GREEN COUNCIL
環保促進會

Webinar:
Building and Construction – What are the missing hotspots?

Redesign the Construction Value Chain for Reducing Embodied Carbon

Mr. Ken Ho
Senior Manager (Sustainability & Environment)
Hip Hing Construction Co., Ltd.

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Redesign the Construction Value Chain for Reducing Embodied Carbon

Content

- Introduction
- BIM
- Electrification
- BESS
- SSME
- Low-Carbon Container
- Capsule Concrete
- Materials Management App
- Alternative Disposal Ground
- Carbon Offset Program

Life Cycle of Building

Embodied Carbon consists of all the GHG emissions associated with building construction, including those that arise from extracting, transporting, manufacturing, and installing building materials on site, as well as the operational and end-of-life emissions associated with those materials.

CO2

Cradle to Gate Embodied Carbon

Extraction | Manufacturing | Construction

CO2

Operational Carbon

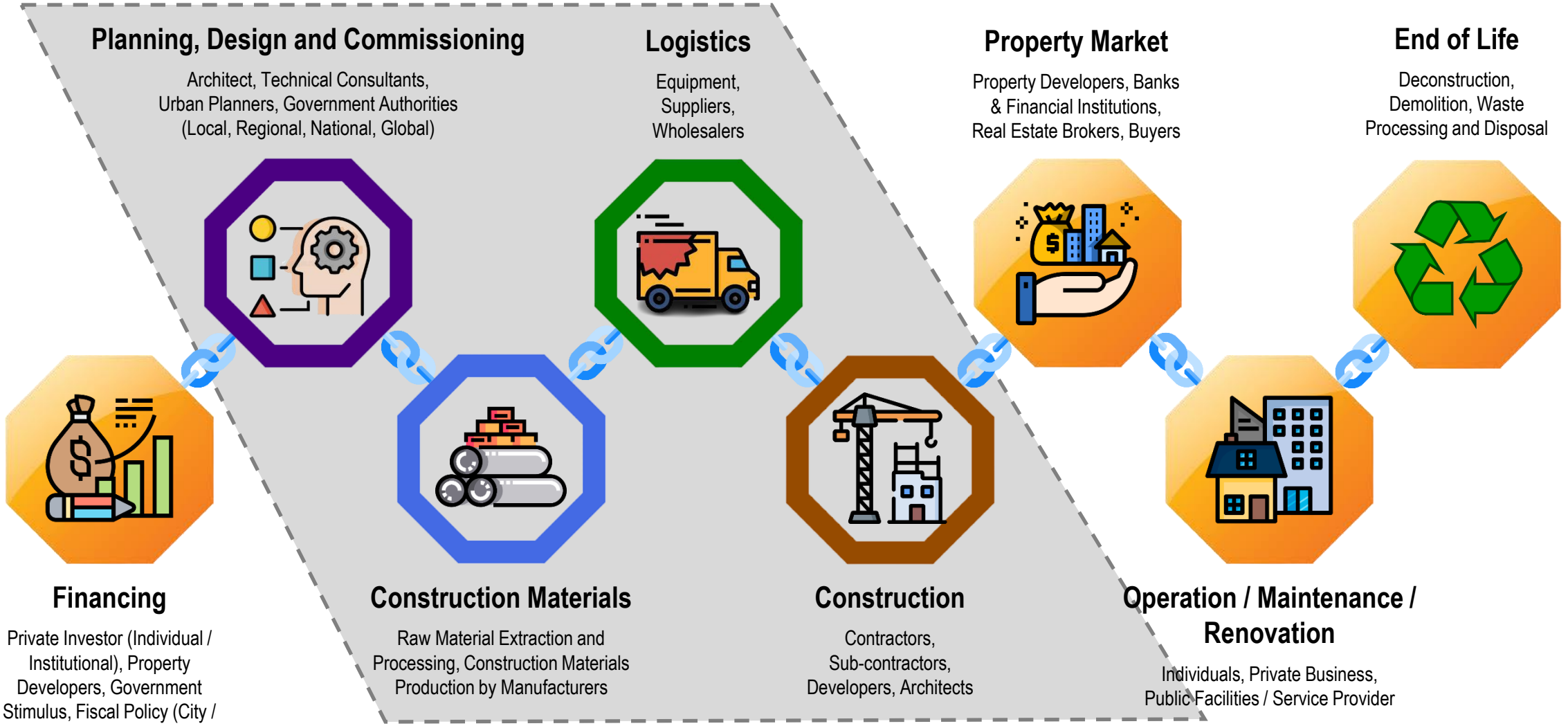
Operation | Repair

CO2

End of Life Carbon

Demolition | Disposal | Recycling

Construction Value Chain



Ways to Reduce Embodied Carbon

Technology

"Digitalization"
Digital twin is believed to be one of the most important technologies for real estate and construction in the next decade and plays a crucial role in helping cities achieve net-zero carbon emissions
(Quote in HKSTP Website)

"Electricfication"
Drive the consumption of Fossil Fuel towards Electricity in projects

Work Flow

"Modular Integrated Construction (MiC)"
Systematic optimization of modular integrated construction for maximum embodied carbon reduction of high-rise residential buildings in Hong Kong
(Quote in HKU Website)

Innovation

Innovation in design and construction methods can play an essential role in reducing embodied emissions from the built environment. However, it is also necessary to focus on the materials that make up buildings.
(Quote in lowcarbonmaterials.com)

Standard & Certification

Embodied carbon is a topic of concern in today's green building industry. Fortunately, it is now measurable, and LEED project teams are encouraged to account for it. The Materials and Resources (MR) credits are designed to address this critical area.
(Quote in USGBC Website)

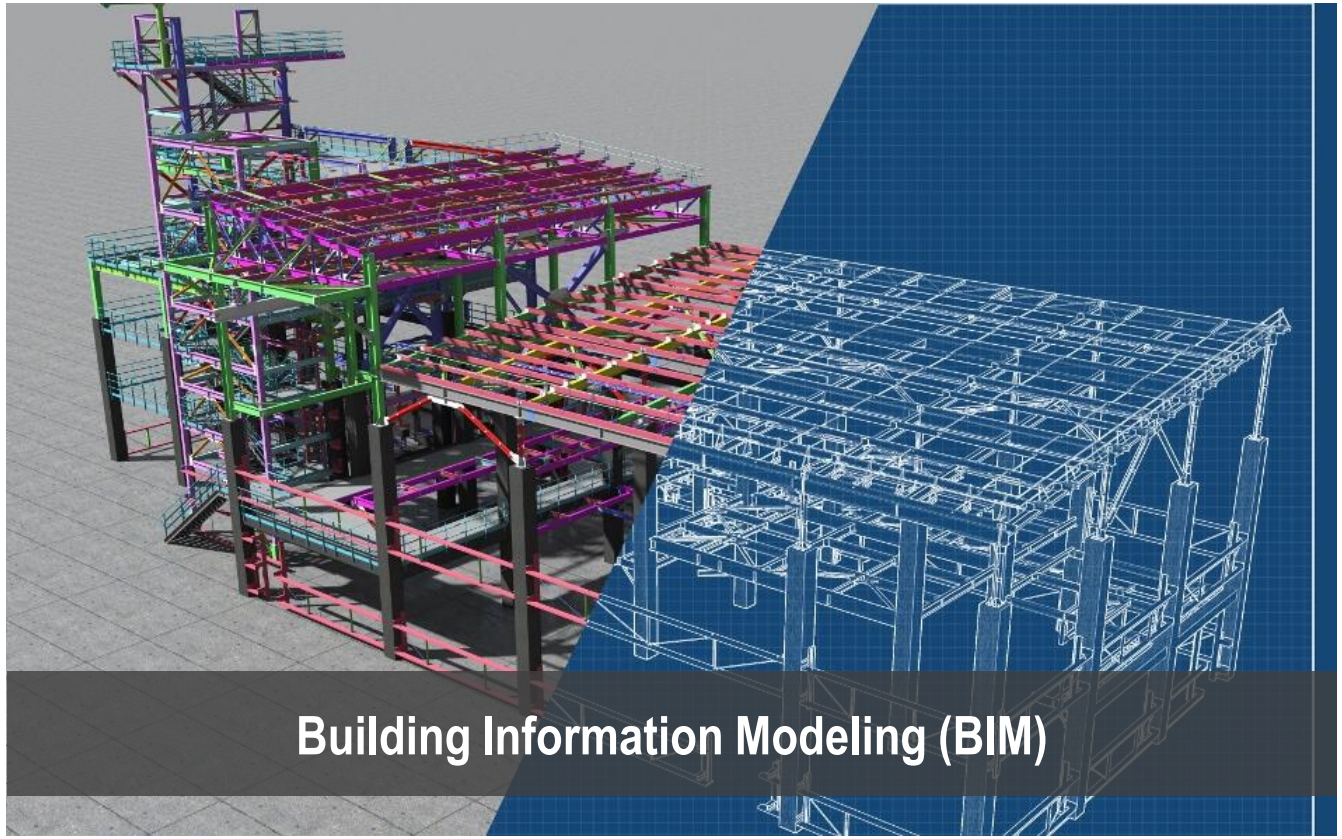
Result Tracking

The aim of the CIC Carbon Assessment Tool is to create a common platform to evaluate the carbon performance of buildings and infrastructure in Hong Kong from raw material extraction to the end of construction. The Tool facilitates the construction industry to contribute to the carbon reduction goal.
(Quote in CIC Website)

