Study on Chiller-System Quantity Control

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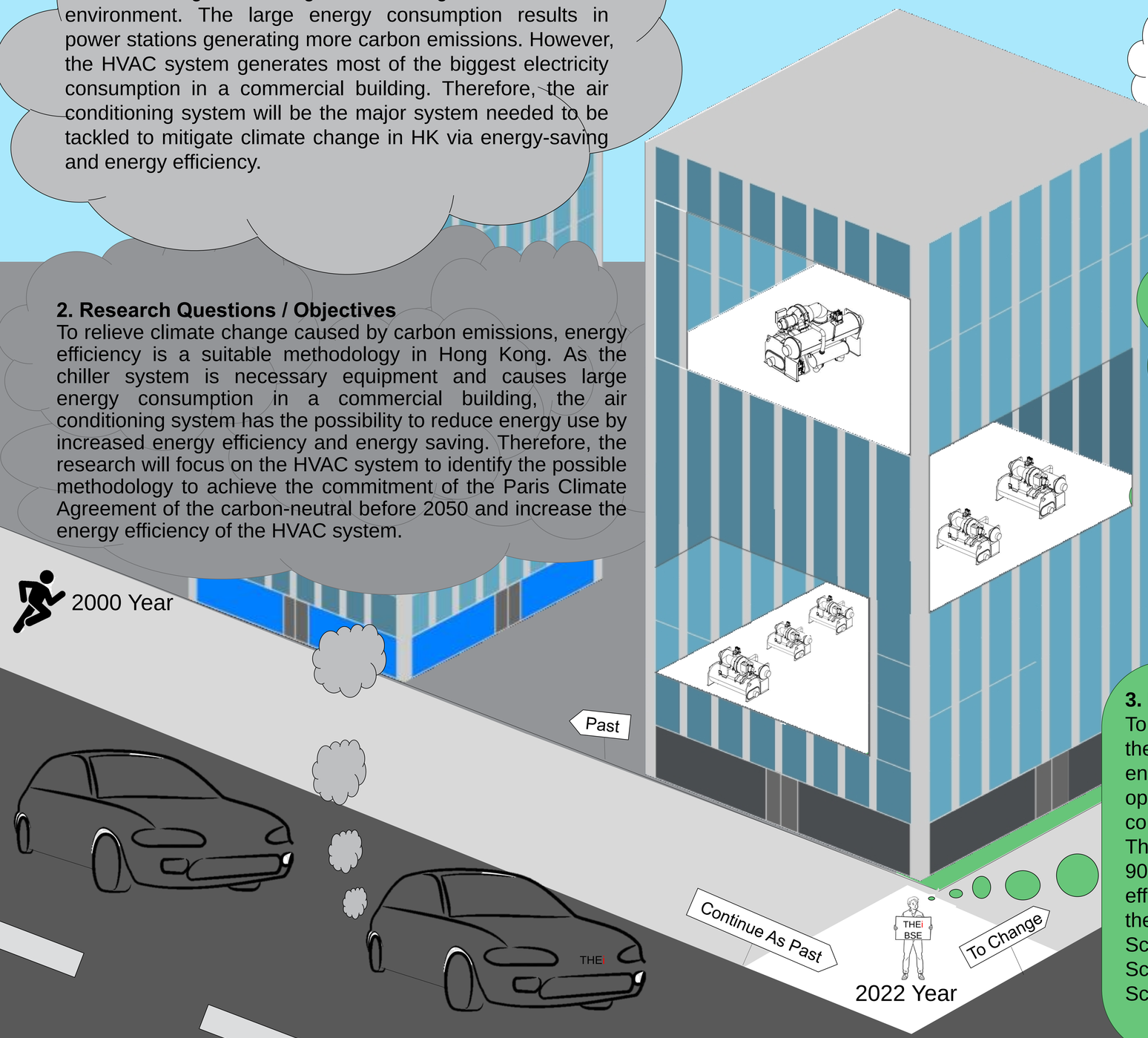
1. Background / Introduction

Climate change causes global warming and affects our environment. The large energy consumption results in power stations generating more carbon emissions. However, the HVAC system generates most of the biggest electricity consumption in a commercial building. Therefore, the air conditioning system will be the major system needed to be tackled to mitigate climate change in HK via energy-saving and energy efficiency.

2. Research Questions / Objectives

To relieve climate change caused by carbon emissions, energy efficiency is a suitable methodology in Hong Kong. As the chiller system is necessary equipment and causes large energy consumption in a commercial building, the air conditioning system has the possibility to reduce energy use by increased energy efficiency and energy saving. Therefore, the research will focus on the HVAC system to identify the possible methodology to achieve the commitment of the Paris Climate Agreement of the carbon-neutral before 2050 and increase the energy efficiency of the HVAC system.



3. Methodology

To find a more energy-efficiency method for the HVAC system, the chiller-system quantity control method is suitable to improve energy-saving for the HVAC system. Three scenarios of chiller operating schedules are compared to identify the least energy consumption chiller operating method in a commercial building. The simulation will be based on the same cool load with 9000kW and chiller operating time to measure the chiller efficiency (C.o.P.) and energy consumption. The scenarios of the chiller operating schedule for the simulation are:

Scenario 1: One large capacity chiller (9000kW)
Scenario 2: Two middle capacity chillers (5000kW)
Scenario 3: Two small capacity chillers (3000kW)
with one middle capacity chiller (5000kW)

*C.o.P. = Coefficient of performance

4. Findings

Scenario 2 with two middle capacity chillers can achieve more energy-saving than the others. This is due to the middle capacity chiller can be operated at the part-load between 70% and 90%. The demand cooling load distribution will be shared to supply the cooling at the same time. As a result, two middle capacity chillers can improve the chiller operating performance by having energy-saving, chiller operating efficiency and reduce energy consumption to achieve carbon-neutral.

5. Conclusion

Suitable energy use for the chiller operating schedule can increase energy efficiency and achieve carbon-neutral to mitigate climate change. To conclude, the research proves there is much energy being wasted. We can change little by little from the source and reduce the influence of climate change for us.