Hong Kong Joint Symposium 2025

18 November 2025

REVEALING SMART, RESILIENT & SUSTAINABLE BUILT ENVIRONMENT

Innovating Wellbeing and Decarbonization from Design to Operation

Organizing Institutions and University

ASHRAE Hong Kong Chapter

The Chartered Institution of Building Services Engineers Hong Kong Region

The Hong Kong Institution of Engineers - Building Services Division

The Hong Kong Polytechnic University Department of Building Environment and Energy Engineering

Hong Kong Joint Symposium 2025

REVEALING SMART, RESILIENT & SUSTAINABLE BUILT ENVIRONMENT

Innovating Wellbeing and Decarbonization from Design to Operation

Organizing Committee

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Prof Christopher Chao, *Fellow of ASHRAE and Senior Vice President (Research and Innovation), The Hong Kong Polytechnic University*

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Ms Ruth Carter

Chief Executive Officer, CIBSE

PROGRAMME

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Mr Ethan POON

Chair of CIBSE Hong Kong Region

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MESSAGES FOR THE CONFERENCE

A Message from The Chairman of Organizing Committee of Hong Kong Joint Symposium 2025

Mr Barry Lau
The Chairman of Organizing Committe of Hong Kong Joint Symposium 2025

On behalf of the Organizing Committee, it is my distinct honour and privilege to express our sincere appreciation for your presence and support at the Hong Kong Joint Symposium 2025. This annual symposium continue to stand as a flagship event in the building services engineering sector, jointly organized by three professional institutions and a well-known university in Hong Kong, including the American Society of Heating, Refrigeration and Air-conditioning Engineers Hong Kong Chapter, the Chartered Institution of Building Services Engineers Hong Kong Region, Hong Kong Institution of Engineers - Building Services Division and Department of Building Environment & Energy Engineering, the Hong Kong Polytechnic University.

The theme of Hong Kong Joint Symposium 2025 is "Revealing Smart, Resilient & Sustainable Built Environment: Innovating Wellbeing and Decarbonization from Design to Operation," reflects our collective commitment to advancing the built environment through integrated engineering solutions that prioritize human wellbeing, climate resilience, operational efficiency, and carbon neutrality. It is a timely and strategic response to the evolving challenges of climate change, urban resilience, and sustainable development. This symposium serves as a multidisciplinary platform for knowledge exchange and professional dialogue, structured around four key thematic perspectives – "Codes and Guidance", "Design and Research", "Operation and Maintenance" and "Smart, Resilient and Sustainability".

We are especially privileged to welcome our Guest of Honour, Ir Daniel LEUNG, Deputy Director of Development & Construction, Hong Kong Housing Authority of the Government of the Hong Kong Special Administrative Region. His presence underscores the critical role of public sector leadership in driving innovation and sustainability in housing development and construction industry. We are also delighted to host distinguished guests from Prof. Christoper Chao, Fellow of ASHRAE , Eur Ing Prof David Cooper MBE, President-Elect of CIBSE UK, and Ms. Ruth Carter, Chief Executive Officer of CIBSE UK. Their contributions today, along with those of our esteemed speakers, will undoubtedly enrich our discussions and inspire forward-thinking approaches. Furthermore, I would like to extend my sincere appreciation to our Session Chairs, whose professionalism and facilitation ensure the smooth delivery of today's programme and foster meaningful engagement among participants.

Finally, I wish to convey my deepest gratitude to the Organizing Committee members and helpers. Their dedication, meticulous planning, and tireless efforts have been instrumental in making HKJS 2025 a successful and impactful event for our profession.

Let us take this opportunity to reaffirm our commitment to engineering excellence, collaborative innovation, and sustainable development in the built environment. May today's symposium be both intellectually stimulating and professionally rewarding.

A Message from The President of ASHRAE Hong Kong Chapter

Mr Jason Kwok
President 2025-2026
ASHRAE Hong Kong Chapter

On behalf of ASHRAE Hong Kong Chapter, it is with immense pleasure and a deep sense of professional pride that I extend our most sincere and heartfelt congratulations on the conclusion of the profoundly impactful Hong Kong Joint Symposium 2025. The event was not merely a conference, but a significant milestone that has undoubtedly set a new benchmark for industry collaboration and intellectual exchange.

The symposium's powerful and comprehensive theme, "Revealing Smart, Resilient & Sustainable Built Environment: Innovating Wellbeing and Decarbonization from Design to Operation," served as a perfect blueprint for the future we must collectively build. It was exceptionally rewarding to witness how the meticulously structured programme gave life to this vision. The seamless progression from foundational codes and groundbreaking research to practical operation and smart integration masterfully illustrated the entire building lifecycle. This holistic approach is crucial, as it underscores that achieving true sustainability and resilience requires connecting ambitious decarbonization targets at the design stage with tangible human wellbeing outcomes in day-to-day operations.

I wish to express our profound gratitude to the Organizing Committee for their visionary planning and flawless execution. Our appreciation also extends to the distinguished session chairs who skillfully guided the conversations, our fellow institutions for their invaluable partnership, and every speaker and participant whose active engagement and willingness to share knowledge were the true engines of the symposium's success. The connections forged and the ideas sparked throughout the day will undoubtedly serve as a critical catalyst, propelling concrete actions and measurable progress within Hong Kong's built environment for years to come.

ASHRAE Hong Kong Chapter is proud to have been part of this collective effort, and we look forward to building upon this momentum in our continued pursuit of a smarter, healthier, and more sustainable future.

Congratulations once again on a truly inspiring and successful symposium.
With highest regards.

MESSAGES FOR THE CONFERENCE

Mr Ethan POON
Chair (2025-2026), Hong Kong Region
The Chartered Institution of Building Services Engineers

A Message from The Chartered Institution of Building Services Engineers Hong Kong Region

On behalf of the Chartered Institution of Building Services Engineers Hong Kong Region (CIBSE HKR), I extend my heartfelt congratulations to the organizers and participants of the Hong Kong Joint Symposium 2025. This prestigious event, under the theme "Revealing Smart, Resilient, and Sustainable Built Environment: Innovating Wellbeing and Decarbonization from Design to Operation", serves as a vital platform for advancing the future of the built environment.

The collaboration among ASHRAE HKC, CIBSE HKR, HKIE-BSD, and the Department of Building Environment and Energy Engineering of the Hong Kong Polytechnic University exemplifies the power of partnership in addressing global challenges. Together, we are driving innovation in sustainable design, resilient infrastructure, and energy efficiency, supporting the urgent global mission of decarbonization.

May this symposium inspire groundbreaking ideas, foster meaningful dialogue, and strengthen our shared commitment to creating smarter, healthier, and greener environments for future generations. Congratulations on this impactful event!