DIGITALIZATION

Building
Information
Modeling

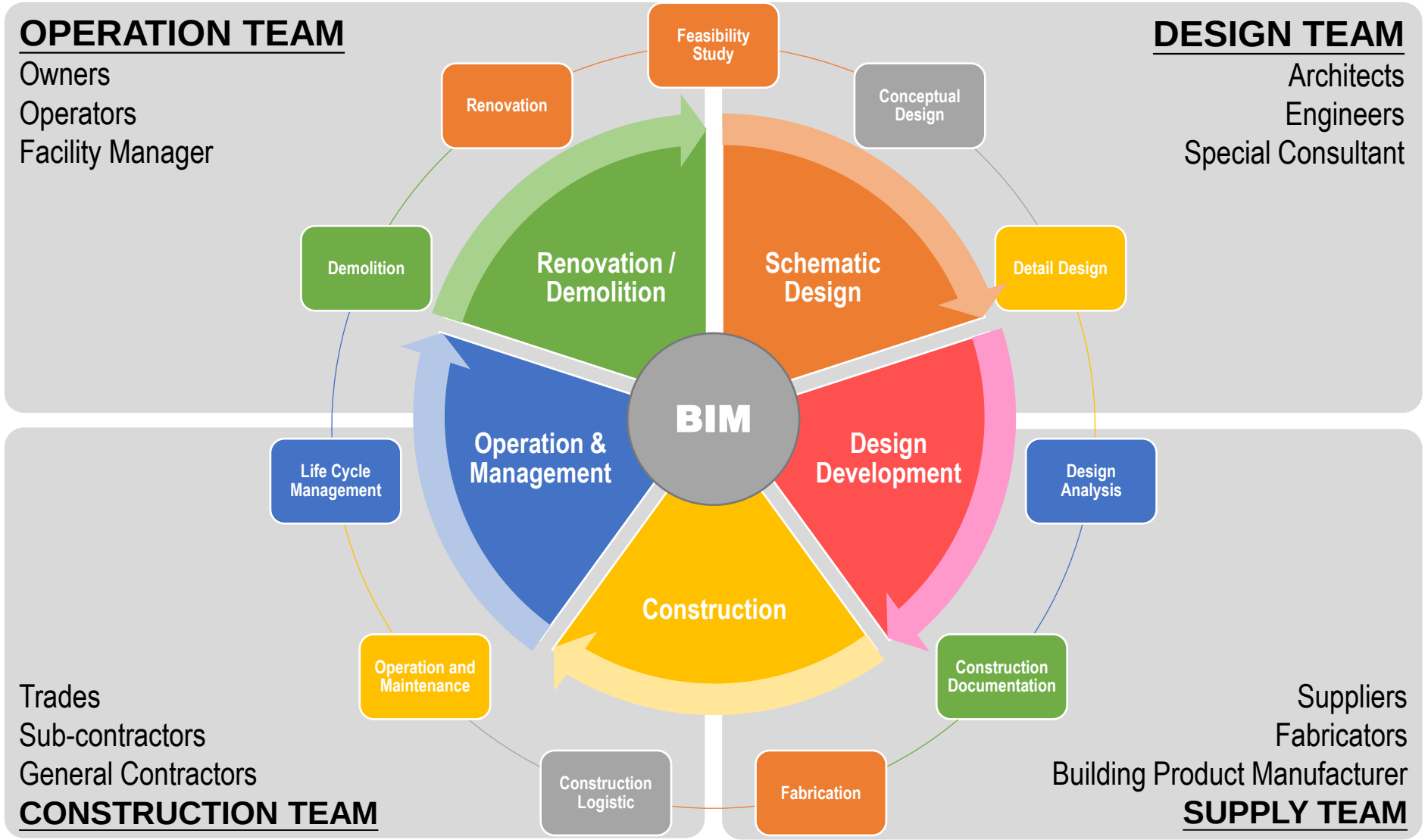
Digitalization



What BIM can do and possibility

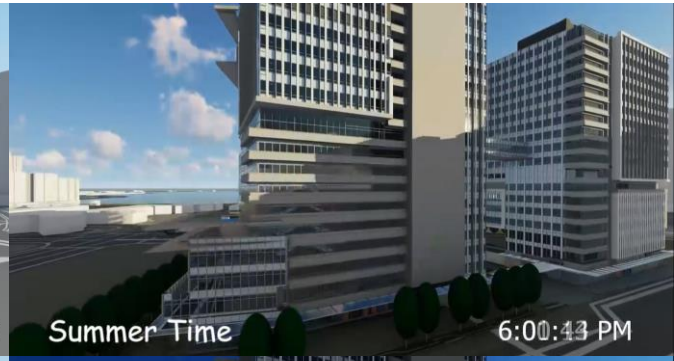
- Digital Twins, Common Data Environment (CDE)
- BIM is the holistic process of creating and managing information for a built asset
- BIM integrates structured, multi-disciplinary data to produce a digital representation of an asset across its lifecycle, from planning and design to construction and operations.

BIM in Building Life Cycle

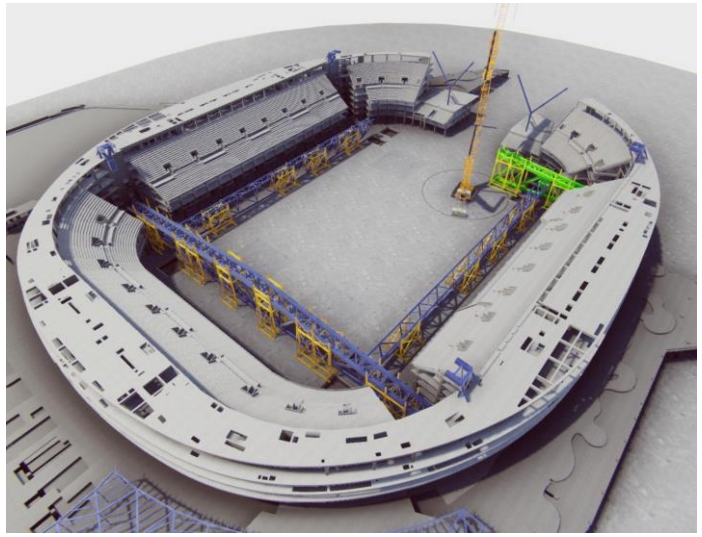


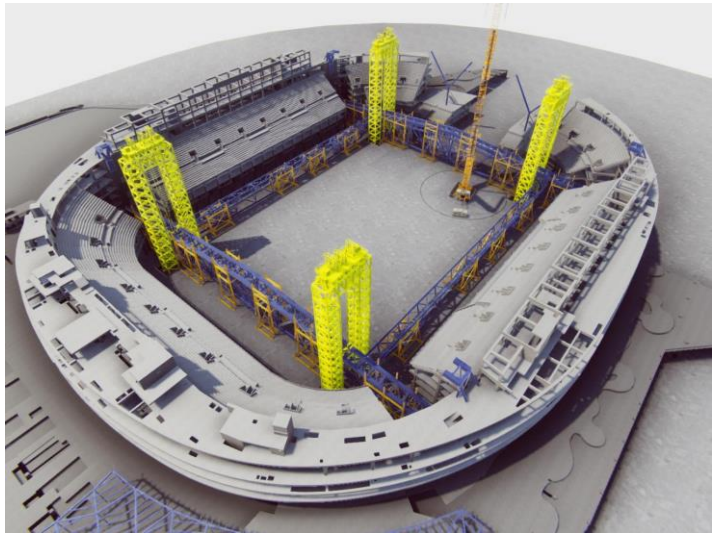
Env. Simulation in Design Stage

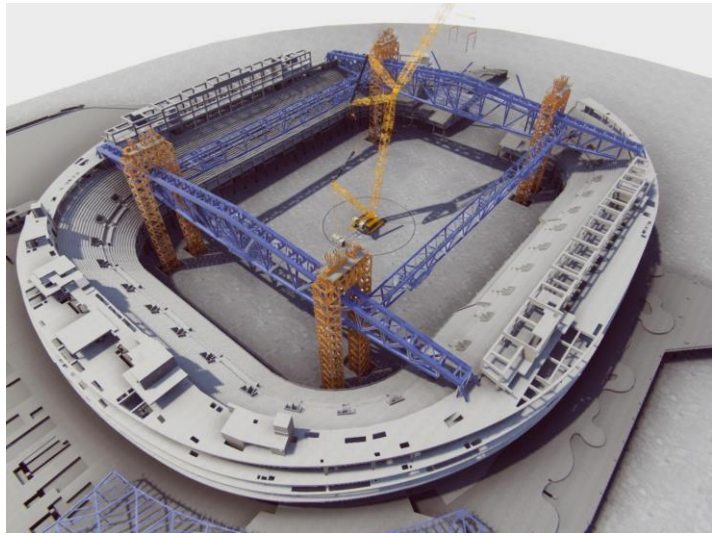
- Solar Study in Summer and Winter
- Sunlight captured in different seasons
- Building orientation
- Structural features design, e.g. planter, fins, window size



