

HKIE Electrical Symposium
Co-Innovation 4O (For Zero)

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Greeting & Introduction

Good Morning, Ir Mandy Leung (The Chairman of the HKIE Electrical Division), Ir Y.H. Leung (Symposium Chairman), distinguished guests, ladies and gentlemen.

It's my great pleasure to give an opening speech for today's symposium. First of all, I'd like to thank the Electrical Division for giving us this interactive platform every year to share up-to-date technologies and innovative ideas. I'd also like to congratulate the Organizing Committee for the symposium thoughtfully planned and well received for 40 years!

The theme for this year's symposium namely "Co-Innovation 4O (Four Zero)" is a creative phrase that could represent the 40th anniversary of today's symposium but also refer to our vision and target for zero (4O) carbon.

With accelerated climate change and global warming, carbon neutrality is a pressing topic for the society and the industry. With the continuous global warming, we are suffering from prolonged summers these years. According to the Hong Kong Observatory, the high temperatures this year has broken several "HOT" records.

I am wondering if some day after tomorrow, a Skynet like that depicted in the famous local movie "Warriors of Future" (明日戰記) or "space bubbles" developed by a team of scientists from MIT to deflect solar radiation is required if we do nothing. Surely Not!

Under the vision and target of carbon neutrality, the industry and the Government have been striving and collaborating to develop innovative engineering solutions in different aspects. Last year, the Government announced the "Hong Kong's Climate Action Plan 2050" which outlines four major strategies to strive for carbon neutrality before 2050.

Our strategies for achieving carbon neutrality in Hong Kong are also **Four Zero** and I would like to name them as (1) first - Zero emission power generation, (2)second – Zero emission transport, (3)third - Zero electricity wastage, and (4)fourth - Innovation for zero.

Zero emission power generation [renewable energy]

In 2020, over 60% of Hong Kong’s carbon emissions come from electricity generation, which depends heavily on fossil fuels. To achieve carbon neutrality, net-zero power generation is one of the key strategies set out by the Government. Now, let’s look at solar photovoltaic as an example of zero emission power generation.

We have been seeing wider adoption of solar PV in Hong Kong in recent years, thanks to technological breakthroughs and the Feed-in Tariff scheme improving the cost competitiveness and ensuring payback in 10 years. So, what’s next? Can we co-innovate and further increase power generation by solar PV? Well, EMSD is always at the forefront in applying innovation to solve problems.

To promote wider use of Solar PV in our city and improve its performance, we have developed two award winning I&T solutions. The first one is the “Hong Kong Solar Irradiation Map”. By showing the estimated solar irradiation received at building rooftops, this tool enables users to preliminary assess the solar energy potential for all building rooftops in Hong Kong. Users can draw a polygon to select an area of a building rooftop for installing PVs, try out different orientations and inclinations of the PVs, and the tool will instantaneously estimate the annual electricity generation. Most importantly, the year-round shading effect from nearby taller buildings would be automatically taken into account in the estimate.

Another I&T solution developed by EMSD is the “Integrated Solar Energy Performance Management System – iSMS”. It is a non-intrusive and automated PV system analysis toolkit. It collects various operational data with IoT sensors for system performance analysis and fault diagnosis. Through innovation and technologies, the iSMS advises the owner if the PV is performing adequately and healthily, so that the owner can timely check and maintain the system to ensure optimal performance. It is another way to enhance the energy transition towards carbon neutrality. Both the above innovative measures won awards in the International Exhibition of Inventions of Geneva 2022.

To achieve zero emission power generation, we cannot solely rely on renewable energy. We need to explore other clean energy source, such as hydrogen, to ultimately support the decarbonisation of electricity generation. In this regard, as a first step, I understand that the CLP and GE have signed an agreement to jointly explore the feasibility of blending hydrogen and natural gas for electricity generation.

Zero emission transport [hydrogen energy]

Apart from electricity generation, carbon emission from transportation make up nearly 20% of total emissions in Hong Kong. To strive for a zero carbon future, our Government proactively explores the use of hydrogen to decarbonise the transport sector.

Leading countries including China, USA, the UK, Japan and Korea, etc. have already drawn up their roadmaps in the past few years, and set ambitious targets on wide adoption of hydrogen in achieving carbon neutrality, particularly in the transport sector.

To catch up the fast-growing pace of hydrogen as fuel adoption, as well as transiting Hong Kong towards a zero-carbon city, the Government has set up an interdepartmental working group and committed to collaborate with the franchised bus companies and other stakeholders to test the use of Hydrogen Fuel Cell buses (HFC buses) and heavy vehicles within three years to formulate a roadmap for the use of new energy public transport by 2025. We are expecting hydrogen buses on the road in late 2023.

Just when we think that hydrogen may only fit for fuel cell vehicles, scientists, researchers and private investors have already been moving ahead and exploring the possible extensions apart from road applications. Looking at railways for instance, the world's first hydrogen tramcar was invented in 2015 in Mainland China. Subsequently, Germany has rolled out the world's first hydrogen-powered train in September 2018. Going to the sea, the Norwegian has recently launched the world's first vessel powered by liquid hydrogen in 2021. Up in the sky, "Airbus", has just announced its plan to bring the world's first zero-emission commercial aircraft to market by 2035, using solely hydrogen for propulsion.