Ir John Chan
Chairman
HKIE Building Services Division
The Hong Kong Institution of Engineers
Session 2025-2026

A Message from The Hong Kong Institution of Engineers Building Services Division

On behalf of the HKIE Building Services Division, I extend my heartfelt congratulations to the organizers and participants of the Hong Kong Joint Symposium 2025. This year's theme, "Revealing Smart, Resilient & Sustainable Built Environment: Innovating Wellbeing and Decarbonization from Design to Operation", is both timely and visionary.

As we navigate the complexities of climate change, urbanization, and technological transformation, the built environment plays a pivotal role in shaping a sustainable future. This symposium not only brings together thought leaders, innovators, and practitioners across disciplines, but also fosters the exchange of ideas that will drive meaningful change—from design conception to operational excellence.

Your commitment to advancing smart and resilient infrastructure, promoting wellbeing, and accelerating decarbonization is commendable. I am confident that the insights and collaborations emerging from this symposium will inspire impactful solutions and set new benchmarks for our industry.

May the symposium continue to be a catalyst for innovation and sustainability in the years to come. I wish the symposium every success and hope all the participants would enjoy the symposium.

Thank you.

MESSAGES FOR THE CONFERENCE

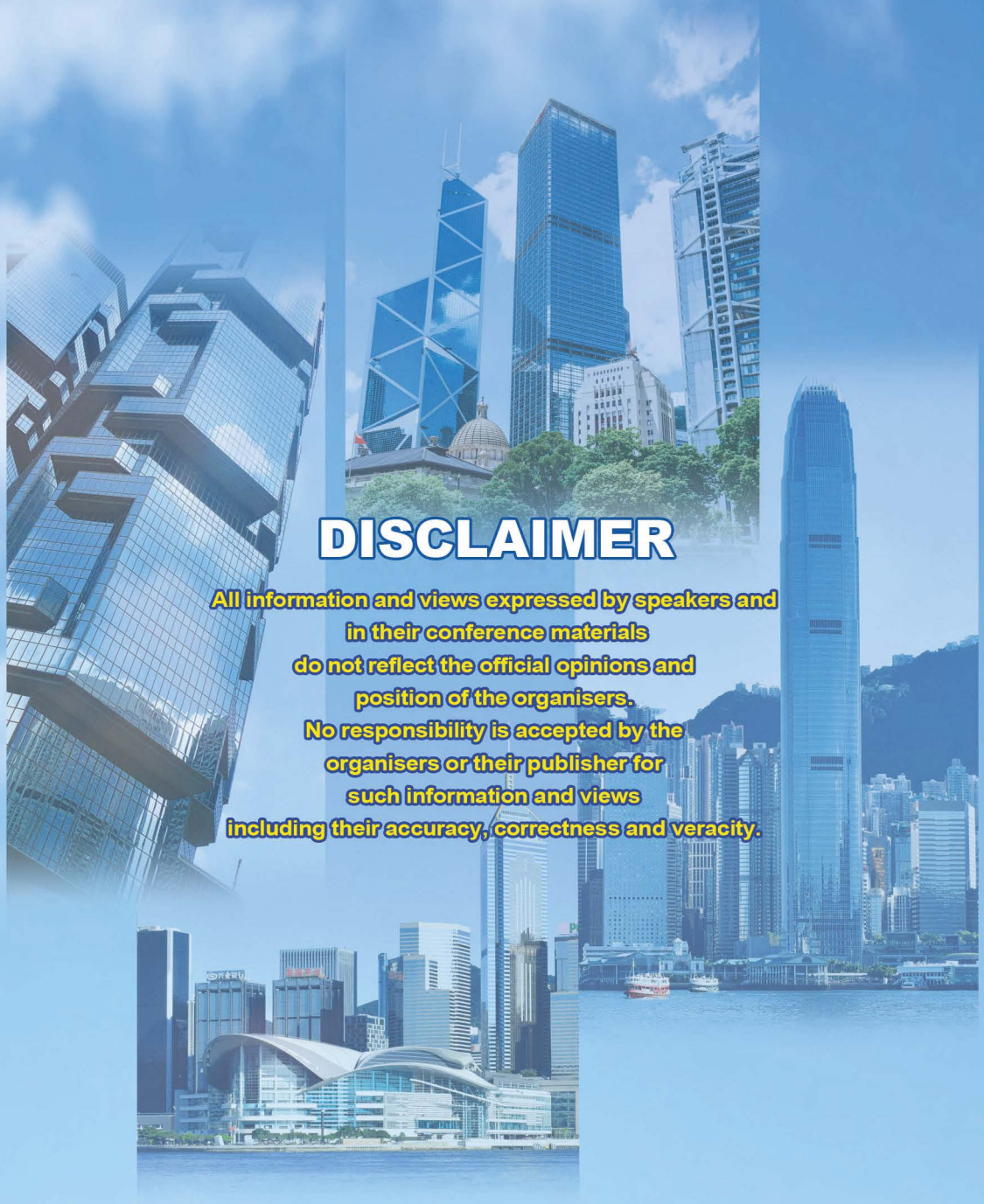
Professor Ni Meng
Head of Unit,
Associate Dean of FCE
Chair Professor of
Energy Science and Technology
Department of Building Environment and Energy Engineering

A Message from the Department of Building Environment and Energy Engineering at the Hong Kong Polytechnic University

On behalf of the Department of Building Environment and Energy Engineering (BEEE), the Hong Kong Polytechnic University, I would like to extend my warmest congratulations to the Joint Symposium 2025 entitled "Revealing Smart, Resilient and Sustainable Built Environment: Innovating Wellbeing and Decarbonization from Design to Operation".

This annual Symposium brings together international and local researchers and practitioners to discuss all aspects of advances in building systems design in the context of building services engineering. I would like to take this opportunity to wish that this year's symposium will continue to promote good practice and foster mutually beneficial discussions and collaborations among the participants.

I would like to extend my heartfelt congratulations to the Organising Committee for the successful execution of the Hong Kong Joint Symposium 2025. Your dedication and meticulous planning have truly set a new standard for collaboration and knowledge exchange in the building services engineering sector. The symposium's impactful theme and the diverse range of discussions will undoubtedly drive meaningful advancements in our industry, fostering innovation and sustainability in our built environment.



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Section 1.1 Paper Title:

A Smarter Consumption Solution to Solve Energy Crises - PEDF for Buildings

Submitted by Priscilla Lin , Xu Yuan, Ganlin Li, Ricky Wong
Schneider Electric

ABSTRACT

Keywords:
PEDF, Direct Current (DC), Photovoltaics (PV), Energy Storage, Flexibility, Current/OS, Droop Control, TN-S Earthing, DC Microgrid, Carbon Neutrality

Achieving a carbon-neutral society is not a trivial activity assigned to individual bodies, companies or technologies. There has to be social-wide consensus coupled with systematic approaches coupled with the renewable energy sources into existing power grid.

