

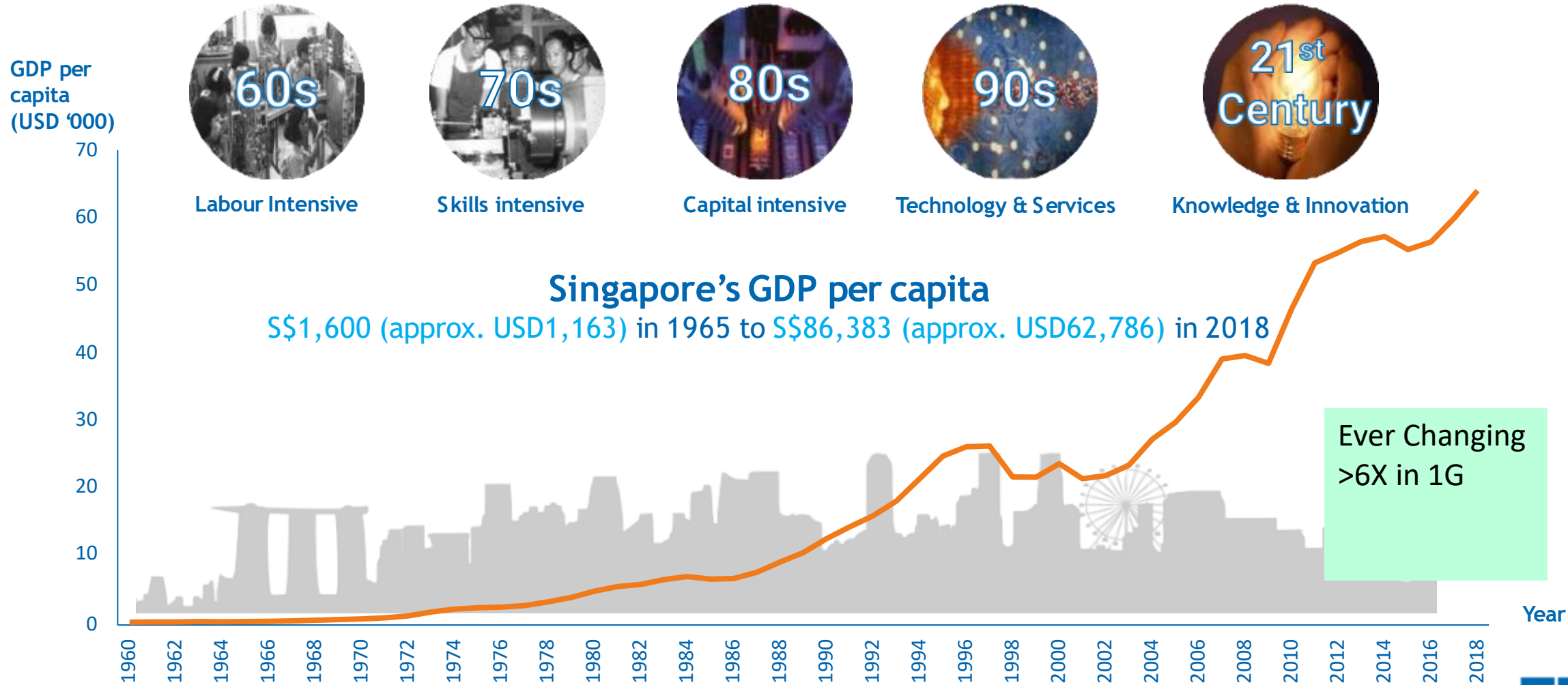


# Driving Sustainability in the Built Environment

by Mr Manohar Khiatani, Senior Executive Director  
CapitaLand Group

14<sup>th</sup> May 2021

# The Economic Journey of Singapore

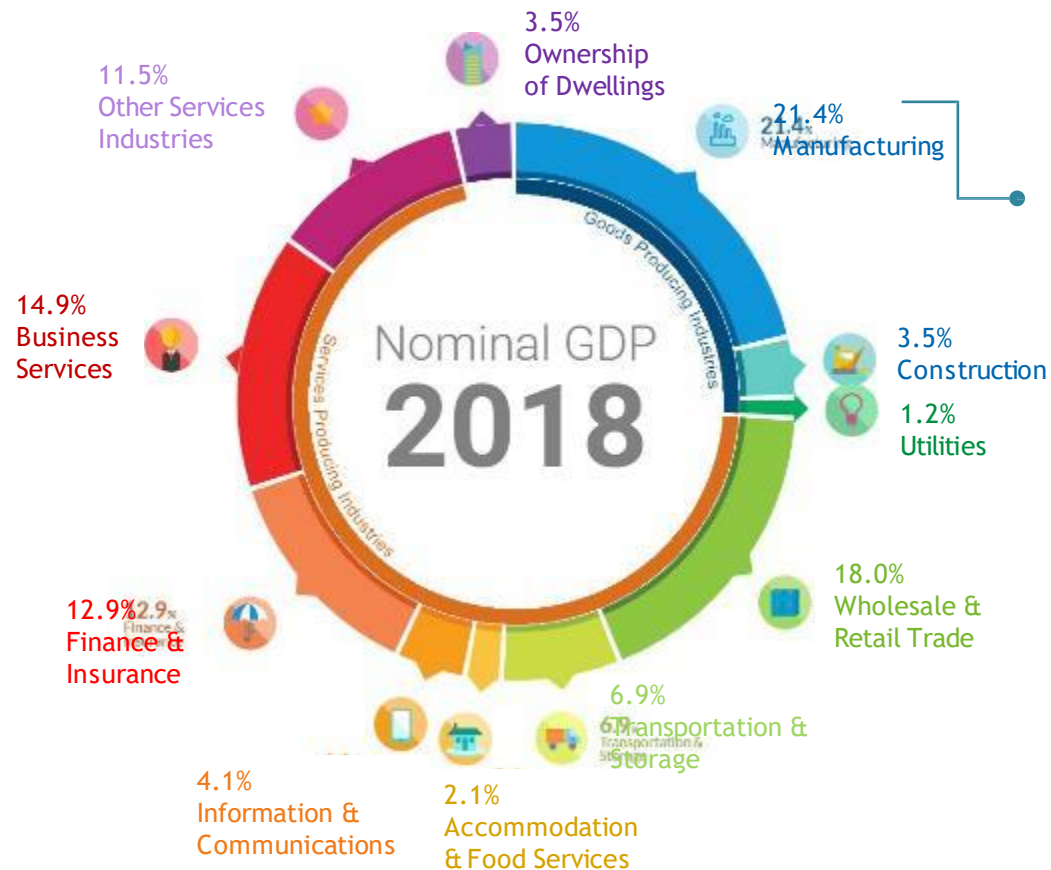


CONFIDENTIAL







# The Economy of Singapore Today

2018 GDP: S\$487 Billion  
(approx. USD 360 Billion)

- 
**Business-friendly environment**
  - Pro-business environment
- 
**World-class Talents**
  - Highly educated workforce
- 
**Critical Connector to the Rest of the World**
  - Connected to the global trade network
  - Openness to talent
- 
**Great Place to Live**
  - A safe and vibrant city to work, live and play
- 
**Trusted Partner**
  - Government as a trusted partner