Work Sequencing







Installation of Main Truss in KTSP

- Simulate and visualize work sequencing
- Easy for communication understanding
- Pre-assess logistics and equipment needs
- Prevent undesirable circumstance

SCAN ME

Virtual Mock-up – BIM Cave

Set-up of BIM Cave

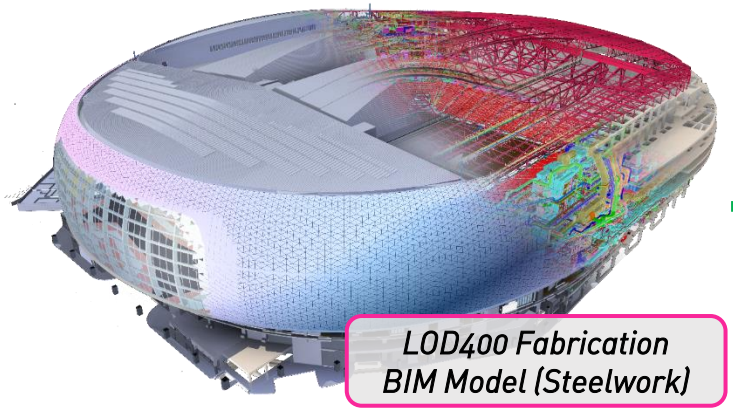
BIM Cave of Kai Tak Sports Park

Mock-up Visualized by VR

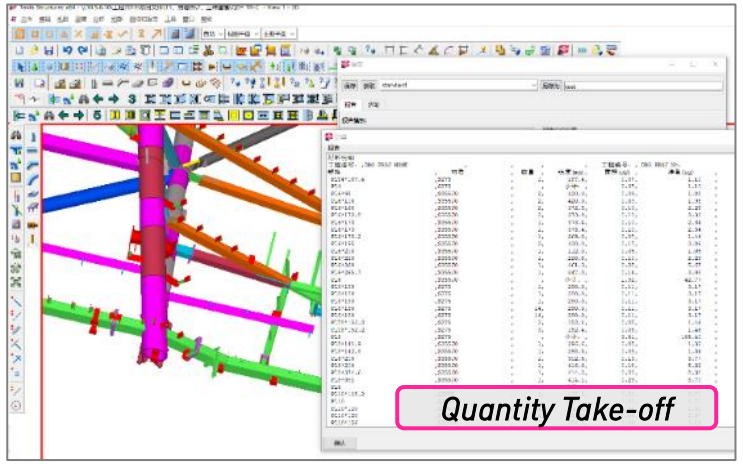
Physical Mock-up

- No Physical Mock-up is needed
- BIM Cave can save
  - Manpower
  - Time
  - Construction Equipment
  - Logistics
  - Energy
  - Cost
  - Embodied Carbon

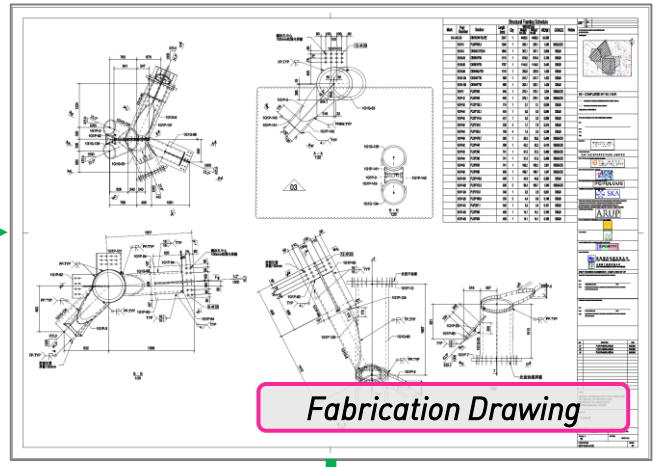
Material Fabrication



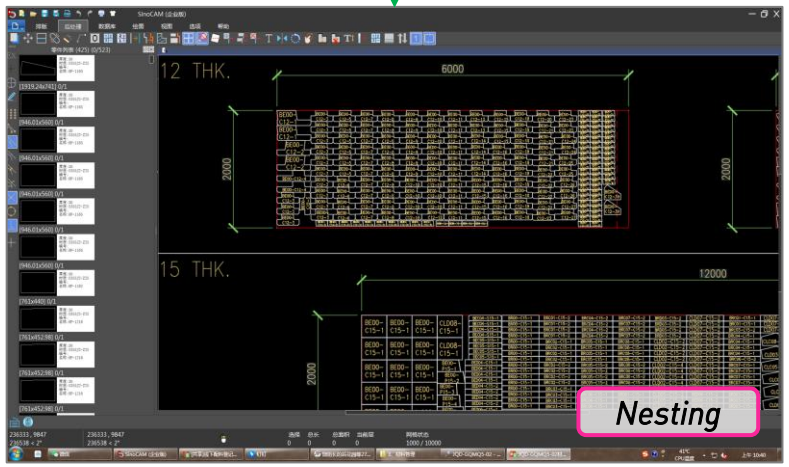
LOD400 Fabrication
BIM Model (Steelwork)



