香港會議展覽中心
Hong Kong Convention and Exhibition Centre

持續卓越創未來
Sustain Excellence for Future

Decarbonisation through Continuous Analysis and Enhancement of Facilities Energy Efficiency

Eric Lau

CEng, REA, MHKIE, MCIBSE, MASHRAE, FHKAEE, BEAM Pro, RCX Pro

Director - Facilities Planning & Operations

UFI Operations and Services Awards Entry
by Hong Kong Convention and Exhibition Centre (Management) Limited

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1. INTRODUCTION OF HKCEC

Hong Kong Convention and Exhibition Centre

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FAST FACTS

The Hong Kong Convention and Exhibition Centre (HKCEC) first opened in **1988**

2 expansions completed in 1997 and 2009

Our Size & Facilities

Size and Scale		Equipment
306,000	m^2	12,000 TR Chiller Plant (13 nos. chillers)
6	Exhibition Halls	79 PAUs, 246 AHUs,
2	Multi-Purpose Halls	39 Lift, 89 Escalators
52	Meeting Rooms	
7	Restaurants	

Leadership in Carbon Emission Management

- First organisation in HK accredited ISO 20121 (Event Sustainability Management System) in 2015
- First energy audit in 2016
- Net Zero Carbon Event Pledge in 2021

Our Events:

1,000 events and **8.5 million** attendance annually pre-COVID-19

44 Entertainment & Special Events

351 Other Events

159 Conferences & Conventions

119 Exhibitions

327 Banquets

2. OUR VISION, COMMITMENT, LEADERSHIP, TARGET

Our Vision

To be among the **best exhibition** and convention centres globally, renowned for excellence and hosting the **world's greatest events** while **enhancing Hong Kong's international image.**

Our Commitment

Commit to **Net Zero Carbon Event Pledge in 2021**

Commit to corporate social responsibility, to reduce carbon emissions associated with our operation and adopt **leadership role for our stakeholders** (visitors and customers, event organisers, contractors and other business), exploring means of improving their efficiency and reducing their resources use, hence the carbon emissions.

Our Leadership

Established **Climate Change Policy in 2023.**

Re-organized our **cross-departmental Sustainability Committee** to explore ways and oversee the implementation of carbon reduction plans / continuous improvement, ensuring climate risks are incorporated in facility and event management mindsets

Our Target

To reduce our carbon emissions by 50% by 2030.

To reduce our carbon emissions by 100% from at or before 2050, achieving carbon net zero.

3.OVERVIEW OF CARBON MANAGEMENT JOURNEY

Major Works Highlight

2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023

Start of Journey (2015)
- **ISO 20121 accreditation**
- **First engagement of energy consultant**

In-depth Study (2016)
- 1st ASHRAE Lv2 Energy Audit
- **Established Energy Baseline and Normalization Model to facilitate tracking future energy use**

Building Finetune (2017)
1st Retro-Commissioning
- Operation Best Practices

Infrastructure Upgrade (2018)
- BMS upgrade together with installing **650 nos of IoT sensors** in our Exhibition Halls
- Power Monitoring System with **450 digital power meters**
- Planning of 5-year Advancement Project

Strategized Reduction (2019)
Start of 1st 5-year Advancement Project
- Installation of Solar Panels
- Lighting Replacement
- AHUs replacement in Convention Hall

Continuous 5-year Advancement Project (2020)
- **Start of AHUs Replacement in Exhibition Halls during COVID period**
- Lighting Replacement for Harbour Road Entrance
- Study of Demand Control Ventilation

The Pledge and Improvements (2021)
- At COP26 (26th Climate Change Conference, HML Managing Director Monitor Lee-Muller became first in HK exhibition industry pledging **50% carbon emissions reduction by 2030, and achieving net zero by 2050**
- 2nd Energy Audit

Continuous Carbon Reduction (2022)
- **2 Nos. of new chillers with high energy efficiency and low GWP refrigerant are put in operations**
- Carbon Audit

Change Management (2023)
- Established Climate Change Policy
- Reorganized Sustainability Committee being lead by senior executive
- **Received LEED EB Gold Award for whole Centre**

4. HOLISTIC MANAGEMENT APPROACHES

01 STRATEGIC

- **Commitment and Organisation Governance** to ensure organisation direction, targets, planning , implementation, verification of results
- **Management Mindset**
- **Oversight** – Sustainability Committee

02 TACTICAL

- **ISO 20121** Management System
- 5-year Advancement Plan – (2020-2025, 2026-2030) continuous improvement planning and execution
- **Change Management** – Incorporating technical advancement, team development, stakeholder engagement and management

03 ACTION

- **Energy/Carbon Management** Programme
- Chiller Upgrade and Optimisation
- Airside System Optimisation-Move-in Move-out Strategy
- Boiler/Lighting/Pumps upgrade
- Using AI and Machine Learning as future planning

