ASHRAE Technical Conference 2024

"Decarbonization Challenge for the Built Environment"

PM Session Sub Theme: Next-Generation Retro-commissioning

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From Commissioning to Optimising – Smarter Buildings for the Future

Ir Raymond POON, JP, Director, EMSD

Greeting and introduction

Good afternoon, Miss Ginger Scoggins (President of ASHRAE), Ir Dr Cary CHAN (Chairman of Organising Committee of today's conference), distinguished guests, ladies and gentlemen. I am deeply honored to deliver the opening speech for the afternoon session of this conference, and I would like to share my views on smarter buildings for the future.

As announced by the United Nations secretary general Antonio Guterres "The era of global warming has ended. The era of global boiling has arrived. It was confirmed that July 2023 had become the hottest month in the past one hundred and twenty thousand years." Being an engineer in Hong Kong, we echo to the carbon neutrality target as mentioned by Miss Diane WONG, the Under Secretary of Environment and Ecology in her keynote speech in the morning session. This goal aligned with the vision of ASHRAE that promoting "a healthy and sustainable built environment for all".

A story of fixing car

For years, we closely monitor and maintain the healthiness of building services systems, like a mechanic that keeps your car running smooth. Let me share with you a story. Once upon a time there was a mechanic who had a reputation of fixing car. One day, a car arrived to the garage and the car owner claimed that it is not working well. The mechanic looked around the engine for a while, picked up a hammer and gave the engine a little bang, problem solved! The mechanic charged the car owner for one hundred dollars. The car owner asked the mechanic: "why it is so costly for just a bang?" Then the mechanic showed him the invoice with breakdown, says "Labor: one dollar, know how to fix the car: ninety-nine dollars". To this end, the car owner realised that

knowledge and experience are so valued. I believe all of us here are the intelligent mechanics of buildings. Your professional knowledge, valuable experience and innovation are the key in making buildings smarter and greener.

Commissioning and Retro-commissioning

Building commissioning is a critical process that ensures the proper functioning and performance of a building's systems as designed. It is vital for ensuring that a building operates efficiently and safely, and provides valuable documentation and knowledge transfer for operation and maintenance. When buildings commence operation, the significance of retro-commissioning becomes apparent. Performance of systems may be degraded and energy saving opportunities have emerged due to changes in occupancy, equipment or operational needs. Retro-commissioning aims to bring the building systems back to their optimal performance. Investing in on-going commissioning process is a prudent step to achieve long-term sustainability for buildings.

The EMSD took the lead to promote retro-commissioning in Hong Kong as one of the decarbonization measures. In 2016, we selected 6 government buildings to conduct retro-commissioning as pilot. The pilot projects had realized that an average of 5% building energy could be saved through the implementation of energy saving opportunities. With positive results, we summarized our experience and launched the first technical guideline for retro-commissioning in 2017. Working together with the trade, the technical guideline is currently updated to 2023 version. From 2018, we started collaborating with institutions in mainland China, Macau and Hong Kong on retro-commissioning of buildings through a Memorandum of Cooperation. We aim at promoting retro-commissioning as a cost-effective tool for building decarbonization in the Guangdong-Hong Kong-Macao Greater Bay Area, sharing experiences and gain synergy in the region. Today I'm happy to see one of our partners from mainland China, Dr WEI of the Tsing Wah University, and he is one of the speakers in this session for sharing his valuable experience in retro-commissioning.

To help build capacity on retro-commissioning expertise, we collaborated with the trade to launch a training and registration scheme since 2019. Up to now, over two thousand practitioners had attended the training and over five hundred of them had been registered. Apart from promoting retro-commissioning in Hong Kong, we also initiated workshops

and experience sharing to members economies of APEC Energy Working Group and the Association of Southeast Asian Nations. In recent years, we had extended retro-commissioning works for over two hundred and fifty government buildings with relatively high energy consumption. We took advantages of innovation and technology in the process, such as the use of IoT platform for data collection, building information modelling for visualization and artificial intelligence for big data analytics. Through innovative adoption of technologies, opportunity in transforming from commissioning to optimizing for smart building arise.