In this paper a concept of PEDF (photovoltaics, energy storage, direct current, flexibility), is proposed to provide an effective solution enabling the carbon neutrality from the demand side. The PEDF system creates a crucial transformation of electrical distribution for buildings enhancing energy flexibility and efficiency with the supporting goal of carbon neutrality by using the renewable energy and the optimization of energy consumption, integrating distributed photovoltaics, energy storages (including traditional and virtual energy storage), and a direct current distribution system into a building to provide flexible supplies for the direct current loads.

The traditional AC distribution network has well known issues of power quality, conversion loss and the instability of transmission and distribution of energy problems. The development of PEDF system has solved the puzzles exploiting the overall energy flexibility of buildings to closely match the renewable energy generation curves. On the other hand, consuming the generated PV directly in DC while storing the excess into the BESS (Battery Energy Storage Systems) becomes more sustainable with the rapid growth of Electric vehicles which could be treated as an extra battery storage participating in the demand side management, of buildings or complexes that at the end constitute a significant piece of the total energy picture of a society.

With the use of smarter DC energy management mechanism (passive or active), the PEDF system can effectively reduce energy waste and optimise the energy usage to optimize the electricity distribution efficiency enhancing the development of sustainable building.

Section 1.2 Paper Title:

Biophilic Urbanism: Synergizing Wellbeing and Decarbonization in High-Density High-rise Cities

Submitted by Tony Ip
Tony Ip Green Architects Ltd.

ABSTRACT

Keywords:
biophilic design, circularity, decarbonization, high-density cities, wellbeing

Urbanization increasingly disconnects residents from nature while exacerbating carbon emissions. This paper presents a biophilic framework that addresses both challenges through the SpaceObject-Activity (SOA) model, demonstrating how nature-centric design in high-density cities can enhance wellbeing while advancing decarbonization.

The framework integrates three key strategies:

I. Passive bioclimatic design optimizes building orientation and spatial configurations (SOA's "spaces") to maximize natural ventilation and daylight, reducing energy demands while creating thermally comfortable environments connected to natural rhythms.

II. Renewable-integrated biophilia incorporates building-applied energy systems as architectural features (SOA's "objects"), where green façades and solar surfaces serve dual roles as clean energy producers and nature-engaging elements.

III. Action for material circularity (SOA's "activities") activates community practices, such as gardening, recycling, and second-hand exchange, that reduce embodied carbon and operational energy while building social cohesion and environmental stewardship.

The SOA model structures these interventions holistically:

I. Spaces become multi-level green networks configured through passive bioclimatic design, where carbon-sequestering infrastructure enables daily nature interactions and reduces operational energy demand.

II. Objects integrate renewable systems and bio-based materials that function as both climate regulators and sources of multi-sensory biophilic experiences.

III. Activities position community rituals as the engine of a regenerative urban metabolism, transforming abstract circular principles into tangible social-ecological practices that synergize planetary and human health.

Implementation in high-density, high-rise contexts like Hong Kong shows this approach consistently improves both environmental performance and human health outcomes compared to conventional development. The passive strategies significantly lower operational energy use, while the integrated renewable systems contribute to carbon reduction targets. Simultaneously, the biophilic design elements enhance mental restoration, social connectivity and physical wellbeing through purposeful nature engagement.

The paper concludes with practical applications for vertical urban environments, providing policymakers and designers with actionable strategies to implement this framework within spatial constraints characteristic of megacities. By treating wellbeing and decarbonization as interdependent goals through the SOA model, cities can create resilient neighbourhoods that meaningfully reconnect residents with nature while achieving climate objectivesthe, biophilic design elements enhance mental restoration, social connectivity and physical wellbeing through purposeful nature engagement.

The paper concludes with practical applications for vertical urban environments, providing, policymakers and designers with actionable strategies to implement this framework within spatial constraints characteristic of megacities. By treating wellbeing and decarbonization as interdependent goals through the SOA model, cities can create resilient neighbourhoods that meaningfully reconnect residents with nature while achieving climate objectives.

Section 1.3 Paper Title:

Nature-based Solutions for Resiliency and Sustainability in the Built Environment

Submitted by David Gallacher
AECOM

ABSTRACT

Keywords:
Nature-based Solutions, Resiliency, Biodiversity, Eco-shoreline

Nature-based Solutions (NbS) address societal challenges through actions to protect, sustainably manage, and restore natural and modified ecosystems, benefiting people and nature at the same time. They target major challenges like climate change, disaster risk reduction, food and water security, biodiversity loss and human health, and are critical to sustainable development. Nature-based solutions have gained significant international attention in recent years, and there is concomitant growing interest in Hong Kong. However, local applications of NbS pose a number of challenges resulting from our unique climatic, environmental and urban development context. In this paper, we will examine critical NbS planning and design principles that can be adopted to successfully implement NbS in Hong Kong. Illustrated with local case-studies, we will demonstrate how NbS can contribute to resilience and sustainability in the built environment.

Section 2.1 Paper Title:

Hong Kong First's Zero-Carbon Chiller System at Nina Tower

Submitted by Ir Raymond Kwok[1], Ir David Chau[1], Mr. Tristan Shum[1], Ir Gigi Kam[2], Mr. Raphael Ng[2], Mr. Eric Chan[2], Mr. Philip Ho[2], Mr. Anson Lee[3], Ir Daphne Chan[3], Ir SC Yu[4], Mr. CY Lau[4]

Chinachem Group[1], CLPe[2], WSP (Asia) Limited[3], Young's Engineering Co., Limited[4]

ABSTRACT

Keywords:
Sustainability, Carbon Neutrality, Innovation, Energy Efficiency, Climate Change

As urban centers confront the pressing challenges of climate change and growing energy demands, innovative solutions are critical for a sustainable future. The First Zero-Carbon Chiller System Project at Nina Tower in Hong Kong exemplifies a transformative initiative that set a new benchmark for energy efficiency and carbon neutrality.

This project replaces 7 nos. of traditional air-cooled chiller plants, into an advanced watercooled system adopting HFO refrigerant with 6 nos. of water-cooled chiller plants. This transformation results in over 50% reduction in electricity consumption and reduces approximately 7,000 tonnes of carbon emissions annually, aligning with global decarbonization goals and the anticipated climate risk.

Central of this transformation is the integration of advanced technologies, including Vertical District Cooling System for enhanced reliability, Multi-trade integrated Mechanical, Electrical, and Plumbing (MiMEP) for streamlined execution, and Building Information Modelling (BIM) for improved project lifecycle management. The use of Digital Twins facilitates real-time monitoring and optimization ability via Artificial Intelligence, significantly enhancing energy saving and system resilience against climate impacts.