3. HOLISTIC MANAGEMENT APPROACHES

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Multi-dimensional Change Management Framework

Change Governance

TOP MANAGEMENT BUY-IN
Commitment, Clear Visions and Leadership, Strategic Direction

COMMITTEE OVERSIGHT
Sustainable Development Risk Management

OPERATION TEAM
Assessment, Planning, Continuous Execution of Advancement Projects

EFFECTIVE COMMUNICATION
Transparency, identify challenges, solution and voice achievements

INDEPENDENT OVERSIGHT
Engage independent external technical experts to verify results

Change Implementation and Communication

INFRASTRUCTURE AND SYSTEM MANAGEMENT & UPGRADE

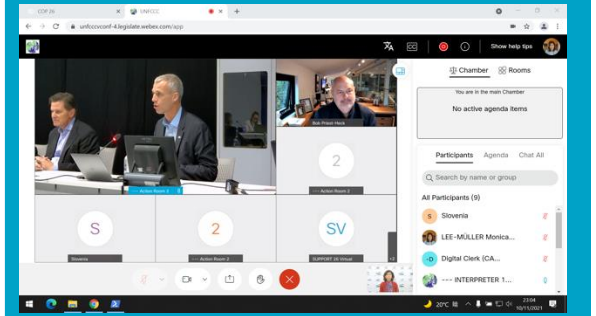
SMART BUILDING ENABLING

01 Building Management Systems

02 Digital Meters and Sensors Installation

03 System Integration- Building Systems with Event Management Systems

INDUSTRY LEADERSHIP



HML Managing Director Ms Monica Lee-Müller spoke at COP26, calling on global event industry to support sustainable development in union.

TECHNOLOGY AND FUTURE ENABLING

01 UNDERSTAND AND DIGITISE
Identify the challenges and Prepare the infrastructure with digital solutions to be installed and implemented

02 INTEGRATE
Integrate event / business metrics with facility management to minimize carbon emission

03 TRAINING AND REALISE
Train the team to use digital solutions and technology to pivot carbon results and realise savings

STAKEHOLDER ENGAGEMENT

Event Organisers
Event installation initiatives to engage more conversation to reduce carbon footprint by the suppliers

Customer
Understand the carbon scope clearly and proactively engage customers to participate in reduction of carbon

Local Community
Extend the sustainable impacts beyond facility boundary

Employees
Leadership programme and initiatives to spark creativity of staff to lead the carbon footprint reduction journey

Media
Timely external and internal communications to update our sustainable and carbon neutral journey

Change Monitoring, Evaluation and Sustaining

TRAINING AND SUPPORT

- Provide ISO training
- Provide training on how saving can be strived from daily operations

- RCx training
- Carbon Accounting
- Risk management

- Team-wide, exhibitioner – resource reduction
- Develop our talents with carbon reduction skillsets

CONTINUOUS MONITORING AND EVALUATION

Key Carbon KPIs and Reduction Target → Technical System/ Key Equipment KPIs/ Renewables → Event Management/ Business Metrics

CONTINUOUS SUCCESS COMMUNICATION

4.PROJECT CASE STUDY – CHILLER PLANT UPGRADE

CHILLER PLANT UPGRADE PROJECT (2021-2023)

The Challenges

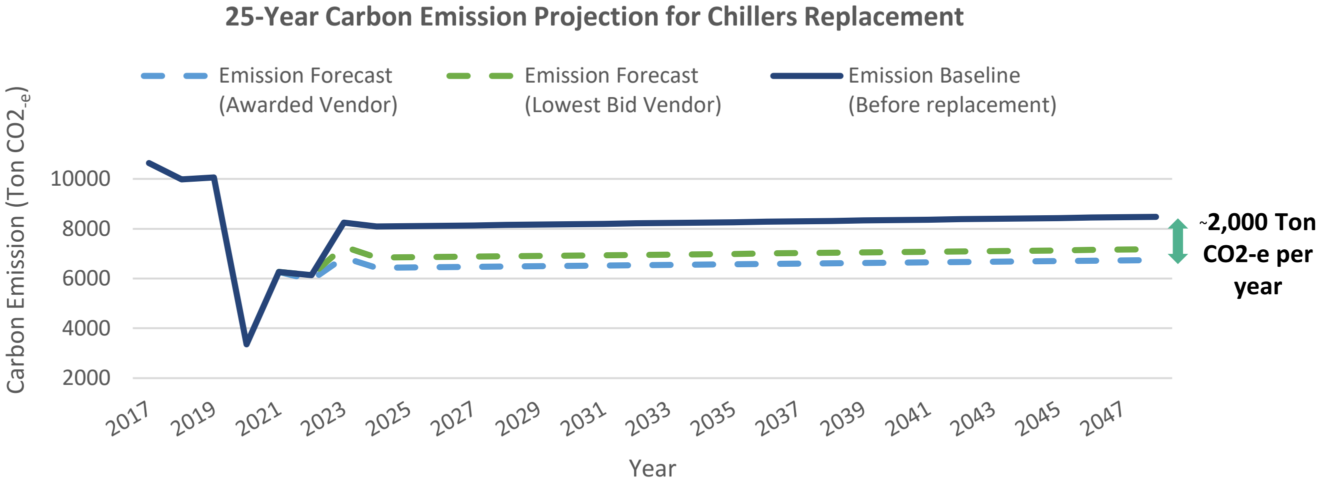
- Invest in **plant upgrade** that consider **values beyond cost and payback**, but also long-term carbon emission and future-enabling continuously optimizations.
- **Fit in the part load energy efficiencies** of chillers offered by different brands of chiller suppliers to **the cooling demand profiles** to work out the least possible energy consumption.

