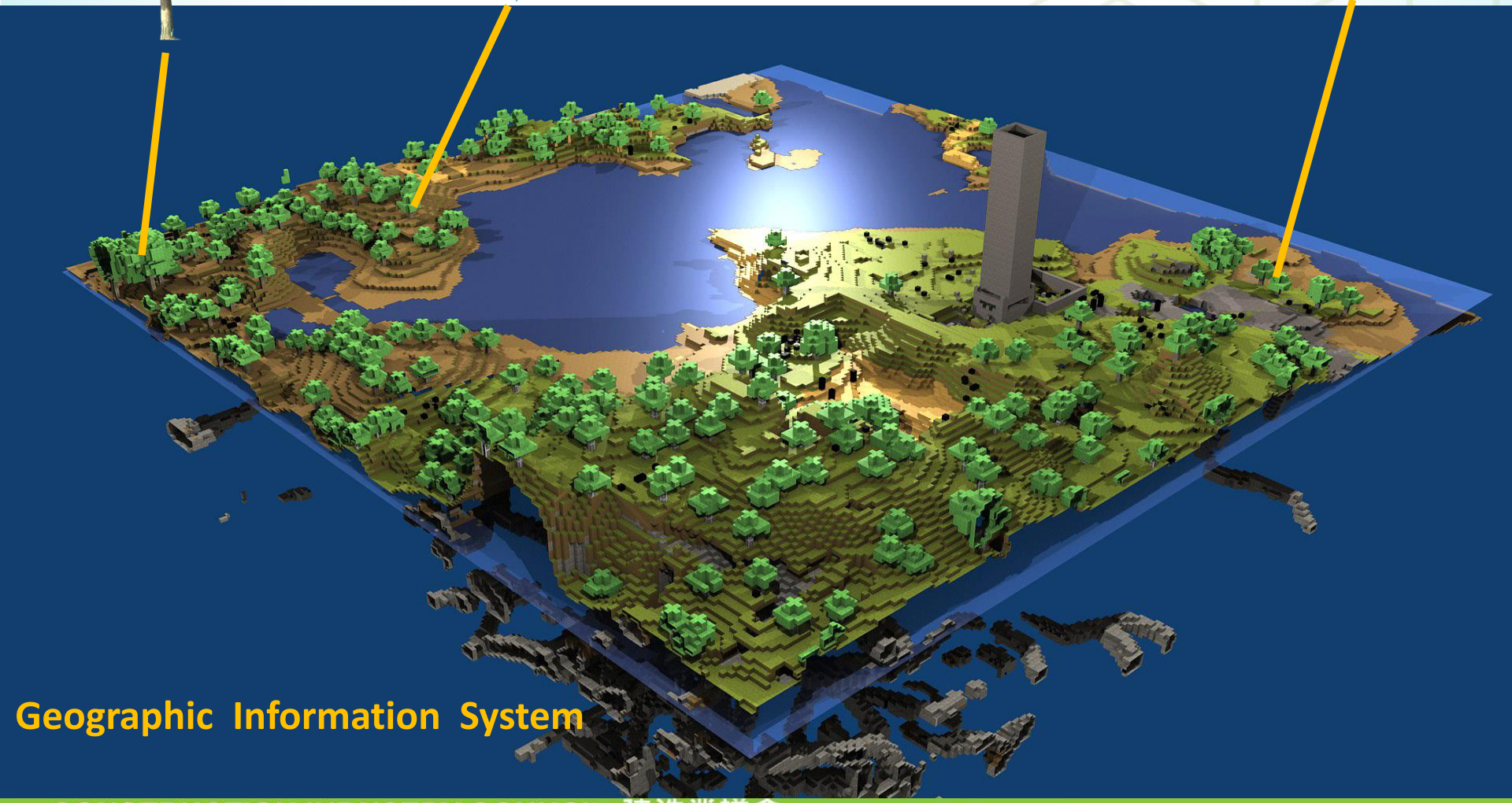
Location C – HKO's Heat Stress Monitoring System

ZCB Smart Tree Management System

ZCB Smart Tree Management System

IoT

To monitor tree health



Geographic Information System

ZCB Smart Tree Management System

- Geographic information system with interesting tree /vegetation stories
- Quarterly drone flying to monitor tree health
- Install iot to monitor tree conditions
- Enrich ZCB open yard with more trees (with flowers), rest areas with shading, memorable landmarks (e.g. statue)
- Share a better garden with the public
- Educate & inspire the public to take more green actions

Hope you like and support these new green initiatives

E-Mail: zcb@cic.hk
http://www.cic.hk/eng/main/zcb/