Quantity Take-off



Fabrication Drawing



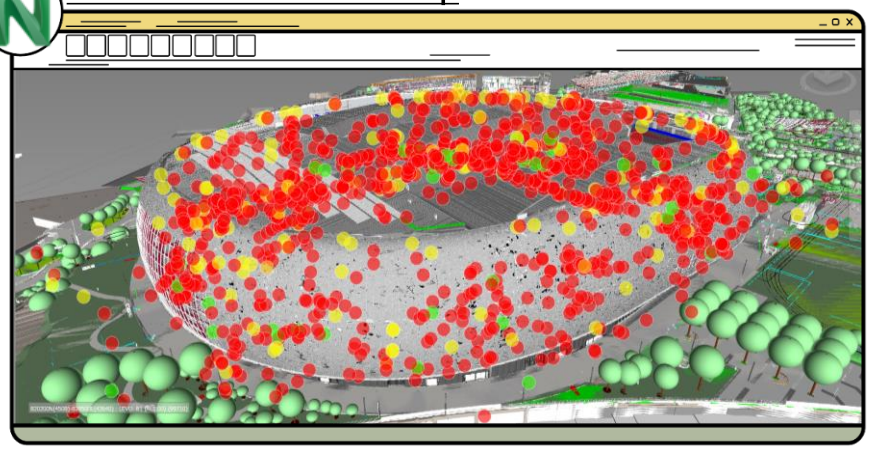
Nesting

Cutting

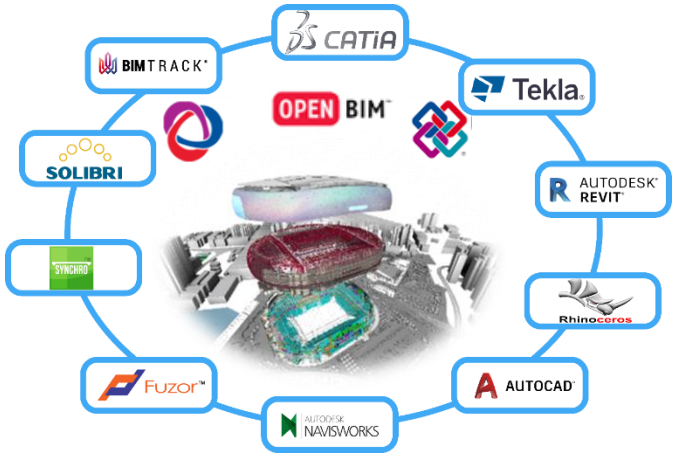
Fabricated Parts

Clash Analysis

Issue Distribution Heat map

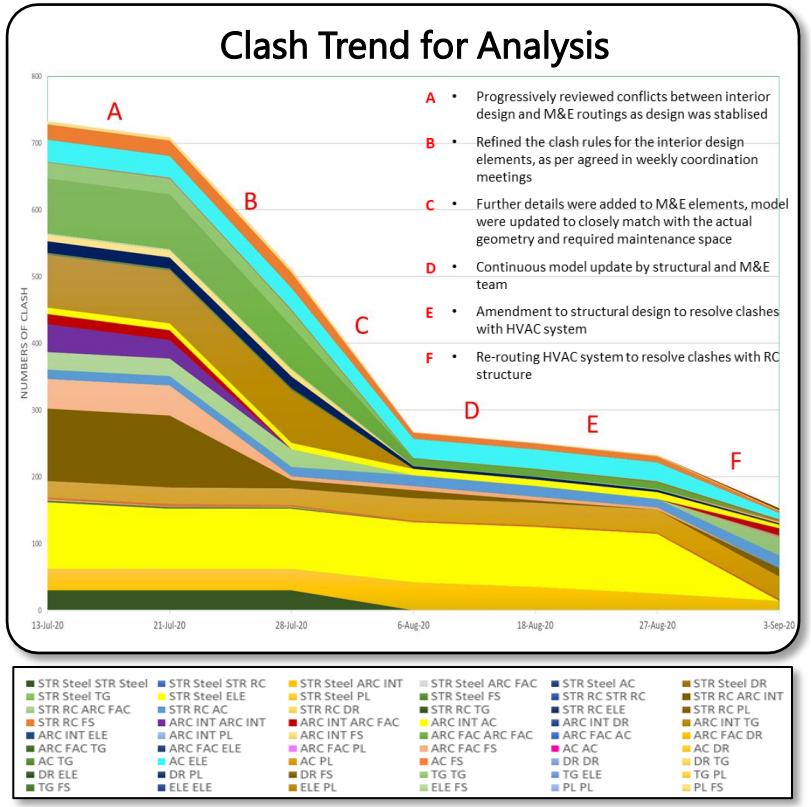


New Issue
Resolved Issue
Rejected Issue
Solved by Consultant



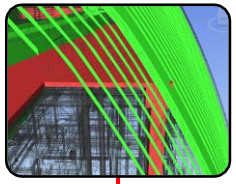
Issue Tracking Tool (BIM TRACK / NAVISWORK)

Trend of BIM Model Maturity

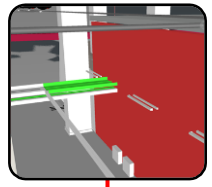


Tracking / Supervising the Maturity Trend

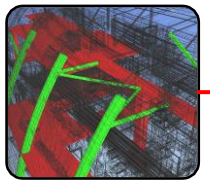
Clash Matrix with Categorization



RC beams/columns clashing with Standing Seam (Resolved)

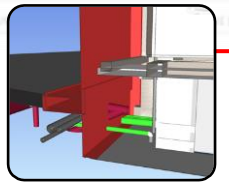


Cable Trays penetrate Doors/walls (Follow up)



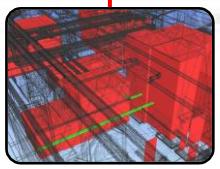
		STR Steel	STR RC	ARC INT	ARC FAC	AC	DR	TG	ELE	PL	FS	Sum
STR	STR Steel	0	14	0	0	0	0	0		0	2	17
	STR RC		34	12	0	19	27	0		0	3	95
ARC	ARC INT			1	10	5	1	0	2	2	0	21
	ARC FAC				2	0	0	0		0	0	2
MEP	AC					0	0	1	10	0	3	14
	DR							0		0	0	4
	TG							0		0	0	0
	ELE									0	0	0
	PL										0	0
	FS											0
											Total:	153

* The clash report only counts the L08 Plant Room element



DR pipe penetrates cladding walls (Resolved by rules)

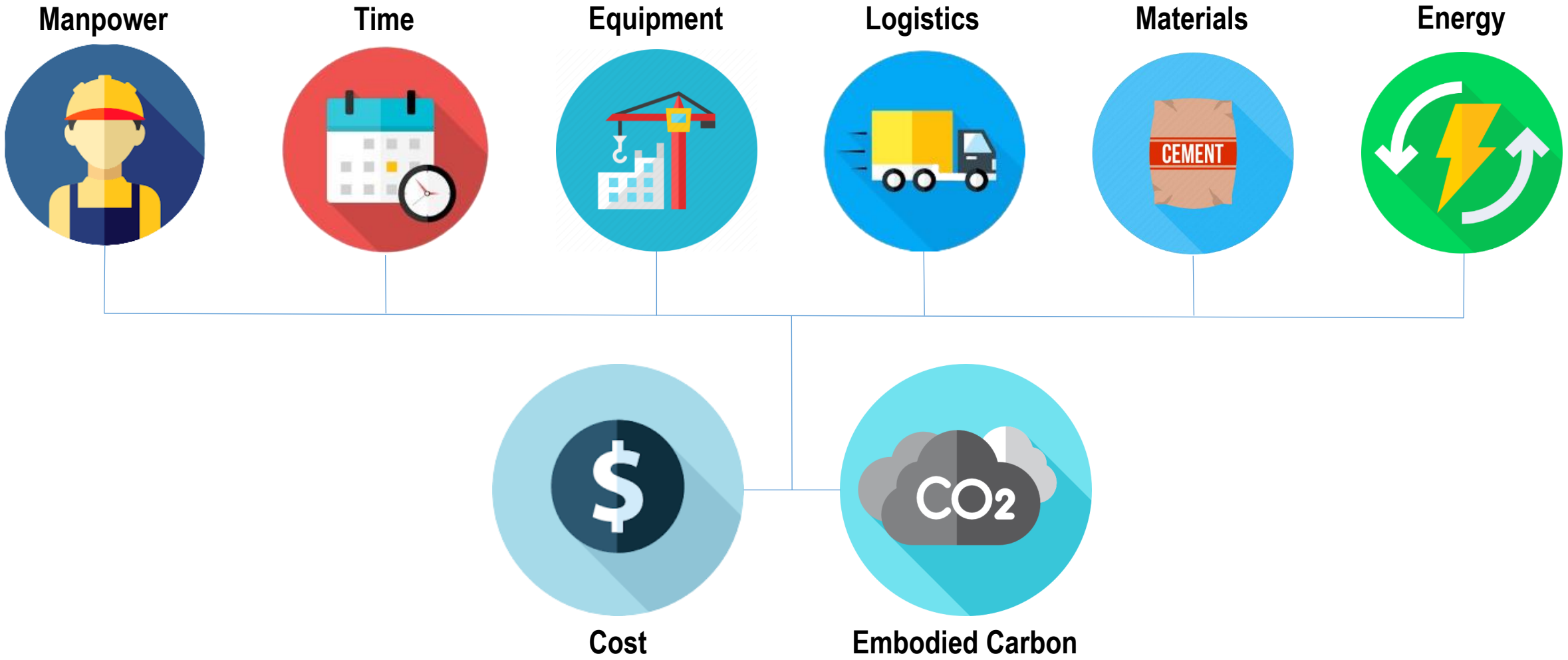
High Priority Clash
Medium Priority Clash
Low Priority Clash



Cable Trays penetrate PAU/AHU (Follow up)

Prioritized and illustrated clash scenarios

What Can BIM Save?



ELECTRIFICATION
(電力化)

The Strategy for
De-carbonization

Electrification Strategy

Points to Note

What to do

- Ensure the availability of Grid Electricity at project start
- Early prepare the application for Grid Electricity
- Source and deploy electrical construction equipment
- Fade-out fossil fuel driven construction equipment

Limitation

- Grid Electricity may not be available at some remote location
- Power supply is not enough, (i.e. 400 Amp or below)
- Availability and cost of electrical construction equipment

Electrification (電力化)

Question
Is Power Supply enough?