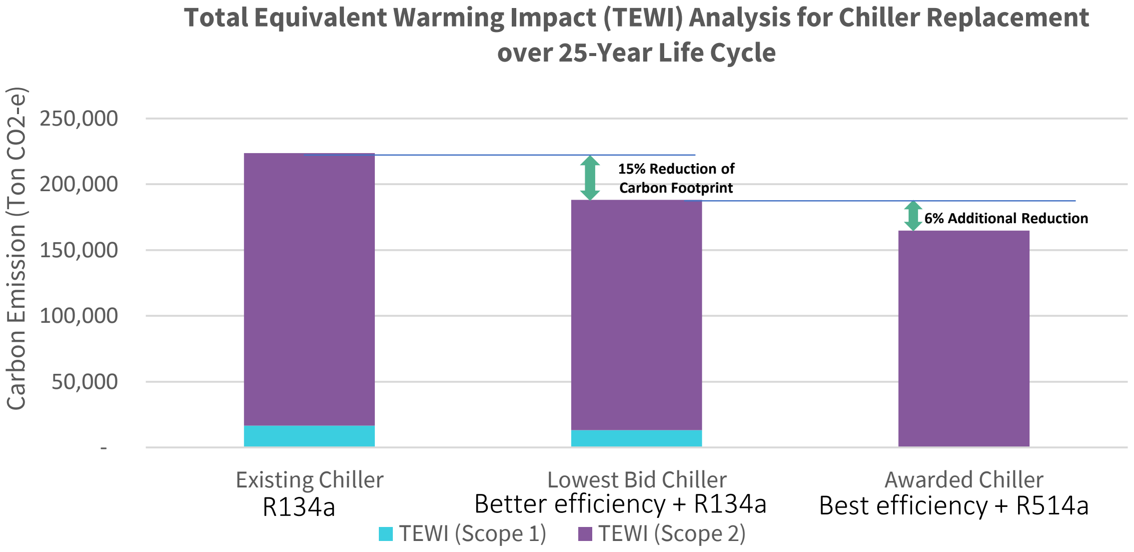
Objectives

- Carbon Emission Reduction Target: 2,000 Ton CO2-e / Year
- Minimise the chiller energy/ carbon emission over the 25-year equipment life cycle.
- Minimise the environmental impacts by selecting a more environmental-friendly refrigerant (i.e., ozone depletion potential, lower refrigerant leakage).

Scope

- **Analyse cooling demand profiles and determine how many numbers and which chillers and associated chilled water pumps to be replaced.**
- **Carry out refrigerants analysis.**
- **In-depth study and compare different types of the chiller plant sequencing controls based on the chiller part load efficiencies.**





4.PROJECT CASE STUDY – CHILLER PLANT UPGRADE

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CHILLER PLANT UPGRADE PROJECT

Achievements

- **Carbon Emissions Reduction Result:** 2,500 Ton CO2-e / Year (Exceed initial target)