### Sectoral breakdown for Manufacturing

-  Biomedical Manufacturing
-  Chemicals
-  Electronics
-  Precision Engineering
-  Transport Engineering
-  General Manufacturing

Source: Ministry of Trade and Industry

Seletar Aerospace Park stands out amongst our industrial estates for its lush greenery and rich history. (Credit: JTC)

SAP – a world class integrated Aerospace Park



# JTC Case Study

← Seletar Aerospace Park  
Greening Jurong Island  
↓



Hampstead Wetlands Park is the first wetlands park in an industrial estate jointly developed by JTC and NParks (Credit: NParks)

# JTC Case Study

## Using waste material to create Sustainable Concrete

**Waste glass powder**  
as cement  
replacement  
(in collaboration  
with NUS, Samwoh)



**Municipal Solid  
Waste (MSW)  
slag** as sand  
replacement  
(in collaboration  
with NTU, NEWRI)



**SUSTAINABLE  
CONCRETE**



**Marine clay** as  
cement  
replacement  
(in discussion  
with NUS)

## Artificial Reef Development in Singapore





Aerial view of the SolarLand installation on Jurong Island. The system is modular and flexible, allowing JTC to maximise temporary vacant land and redeploy the land when needed. (Credit: JTC)



JTC's SolarRoof model at JTC Space @ Gul enables the direct export of solar power generated from industrial rooftops to the national power grid. (Credit: JTC)

# Extensive solar installations in Singapore



**Total Installed Capacity** (as at end Q1 2020)  
**376,913.2 kWp**  
 of which **363,849.5 kWp** Non-Residential  
**13,063.7 kWp** Residential

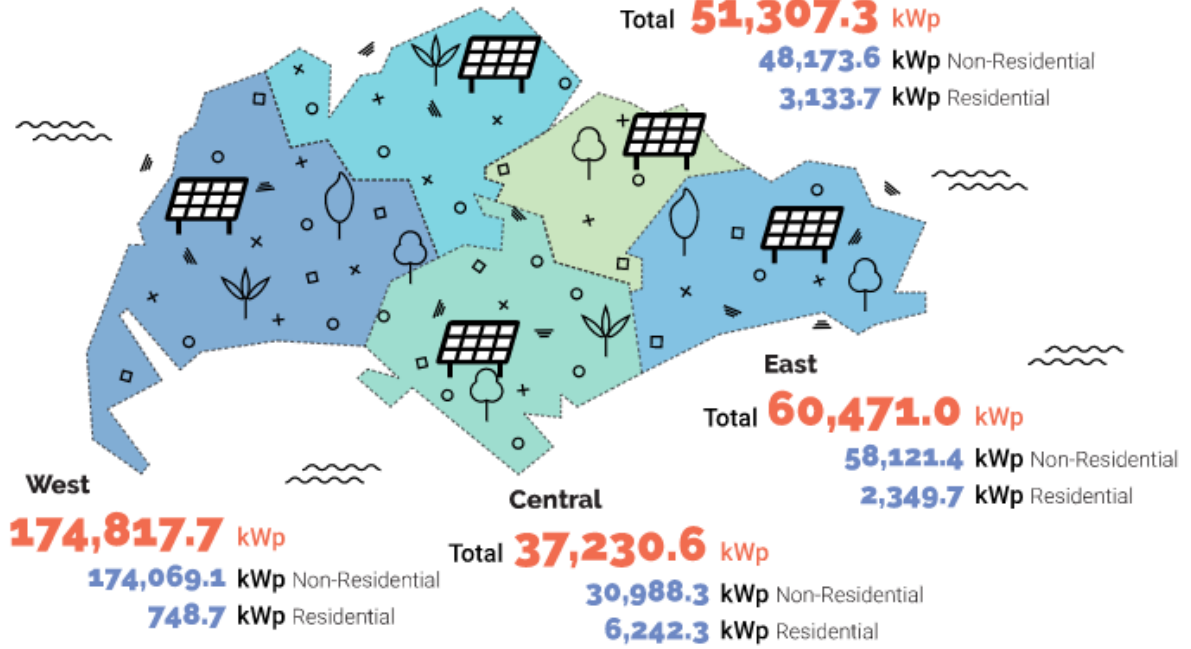
JTC  
 SolarLand  
 SolarRoof

## North

Total **53,086.4 kWp**  
**52,497.1 kWp** Non-Residential  
**589.3 kWp** Residential

