American Society of Heating, Refrigerating and Air-Conditioning Engineers
One-day Seminar - Advancing Net Zero Carbon Building Design
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Opening

Good morning, Mr. Joe Chan (President of ASHRAE Hong Kong Chapter), Mr. Barry LAU (Chairman of OC), Honourable speakers, distinguished guests, ladies and gentlemen.

It's my great honour to join this seminar today. As we gather here, I would like to take this chance to express my gratitude to ASHRAE for her continuous dedication in promotion and facilitation of sustainable and energy efficient practices in the built environment, in particular "Advancing Net Zero Carbon Building Design", which is the theme of this seminar. This seminar is a great platform to exchange and share insights and perspectives for advancing net zero carbon building design from all speakers and experts.

IPCC AR6

You may be aware that the United Nation's Intergovernmental Panel on Climate Change (IPCC) has just launched the 6th Assessment Report last month. According to the report, human activities have unequivocally caused global warming with a temperature rise of about 1.1°C. It mentions that it is only possible to limit warming to 1.5 °C if massive and immediate cuts in greenhouse gas emissions are made. So, we are at a crucial turning point in our fight against climate change. The need to advance net zero carbon buildings has never been more urgent.

Technology is the Key

The IPCC's Report also pointed out that technological innovation can play an important role in combating climate change. Technology provides opportunities to create social and environmental co-benefits, achieves sustainable development goals and eventually lower greenhouse gases emissions. And the good news is, we have the technology in our hand, and it is a disruptive technology! I immediately think of a recent hot tool: the

ChatGPT, a chatbot using Open Artificial Intelligence Platform. I think some of you have already got a funny try on it. With that said, the tool may not be 100% accurate and not all questions can be answered properly, but it is not a bad idea to give it a try.

Hints toward Net Zero Carbon Building

Once in a while, I asked the Chatbot: "What can we do to achieve Advancing Net Zero Carbon Building?". It reverts with several hundred words and some suggestions are, as expected, in line with what we are doing now. From this bunch of information, there are some key elements that give us hints for our next step in the journey towards net zero carbon emission. I am especially impressed by the tag of **"Data", "Information" and "Technology".**

Data and AI

Mr. Peter Sondergaard, one of the most influential executives in the tech world, once said: "*Information is the oil of the 21st century, and analytics is the combustion engine".* With no doubt, data is the foundation of technology development and of course for sustaining the operation of Artificial Intelligence (AI).

E&M Digitalization

In the wave of AI, Hong Kong has an edge in developing this emerging technology in view of its high level of academic research and the high international ranking of local universities. Though we expect that the application of AI for net zero carbon buildings can have a contributory growth, the building industry is, nevertheless, facing the constraints of data availability and data quality of traditional E&M systems.

That's why we are proactively advocating E&M digitalization. As early as 2013, the Electrical and Mechanical Services Department started to provide digitized E&M engineering and innovative solutions for government facilities. The crucial data of these facilities is gathered by the integrated Building Management System using, among others, the ASHRAE's BACnet as the protocol. We deployed Building Information Modelling on asset management to connect E&M assets with real-time data infeed, and established the first Regional Digital Control Centre (RDCC) in 2020 as a centralised data processing and modelling centre for real-time monitoring, data analytics and energy management.

Semantic AI Innovation for Energy Management

The E&M digitalization paved way for energy management. Together with experts from international institutes and universities, EMSD has developed a semantic AI platform to allow data scientists to conveniently deploy AI applications across multiple buildings. AI model developed from a specific building can now be portable across to other buildings and redeployed on regional and then city scales.

Semantic AI has been deployed to perform analysis on energy performance of building, using prediction model to analyze trend, forecast cooling demand and recommend optimized setting for maximum energy saving. Through its implementation for the chiller plant control system in a government office building, the semantic AI achieved 99% accuracy in cooling load prediction, bringing about 15% improvement on energy performance of the chiller plant.

Global AI challenge

To further unleash the potential of AI in building E&M systems, EMSD and the Guangdong Provincial Association for Science and Technology (廣東省科學技術協會) jointly organized the first "Global AI Challenge for Building E&M Facilities" in late 2021. This event had gathered more than 40 organisations and received overwhelming global response.

Participants of the challenge applied different AI algorithms such as Extreme Gradient Boosting (Xgboost) and k-nearest neighbors (KNN) to develop cooling load prediction model in just one month. Despite limited data available and stringent timeframe under the competition, the accuracy of the award-winning models had already reached over 90%, displaying good potential in achieving higher accuracy when more historical data of affecting parameters are available. The competition successfully inspired participants, industry leaders, innovators, and researchers to exchange ideas, and encourage the adoption of AI, thereby contributing to our goal of carbon neutrality.

Collaboration

To stay ahead of evolving technologies and to facilitate its further advancement, EMSD launched the E&M AI Lab last year. The Lab is a collaborative initiative with stakeholders from the Government, industry, academia and research institutions, focusing on the

application of AI in the building E&M engineering industry. It also facilitates further knowledge exchange on data and semantic AI, and fosters partnerships to co-create on the AI development for E&M systems. By leveraging the power of AI through the E&M AI Lab, I believe that the trade can accelerate the application of AI in achieving net zero carbon building.

I would like to report that the E&M AI Lab had organized their first livestreaming hybrid event, the Pitching Forum, last month. The winning teams of Global AI Challenge shared the recent researches and projects they are working on, and their learnings and insights related to big data and AI applications for building E&M systems to further enhance the energy efficiency of buildings.

Closing

We are facing a climate crisis of unprecedented magnitude. Advancing net zero carbon building design is one of the essential elements for low carbon city. This goal requires the close collaboration from all sectors of the society. Besides, any new emerging, disruptive and innovative technology such as AI, big data analytic, etc. is the magic to be deployed for a big step towards carbon neutrality. Guided by digitalisation, powered by technological innovation and energy structure reform, AI will effectively help realize the much awaited comprehensive green and low carbon transformation.

It's important to remember that AI is created and developed by humans. Collaboration with AI is not enough on its own. AI actually needs humans to input as much data as possible for its development. We need to prioritize the collaboration between humans to work together to continuously generate innovative ideas and develop sustainable strategies. Maybe what we have shared in this seminar today will be suggested by the ChatGPT tomorrow. The clock is ticking, and we cannot afford to wait any longer. Let’s continue to work together towards a carbon-neutral world, today and every day.

Thank you.