Old Refrigerant (R134a)
1,430
GWP

Reduced by
Nearly 100%

New Refrigerant (R514a)
2
GWP

Old Ch Efficiency
0.7
kW/TR

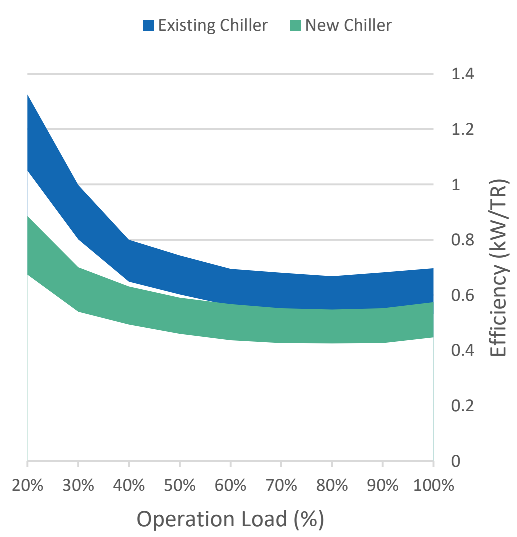
Improved by
28%

New Ch Efficiency
0.5
kW/TR

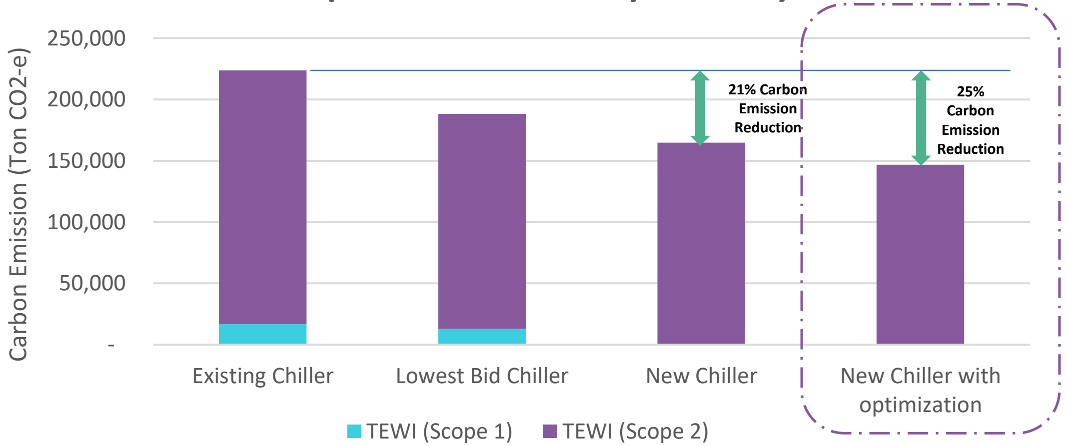
Old Control
10.9M
kWh/annum

Reduced by
8.69%

Optimized Control
9.7M
kWh/annum



Total Equivalent Warming Impact (TEWI) analysis for chiller replacement over 25-year life cycle



4.PROJECT CASE STUDY – CHILLER PLANT UPGRADE

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OPTIMISED CHILLER PLANT CONTROL EXAMPLES

STAGING OPTIMISATION

- Ensure correct time to switch on-off equipment
- Optimised staging setpoint according to event, weather

LEAD-LAG OPTIMISATION

- Select sequence of equipment to turn on / off
- Optimised with weather and equipment actual efficiency

PUMPS SEQUENCING OPTIMISATION

- Adjust staging of pump to fully utilize saving potential of VSD
- Utilize DAS for data driven decision for pump setpoint reset

TRANE 1050TR

Partload COP for 3692 — 3691.8

% Loading	17	20	21	22	23				
100%	8.31	7.84	7.69	7.53	7.36	6.85	6.67	6.50	6.33
90%	8.47	8.00	7.83	7.67	7.50	6.98	6.81	6.65	6.49
80%	8.59	8.06	7.89	7.71	7.54	7.01	6.83	6.67	6.51
70%	8.46	8.02	7.84	7.67	7.50	6.98	6.81	6.64	6.46
60%	**8.27**	**7.79**	**7.64**	**7.47**	**7.29**	**6.77**	**6.60**	**6.44**	**6.28**
50%	7.93	7.40	7.25	7.09	6.92	6.44	6.29	6.16	6.03
40%	7.36	6.89	6.74	6.62	6.51	6.06	5.92	5.78	5.65
30%	6.69	6.28	6.12	5.92	5.84	5.49	5.35	5.21	5.08
20%	5.41	5.04	4.92	4.80	4.70	4.32	4.21	4.11	4.02
10%	4.51	4.15	4.04	3.89	3.39	3.07	2.98	2.91	2.84

By considering CH efficiency only, the optimal operation is between **70% - 90%**

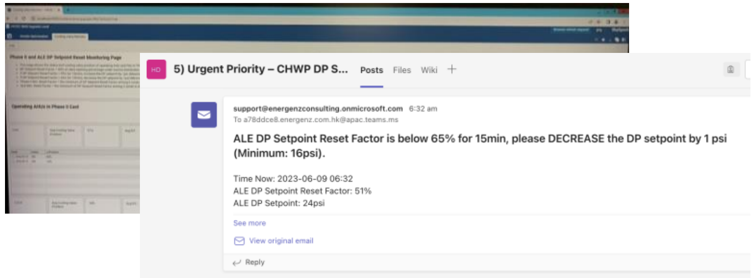
Partload kW with PCHWP for 3692

Partload kW for 3692

% Loading	17	20	21	22					
100%	7.67	7.27	7.14	7.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
90%	7.74	7.35	7.21	7.07	6.92	6.48	6.33	6.19	6.05
80%	7.76	7.32	7.18	7.03	6.89	6.45	6.29	6.16	6.02
70%	7.55	7.20	7.05	6.92	6.78	6.35	6.21	6.07	5.92
60%	7.27	6.90	6.78	6.65	6.50	6.09	5.95	5.82	5.69
50%	6.85	6.45	6.34	6.22	6.08	5.71	5.59	5.49	5.39
40%	6.23	5.89	5.78	5.69	5.61	5.27	5.16	5.06	4.96
30%	5.48	5.21	5.10	4.96	4.90	4.65	4.55	4.45	4.35
20%	4.28	4.04	3.97	3.89	3.82	3.57	3.49	3.42	3.36
10%	3.11	2.93	2.88	2.80	2.53	2.35	2.29	2.25	2.21

