

Construction Inno Expo 2022
“International Conference on Green Construction”
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Green Evolution of E&M Engineering

Ir Eric PANG JP, Director, EMSD

Ir Albert CHENG (CIC Executive Director), distinguished guests, ladies and gentlemen,
good afternoon

It is my great honour to be here with you today, sharing my views on “Green Construction”, which is the theme of today’s conference.

Christmas is just around the corner. When it comes to Christmas, everyone will think of the mysterious man who brings gifts to children - Santa Claus. Legend has it that Santa Claus flies all over the world in a sleigh pulled by magical flying reindeer and sends presents to children every Christmas.

Every year Santa receives millions of hand-written letters from all over the world. Handling these wishes manually is very time-consuming and ineffective. Reading the wishes one-by-one and arranging the delivery of the right gifts to the right children might also sometimes result in errors. There is a great potential for improvement. Is it possible to go for “digitalization”? Can AI be adopted to help him manage the “digitalized” wishes? Could we share our experience in EMSD with Santa? All these questions come up in my mind.

Not only "Innovation" but also "Green"

Technology is changing everyday. It turns out that the joyful old man, Santa, could keep up with time and apply technology to prepare and deliver gifts to children. He loves children and is concerned that climate change would affect his beloved children in the coming generations. I thanked Santa for his love and care for our kids, who are our future, and would like to share with him what EMSD has done in our journey of “Innovation”

and “Green” in facing the ever growing challenges of climate change. Hopefully our experience could inspire him to further improve his work process and also enable him to contribute to the larger goal of “Carbon Neutrality”.

The development of green construction greatly depends on “innovative thinking”, application of “advanced technology” and the collaboration of all stakeholders from the industry. Along the philosophy of “Connect, Share and Co-create” , EMSD launched the “E&M InnoPortal” in 2018. The Portal is built to facilitate matching of pain-points and wishes of Government departments with I&T solutions from start-ups and research institutes. Up to November 2022, there were over 1020 I&T solutions, over 420 I&T wishes, over 160 matched I&T projects. You can find the reports of completed trials on the InnoPortal website.

Santa could make reference to our “E&M InnoPortal” to match his pain-points with the solutions so that all wishes from children could be easily managed and matched against the gifts based on criteria like interest, age and expectation, and the processing time could be shortened. Of course, the digitization of children’s wishes into the cloud generated a great “pool of data” which would be hard to handle for Santa. Hence, automatic data analytics will be essential to make these collected data useful. Santa Claus could gather gift delivery data from previous years, generate big data, and finally use AI to estimate what and how many gifts need to be prepared in the coming festive seasons. This will greatly enhance efficiency and productivity, and it can also reduce wastage of delivering the wrong gifts to the children.

Semantic AI

Being the engineering service provider for various government departments in Hong Kong, EMSD maintains the electrical and mechanical systems in more than 8,000 venues. These E&M systems generate an enormous amount of operational data every day and it would be impossible for anyone to interpret and analyze the data manually. We have therefore been exploring the use of semantic AI to help us manage and analyse these massive volume of data.

Taking air conditioning system as an example, we use semantic AI to perform prediction

modelling in forecasting cooling demand and equipment performance, so as to recommend optimized air-conditioning system setting for energy saving. The Sematic AI won us a Gold Award in the Inventions Geneva 2021. Instead of constructing a building specific AI model one by one, knowledge graphs and natural language processing (NLP) are utilized to represent the building itself in a machine-readable format, enabling the swift building up of an A.I. model for the building. With this technology in our hand, experts from different domains such as E&M engineers and data scientists can have a common language 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. The first such model was implemented on the chiller control system in one recently commissioned government office, and achieved a 95-97% accuracy in predicting the cooling demand, bringing at least 10% improvement on plant performance.

Our “Connect, share and co-create” are not limited to the territory of Hong Kong. We also connect, share and co-create with the Greater Bay Area (GBA), the Mainland and the world. 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 organised the “Global AI Challenge for Building E&M Facilities” in late 2021. With over 120 teams participating, the competition successfully inspired participants, industry leaders, innovators, and researchers to exchange ideas, and promote the adoption of A.I.. With this success, we further establish the “E&M AI Lab” in September this year as a collaborative international platform to accelerate the partnership and sharing in our journey towards the development and use AI for Building E&M Facilities.