Yes

No

Battery Energy Storage System

Tower Crane

Scissor Platform

Electric Vehicle

Forklift

Cherry Picker

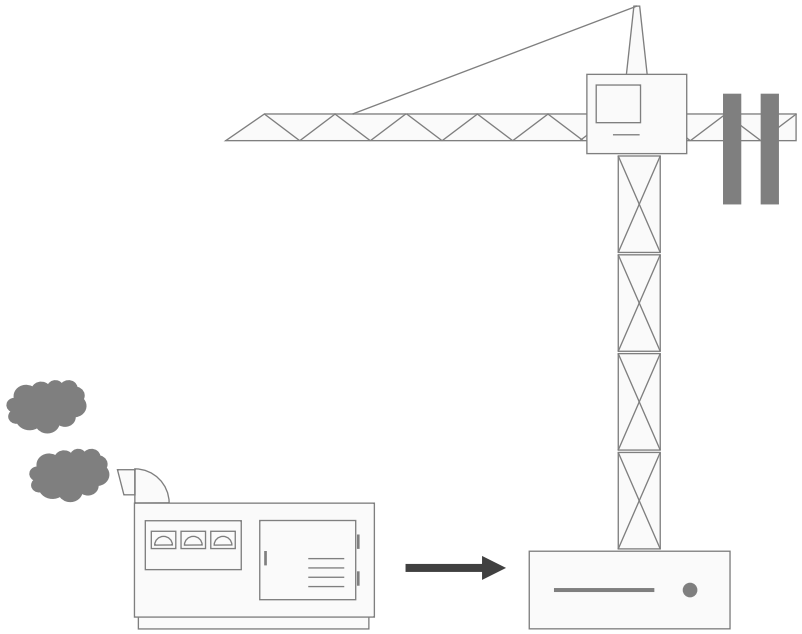
Hoist

Electrical Grid | **Construction Site**

BATTERY ENERGY STORAGE SYSTEM

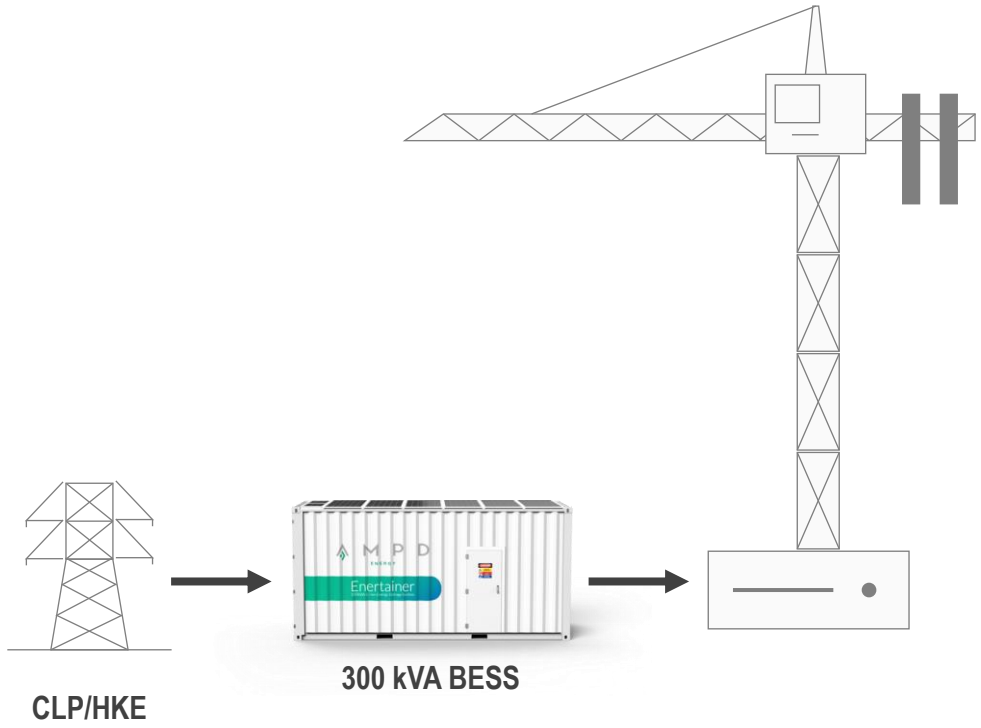
Best Solution to Replace
Diesel Generator

Replacement of Diesel Generator



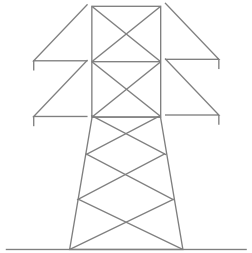
300 kVA Generator

VS



Usage Optimization

1 BESS replaces
3 Diesel Generators

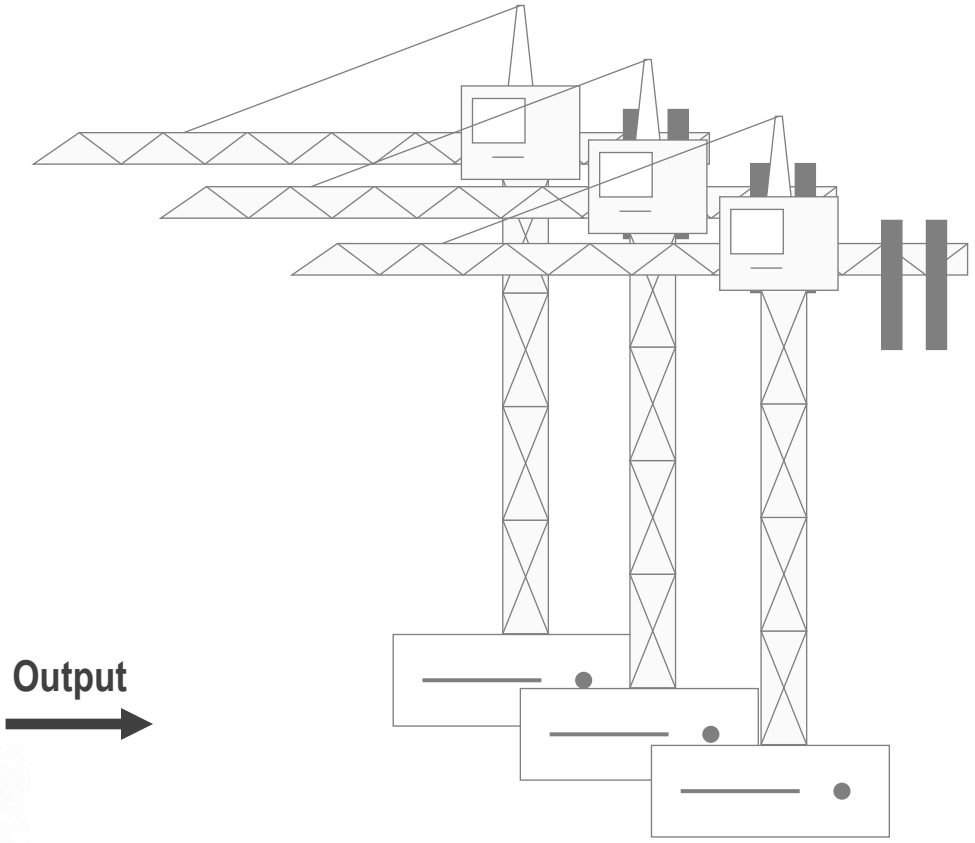


CLP/HKE

Input

BESS

Output



3 Tower Cranes

BESS Adopted in Projects


HH01 NKIL 6553


HH02 Tai Wo Ping


HH03 KTSP


HH04 CLP KTN


HH05 NKIL6607


HH06 2 Murray Rd


HH07 Sogo (Site B)


HH08 2 Murray Rd


HH09 ImmiHQ


HH10 ImmiHQ


HH11 Off Sin Fat Rd


HH12 AIA


HH13 Tai Wo Ping


HH14 MEC


HH15 NKIL 6554


HH16 NKIL 6554


RD34 NKIL 6577

17 Enertainers
in
13 Projects

Performance (1st Half of FY2023)

17 Units
BESS Adopted

762,388 L
Fuel Saved

1,674 Ton
Carbon Emission Saved

SMART SYSTEM IN MOBILE ELECTRICITY

Minimize Fuel Consumption if
Grid Electricity is unavailable

Smart System in Mobile Electricity

What is SSME

- Connect generators to form a mini power station
- Regulate and distribute electricity to designated equipment through local network
- In one of projects, the no. of generators is reduced from 6 to 3 when using this system
- Reduce use of generators and diesel consumption

SSME adopted in Projects

KTSP (3 sets SSME with 13 Generators)

NKIL 6553 (1 set SSME with 2 Generators)

NKIL 6554 (1 set SSME with 3 Generators)

Performance (1st Half of FY2023)

5 Sets

SSME Adopted

419,162 L

Fuel Saved

1,112 Ton

Carbon Emission Saved

Low-Carbon Container

Low-Carbon Container

Performance (4-month)

