IET Hong Kong The 20th Annual Power Symposium 2022:
Building the Carbon Neutral Future – Challenges and Opportunity

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Good morning, Ir Keith Chan (Chairman, The IET Hong Kong), Ir Thomas Chan, Mr Paul Tomlinson, Honourable speakers, distinguished guests, ladies and gentlemen.

It's my great honour to join this symposium today. I'm very delighted to share my view on the challenges and opportunity in "Building the Carbon Neutral Future", which is the theme of today's symposium.

Introduction

For Carbon Neutral, of course, let's talk about something green. Just take a look at this beautiful green background with some shiny little white spots over there. Do you know what they are? They are football players in the middle of a World Cup match hosted in the stadium with full-house of fans. I guess most of you can never forget the devotion, excitement and enjoyment a football match can give us, especially if we are one of these people out there, whether you are a fan or even a player. The FIFA World Cup, which is the most eagerly awaited world-class football event for every 4 years, is coming in about 2 months!

Do you know when and where the first World Cup was held? The very first World Cup, taken place in Uruguay, was held in 1930, almost a hundred years from now. Over this long period of time, there had been many changes along with the development of this world-class event. And among all the changes, expansion in the number of participants is exceptionally significant.

Back to 1930, there were only 13 teams from 3 continents competing in the tournament; 10 from North and South America, and only 3 from Europe. When time goes by, 17 countries had hosted 21 nos. of World Cup final so far.

The next World Cup final will be hosted by Qatar in November this year. What you may not have imagined is that: Over 200 teams from 6 continents are participating in the World

Cup this year. Not only the number of participating teams has significantly expanded, the World Cup has also become the most widely viewed and followed sport event in the world since its first broadcast on television in the 1950s. More stunningly, the last World Cup in 2018 had attracted over 3.5 billion of people watching from all over the world.

Moreover, through technological development, the ball itself, the attire of the players such as their boots, and the equipment in the stadium have all been advancing significantly and continuously to uplift the quality and enjoyment of the game to a completely different level of satisfaction. Despite all these changes over the past century, the World Cup has united people around the world using the magical power of just one object, that's the "football".

This year, FIFA particularly emphasizes the values of the game to build inter-cultural understanding and develop opportunities among all people, and to promote "advance ongoing mission for a sustainable future for the world". No doubt, we all strive for a sustainable future for our world. This is also the same shared value and mission of our world, that is becoming "Carbon Neutral". Here in Hong Kong, the <Hong Kong Climate Action Plan 2050>, announced by the Government last year, has set out the vision of "Zero-carbon Emissions – Liveable City - Sustainable Development" for Hong Kong and outlines four major strategies to strive for carbon neutrality before 2050.

Our journey to Carbon Neutral can be very similar to the history and development of the World Cup : (i) Both involve many people and major players who have different skills, functions and contribution; (ii) We have different techniques, tools and methods to deal with every single issue; (iii) From this, we anticipate to face differences and tackle difficult obstacles; (iv) Somehow and somewhere in time, there could inevitably be some controversies. But we need not be afraid of, because we all learn from the past to make the future better.

Let's see what we can learn from the World Cup's history with its nearly a century-long development to help formulate our strategy to achieve Carbon Neutral in Hong Kong. There are three key elements and I would like to name them as:

1) Continuous Improvement
2) Technological & Regulatory Breakthrough; and
3) Carbon Neutral for All

Continuous Improvement

Let's go back to 1930 to check the first World Cup final. I guess some of you may know that the Champion of the first World Cup was Uruguay, who defeated Argentina by 4 to 2 in front of a crowd of nearly 70,000 people. But do you know how the ball and boots look like then? They were made by vintage leather with laces.

Let's now return to 2022. The 2022 World Cup ball is named "Al Rihla". It is lighter in weight, moves quicker, improves accuracy and consistency, and keeps in shape longer. The boots of the new generation players can be made even much lighter than before, it is "a shoe likes a sock". Its material is also stronger, and it protects the player's foot better. Most surprisingly, stitches on the football and laces on the boots can all disappear. That's a remarkable improvement.