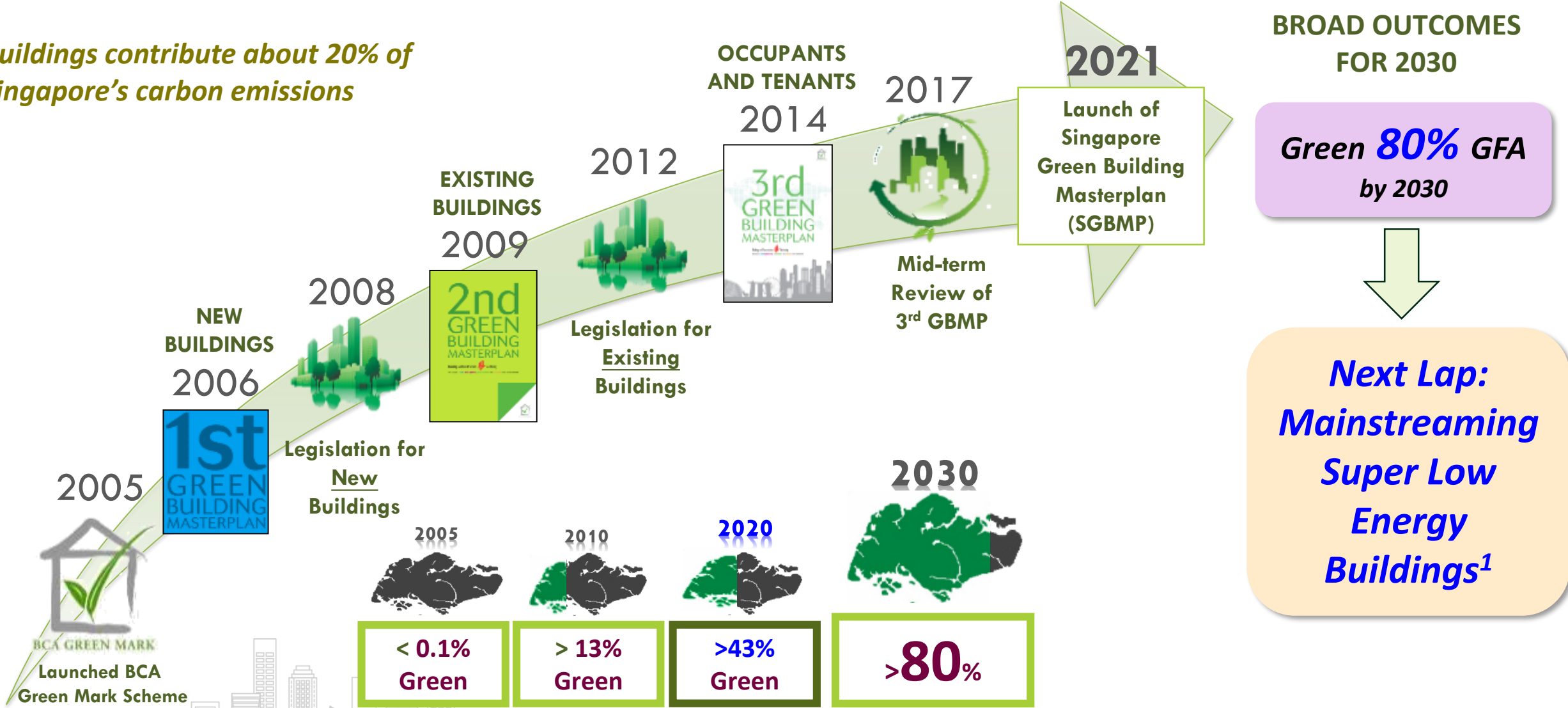
## North East

Total **51,307.3 kWp**  
**48,173.6 kWp** Non-Residential  
**3,133.7 kWp** Residential



# BCA's green building journey.....

*Buildings contribute about 20% of Singapore's carbon emissions*



<sup>1</sup> Best-in-class energy performing Green Mark Building that achieves at least 40%\* energy savings based on prevailing code.  
\*(equivalent to 60% energy savings above the 2005 building code)



## The SGBMP aims to deliver 3 key outcomes: '80-80-80 in 2030'

### VISION

*"A leading green Built Environment sector mitigating climate change and providing a healthy, liveable and sustainable Built-Environment for all"*



### 80% of buildings to be green by 2030:

- *Step up the pace* of greening our buildings
- *Raise the sustainability standards* of our buildings



### 80% of new developments to be SLE from 2030:

- *Mainstream Super Low Energy (SLE) performance of new buildings* so that from 2030, large majority of new development would be achieving today's SLE energy performance standards



### 80% EE improvement (from 2005 levels) by 2030:

- *Push boundaries in energy efficiency for best in class green buildings* through research, innovation and implementation



An aerial photograph of a modern city skyline. The central focus is a tall, cylindrical building with a white metal grid facade and multiple levels of green terraces. At the top of this building is a large, red, abstract sculpture that resembles a stylized flower or a modern architectural element. The surrounding area is filled with other high-rise buildings, some with glass facades and others with more traditional architectural styles. The sky is clear and blue.

# CapitaLand's 2030 Sustainability Master Plan

Sustainability is at the Core of  
Everything we do !

# CapitaLand's 2030 Sustainability Master Plan Framework is Our Strategic Blueprint to Guide Our ESG Efforts



## ENVIRONMENT



### Low Carbon Transition

Science-based targets validated by SBTi for "well below 2 deg C" scenario



### Water Conservation & Resilience



### Waste Management & Circular Economy

## SOCIAL



### Healthy & Safe Buildings



### Robust Supply Chain Management



### Proactive Customer Relationship Management



### Dynamic Human Capital

## MARKET LEADERSHIP



### Sustainable Operational Excellence



### Sustainability Innovation & Technology



### Sustainable Finance

**RETURN ON SUSTAINABILITY**

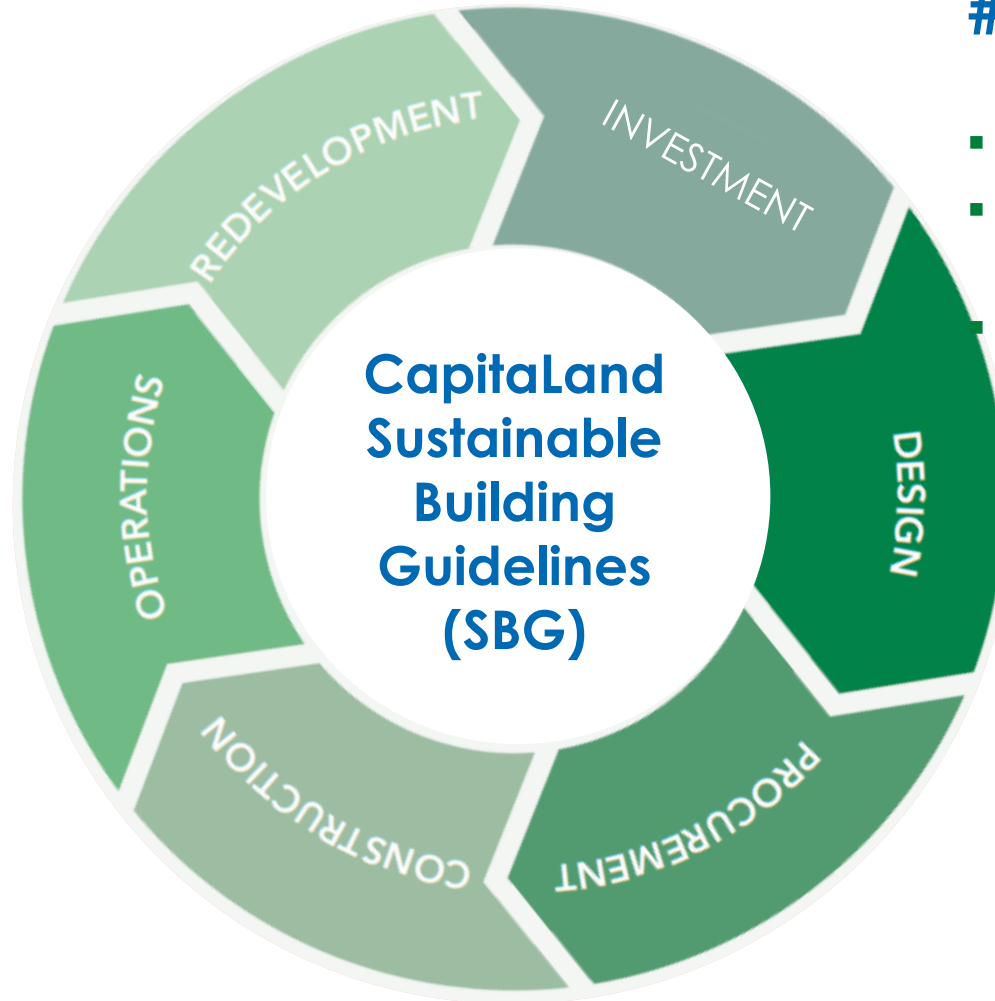


# Integrating Sustainability in CapitaLand's Real Estate Lifecycle



## #3 Operations

- **Asset planning** to align with SMP
- **Sustainable operational excellence**
- **Innovation & Collaboration**
- EHS Committee