By considering overall CH efficiency (CH+PCWP), the optimal operation is between **80% - 100%**

Original	Optimize
New 1000TR MD	New 1000TR MD
New 1000TR	New 1000TR (summer) / New 600TR (winter)
Existing 1000TR	New 1000TR
New 600TR	Old 1000TR



Original

SeaWater Pump Control — 315 — Rated flow — 734

Chiller operation	Pump Qty	Speed	Total SWP Power	Flow @	Total SWP Flow
0	1	25	0	0	0
1	1	32	94.41	469.76	469.76
2	1	34	[illegible]	[illegible]	[illegible]
3	1	40	[illegible]	[illegible]	[illegible]
4	2	34	[illegible]	[illegible]	[illegible]
5	2	36	[illegible]	[illegible]	[illegible]
6	2	40	[illegible]	[illegible]	[illegible]
7	2	43	[illegible]	[illegible]	[illegible]
8	3	36	[illegible]	[illegible]	[illegible]
9	3	40	[illegible]	[illegible]	[illegible]
10	3	43	[illegible]	[illegible]	[illegible]
11	3	40	[illegible]	[illegible]	[illegible]
12	4	40	[illegible]	[illegible]	[illegible]
13	4	40	[illegible]	[illegible]	[illegible]

Optimizaed

SeaWater Pump Control — Rated Power 315 — Rated flow 734

Chiller operation	Pump Qty	Speed	Power @	Total SWP Power	Flow @	Total SWP Flow
0	1	25	0	0	0	0
1	1	30	79.30835279	79.31	440.4	440.4
2	1	35	120.2472801	120.25	513.8	513.8
3	1	40	172.4461563	172.45	587.2	587.2
4	2	30	79.30835279	158.62	440.4	880.8
5	2	35	120.2472801	240.49	513.8	1027.6
6	3	30	79.30835279	237.93	440.4	1321.2
7	3	32	94.40532323	283.22	469.76	1409.28
8	3	37	139.7128002	419.14	543.16	1629.48
9	3	40	172.4461563	517.34	587.2	1761.6
10	4	33	102.5838938	410.34	484.44	1937.76
11	4	37	139.7128002	558.85	543.16	2172.64
12	4	42	196.7272976	786.91	616.56	2466.24
13	4	43	209.6314181	838.53	631.24	2524.96

4.PROJECT CASE STUDY – AIR SIDE SYSTEMS ENHANCEMENT

AIR SIDE SYSTEMS ENHANCEMENT (2019-2023)

The Challenges

- Just one-to-one Air Handing Unit (AHU) replacement cannot maximize the carbon emission reduction.
- Different types of events has its own characteristic of occupancy / thermal demand patterns, hence **it implies one control mode for AHUs difficult to make energy efficient operations for all types of events.**
- For different types of events, need to review, monitor and adjust the controls of fresh air supply smartly to fulfill the indoor air quality requirement as well as conserve the energy consumption.