12 Units

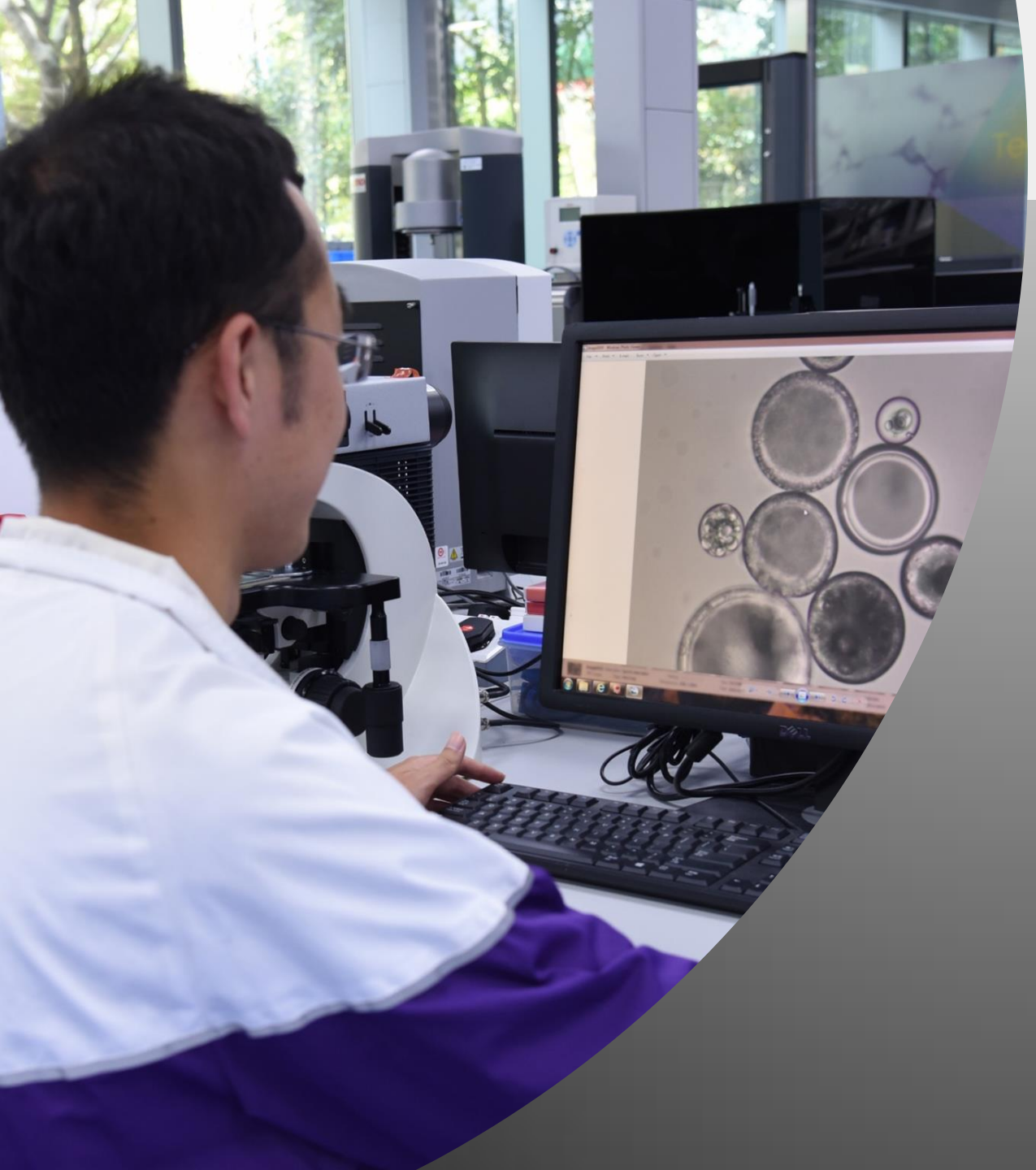
Mono-crystalline Silicon Solar PV Panels

739 kWh

Renewable Energy Generated

288 Ton

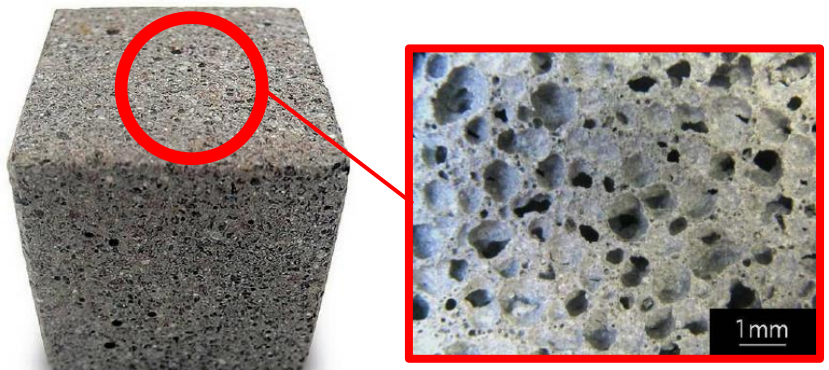
Carbon Emission Saved



Research & Development For Material

Capsule Concrete

Normal Lightweight Concrete



Foamed Concrete

Type of Lightweight Concrete

- Lightweight Aggregate Concrete
- Aerated, Cellular, Foamed or Gas concrete
- No-fines Concrete

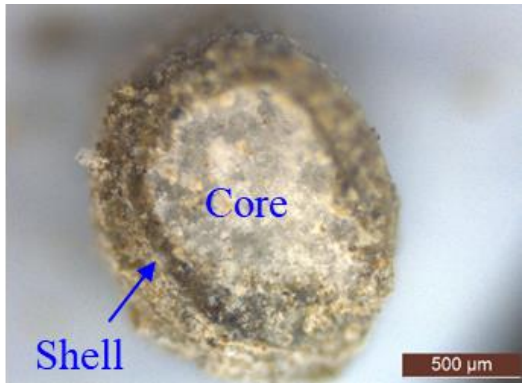
Characteristics

- Lightweight
- Low strength (between 7 and 14 Mpa)
- Good thermal insulation

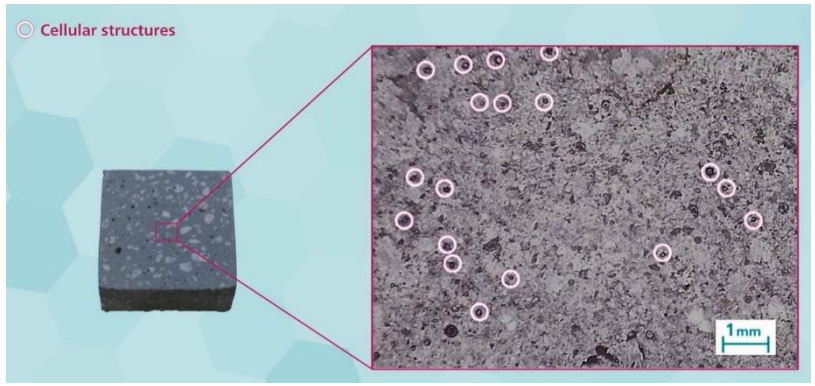
Limitation

- Difficult to scale up
- Uneven distribution of the foam during prolonged transportation
- Aggregate settlement at the bottom

Capsule Concrete



Capsule



Even Distribution of Capsule and Aggregate

Characteristics

- Capsule enabled lightweight Cellular Concrete
- 30% lighter in weight than traditional concrete
- high fire resistance
- Lower thermal conductivity
- good sound insulation
- suitable for the construction use of facades and floor slabs.

Advantage

- Reduce the mass of superstructure
- Reduce the design of foundation structure
- Reduce Embodied Carbon

Achievement

- Successfully adopted in Immigration Headquarters at Tseung Kwan O
- IP rights granted:
  - China patent no.: CN 108395269 B
  - Hong Kong patent no.: HK1256097
  - US patent no.: US 11,084,760 B2