## #1 Investment

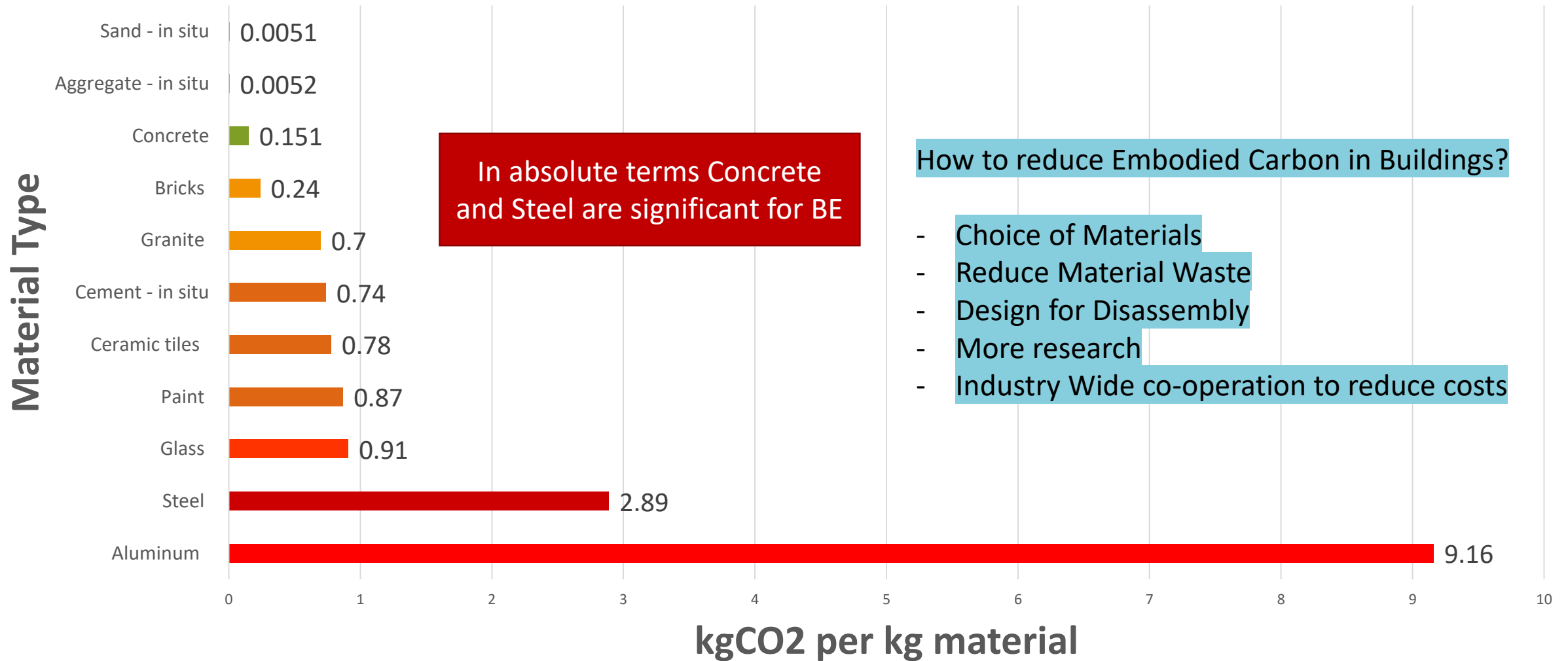
- Align with **Sustainability Master Plan (SMP)**
- Conduct **Environment, Health and Safety Impact Assessment (EHSIA)**
- Quantify **Return on Sustainability (ROS)**

## #2 Design, Procurement, Construction & Redevelopment

- Design in accordance with **CapitaLand Sustainable Building Guidelines**
- Testbed **innovations**
- Monitor and report performance

# Embodied Carbon in Materials has an impact

## Default Embodied Carbon Intensity (kgCO2 per kg material)

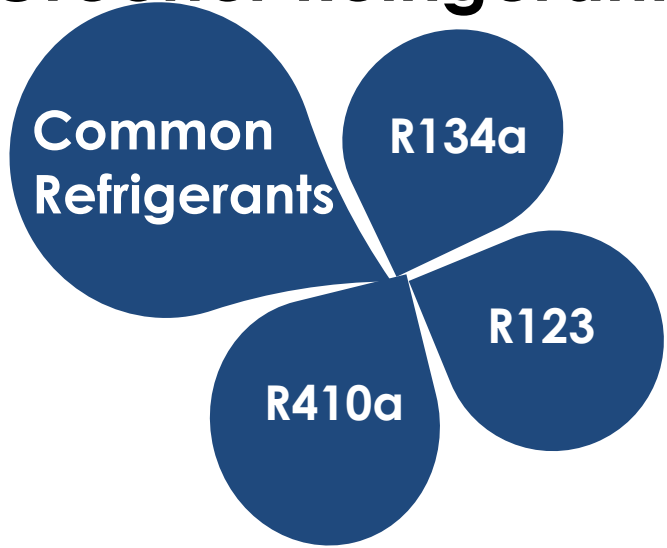


# Future of air-conditioning ...

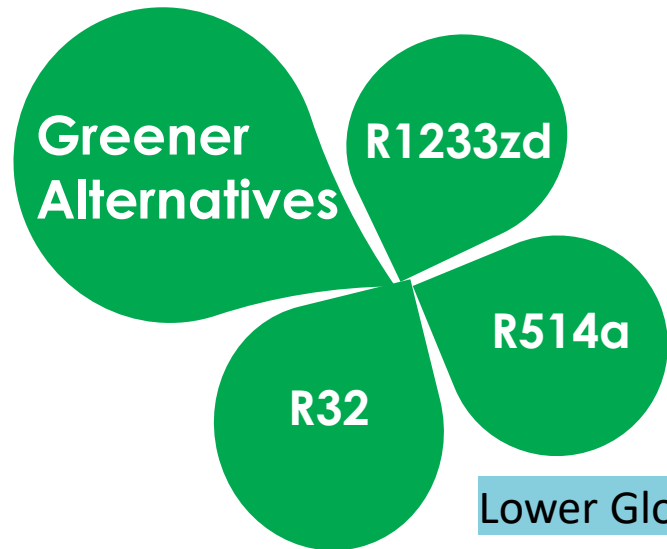
A critical invention!



## Greener Refrigerant



- 1 Cleaner, non-flammable, non-toxic refrigerant – lower GWP
- 2 Energy efficient compressors.
- 3 Passive displacement cooling.  
*Acceptance?*
- 4 Dynamic air-conditioning system monitoring and control via Machine Learning (ML) and Artificial Intelligent (AI).