The project also underscores the importance of Green Electricity Certificates sourced from renewable energy by CLP' Yunnan Xundian II Wind Farm in Mainland China, ensuring the entire cooling system operates on zero-carbon principles. This initiative aligned with Climate Action Plan 2050, targeting substantial reductions in operational carbon intensity by 2030.

This paper will provide insights into the innovative design, implementation, and operational strategies that underscore this flagship project, showcasing how innovative engineering and strategic partnerships can drive meaningful advancements in urban sustainability and resilience. Through this pioneering initiative, we aim to inspire similar initiatives globally, demonstrating that smart, resilient, and sustainable built environments are not just aspirational but achievable goals for our cities. Looking ahead, we will continue to explore pathways to a sustainable future that prioritise both wellbeing and environmental integrity.

Section 2.2 Paper Title:

MiMEP from Inception to Operational

Submitted by Ir Dr Cliff KW Wong
China Bright MiMEP Limited

ABSTRACT

Keywords:
MiMEP, Off-site Prefabrication, Modularisation, BIM, Factory Production, AI Robotics, TDC Ductwork, VR & 3D Scanning, Aeroseal Technology, Ductwork Re-born

Over the past 30 years, the concept of off-site prefabrication of Building services product leading to the current MiMEP is raising the industry bar at a higher level in term of cost, time, quality and safety. Any project, to support its operation and sustainable development, an extensive appraisal on modularisation assessment, concept selection and strategy development, and modularisation definition, project delivery and execution planning is of essence.

The process involves BIM, preparation of shop drawing & factory manufacture drawing, design for operation & maintenance, production work stream, quality control, logistic plan and on site installation. MiMEP to manufacture the E&M works as far as possible in the factory such as ductwork & pipework module complete with the thermal insulation, cladding, labelling & lettering. Adoption of AI robot can also minimize the dependent of labour force in elsewhere of the world. Automated machine e.g. manufacture of "TDC" ductwork, robotic arm welding & laser cutting, ground tank for delivery … etc. to assure its productivity and workmanship . Application of VR and 3D scanner (showmanship device) to verify the design against actual works sounds an essential tool for quality control.

This paper contains many factory production photos and product photos in supporting the actual process flow from inception up to final installation, pro and cons findings and my observation will be shared in the Symposium.

Beside MiMEP, I will introduce an innovative way for Ductwork Re-born, any installed ductwork with serious leakage in particular pipe duct and ceiling void, remedial work by removing the false ceiling and open up pipe duct is of expensive cost. The application of "Aeroseal" technology by injection of sealant into leaked ductwork to fix the leakage problem by 90% to the save the fan power energy and air-conditioning enthalpy will be effective in term of cost and time.

Section 2.3 Paper Title:

Innovative Case Studies in Action: Implementing Wellbeing and Decarbonization Strategies from Design to Operation

Submitted by Ir Dr. Leonard K. H. Chow, Ms. Killary S. C. Lui, Mr. Roger H.C. Mak
Asia Pacific Rim Development of AEE, ISPL Consulting Ltd

ABSTRACT

Keywords:
wellbeing, decarbonization, sustainable design, NGO sustainability, financial sector Sustainability

This research examines the integration of wellbeing and decarbonization strategies in Hong Kong's built environment through two distinctive case studies: the Hong Kong Young Women's Christian Association (YWCA) and the Bank of Communications (BOCOM). The study establishes sectorspecific baselines through analysis of three NGOs and three financial institutions, providing a comparative framework for evaluating innovative approaches. The YWCA's comprehensive decarbonization program across six properties demonstrates projected energy savings of 17-22%, while BOCOM's branch renovation project achieves 25-35% energy reduction through integrated sustainable design. Both cases illustrate how early design integration, smart building technologies, and systematic performance monitoring can simultaneously advance environmental and occupant wellbeing objectives. The research reveals that specialized organizational contexts present unique opportunities and constraints for sustainability implementation, requiring tailored approaches that differ from conventional commercial buildings. Findings indicate that wellbeing and decarbonization strategies create synergistic benefits when implemented holistically throughout the building lifecycle, offering valuable insights for similar organizations seeking to advance sustainability goals.

Section 3.1 Paper Title:

Revitalisation for a Smart and Green Future: ATAL Tower

Submitted by
ATAL Building Services Engineering Ltd

ABSTRACT

Keywords:
ATAL Tower, Revitalisation, Intelligent Green Facility, Advanced Technologies, Innovative Design, Sustainability, Design Objectives, Technological Innovations, Operational Efficiencies, Community Impact

This paper provides an extensive analysis of the revitalisation of ATAL Tower. The transformation from a traditional industrial building into a state-of-the-art intelligent green facility exemplifies effective integration of advanced technologies, innovative design principles, and a commitment to sustainability. This paper explores the design objectives, technological innovations, operational efficiencies, and the broader impact of the project on the community and environment.

Section 3.2 Paper Title:

Building Optimization Transformation: Real time Monitoring-based Commissioning Platform to Drive Operational Efficiency

Submitted by Ir Dr. Cary Chan, MH, JP, Ir Barry Lau, Ir Dr. Chun-Sing Wong, Ir Patrick Huang
ASHRAE Hong Kong Chapter

ABSTRACT

Keywords:
Building optimization, retro-commissioning, retrofitting, artificial intelligence, energy efficiency, real time monitoring-based commissioning platform

To improve building energy efficiency, there are typically two main methods, one being retrofitting, where less-efficient equipment replaced by higher efficiency one for performance enhancement and/or its lifespan extension. The second being retro-commissioning, which is a data-driven approach to optimize the existing equipment and system performance via data analytics to meet operational needs and achieve higher efficiency. However, both these methods are periodic in nature, where equipment replacement is a one-off action, while retro commissioning is labor intensive and may only be carried out every few years or after major operational changes. Thus, in between carrying out these works, the building may have been operating inefficiently, leading to higher energy consumption.

To further drive building energy efficiency, a digital platform of real-time monitoring-based commissioning is recommended to continuously monitor operational data and provide actionable insights to enhance operational efficiency. Artificial intelligence (AI) with machine learning can be integrated into the platform to realize optimization of chiller plant operation more effectively. Data quality would be of utmost importance to sufficiently monitor and provide suggestions. However, to realize the full potential of the platform, it is important to integrate domain knowledge and experience gained from retrofitting and retro-commissioning works into the platform. This can help build the platform to provide precise suggestions and to ensure that the dataset used to train the AI models are of good quality. The platform enables to monitor major key performance indicators (KPIs) such as energy use intensity (EUI), equipment and system efficiency, approach temperature, and others. The platform, through its AI, is also able to provide real-time optimized control suggestions to the chiller plant.