Material Management App

Here Logistics Management can be better

Logistics Management

Construction Equipment & Materials

Project A

Project B

Inert Materials

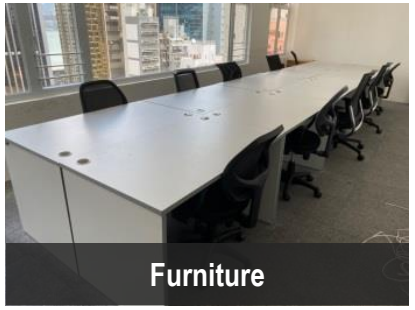
Project A

Project B

Digital Platform for Material Exchange


Soil


Aggregate


Furniture

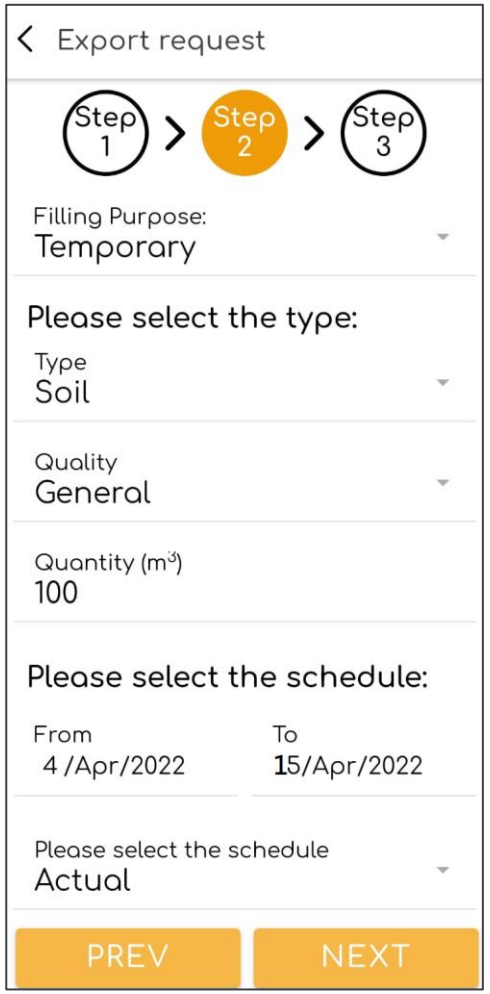

Road Barrier


Catwalk

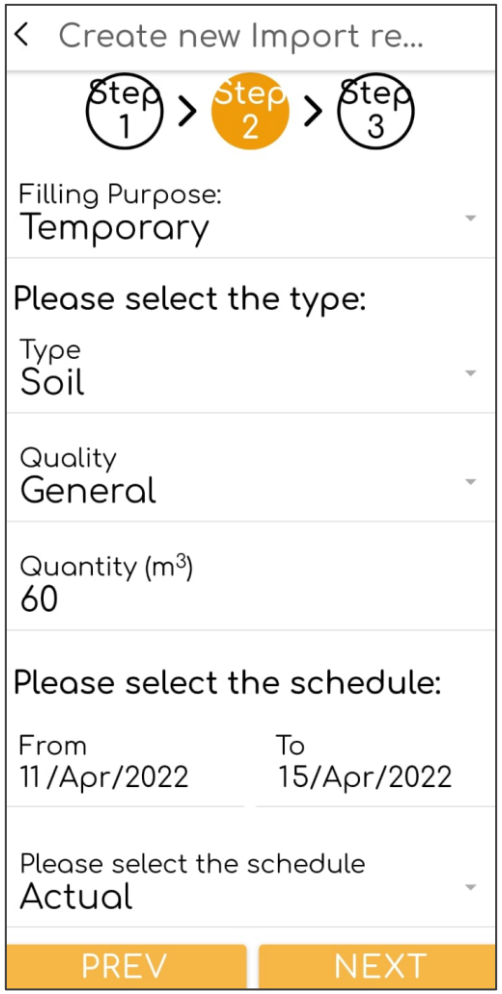

Noise Barrier

Example

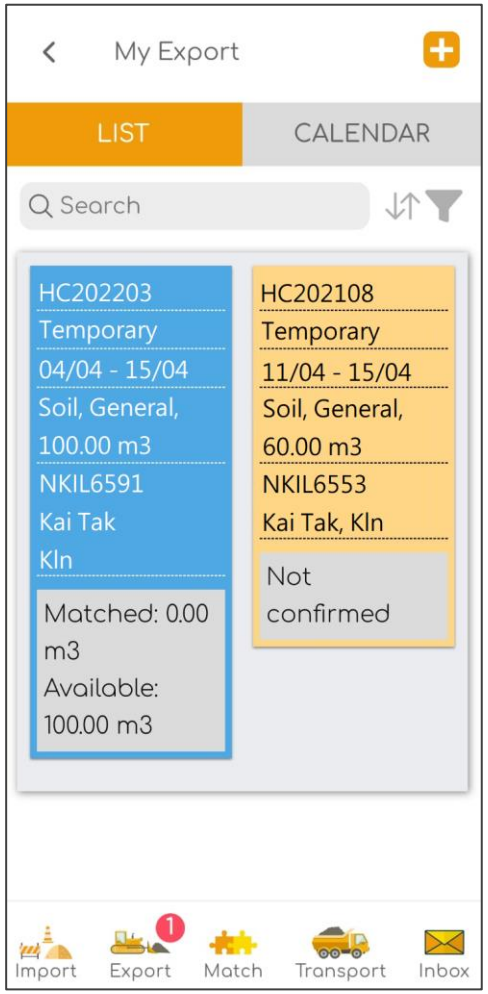
Exporter (NKIL6591, 新世界)



Importer (NKIL 6553, 華潤)

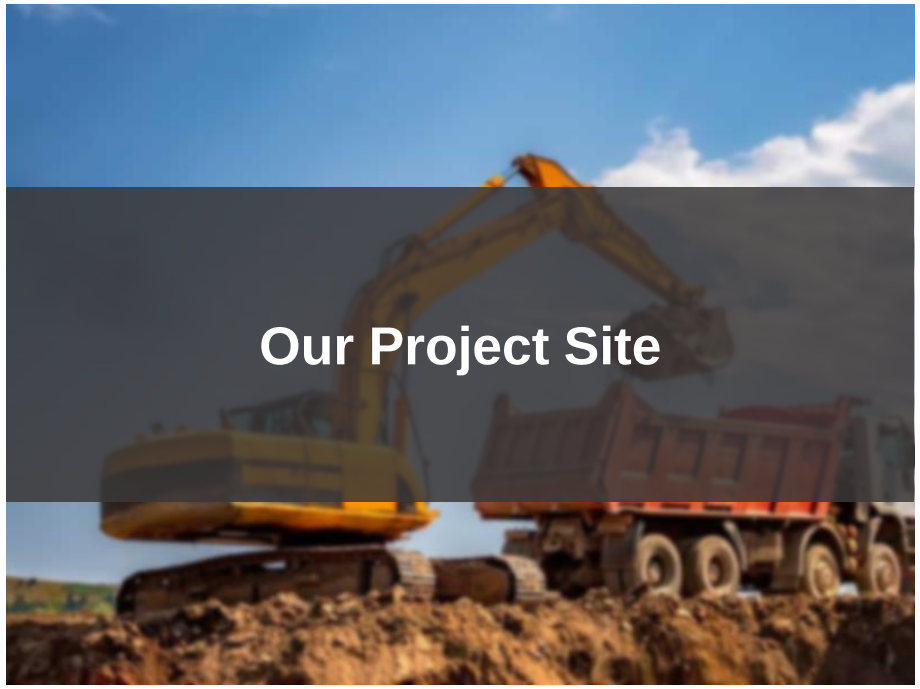


Matched



Alternative Disposal Ground

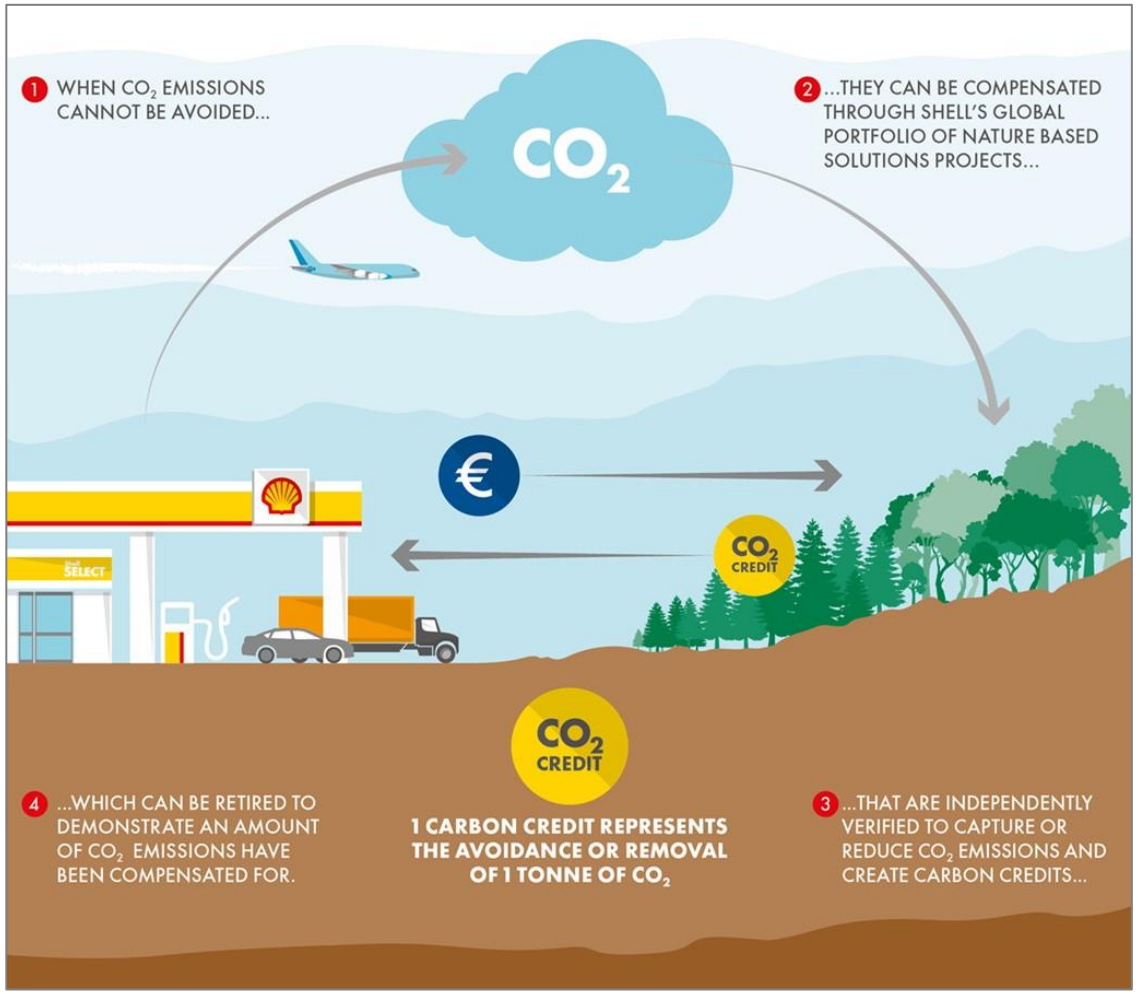
Alternative Disposal Ground



CARBON OFFSET PROGRAM

Decarbonized
Solution for Fleet

Carbon Offset Program



How does it work?