Lower Global Warming Potential values

# Improvements in Chiller Technologies

Magnetic-bearing compressors



Multi-stage compressors

VSD  
Less Friction  
Less Maintenance



HP compression  
Less Leakage loss  
Higher cooling eff

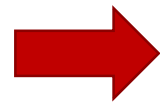
Magnetic-Bearing Chiller Compressor

Multi-stage Chiller Compressor

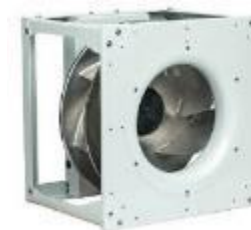
# Improvements in Air-side technologies



Belt Driven Fan



VSD Plug Fan



EC Plug Fan

Electronically Commutated  
Lower Energy Use  
Quiet

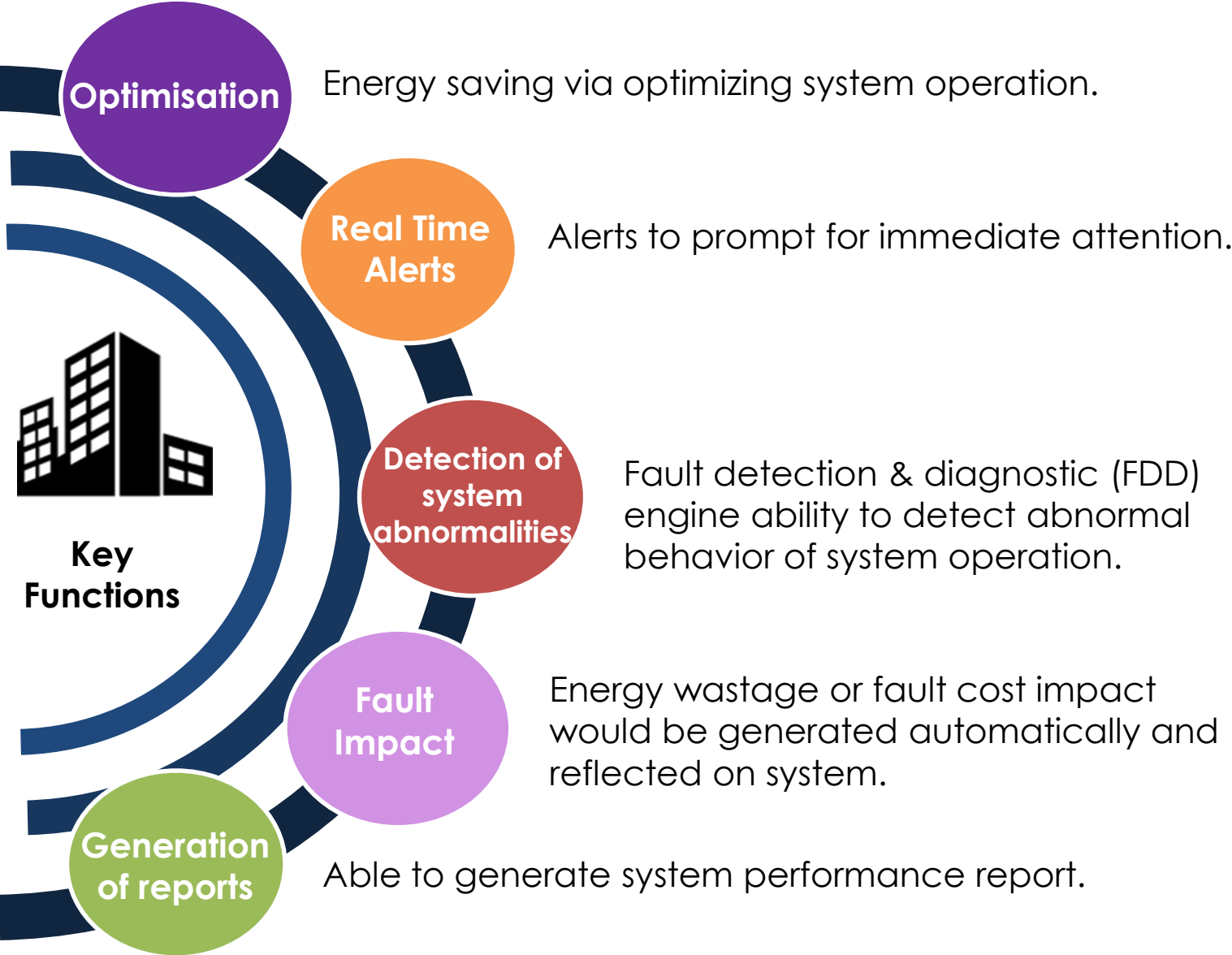
# Digitalisation - Intelligent Building Platform System

- Intelligent Building Platform (IBP) is a **data-driven approach** towards optimizing asset performance, energy optimization, and condition-based maintenance.
- Identify energy conservation measures many of which will be visible on the interactive data analytics platform



*\*For illustration purposes only.*

# Digitalisation - Intelligent Building Platform System



## Stages of Data Analytics

- Descriptive
- Diagnostic
- Predictive
- Prescriptive

# Sustainable finance

- **Triple** sustainable finance portfolio to S\$6 billion by 2030.
- **First** real estate company in Singapore to set a public sustainable finance target and **tying financing with ESG performance**
- Some of CapitaLand's current sustainability-linked loans which are tied to our sustainability performance have resulted in **interest rate savings**.
- **Utilities cost avoidance: S\$208 million**
- (since 2009 due to operational efficiency)

# Green leases



- Implement **environment-friendly features** & embrace more sustainable practices.
- **Green fit-out guide** focusing on areas such as energy and water conservation, proper waste management, indoor environmental quality, green purchasing and good maintenance practices.
- **Improves** overall well-being of tenants & their customers while achieving **cost savings** from **reduced utilities consumption**.

# Case Study: Raffles City Chongqing, China



- Located at the confluence of Yangtze and Jialing rivers with The Crystal sky bridge nestled above four 250-metre-tall skyscrapers.
- Total investment: RMB24 billion
- Total construction floor area: 1.12 million sqm
- 235,000 sqm shopping mall and 150,000 sqm Grade A office space
- 1,400 residential apartments, Ascott Raffles City Chongqing serviced residence and InterContinental Chongqing Raffles City hotel

- Advanced district cooling system
- 50% energy cost savings
- S\$30m utility cost avoidance



# Case Study: CapitaGreen, Singapore

➤ BCA Green Mark  
Platinum



- 1** **Extensive greenery** is found throughout the perimeter of the façade helping to **diffuse strong sunlight**, providing occupants with a comfortable indoor working environment.
- 2** **Double Skin Façade** helps to **reduce solar heat gain** and diffuse strong sunlight penetrating the building. Expected to **cut heat gain into the building by up to 26%** which translates to **energy savings**.
- 3** Innovative central circulatory system running through the lower 34 storeys of the building known as the **Cool Void** channels **higher-altitude, 2° cooler air** to air handling units and **reduces energy** to cool the building, resulting in energy cost savings.
- 4** **Rainwater Harvesting system** reduces stormwater drainage requirements & auto-drip irrigation system **uses rainwater collected to water greenery**.