Real-time Commissioning

Traditional retro-commissioning process relies on data collection, human analysis and manual adjustment of control set points of E&M systems, which is performed on a periodic basis and requires considerable resources. The innovative adoption of technologies can promote a continuous, faster and real-time commissioning for energy optimization. Unlike the traditional discrete approach of commissioning, real-time commissioning in smart buildings can play a vital role in leveraging data driven decision marking and automatic control to drive continuous energy optimization.

EMSD promotes Innovation and Technology

We realized the importance of green innovation and technologies in the journey of smart building development. EMSD, as the HKSAR Government's innovation facilitator, actively promotes I&T by launching the "E&M InnoPortal" in 2018. The portal pairs up I&T wishes from the government departments and public bodies with potential I&T service providers. Today, there are more than five hundred I&T wishes initiated, twelve hundred I&T solutions offered and two hundred trial projects conducted, which cover green innovations and technologies, and other smart E&M applications.

In 2021, with the support from more than forty co-organisers and supporting organisations, we organized a Global AI Challenge, which was the largest global artificial intelligence event related to building E&M industry. The Challenge received overwhelming response from more than one hundred and twenty teams around the globe for the competition. Follow the competition, EMSD initiated the E&M AI Lab to establish a network of specialists from the Government, industry, academia and research institutes, for the shared goal of applying big data and artificial intelligence in building E&M

facilities. As the role of artificial intelligence became more and more important, last year, EMSD signed a Memorandum of Co-operation with two mainland China institutes in Guangdong Province to further deepen collaboration on the development of standards and guidelines for artificial intelligence application for E&M systems.

Real-time Commissioning

Apart from adoption of innovation and technologies for smart building development, another key element is the availability of data. That is why EMSD is eager to drive E&M digitalization to facilitate smart building transformation. We gather data using ASHRAE BACnet protocol and connect more than four hundred major government buildings to our Regional Digital Control Centre, laying a solid foundation for big data analytics and implementation of cloud based real-time commissioning process.

With massive streams of real-time data, we can harness artificial intelligence to predict demand and auto commission the set points of E&M systems for continuous energy optimization. Chiller plant consumes majority of energy in building. Implementing real-time commissioning for chiller plant will be exceptionally effective in reducing building energy consumption. To trial out real-time commissioning for chiller plant, EMSD recently developed a homebrew AI chiller optimization platform called ChillStream. With the real-time collection of operating parameters, ChillStream is able to predict the cooling load demand in high accuracy, and determine the most energy efficient operating sequences and chilled water supply temperature set point at a 5 minutes interval. The optimal operating sequence of the chiller plant and control set points are then send back to the building for automatic implementation. The cloud-based analytics-as-a-service platform can also pave way for large scale deployment to more buildings in the future.

Through round-the-clock trial in a laboratory building in Hong Kong, ChillStream was proven to be capable to achieve an overall energy saving up to 5% at this stage. I imagine ChillStream as a virtual energy saving companion which never gets tired, and help to unlock opportunities of real-time commissioning to make building smarter. Combining the features of continuous data monitoring, data analytics, fault diagnostics and optimization, real-time commissioning will become a powerful tool to continuously manage building assets for energy optimization, leading to improved energy efficiency,

reduced operating costs, and enhance the ESG performance. From overseas experience, real-time energy management has found a portfolio-wide average of further 2% energy savings over the discrete retro-commissioning process.

Closing

The future of commissioning is brimming with possibilities. The future of commissioning is expected to characterize by digitalization, machine learning based data analytics and continuous energy optimization in real-time. These advancements will enhance the efficiency of commissioning process, leading to better performing, sustainable and resilient smart buildings. I believe real-time commissioning will play a crucial role in adapting the changing environment and dynamic operation of buildings. To achieve long-term energy saving in the journey towards carbon neutrality, a paradigm shift in the discrete commissioning process would be required. The advancements of technologies and our innovation will continue enhance the process of commissioning, leading to smarter and greener buildings in the future. I am looking forward to collaborating more and working closely with all of you in the journey to carbon neutrality. Thank You.

(About 1450 words; about 15 mins)