We want to make things better, I call it "IMPROVEMENT". Make good use of the mature technologies to improve. Here is an example: Solar Photovoltaic. Solar PV directly converts sunlight into electricity by PV cells built with a layer of semi-conducting materials. The first generation is mainly rigid silicon cells, which is now predominant in the current market. To minimize material use, the second generation emerges which has enabled solar PV to be lighter, more flexible and easier to integrate with the built environment for wider application, for example, at the skylight of a building or a glass canopy of a covered walkway, etc.

Technological improvements have led to higher efficiency and/or lower cost. So what's next? To install more PV systems? To make PV systems more efficient? And how to start?

In promoting the wider use of Solar Photovoltaic in our city and improving its performance, EMSD has developed the "Hong Kong Solar Irradiation Map" and the "Integrated Solar energy performance Management System (iSMS)", which are recognized with two awards at the International Exhibition of Inventions of Geneva this year.

By showing the estimated solar irradiation received at building rooftops, the Hong Kong Solar Irradiation Map (the Map) enables users to perform a preliminary assessment of the solar energy potential for their building rooftops. Users can draw a polygon to select an area of their building rooftops for installing their PVs, try out different directions that

their PVs should face, and at what inclination to the ground, etc., and the system will estimate the annual electricity generation, as well as the possible Feed-in Tariff (FiT) income for eligible buildings, instantaneously. Most importantly, the year-round shading effect from nearby taller buildings has been automatically taken in account in the estimate.

As for the Integrated Solar Energy Performance Management System – iSMS, it is a non-intrusive PV system analysis toolkit. It collects various operational data by IoT sensors for the system to monitor and analyze system performance and fault diagnosis. The iSMS automatically recommends optimal maintenance schedule to maximise PV output, thereby maximizing your FiT return on one hand, and enabling energy transition for reaching carbon neutrality on the other hand.

Technological & Regulatory Breakthrough

Back to another exciting topic of the World Cup matches. We all can still recall some classic controversial moments in the World Cup years after it happened.

- In 1986, Maradona of Argentina scored his controversial goal by the "Hand of God" against England. Some commenters said that this score basically pushed Argentina all the way to the final and won the Cup.
- In the 1966 World Cup Final match, the referee ruled that the ball shot by the England team had crossed the line, and England went on to win the match against West Germany.
- In the 2010 World Cup, and once again involving the England team, the referee ruled that the ball shot by England did not cross the line instead, and Germany went on to win the match.

In fact, the players, referees and spectators all aim to make the game fair for everyone. However, referees are all human, and their eyeballs are just human flesh. So their instantaneous judgements can be subject to error.

For some fans, such controversy is part of the game's enjoyment and attraction. Irrespective of whether the decisions are right or wrong, the 'spirit' of the game requires that referees' decisions must always be respected. But how can we prevent these situations from happening again? To make the football matches keeping up with time and to ensure fairness, the Law of the Game would need to be updated from lessons learnt

in the past. And then, how to update the Law? From time to time, "Breakthrough in Technology" could assist the referee to improve the level of judgement and make the right decision for a fair game.

- Since 2012, goal-line technology has been permitted in matches. Since the World Cup 2014, Goal-line technology (in Chinese "門線技術") has been officially used for minimal interference and maximum benefit in both ends.
- Since the World Cup 2018, FIFA officially approved the use of video assistant referee (VAR). New gesture was introduced to the referee, following extensive trials in a number of major competitions
- What's more? In the coming World Cup, new semi-automated offside technology will be adopted.

The development of football matches and the Law of the Game have a long history of time. Breakthrough is achieved by evolving technology from time to time. As quoted from International Football Association Board (IFAB), "For every proposed change on the Law, using technology to enhance the game" is one of the essential focus.

This is the same for our regulatory tools for energy efficiency in Hong Kong, the Buildings Energy Efficiency Ordinance and Mandatory Energy Efficiency Labelling Scheme. We keep abreast of the latest technological advancement through regular comprehensive reviews on the associated Codes of Practices.

Striving towards Carbon Neutrality, there will certainly be involvement of new technology in decarbonisation. In the Policy Address 2021 and Climate Action Plan 2050, trial of hydrogen fuel cell bus was mentioned. Application of hydrogen fuel cell in vehicle is brand-new to Hong Kong. It is an important "step change" on fuel application. Subject to the positive result of the trial test run in coming years, its safety and regulation for the whole process from production, importation, transportation, storage, refilling, to vehicle operation and maintenance of hydrogen as fuel shall be properly put in place for Hong Kong.