# The Tower as a Living Plant

## 1 Hexagonal Plan

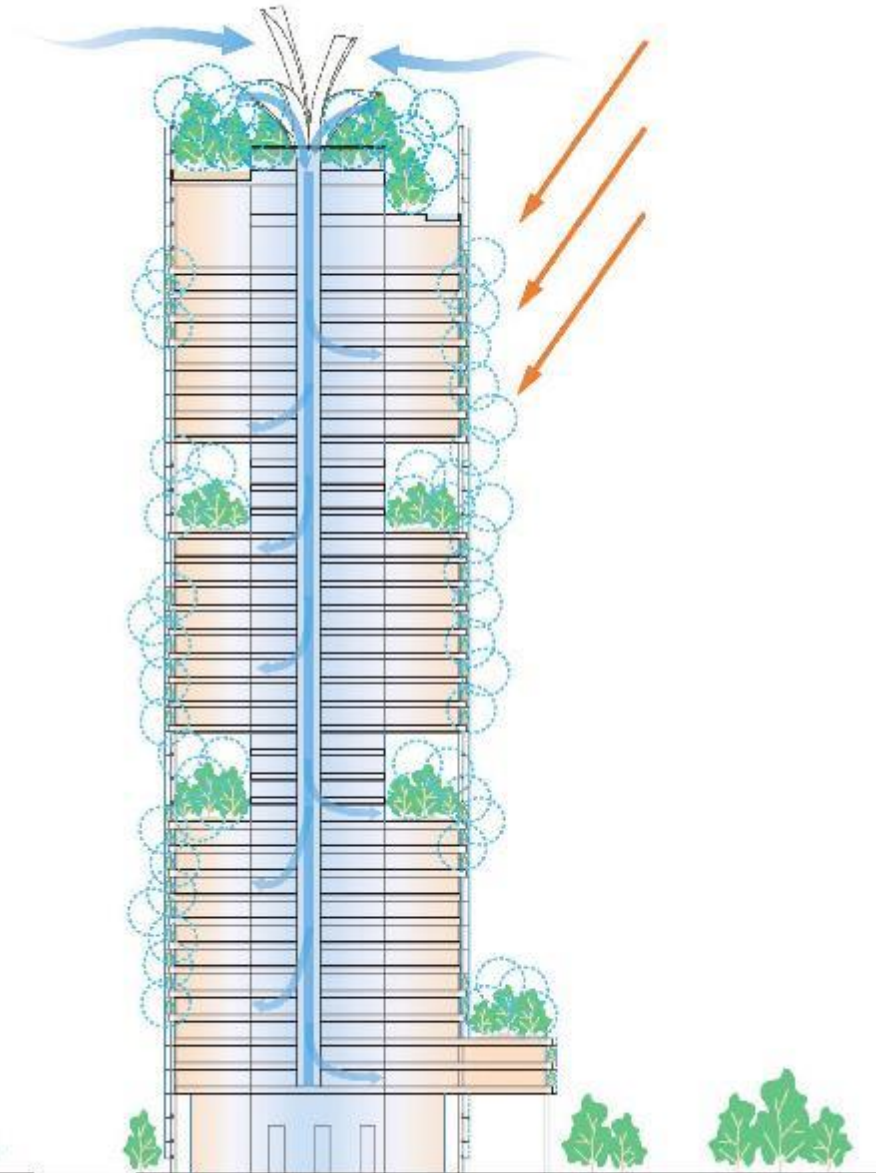
- Multiple Faces towards City
  - Various Approaches to Building
- Maximize Building Height and Floor Plate size