By thorough consideration of the whole process of building optimization transformation, i.e. implementation of retro-commissioning and retrofitting with real-time monitoring-based commissioning platform, the building operation can always be kept consistently at the highest energy efficiency to achieve carbon neutrality.

Section 3.3 Paper Title:

A Case Study of the First R-1234ze(E) Low-GWP HFO Air-cooled Chiller at a Public Hospital in Hong Kong

Submitted by P. L. Yuen [1], Y. Y. Wong [2], H. N. Chen [2], W. K. Wan [2], Y. C. Wong [2], K.T. Cheuk [3], J. Y. Bao [3]
Hospital Authority [1], Electrical and Mechanical Services Department [2], Trane Hong Kong [3]

ABSTRACT

Keywords:
HFO, R-1234ze(E), Low-GWP refrigerants, A2L, Green solutions

To meet the requirements of the Kigali Amendment and support the global transition from hydrofluorocarbons (HFC) to hydrofluoroolefins (HFO) refrigerants, the use of low global warming potential (GWP) refrigerants in chillers in Hong Kong was explored. This initiative aligns with the government green strategy to achieve carbon neutrality and improving building energy efficiency. R-1234ze(E), a refrigerant with characteristics comparable to conventional HFC refrigerants, is considered as a promising alternative due to its ultra-low GWP (=7), zero ozone depletion potential (ODP), short atmospheric lifetime, and high efficiency. However, its A2L flammability classification presents challenges for applications in Hong Kong.

This paper evaluates the safety of R-1234ze(E) through the implementation of holistic safety provisions in chiller plant design, using a case study of the first pilot trial chiller retrofit project at a local hospital. In addition, this case study provides a comprehensive evaluation of the operational performance, energy efficiency, environmental benefits and economic advantage of low-GWP chiller applications in Hong Kong. The findings indicate that R-1234ze(E) air-cooled chillers offer an energy-efficient and environmentally sustainable solution for retrofitting traditional HFC chillers. Based on these results, the paper further highlights the potential for wider adoption of R-1234ze(E) chillers in Hong Kong.

Section 4.1 Paper Title:

Climate Adaptation: from Science to Engineering

Submitted by H. Wong [1], I. Liu [1], J. Leung [1], J. Chan [1,2], G. Ren [1], J. Wang [1], B. Chong [1]
Arup Climate and Sustainability [1], City University of Hong Kong [2]

ABSTRACT

Keywords:
Climate Adaptation, Resilience, Resilience Engineering

Climate change has introduced unprecedented challenges to the built environment, particularly in East and Southeast Asia, where extreme weather events such as typhoons and intense rainfall are becoming more frequent and severe. These phenomena pose significant risks to the operation and integrity of infrastructure, necessitating a paradigm shift in the way buildings and systems are designed and managed. In parallel, regulatory frameworks are evolving, with new climate-related disclosure requirements taking effect from 1 January 2025 under Part D of the ESG Reporting Code. These requirements align closely with the IFRS S2 Climate-related Disclosures issued by the International Sustainability Standards Board (ISSB), underscoring the urgent need for integrating climate projections into engineering practices and corporate operations.

This paper addresses the critical knowledge gap between climate science and engineering application. It emphasizes that reliance on historical climate data is insufficient for future planning, and instead, a scientific understanding of climate systems, such as precipitation dynamics and temperature shifts, is essential. Furthermore, the misinterpretation of climate data, particularly regarding time horizons and engineering relevance, remains a major barrier.

The paper explores an end-to-end approach to climate adaptation, beginning with the interpretation of regional climate models. It discusses the selection of appropriate climate models, ensemble analysis, and the use of downscaling techniques to derive localized projections. The correction of biases in model outputs is also examined, ensuring that climate projections are robust and actionable.

On the engineering end, the paper delves into resilience-oriented design strategies. It outlines methodologies for hazard and exposure assessments, resilience design reviews, and the integration of climate data into multidisciplinary engineering processes. By connecting climate science with practical engineering solutions, the study aims to enhance climate resilience in infrastructure development and operational planning across the region.

Section 4.2 Paper Title:

Practical Explorations of AI for Smart Control of Chiller Plants

Submitted by Xiao Wang[1], Ye Zhang[1], Jean Qin[2], Ye Liu[1], Barry Lau[2], Xuyuan Kang[1], and Da Yan[1]
Tsinghua University Building Energy Research Center[1], Swire Properties Limited[2]

ABSTRACT

Keywords:
Chiller plant, Smart control, Load prediction, AI, On-site implementation

Energy management of chiller plant is vital to decarbonization. Optimal control methods of rule-based control and model predictive control are frequently implemented for chiller plants, but the control performance still has potentials of improvement. The emerging artificial intelligence (AI) technologies bring promising potential for further improvement on energy efficiency of chiller plants. However, few studies have implemented AI in practical control of chiller plants. Therefore, this study aims to implement AI technologies for smart control of chiller plants on site to further improve the energy and cost efficiency of chiller plants. This study proposed a cooling load prediction-based control framework for chiller plants using various AI technologies. A hardware of AI controller was developed for convenient implementation of the proposed control framework. Comparative experimentations were conducted to evaluate the performance of the developed AI controller. The proposed AI controller was deployed in two real cases of large chiller plants. For a chiller plant with an ice-based thermal energy storage system in Beijing, the experiment result showed a cost reduction rate of 7.6% by AI controller compared to a fixed schedule. For a cooling system of a chiller plant in Guangzhou, the AI controller was tested and to have an energy reduction rate of 8.1% compared to a rule-based control. AI technologies were validated to be promising for further improvements on the energy and cost efficiencies of chiller plants in real-world implementations. Further studies will keep on conducting more on-site implementations in real cases of chiller plants.

