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**DESIGN
CRITERIA**

FEASIBILITY STUDY ON FREE COOLING FOR OFFICE BUILDINGS IN HONG KONG

Free Cooling

SYSTEM EFFICIENCY

THERMAL COMFORT

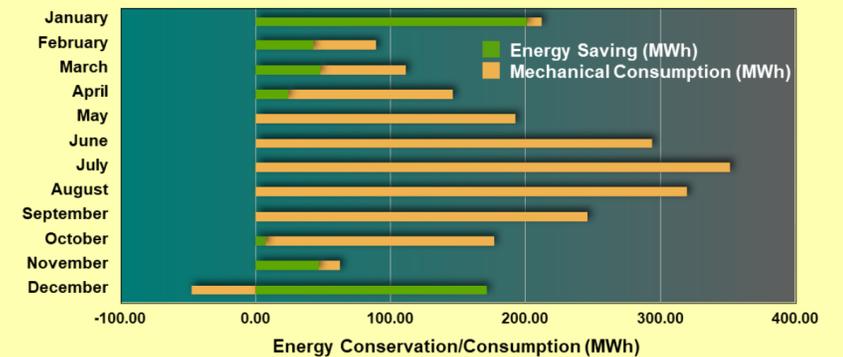
CARBON EMISSION

ENERGY CONSUMPTION

CLIMATE CONDITION

Findings

Monthly Energy Conservation under Air Economiser

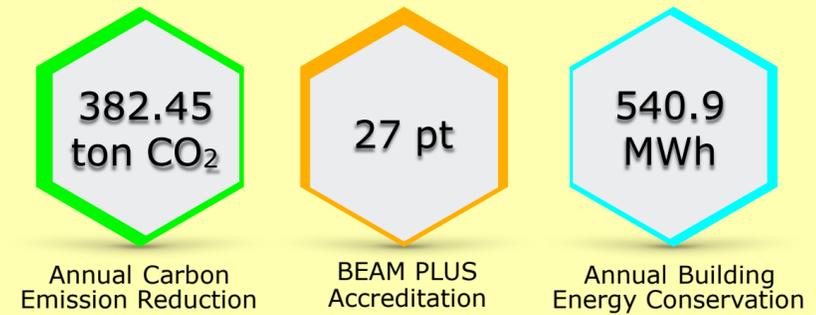


MVAC System Design Consideration



Data Analysis

- ❖ 43% of days in 2019 reached the max. set-point (25.5°C_{d.b.}/ 51.8%_{r.h.})
- ❖ Three-quarter of respondents found thermal dissatisfactory in offices
- ❖ Occupants experienced excessive CO₂ and undesired air velocity
- ❖ Concurred that CO₂ concentration can be improved by air economiser
- ❖ Peak cooling load at around 1600 kW from June to August
- ❖ 23.26% reduction of annual energy consumption & carbon emission



Conclusion

Free cooling optimises system performance significantly, and it is necessary to assess the actual thermal comfort after building occupation. Another issue is to figure out the desired point with an energy-saving approach to meet occupants' needs.

Outdoor ambient condition is the essential determinant of free cooling technology, so year-round climate trend needs to be well-studied, i.e. data analysis can be conducted using building modelling with energy simulation software, to assess the feasibility of free cooling for Hong Kong office buildings.

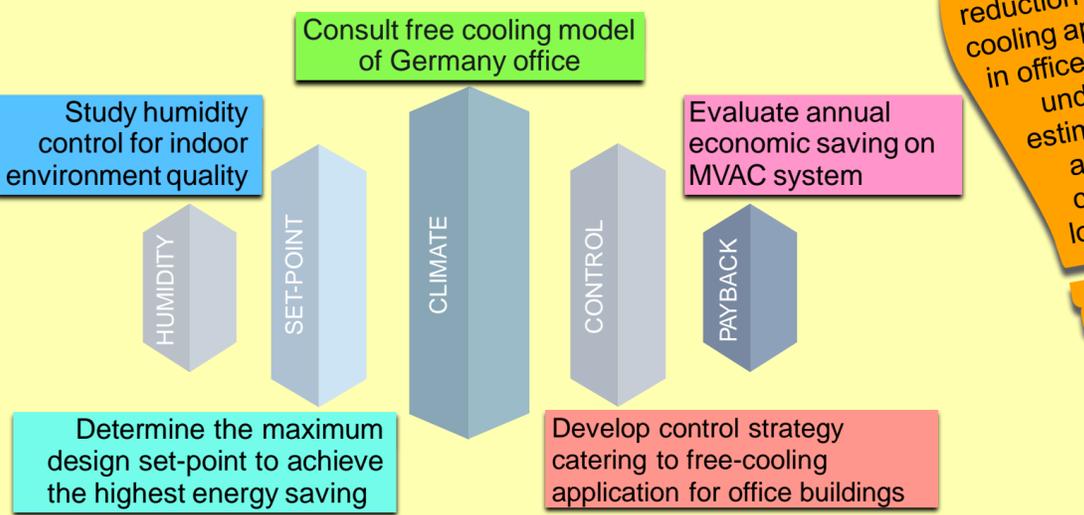
Free cooling fully introduces outdoor air for indoor cooling. Consequently, it reduces energy consumption and carbon dioxide generation. Free cooling is commonly applied in foreign data centres and commercial buildings. Thus, this research aims to investigate the adoption of free cooling ventilation for Hong Kong office buildings.

- Draw **100%** fresh air to supply into buildings
- Reduce carbon intensity by 65%~70% by **2030**
- Optimise **30%** building energy consumption

Research Objective

- ❖ Identify the adoptability of free cooling technology for Hong Kong office buildings
- ❖ Study commercial building projects with a free cooling integrated system
- ❖ Analyse the energy conservation and carbon intensity by free cooling
- ❖ Determine indoor air quality by survey inquiry from occupants satisfaction
- ❖ Assess design feasibility in terms of energy performance and efficiency

Literature Review



evaluate energy-saving and carbon reduction from free-cooling applications in office buildings under the estimation of annual cooling load and power usage

assess occupants' views and expectations on existing ventilation systems and free-cooling applications in terms of indoor air quality through an online survey

ENERGY PROFILE

FREE COOLING RUNNING HOUR

study the availability of free cooling systems in Hong Kong by filtering the days satisfying the maximum set-point (52.7 kJ/kg enthalpy)