## 2 Sky Forest & Cool Void

- Sun Shading
- Cool Wind Intake
- Supply Air to Office Space

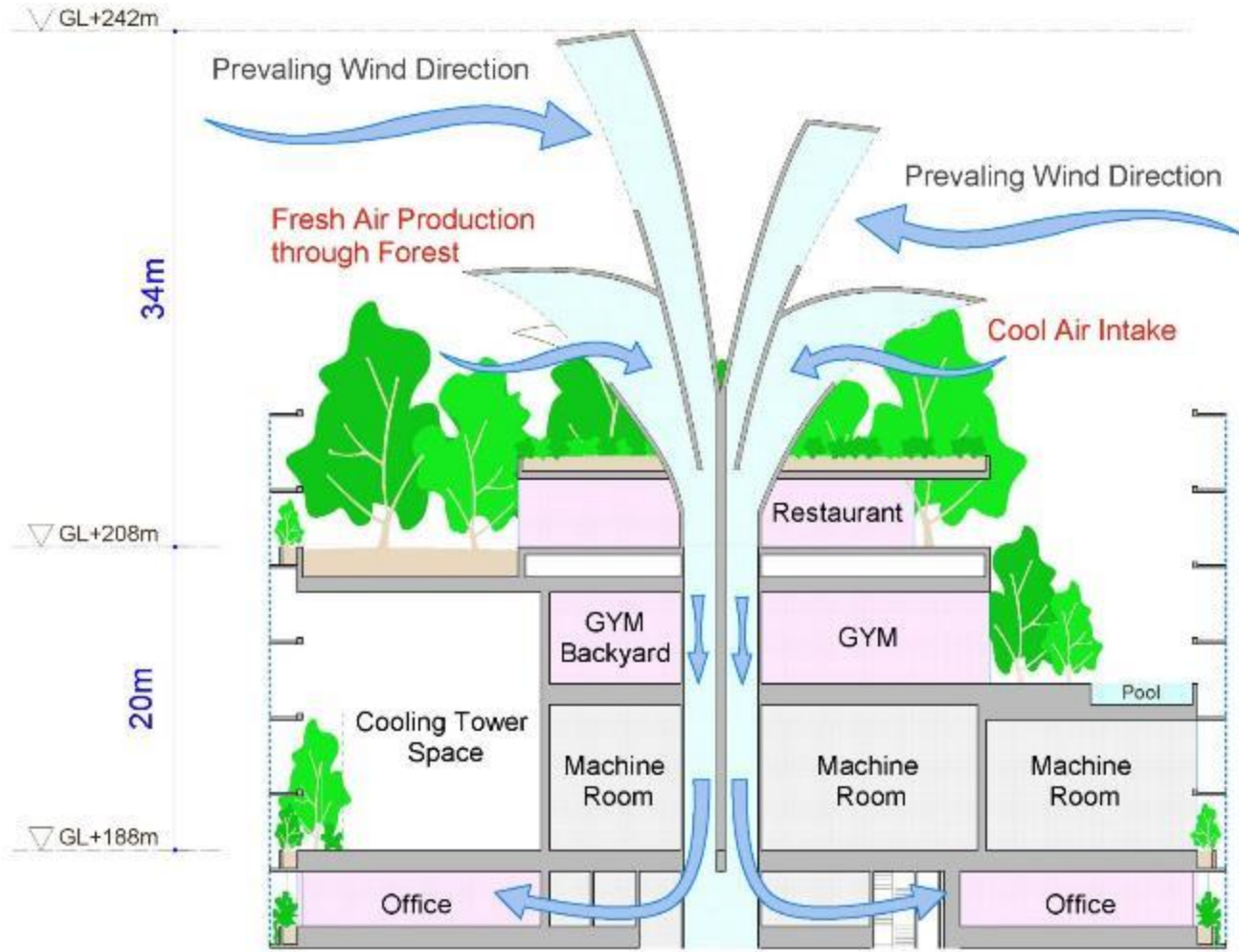
## 3 Green Façade + Urban Façade

- Temperature Control
- Sun Shading + max. visibility

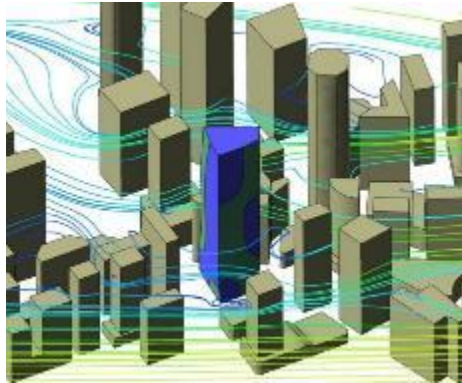


# Sky Forest & Cool Void

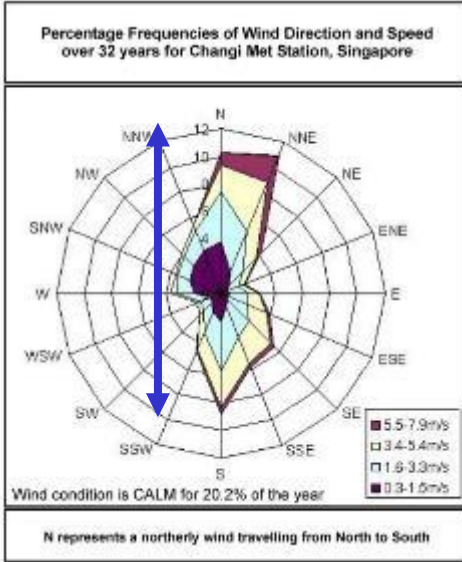
-Temperature of intake air is further reduced by the sky forest



## Wind Analysis

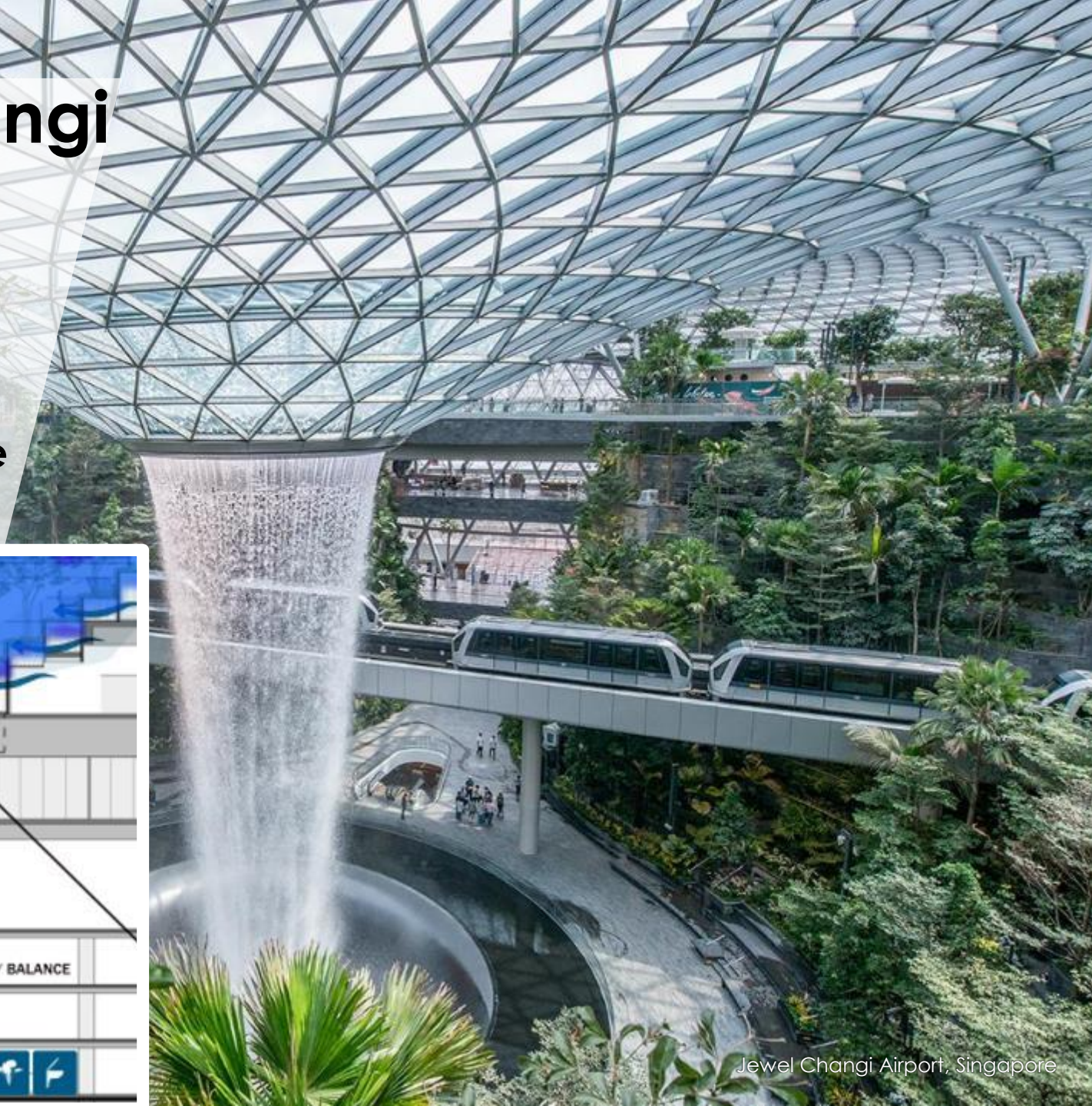
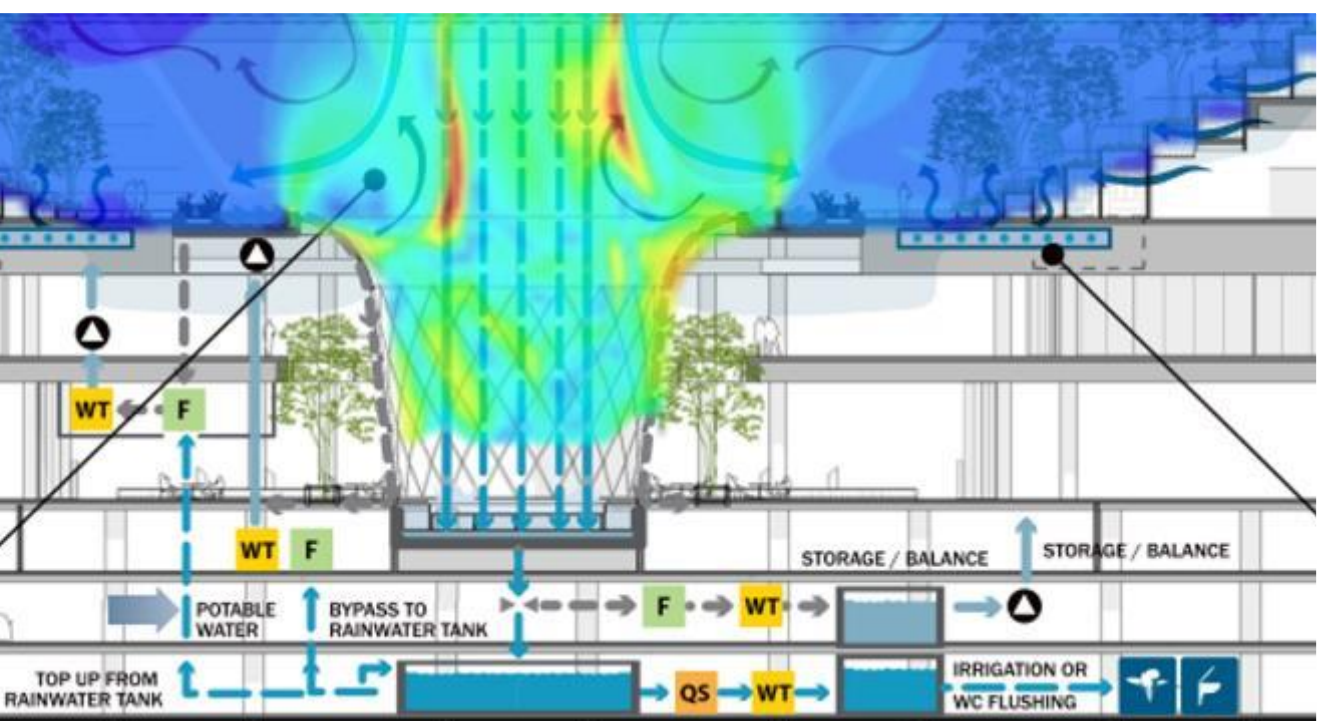