BIM-AM

Every year when December comes, we will prepare for the joyful Christmas and get everything well organised to celebrate with our family and friends. This year’s December is a special one, because we are having another fantastic event. This is the World Cup at Qatar! How many matches have you watched ? The final match will be held on coming Sunday. Which team do you think will be the World Champion? Definitely, the World

Cup brings us many surprises, but also joyful and memorable moments. In order to prepare for the mega event, Qatar has built 8 stadia, each with seats ranging from 40,000-80,000. Qatar adopted the approach of Green Construction for this worldwide tournament and Qatar is committed to delivering the first carbon neutral World Cup. They have applied very stringent sustainable measures in order to minimize the carbon footprint with the application of advanced technology like BIM and MiC. During their construction, they have recycled and reused wherever possible and implemented a vast range of energy and water efficiency solutions.

Likewise, BIM is widely used nowadays locally in the construction industry for new projects. EMSD has gone a big step forward and developed the patented BIM-AM system to ride on the BIM model already in place in the project stage to help technical staff manage and maintain the building facilities. Maintenance of E&M assets in buildings is actually not an easy task as many system components are hidden behind the false ceilings, the wall and underneath the floor.

Using BIM-AM, engineering assets are now overlaid on 3-D BIM models. Furthermore, the BIM-AM platform connects the digitized assets of a building with data collected from various sources such as the Building Automation System and IoT sensors in real-time. Staff can use smart glasses or tablets to view components or trunkings hidden behind the false ceilings. They can even get real-time operation performance data, as well as asset information and maintenance records, on the spot to determine if the system is functioning properly. Based on the pilot at EMSD Headquarters, at least 15% time-saving can be achieved in the O&M workflow.

MiMEP and DfMA

Back to the Qatar World Cup, with the population of Qatar at only around 2.7 million, it is obvious that Qatar does not need to maintain so many grand stadia after the World Cup. With the foresight of possibly demolition of some stadia, one of the most important measures is to design and construct the first fully demountable stadium from modular shipping containers. Also, the reuse and recycling of building materials after the World Cup has been considered right from the beginning. Qatar canvassed communities to

identify what facilities they needed and implemented their ideas and suggestions into the stadium developments. The result includes a proposal to remove the modular upper tier from several stadia and ship the seats to countries in need of sporting infrastructure. Thanks to the modular design, stadia can now be built with less waste produced and at the same time easily dismantled, relocated and re-assembled elsewhere.

Similarly, we applied the same modular design principle in our construction industry – MiC, or what we called MiMEP when it came to the E&M trade. In EMSD, we have recently completed a MiMEP-based pilot project for chiller replacement at Tai Lung Veterinary Laboratory. With ground-breaking adoption of ten latest technologies, including BIM and its extension to BIM-AM, MiMEP, AR, robotics manufacturing, GWIN, integrated Building Management System, semantic AI, IoT, etc., the project overcame many challenges, and achieved saving in time, material and on-site manpower, reduced operational disruption, and enhanced productivity, quality control, site-safety and site management. Apart from the chiller replacement project at Tai Lung, we have also adopted MiMEP and DfMA for construction of our new Additional District Cooling System (DCS) plant.

If you would like to know more about these projects, I sincerely invite you to visit our booths in this exhibition hall.

DCS

I notice that most of the Qatar 2022 stadia and buildings around them have adopted the District Cooling System (DCS), rather than using conventional individual air-conditioning system for each building. This centralized approach significantly reduces energy consumption and lower greenhouse gas emission. In Hong Kong, we have similar system already in use in the Kai Tak Development, and there will be many more DCSs in new development areas. Compared to traditional air-cooled system, DCS consumes about 35% less electricity. I understand that there is also a booth in this exhibition hall to showcase this energy-friendly infra-structure.

Traditionally, the efficient operation of central air-conditioning system is highly dependent on the experience of plant operator in order to determine the optimal operating

combination of the plant equipment. Now a customized energy management solution has been introduced to the Kai Tak North Plant for trial run. Using historical operational data and weather forecast from the Hong Kong Observatory, the optimization tool predicts the total consumer cooling demand on hourly basis and recommends the best operational combination. After a trial for 20 months, we confirmed that the plant produced 17% to 21% more cooling capacity under the same electricity consumption.

Closing

The road to “Green” & “Carbon Neutrality” is very challenging, but by applying innovative technology, innovative mindset and innovative processes at each phase of a project from construction right through the operation and maintenance stage, I believe we have every chance to make this vision come true. With Christmas approaching, I would like to make a Christmas Wish here, I wish that everyone of you here can join hand in applying I&T in your operation, and moving towards our “Carbon Neutrality” goal.

Merry Christmas and thank you very much!