- Opt-in to compensate the CO_2e emissions for your plant or fleet with every purchase of fuels
- Track your plant or fleet's overall fuel consumption and calculate the associated CO_2e emissions
- Offset these emissions against our global portfolio of nature-based projects.
- Purchase carbon credits equivalent to the amount of your plant or fleet's emissions
- Issues an annual Shell carbon reduction certificate confirming that the fuel has been compensated

Carbon Offset Program

Carbon Credits Retirement Certificate

This is to certify that: **44**

carbon credits were retired for:
HIP HING CONSTRUCTION COMPANY LIMITED

by Shell from their global carbon credits portfolio on:
10 February 2022

to compensate for **44**
tonnes of CO_2e[1] emissions from the Shell products purchased in **2021**.

Serial number
SHKL2-126A-2022M2D10-B-2021-1-18

THIRD PARTY VERIFIED CARBON CREDITS

Project information

38.0% Cordillera Azul Project, Peru, VCS ID 985
26.0% Katingan Mentaya Project, Indonesia, VCS ID 1477
26.0% Kasigau REDD Project - Phase II, Kenya, VCS, ID 612
3.7% Mickli Afforestation Project, China, VCS ID 1866
3.6% Hechu Afforestation Project, China, VCS ID 1855
1.6% Qianxinan Afforestation Project, China, VCS ID 1847
0.7% Xiguan Afforestation Project, China, VCS ID 1865
0.4% Hadong Afforestation Project, China, VCS ID 1832

Carbon Credits Retirement Certificate

This is to certify that: **37**

carbon credits were retired for:
VIBRO (H.K.) LIMITED

by Shell from their global carbon credits portfolio on:
10 February 2022

to compensate for **37**
tonnes of CO_2e[1] emissions from the Shell products purchased in **2021**.

Serial number
SHKL2-126A-2022M2D10-B-2021-1-40

THIRD PARTY VERIFIED CARBON CREDITS

Project information

38.0% Cordillera Azul Project, Peru, VCS ID 985
26.0% Katingan Mentaya Project, Indonesia, VCS ID 1477
26.0% Kasigau REDD Project - Phase II, Kenya, VCS, ID 612
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0.7% Xiguan Afforestation Project, China, VCS ID 1865
0.4% Hadong Afforestation Project, China, VCS ID 1832

Carbon Credits Retirement Certificate

This is to certify that: **8**

carbon credits were retired for:
KAI TAK SPORTS PARK LIMITED

by Shell from their global carbon credits portfolio on:
10 February 2022

to compensate for **8**
tonnes of CO_2e[1] emissions from the Shell products purchased in **2021**.

Serial number
SHKL2-126A-2022M2D10-B-2021-1-25

THIRD PARTY VERIFIED CARBON CREDITS

Project information

38.0% Cordillera Azul Project, Peru, VCS ID 985
26.0% Katingan Mentaya Project, Indonesia, VCS ID 1477
26.0% Kasigau REDD Project - Phase II, Kenya, VCS, ID 612
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0.4% Hadong Afforestation Project, China, VCS ID 1832

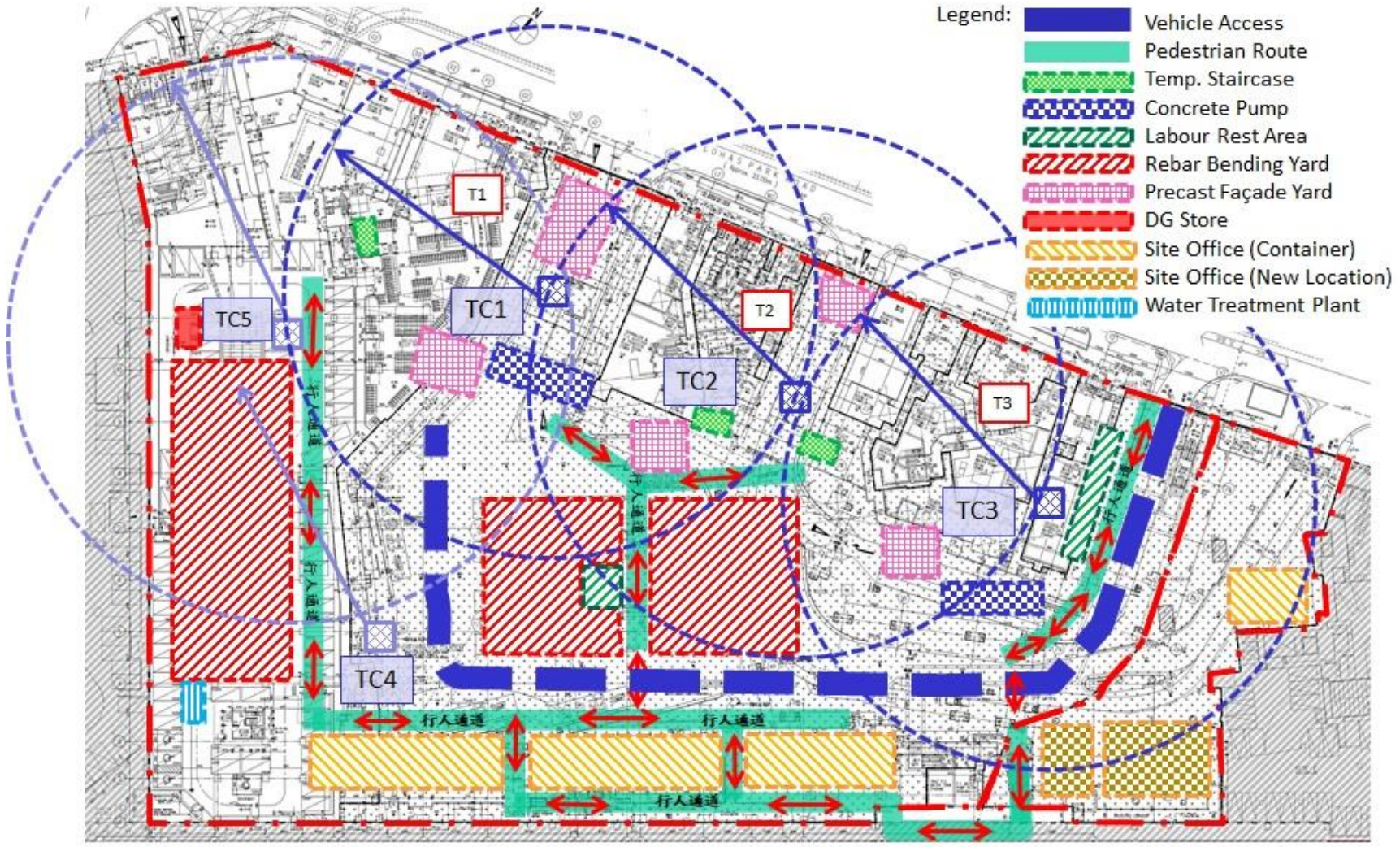
THANK YOU!

Case Study – Malibu (Lohas Park 5)

Construction Project of

- **3 High-rise Residential Towers** (1,600 Units)
- **5-storey Podium** (including Recreational Facilities, Carpark, Public Transport Interchange, etc.
- **Associated External Landscaping Area**
- **Period: Q3 2016 to Q1 2020**

Case Study – Malibu (Lohas Park 5)



4 Tower Cranes

6 Passenger Hoists

6 Material Hoists

2 Rebar Bending Yards

1 Site Office

196 Temp. Electricity Distribution Boards

And…….

Case Study – Malibu (Lohas Park 5)

Bulk Power supply required

Approximately 6170A, 380V power supply is required in this project. A **400A** temporary electricity supply were provided, **nine units diesel generators** were also deployed (400kVAx3, 300kVAx5, 200kVAx1)

Equipment	Quantity	Amp (in 380V)	Diversity	Sub-Total in Amp
Tower crane	4	200	1	800
Material Hoist	6	60	0.8	288
Passenger Lift	6	100	0.8	480
Bending Yard	2	100	0.5	100
Site office	1	200	1	200
Temp. Electricity Distribution Boards	196	60	0.3	3528
Dewatering pumps	30	15	0.4	180
Water upfeed pumps	6	30	0.8	144
Exhaust Fans	30	15	1	450
			Total	**6170 Amp**

Case Study – Malibu (Lohas Park 5)

What If

Use of “Battery Energy Storage System (BESS)” Now?

Case Study – Malibu (Lohas Park 5)

Bulk Power supply required

Approximately 6170A, 380V power supply is required in this project. A **400A** temporary electricity supply were provided, **nine units diesel generators** were also deployed (400kVAx3, 300kVAx5, 200kVAx1)

Equipment	Quantity	Amp (in 380V)	Diversity	Sub-Total in Amp
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Site office	1	200	1	200
Temp. Electricity Distribution Boards	196	60	0.3	3528
Dewatering pumps	30	15	0.4	180
Water upfeed pumps	6	30	0.8	144
Exhaust Fans	30	15	1	450
			Total	**6170 Amp**

2 BESS
Replace
6 Generators