These applications serve as crucial milestones in demonstrating our readiness of switching to hydrogen use in the near future to fully achieve zero-emission transport.

Zero electricity wastage [DCS]

In fact, the major source of carbon emissions in cities is the building sector, which accounts for 90% of electricity usage in Hong Kong. EMSD aims to enhance the energy efficiency of air-conditioning systems in buildings. Implementation of district cooling systems (DCS) is one of our strategies to achieve electricity reduction in the building sector. Compared to traditional air-cooled system, DCS consumes about 35% less electricity.

But our DCS in Kai Tak Development is more than that. A customized energy management solution was introduced to the Kai Tak North Plant for a trial run. Using the historical operational data and weather forecast from the Hong Kong Observatory, the optimization tool predicts the total consumer cooling demand on hourly basis. The tool recommends the best operational combination of chillers and cooling towers to match with the operational requirements. After a trial for 20 months, we compared the produced cooling capacity before and after the implementation of the energy management solution, and confirmed that the plant produced 17% to 21% more cooling capacity under the same electricity consumption.

EMSD will not stop here. Following the success of Kai Tak, we also spearhead the construction of DCS in Tung Chung New Town Extension and Kwu Tung North New Development Area. Upon full utilization, it is estimated that the overall annual saving will be over 200 million kWh (kilowatt-hour) in electricity consumption. In connection with the development of the Northern Metropolis, we have different DCS projects in the pipeline, like that for Hung Shui Kiu, San Tin Lok Ma Chau, Artificial Islands in Central Water, etc.

Moreover, EMSD has planned to widely adopt AI technology in our upcoming DCS projects. By utilizing Big Data analysis and AI optimization control algorithm, we believe it can further enhance the overall operational efficiency year-round to strive towards the goal of zero electricity wastage.

Zero electricity wastage [RCx]

Apart from promoting energy conservation in new buildings, we also explored the energy efficiency enhancement in existing buildings. Hong Kong is a highly urbanized city. With increasing number of aged buildings, there would be huge energy saving potential to

reduce the electricity consumption effectively in more than 42,000 existing buildings in Hong Kong.

Retro-commissioning (RCx) is an effective tool to enhance the energy efficiency performance of existing buildings. It identifies energy saving opportunities to improve operational performance of buildings and improve overall building energy efficiency.

EMSD has launched a 7-year RCx program since 2019 for over 200 major government buildings in different operational categories. Retro-commissioning is the one of the starting points in our decarbonisation journey for buildings. It brings about incremental enhancement in building energy efficiency but we also need innovative and technological breakthroughs from time to time to achieve significant and persistent stepwise reduction. The successive applications of incremental and stepwise reductions through retro-commissioning leads us towards zero electricity wastage.

Innovation for Zero

Advancement of technology like AI has been proven as a game changer in different industries. In order to unleash the potential of AI on building facilities hence to realize Innovation for Zero, we started collecting Big Data around the territory. Our Regional Digital Control Centre (RDCC) collects up to six hundred thousand data from a single building each day. This system is supported by an analytic engine with AI and machine-learning capability. The ultimate goal is to enhance EMSD assets' operational efficiency and environmental performance. We also collaborate with international and local partners to establish a portable AI service and model deployment.

The use of the AI in optimization of the building's energy efficiency has been implemented in various venues like the West Kowloon Government Office and Tseung Kwan O Hospital. The more accurate cooling load prediction made by the AI helps cut down the energy consumption of the chiller plant by around 5 to 7%.

In order to adopt AI at the city level, we have developed a scalable Semantic AI model for automatic building insight extraction. Compared to conventional AI models, the Semantic AI model is built upon a machine readable and standardized language for describing the relationships between E&M facilities which allows automatic machine-level query and insight extraction without human intervention. This approach dramatically reduced the AI redeployment costs and time.

With the success of Semantic AI development, EMSD forged ahead - together with the Guangdong Provincial Association of Science and Technology in organizing the Global AI Challenge for Building E&M Facilities. Diverse mix of events were hosted to inspire participants to exchange ideas, and to strengthen the role of AI technology to fight for zero.

To continue to inspire the development in Semantic AI on Building E&M facilities, the EMSD has just launched the E&M AI Lab. The E&M AI Lab is a co-innovation platform to gather experts and interested practitioners all around the world to share their knowledge, experience and expertise, and to co-operate in developing data architectures, best practices and standards for AI in this specialised field. For more details, you can scan the QR code and visit our website.

Closing Remarks

The Climate Action Plan 2050 is the foundation stone that changes our industry and our daily lives in the decades ahead. I am glad to share with you in the 40th Anniversary of HKIE Electrical Symposium the key message - "Co-Innovation 4O (for Zero)" through the four zero (4O) initiatives of:

- Zero emission power generation;
- Zero emission transport;
- Zero electricity wastage; and
- Innovation for zero.

Last but not least, I wish you all enjoy and share your innovative idea at the **40th** HKIE Electrical Symposium today. Let's join hands together to strive for continuous improvement towards Carbon Neutrality for us all. Thank you very much.