Same as the football matches, the regulations and guidelines should keep up with times to match with the development of evolving technology so that the trade and the community can go at the same pace and towards the same direction. There are also a lot of opportunities on the development of hydrogen application with the growth of

technology. For example, the Green Tech Fund is currently supporting a number of research projects from local universities on hydrogen.

Taking the "Long Lift Hydrogen Fuel cell" from HKUST as an example. Conventionally, the polymer electrolyte membrane fuel cell combines hydrogen and oxygen to generate electricity and makes use of platinum as catalyst, resulting in high cost but short lifespan. Scientists have strived to develop alternatives by replacing platinum with more common and inexpensive materials, but those materials are either proven inefficient in power generation or have poor durability. The research team in HKUST finds a new formula and develops a new hybrid catalyst which would not only cut down the proportion of platinum used by 80%, but also set a world's record in terms of the cell durability.

We hope there will be increasing technology breakthrough to further enable hydrogen as fuel in a more durable and cost-effective manner, paving the way for its wider application as a green energy source in the carbon neutral world.

As we can see from the World Cup, the development and application of A.I. technology can benefit human with more precise judgement and at higher effectiveness and efficiency. AI technology can also be applied to enhance energy performance of buildings.

- Semantic A.I. to achieve energy saving

  EMSD carried out a project on "Semantic AI on the Building Operation and System Optimization". The Semantic AI technology won a Gold Medal at the International Exhibition of Inventions of Geneva in 2021. The project combines digitisation and natural language processing (NLP), making the programmes of the AI machine-readable, and enabling the swift building up of an A.I. model for buildings.

  With this system, experts from different domains such as E&M engineers and data scientists can have a common language to communicate and to readily understand the building E&M system, and the semantic model of a building can be readily adapted to another building, thereby significantly reducing the time required to optimize the performance of a group of buildings.

  EMSD has also been exploring the use of semantic A.I., with experts in the field, to perform prediction modelling in forecasting cooling demand and equipment

performance, so as to recommend optimized setting and controls of air-conditioning system for energy saving.

In its implementation for the chiller control system in West Kowloon Government Offices, the Semantic AI achieved a 99% accuracy in predicting the cooling demand, bringing around 15% improvement on plant performance.

- Global AI Challenge

  To further unleash the potential of A.I. in building E&M installations, EMSD and the Guangdong Provincial Association for Science and Technology (廣東省科學技術協會) jointly kicked off the "Global AI Challenge for Building E&M Facilities" in late 2021. The campaign first started with an international conference with over 2000 participants joining online. It was followed by an international competition on A.I. application in the building services sector. Over 120 teams registered.

  The competition successfully inspired participants, industry leaders, innovators, and researchers to exchange ideas, and to promote the adoption of A.I., thereby contributing to our carbon neutrality goal.

  The award ceremony will be held this afternoon and I trust that some of you have received invitation to join the event. Our "E&M AI Lab" will also be set up today as a collaborative international platform to accelerate the partnership and sharing in our journey towards Big Data and AI Development on Building E&M Facilities.

Carbon Neutral for All

We all know that in a football match, there are eleven players in each team on the field. In the football world, we have a jargon claiming that the audience is the 12th player (in Chinese "第十二人").

With almost 2.5 million tickets sold and a projected 5 billion audience for the World Cup 2022, the audience, together with their vocal support urging their teams to win the game, will often encourage their teams; or boost team's morale to stretch their limit. The 12th player always has a potentially helpful and significant role in the game.

In fact, a fantastic football match does not just rely on the performance of 22 players on the field. Participation and supports from "officials", "coaches", "technical staff", and

even “the fans or the supporters” are vital. This principle also applies to our work in energy efficiency and conservation. It can never just rely on the effort of the Government alone, but requiring the full engagement, support and contribution from all stakeholders including the regulatees, trade practitioners, and more importantly, every one of us to act together.

Therefore, not only did we “strike for the goal”, we also take up the role as a promoter and a facilitator to encourage our partners and all stakeholders to strive for the goal of Carbon Neutrality together.