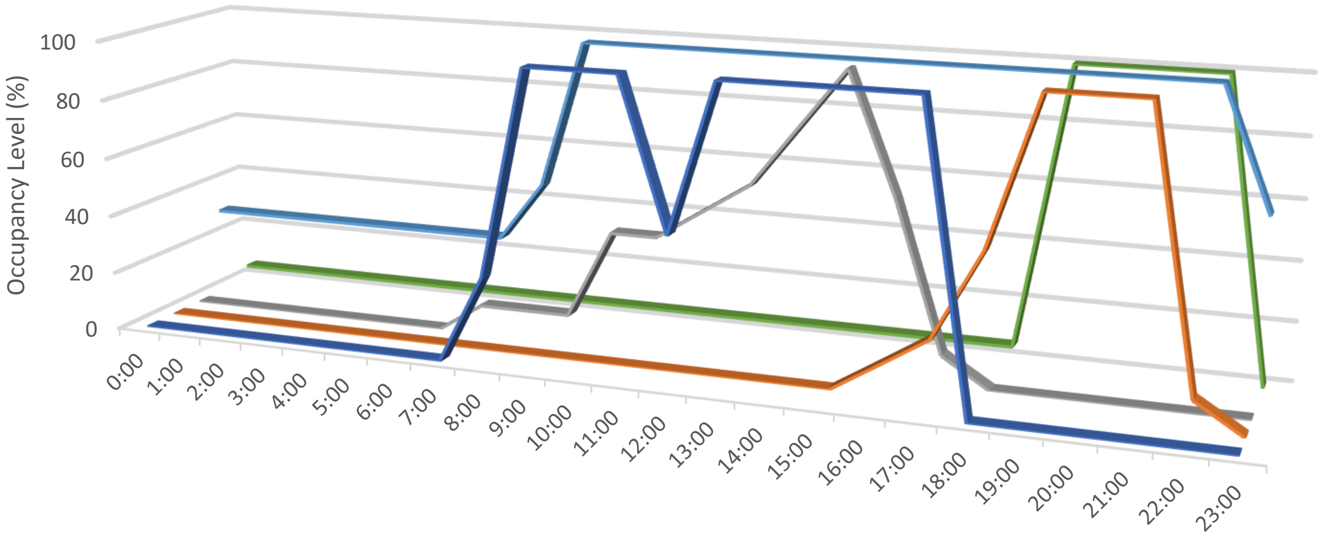
Objectives

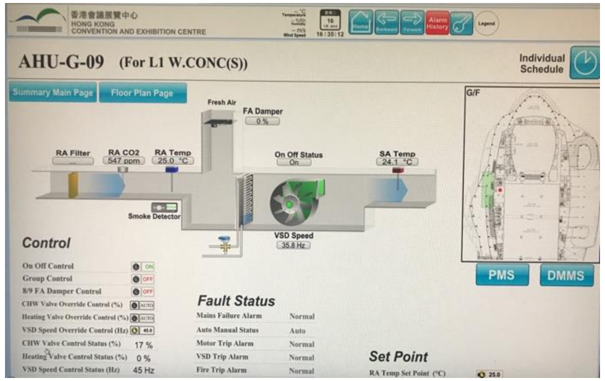
- Carbon Emission Reduction Target: **700 Ton CO2-e / Year**
- Equip the facility with digital meters to enable further in-depth analysis for adjusting the controls if necessary.
- Redesign of air side controls to suit complex occupancy levels arising from different types of events.

Scope (Multiple Projects)

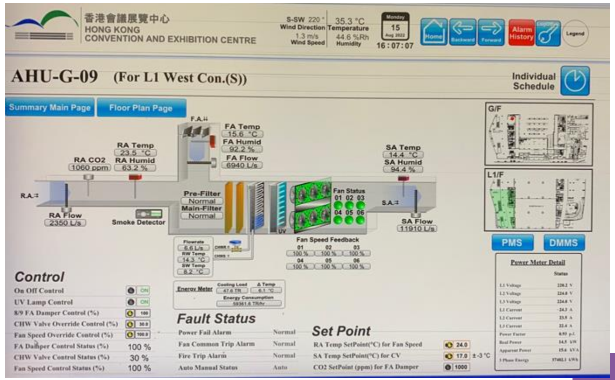
- Study and adopt latest technologies applicable to Air Handling Units (AHUs) replacement projects for our Exhibition Halls in Phase II
- Study different AHU control logics and settings to suit different types of events
- **Launch the demand ventilation controls for AHUs serving Exhibition Halls and Kitchen Exhaust System**

Occupancy level of different event types





BMS Controls Before AHUs Replacement



BMS Control After AHUs Replacement

4.PROJECT CASE STUDY – AIR SIDE SYSTEMS ENHANCEMENT

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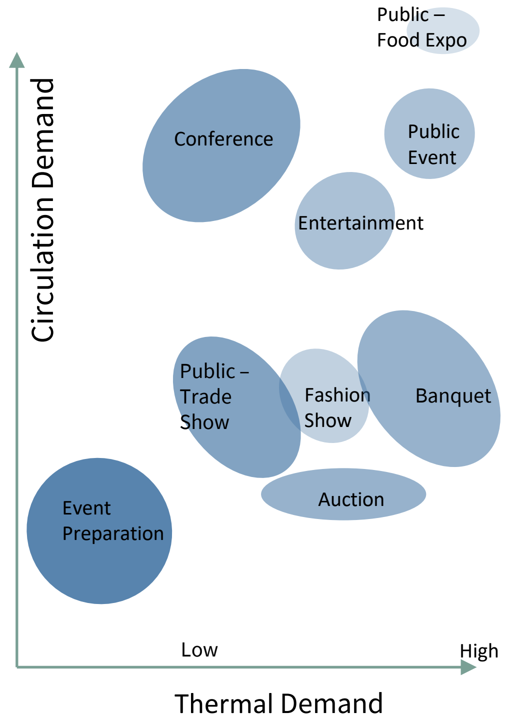
AIR SIDE SYSTEMS ENHANCEMENT

01 UNDERSTAND



02 DIGITISE & UPGRADE

650 nos. of IoT sensor (Temp, Humidity, CO_2, PM 2.5, PM 10, VOC)