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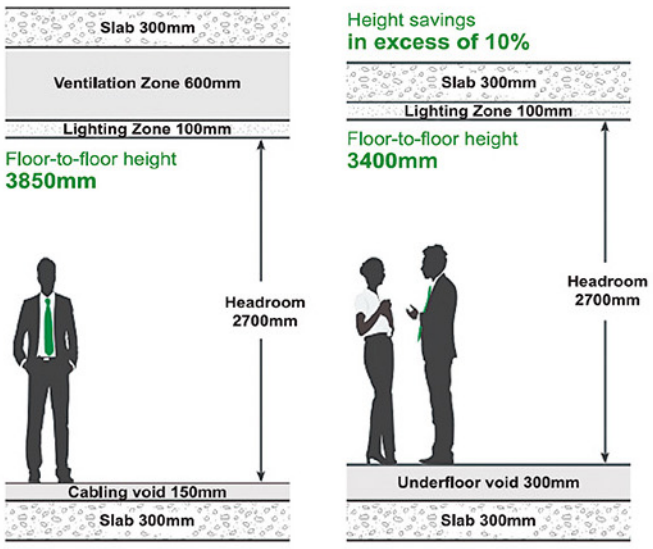

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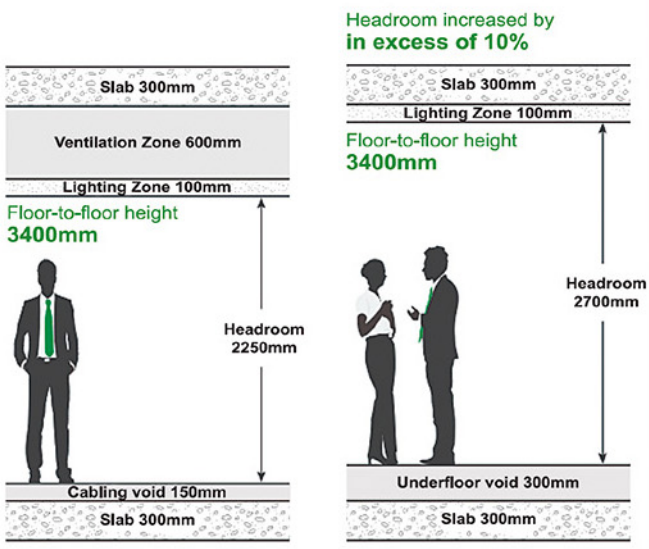

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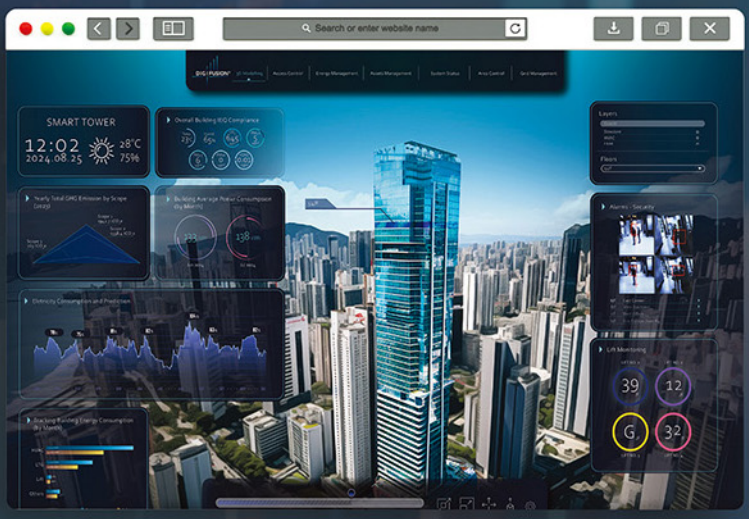

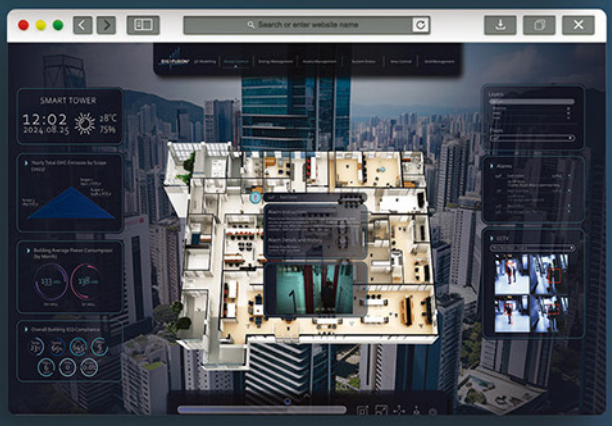

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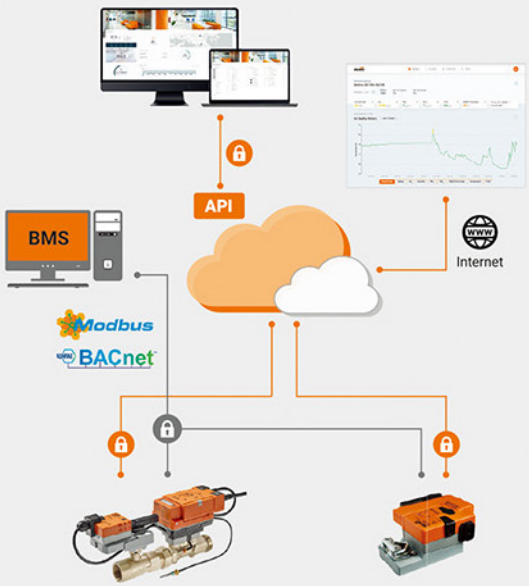

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* Subject to the selected model

BACnet CAN Bus

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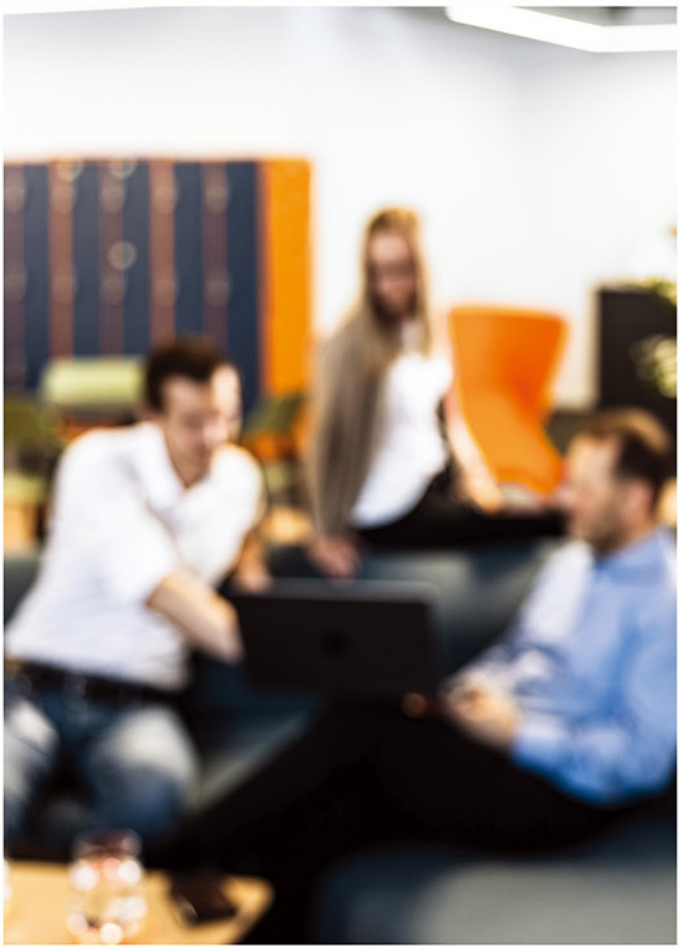