Characteristic Wind Flow



# Case Study: Jewel Changi

- 1 Rain vortex, a natural attraction & provides localised cool breeze.
- 2 **Rainwater harvesting** through rainwater vortex & irrigation tanks.
- 3 Rainwater collected at base **will be reused**.

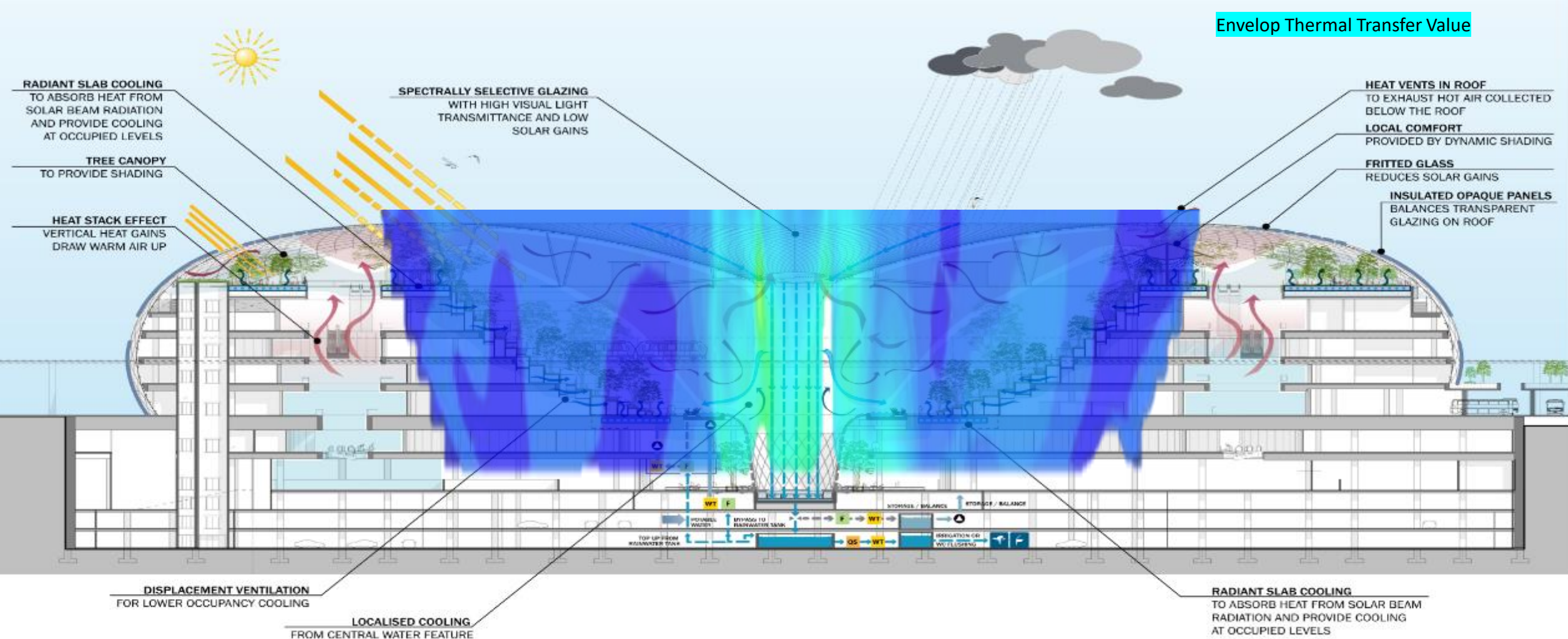


Jewel Changi Airport, Singapore

# Case Study: Jewel Changi

Sustainability Features Summary Jan 2021

- Energy savings: 17,863MWh (offset approx 3,200 5-room HDB flats' consumption per year)
- High Performance Building Envelope with ETTV < 40W/m2.
- Innovative efficient air-conditioning
- Solar panels

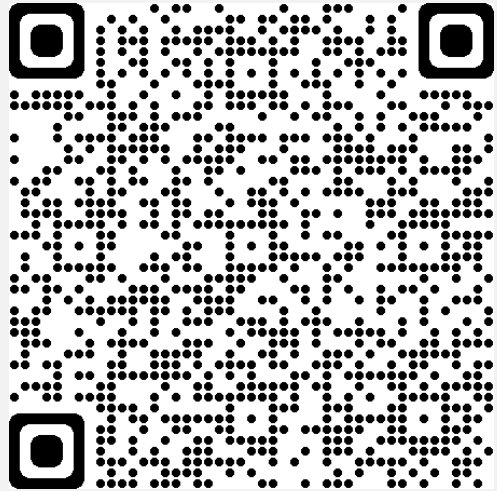




# Strengthening Sustainability Innovation & Collaboration – Open Innovation



## CAPITALAND SUSTAINABILITY X CHALLENGE



Launched in Nov 2020 to **globally source** for emerging sustainability technologies and solutions.

270 entries from over 25 countries. 6 finalists.

Register here to watch the **Grand Finale live on 11 June (Friday), 4pm – 6.30pm!**

## CapitaLand Smart Urban Co-Innovation Lab (SmartLab)



An Innovation lab in partnership with **Infocomm, Media Development Authority (IMDA)** and **Enterprise Singapore** provides CapitaLand with a platform to support the group’s innovation needs and catalyse new potential partnerships.



Thank you