The promotion of I&T is set at high priority in the strategy of the Hong Kong Government’s long-term economic development plan. We have been putting lots of efforts to facilitate the trade to flourish their Green I&T projects, contributing to the goal of Carbon Neutrality. In particular, the Government has set up a Green Tech Fund to provide better and more focused funding support for R&D on decarbonisation and green technologies and their applications in the pursuit of Carbon Neutrality in 2050 in Hong Kong.

In supporting the policy of the I&T development in Hong Kong, EMSD has also launched the E&M InnoPortal© to facilitate and strengthen the collaboration between government departments, public organizations, the E&M trades, and the I&T sector, in particular the start-ups and universities to match relevant I&T solutions with the wishes and pain points in order to improve services and support smart city development.

In September 2020, President Xi Jinping announced that our country will reach the carbon emissions peak by 2030 and then carbon neutrality by 2060. With the common goal on carbon neutrality, we have worked closely with organizations and partners in the Guangdong-Hong Kong-Macao Greater Bay Area (GBA) to formulate our roadmap to support the transition to low carbon energy systems.

Following the signing of the Memorandum of Co-operation on Retro-Commissioning of buildings among institutions in the GBA in 2018, we have been promoting technical guidelines on RCx to our MoC partners for periodic inspection in existing buildings on performance of their facilities in order to identify operational improvements. With the success of this MoC, our MoC partners are planning to extend the coverage of the MoC to retro-fitting, which is another cost-effective process to accelerate energy saving in

existing buildings. We are looking into cooperation among various organizations in the GBA to encourage the retro-fitting concepts and technical developments.

Not only did we foster collaboration in the Greater Bay Area, we are also working with the Asia-Pacific Economic Cooperation (APEC) economies to explore further cooperation with international and external stakeholders. As other twenty APEC economies, Hong Kong commits to the regional common goals of reducing the aggregate energy intensity by 45% by 2035 and double the share of renewable energy in APEC's overall energy mix by 2030.

We have been proactively contributing to the APEC in past years, and have organized expert group meetings and various capacity building workshops with topics on "District Heating and Cooling Systems", "Energy Intensity Reduction in Urbanised Cities", "Retro-commissioning", "Energy Efficient and Resilient Data Centre", etc., encouraging experience sharing and direct dialogue among APEC members with a view to meeting our common goal.

Our effort has been recognized by APEC economies and our EMSD colleague has been elected as the Deputy Chairman of the Energy Working Group and Chairman of the Expert Group on Energy Efficiency and Conservation. We are now leading a taskforce of the Energy Working Group to set the stretched target for energy intensity and renewable energy for APEC economies.

With international collaboration, economies including both developed and developing ones, will gain mutual benefits from the exchange of knowledge and experience in promoting energy-efficient and renewable energy, as well as driving digital economy and technology towards innovative sustainability.

Supporters play an important role in a fascinating football match, and so is the whole community in our goal towards Carbon Neutrality. We spare no effort to promote and facilitate the whole community to take part in our common journey towards Carbon Neutrality. All parties, including commercial and industrial sectors, professionals and the youngsters, shall take proactive actions together to combat climate change.

Our Green I&T Day and Inno@E&M Open Day will soon be held in early November 2022 to foster collaboration towards Carbon Neutrality with the adoption of I&T. We

are looking forward to meeting you all there!

Concluding Remarks

There is, in fact, no loser in a football match. No matter who wins the game, with the commitment to continuous improvement and tremendous effort made on the field, both teams will win the applause from supporters.

Although players of different teams of different countries are rivals in a match, they share the same pitch and strike for the same goal. Similarly, all of us share the same "World" and the same "Home". The spirit of competing in a football match is no different from the spirit where people of different countries and cities are trying their best in protecting our "Homes" and our "World" from more catastrophic climate changes in the near future.

Carbon Neutrality is very much beyond a competition, it is our world's "Mission". Joint effort of all is vital to stretch our limit to achieve the goal. We shall show our indomitable sportsmanship in the carbon neutrality journey. Keeping our current effort of improvement alone is not enough, technological breakthrough and public engagement are also crucial to speed up the transformation to carbon neutrality.

Let's join hands together to strive for continuous improvement and Technological & Regulatory Breakthrough towards Carbon Neutrality for us all.

"Alone we can do so little, together we can do so much."

Thank you very much.