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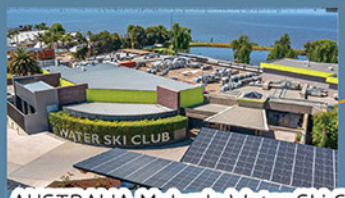

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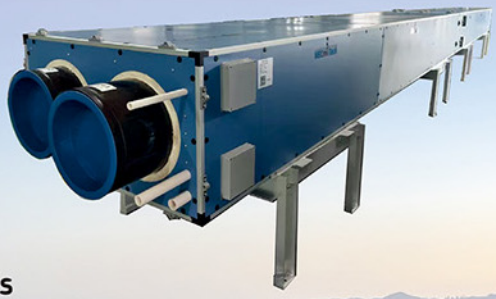

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中電致力支持政府計劃於2050年前達致碳中和的目標。為全力協助工商客戶向可持續發展邁進並實踐低碳節能模式，中電提供各種節能方案和可再生能源項目，其中包括能源審核服務、可再生能源證書和能源數據專家等。

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Details 了解更多

CLP 中電

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節能設備升級計劃

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Provides Subsidies for Business Customers to Replace Electrical Equipment with More Energy-efficient models
資助工商客戶更換或添置具更高能源效益的設備

Details
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Eligible Electrical Equipment 合資格節能設備

LED light bulbs / downlights LED 燈膽/筒燈	LED tubes / light strips / panel lights^ LED光管/燈帶/燈盤^	Air-conditioner with Grade 1 energy label under the Mandatory Energy Efficiency Labelling System (MEELS)+ 一級能源標籤冷氣機 (獨立式/分體式)+	Highly energy efficient air-conditioning system not covered by MEELS 非《強制性能源效益標籤計劃》的高能源效益冷氣系統	Other equipment with energy-saving features such as variable speed drives, inverters, heat recovery systems, or equivalent technologies 具有節能成效的裝置 (如變速器、逆變器、熱回收系統或同類型的技術等)

Note: CLP Power has not authorised, appointed, or partnered with any intermediary companies or vendors to sell or install eligible products under the Electrical Equipment Upgrade Scheme (EEUS). Applicants are free to choose their own vendor to buy eligible products under the scheme. Application guidelines will be updated by CLP from time to time.

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Details
計劃詳情

*Subject to terms and conditions. Please visit the CLP website for more details.

^The length of LED tubes and LED panel lights should be 60cm or above and the length of LED light strips should be 1 metre or above.

+Registered with the Mandatory Energy Efficiency Labelling System announced by the Electrical and Mechanical Services Department of the Hong Kong SAR Government.

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^LED光管及燈盤長度為60厘米或以上，燈帶長度為1米以上。

+型號只限已登記於機電工程署公布之《強制性能源效益標籤計劃》內的《表列型號記錄冊》。

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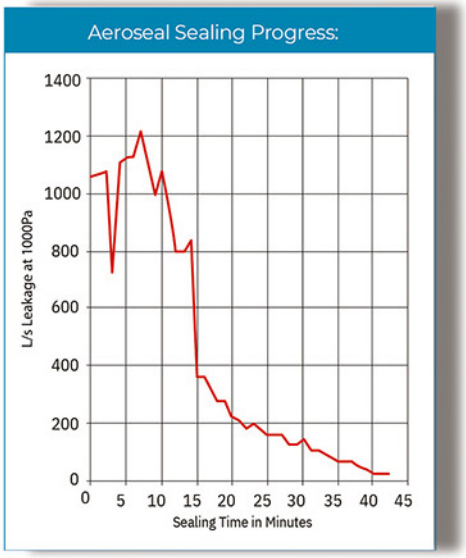

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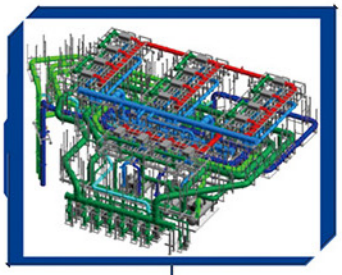

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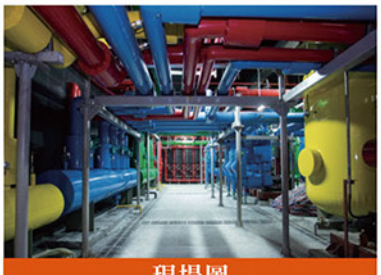
啟德1E1公屋地盤（樂啟軒）
澳洲悉尼Herring Road學生公寓項目
海口美蘭國際機場
廣州地鐵11/12/13/14/22號線


模型圖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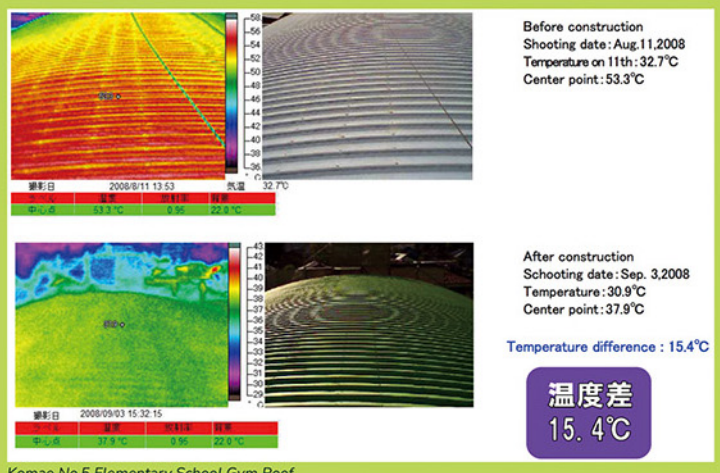

Komae No.5 Elementary School Gym Roof

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Email: info@fseng.com.hk
Website: www.fseng.com.hk

McQuay International

Breathing ESG into Every Space

Trusted by Government, Healthcare, & Commercial Facilities Across Hong Kong

Since 1872, McQuay engineers HVAC excellence beyond temperature control, actively contributing to:

ENVIRONMENTAL STEWARDSHIP
McQuay HVAC systems delivering higher energy efficiency

SOCIAL RESPONSIBILITY
Hospital-grade IAQ protecting 50+ medical facilities

GOVERNANCE EXCELLENCE
EUROVENT & AHRI CERTIFIED PERFORMANCE across global manufacturing hubs

APPLIED PRODUCTS

VFD Total Energy Heat Pump

Air-cooled VFD Screw Chiller

AAF Air Handling Unit

Water-cooled Centrifugal Chiller with HFO Refrigerant

AAF Air Filter

VRF SYSTEM

VRF Outdoor Unit

Cassette Unit

Wall Mounted Unit

Jet Diffusing Unit

Ducted Unit

McQuay Air-conditioning Ltd.