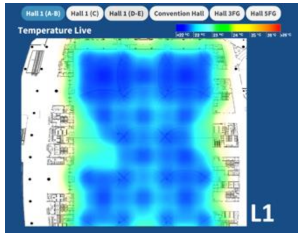
Enhanced Control Metering
Additional monitoring point, Energy Valve and review of control logic to provide flexible control due to high variety of operation demand

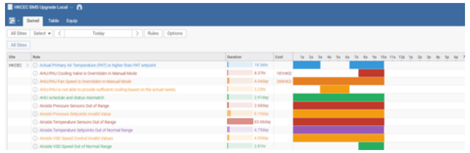
New Installed digital power meters during replacement / upgrade project

New Installed Pressure Independent Energy Value during upgrade

03 ANALYSE & RESOLVE

Heat Map (live with playback capability) for detail review of operation





Data Analytic System (DAS) for rule base monitoring

Work order management

04 MONITOR AND EVALUATE

System Enhancement

- AHUs Replacement
  - Apply energy-saving technology
  - Control Logic Upgrade
- Demand Control Ventilation Upgrade
  - Install VSD, Energy Meter
  - Control Logic Upgrade

Adoption of Data Analytic System (DAS)

- Realtime alerts on equipment controls and settings when they are operating out of boundaries
- Operators to take necessary actions for avoiding energy wastage
- Finetune precool and setback time based on historical data

Mindset Change (Best Practice)

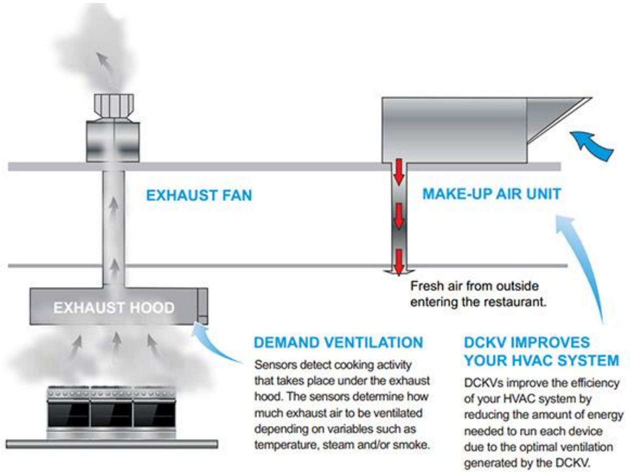
- Setpoints adjustment
- Event Prep time operation
- Regular review of improvement projects

AIR SIDE SYSTEMS ENHANCEMENT

Achievements

Carbon Emissions Reduction Result: 850 Ton CO2-e / Year (Exceed initial target)

	Reduced by	
Emission for Old AHUs 541 Ton CO2-e	40.8%	Emission for New AHUs 320 Ton CO2-e
Emission without DAS 1,000 Ton CO2-e	14.1%	Emission with DAS 859 Ton CO2-e
Emission without Demand Control Ventilation 1,535 Ton CO2-e	31.8%	Emission with Demand Control Ventilation 1,047 Ton CO2-e



Reduce FA intake for >50% Operation time

EC Plug fan Energy Saving >40%

5.SUMMARY OF ACHIEVEMENTS

By end of FY2023, percentage of carbon footprint will be reduced by 21.8%

	2017	2018	2019	2020	2021	2022	2023
Accumulated Carbon Reduction		456.62 TCO2-e	1,862 TCO2-e	5,584 TCO2-e	6,195 TCO2-e	6,926 TCO2-e	8,870 TCO2-e

Baseline 2017/18^
40,644 TCO2-e

2018
Optimise demand control ventilation
Lighting replacement
Optimise DP on SCHWP
Hall AHU/Lighting Best Practice
3 RCx projects

2019
Lighting replacement
Chiller auto Staging Control
Rectify idle chiller bypass
2 RCx projects

2020
AHU replacement
Lighting replacement
Rectify idle chiller bypass
Optimise demand control ventilation
CHW header DP setpoint reset
3 RCx projects

2021
Lighting replacement
AHU replacement
Rectify existing kitchen exhaust demand control
CHW diff. pressure reset
Rectify Escalator VSD operation
4 RCx projects

2022
Chiller Replacement Stage 1
AHU replacement
Lighting replacement
Kitchen demand control ventilation
Lighting replacement
Review move-in/out AHU/PAU operation
6 RCx projects

2023
Chiller Replacement Stage 2
Chiller plant optimization
Hall demand control ventilation
Lighting replacement
PAU setpoint reset
1 RCx projects

12,493,585
KWh

8,870
tCO_2e

Carbon Reduction
8,870 TCO2-e
(21.8% reduction relative to baseline)

^ Major Carbon Emission of HKCEC by Scope 2 (electricity purchase) only

5.SUMMARY OF ACHIEVEMENTS

Values and Benefits of Decarbonization

Environmental Benefit

8,870 Ton CO2-e or 21.8% by end of 2030 relative to 2017 as baseline,

Planting of 386,000 trees

Financial Benefit

Cumulative reduction on electricity consumption since 2017:

Over 12M kWh

Cumulative cost saving:

Up to HK$20M

Other Intangible Values

Internal

Demonstrate a "can-do" mindset to our staff on moving towards net-zero carbon pledge

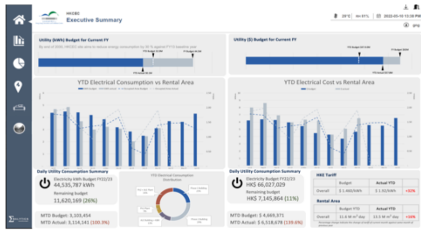
External

- Influence positively our stakeholders for collaboration to reduce the carbon emissions of their events
- Share what we learnt to other venue operators aiming to support the decarbonisation of the whole industry

6.FORWARD LOOKING PLANNING

Moving Towards Digitization

UTILIZATION OF ENGINEERING DATA



To develop the current Single SMART Platform for real-time monitoring

- Energy Consumption and Usage Intensity
- System operation vs Event Schedule

Venue Energy Management

Enhance data coverage to show

- Venue Energy Consumption
- Venue Water Consumption

Development Plan

DATA INTEGRATION

Flexibility of integration

- DAS is adopted in 2017 and support integration to building service, IT system

Integration to non Engineering Data

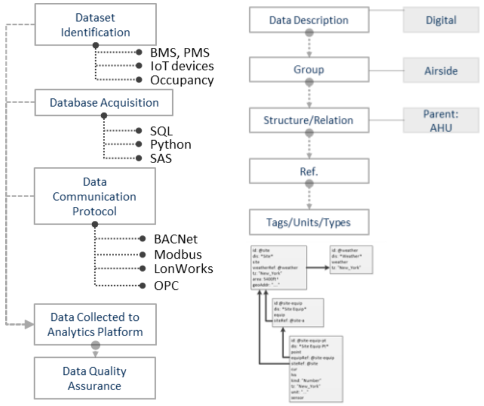
- Event Management System
- People Counting System

Data Transparency to Organizers

- Venue Energy / Water consumption
- Carbon footprint for Event

Integration with Events Data

FUTURE MODEL DATA PREPARATION AND SET UP

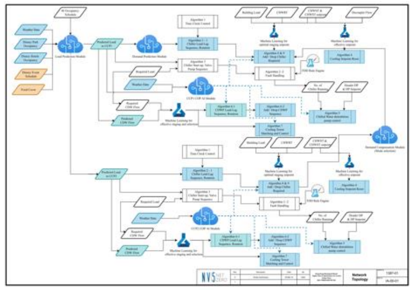


Model data preparation

- Current DAS already stored 4+ year of operation data
- Create relationship among Engineering and non-Engineering data for future modeling
- All data will be analysed and utilized as appropriate for future AI / ML system integration

Future Enabling

FUTURE AI AND MACHINE LEARNING ENBLED DECISION- MAKING



AI / Machine Learning-based decision making

- Turn on-off equipment at the correct time
- Adjust setpoint based on event type, actual operation, and current weather condition
- Data-driven decision on which equipment to turn on based on the historical efficiency

Future Scenario

6.FORWARD LOOKING PLANNING

Development Pathway

FUTURE

2023
DEFINE & PLAN
The boundaries of our carbon footprint should be defined using the Scope 1, 2 and 3 guidance and a plan should be in place

2025
MEASURE & EMBED
Systems to measure our footprint at corporate and event level are in place and sustainability criteria is embedded in all contracts

2030
REDUCE
Carbon emissions are reduced through efficiencies and eliminating carbon intensive items and processes from the system

2035
REPLACE
Remaining carbon intensive activities and items are replaced with renewable, reusable, sustainable alternatives

2040
REMOVE
Any residual carbon emissions are removed from the atmosphere using robust and accredited carbon capture or removal processes

2050 NET ZERO

PRESENT

Reorganize to Sustainability Committee

- Reorganize committee to ensure HML is responsible, resilient and sustainable
- **Strategy change- target Net Zero Carbon, promote CSR.**

No 'BAU' Mindset (Internal Engagement)

Breaking Business-as-Usual static mindset of traditional equipment upgrade (1-on-1 replacement), to explore emerging technology for long term carbon reduction.

Event Organiser 'Net Zero (External) Engagement

Active engagement with the biggest event organisers/key partners of HKCEC, to collaborate with them to reduce Scope 3 emissions.

PAST

ISO 20121

Corporate Sustainability Governance

Management framework and organization sustainability governance first established

5-Year Advancement Plan

Think Before Plastics

Mass internal and external engagement to achieve resource management - Proven Success: **1.6 Million Ton Plastics**

Carbon Emission Baselining

香港會議展覽中心
Hong Kong Convention and Exhibition Centre

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Sustain Excellence for Future

THANK YOU!

Hong Kong Convention and Exhibition Centre (Management) Limited