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商界展關懷 caringcompany 2020-24
Awarded by The Hong Kong Council of Social Service 香港社會服務聯會頒發

AAF INTERNATIONAL

NANOFIL
Breathe Freely

Hong Kong R&D Achievements Invention Patents Quality Assurance

LOW ENERGY AIR FILTER

2022 HONG KONG GREEN INNOVATIONS AWARDS
CERTIFICATE OF MERIT

GREEN BUILDING AWARD 2023
BUILDING PRODUCTS & TECHNOLOGIES CATEGORY
GRAND AWARD

WORKS WITH WELL

NANOFIL MINI-PLEATED PANEL SERIES
ALIGN WITH SPECIFIC REQUIREMENTS IN THE
WELL BUILDING STANDARD (V2)

BENEFITS TO OUR CLIENTS TIL AUG 2025

ANNUAL ENERGY SAVING:
3,891,552 KWH

ANNUAL CO_2 REDUCTION:
1.52 MILLION KG

ANNUAL FILTER WASTE REDUCTION: 13,819 UNITS

TOTAL COST REDUCTION (TCO):
HK$8.34 MILLION

FREE IAQ measurement

Please email us at info@nanofil.com.hk for FREE IAQ measurement or consultation on energy saving by Low Energy Air Filter.

CLP
Eco Building Fund
The subsidy amount has been increased from $0.9/kWh to $1.0/kWh energy saving

Nanofil Filtration Technology Limited
Unit C & D, 6/F, Tsuen Tung Factory Building, 38-40 Chai Wan Kok Street, Tsuen Wan, N.T., Hong Kong
(852) 3708 1838 (852) 3956 2372 +852 6273 0573
info@nanofil.com.hk www.nanofil.com.hk
www.nanofil.com.hk

Oxprime (International) Limited
鑫輝(國際)有限公司

ARMSTRONG

Canada / PRC

Products:
Armstrong Split-coupled Vertical In-line Pump w/ Integrated VFD & Control

Descriptions:
Armstrong has the best commercial HVAC pump design since 1969. Life cycle value at every turn

Installation
Integral components of the pipework
Eliminate:
- Inertial base
- Spring vibration isolator
- Flexible pipe connector
- Field grounting
- Alignment

Space
Greatest floor space savings result from less piping and accessories

Maintenance
Split spacer couples design allow easy mechanical seal replacement

Reliability
Quiet and long-lasting pump operation
- No pump bearing to be serviced
- Minimal operating vibration
- Weatherproofing

Armstong VIL pump coin test

Mechanical Seal Change

PRODUCTS THAT SUSTAIN THE WORLD

OXPRIME is not only a significant supplier of **HVAC** equipment but also a sole distributor of **ESG**-aligned manufacturers which have improved the world through innovative and sustainable solutions.

www.oxprime.com

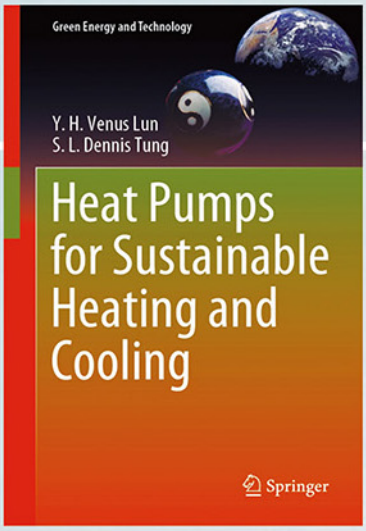
45 Years ANNIVERSARY

SustainE

TO SHARE OUR KNOWLEDGE
WE HAVE PUBLISHED THE BOOK:

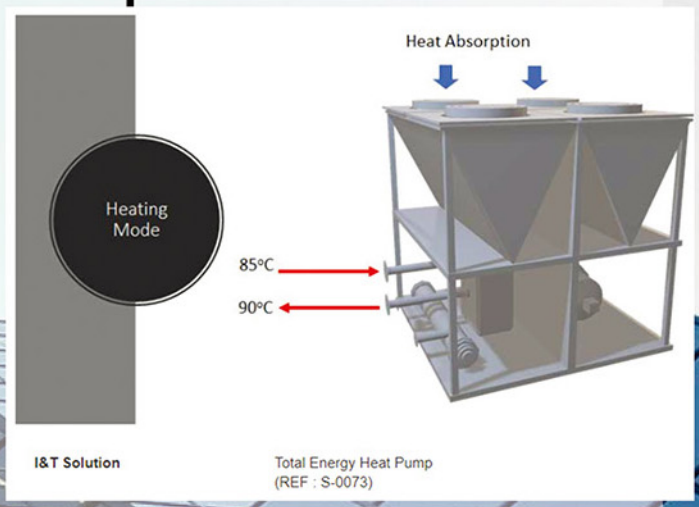
HEAT PUMPS FOR SUSTAINABLE HEATING AND COOLING

www.sustaine.com.hk



Total Energy Heat Pump

- R513a Refrigerant - Low GWP
- HWR up to 85C operation
- Dual Circuit Operation
- Reduce plant space:
  - By combing air source and water source heat pump
  - Equipment accessories, i.e. circulation pumps, valves & strainers



- IoT monitoring on equipment performance & BMS integration
- DLRI - IoT monitoring project by enjoy tax reductions

- Optional: Double wall heat exchanger to minimise plate heat exchanger system, circulation pumps and accessories

Contact us now:
info@sustaine.com.hk
23708300 / 90270632

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Queensway Government Offices Project By Trane-EMSD-HKGBC

Honored with Three ASHRAE Awards

32.8% of energy savings

900 tonnes of CO_2e reduction per year

green building award 2019 環保建築大獎

Grand Award

PLATINUM

CIC GREEN
PRODUCT CERTIFICATION
CICGPC-L-22256(Chi)

Trane® CenTraVac® Chillers @HFO R514A

Trane Hong Kong

Tel.: (852) 3128 4711 E-mail: thk@jec.com Website: www.tranehk.com

TRANE TECHNOLOGIES

Note

ORGANIZING INSTITUTIONS AND UNIVERSITY

ASHRAE Hong Kong Chapter

CIBSE Hong Kong

HKIE THE HONG KONG INSTITUTION OF ENGINEERS 香港工程師學會 | BUILDING SERVICES DIVISION 屋宇裝備分部

THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學

Department of Building Environment and Energy Engineering 建築環境及能源工程學系