BUSINESS ENVIRONMENT COUNCIL
商界環保協會

Accelerating Hong Kong's Net-zero Transition through Digitalisation

A document collection of replicable cases

First edition – October 2023

Contents

Introduction

1.1 Digitalisation for Decarbonisation

Digitalisation describes the use or implementation of digital technologies (which could include sensors, remote or cloud-based data storage, smart analytics, and devices) into systems or infrastructure to create changes to a business model or offer further positive opportunities.

Digital solutions can contribute to the reduction of carbon emissions and enhancing operational efficiency across various industries. For instance, digital technologies can offer significant opportunities if deployed across sectors including buildings, transportation, power and utilities, agriculture and heavy industry. While the uptake of digital solutions was already growing at a steady rate before the pandemic, the last few years have compounded the importance of adopting digital solutions.

Thus, the role and importance of digitalisation is being increasingly recognised as a means of enabling decarbonisation both locally and globally – and thus, can play a significant role in Hong Kong's transition to a low-carbon economy.

1.2 Relevance to the Hong Kong Context

In Hong Kong, electricity generation has continued to represent the largest source of the city's emissions since 2020, representing approximately 60.4% of the Hong Kong's total emissions. This was followed by the transport sector, which made up 19.7% of emissions and waste management with 8.7%. Buildings account for around 90% of electricity consumption. This majority highlights a key area of opportunity for improvement while accelerating the transition to a low-carbon economy.

From a top-down perspective, the HK SAR Government released the Hong Kong Climate Action Plan 2050 ("CAP2050") in 2021, which outlines its ambitions to achieve carbon neutrality by 2050 and outlines the city's decarbonisation roadmap. The publication introduces a vision for "Zero-carbon Emissions, Liveable City, Sustainable Development" and highlights four major decarbonisation strategies, namely *net-zero electricity generation*, *energy saving and green buildings*, *green transport* and *waste reduction* as key pillars to facilitate achieving carbon neutrality based on Hong Kong's industry landscape and emissions-dominant sectors.

Long-term and medium-term targets are outlined based on the four core pillars of the decarbonisation strategy. Under energy saving and green buildings, the long-term target states a commitment to reduce the electricity consumption of commercial buildings by 30% to 40%, and that of residential buildings by 20% to 30% by 2050, followed by an interim target to decrease the electricity consumption of commercial buildings by 15% to 20% and that of residential buildings by 10% to 20% by 2035. Under the waste reduction pillar, the medium-term target states enhanced waste reduction and recycling to achieve a long-term goal of reaching carbon neutrality in waste management.

Adopting digital solutions can support the emissions reduction of these sectors by generally enabling operations to be smarter, more efficient and more connected, supporting reduced sectoral emissions across the city.

The Government's recently released 2023 Policy Address emphasised its commitment to accelerate the development of a digital economy across Hong Kong. The address noted intentions to launch 110 new digital Government and smart city initiatives between 2024 to 2025 facilitated by technologies including blockchain technology, artificial intelligence and video analytics.

As such, digitalisation also has a role to play in supporting smart city development to address urbanisation challenges, improve the quality of life for citizens and maintain competitiveness while ensuring sustainable growth. Since 2017, the Government has published two versions of its Smart City Blueprint, with the revised edition of Hong Kong Smart City Blueprint 2.0 released in 2020 expanding to include 140+ initiatives aligning with six Smart City areas it aims to address. To explore how the Government can work with the wider community to accelerate the adoption of smart city initiatives, BEC conducted a research project, *Smart and Sustainable City Development: Hong Kong and International Experiences*, and published its findings in a publication in July 2022.

1.3 Taskforce on Digitalisation

Business Environment Council ("BEC")'s Sustainable Living Environment Advisory Group is taking a step forward to facilitate business sectors in exploring digital solutions to forge a more sustainable Hong Kong, strengthen capacity building and knowledge exchange among BEC members and the broader local business community. To incubate this continuous effort, a taskforce was formed comprising of 18 members from companies considered to be industry leaders with expertise in such areas.

The taskforce was established in the 2022/2023 calendar year and subsequent meetings have seen taskforce members guide and discuss the project's key outcomes and deliverables, conduct stakeholder interviews with demand-side and supply-side companies to obtain insights on existing under-utilised digital solutions in the market. These insights supported the compilation of business cases for further engagement from BEC's P&R team.

The main stakeholders of the taskforce include companies representing the supply and demand side of digital solutions, as well as companies that can facilitate the matching of digital solutions. The taskforce members represent related sectors including property service providers, EV charging providers, land developers, telecommunication companies and automation companies.

1.4 Project Objectives

The overarching goal of this project is to encourage greater adoption and implementation of existing digitalisation and digital solutions in the market in Hong Kong. The business cases presented in this publication will serve to promote digital solutions in local business sectors that may be under-utilised, which can positively support local emission reduction and energy efficiency, green building, green transportation, and waste reduction in Hong Kong. The cases will also identify the mechanisms needed to bridge the utilisation gap between the supply and demand side, and share best practices with the wider business community.

So far, BEC's P&R team has collected and produced case studies of five replicable business cases showcased in this publication. However, additional case study submissions have already been received from interested solution provider companies. Taking this into consideration alongside interest from demand-side users, BEC intends to keep adding to this publication continually. In a sense, this publication will serve as a live document which will see multiple revisions published to showcase the growing collection of cases. BEC intends to incorporate future cases offering a wide representation of solutions in alignment with the key pillars of CAP2050, such as ensuring solutions aligned with the pillar of "Green Transport" are included.

Case study	Pillar of CAP2050
Centralised Remote Energy Monitoring	Green Buildings
Utilising AI to Optimise Data Centre Cooling	Energy Savings and Efficiency
Optimising Data Centre White Space Cooling	Energy Savings and Efficiency
Platform to Access Live Waste Intelligence	Waste Reduction
Cloud-based Smart Energy Management	Green Buildings

Figure 1: Case collection and relevant CAP2050 pillars (first edition – Oct 2023)

Centralised Remote Energy Monitoring

Green Buildings

2.1 Case Study: Enabling centralised energy monitoring to improve building energy efficiency and footprint through a cloud-based platform

Snapshot

In Hong Kong, the building sector accounts for a significant portion of the city's total electricity consumption and carries over half of the city's annual CO_2 emissions each year. Increasing energy efficiency across the building sector will become more important in coming years given Hong Kong's 2050 carbon neutrality target. At the same time, stakeholders in both the public and private space have been pushing for a wider adoption of energy-saving measures across the industry.

As such, improving the operational energy efficiency in buildings forms a valuable area of opportunity to accelerate decarbonisation efforts. Utilising emerging and innovative technologies can help facility managers do this – such as implementing a centralised management platform to monitor and analyse a building's energy consumption.

This cloud-based platform can support green buildings to improve energy saving and energy efficiency, alongside facilitating and optimising energy management.

Technology attributes:

- Delivering reduced CO_2 emissions
- Providing greener, smarter and healthier buildings for tenants
- Multiple savings on energy, time, resources, finances and labour
- Optimised processes
- Enabling efficient and automated data gathering and management

Figure 2: Key features of this digital solution

A summary of the digital solution offering

The infrastructure of the digital solution includes hardware and connected products; software for different controls; remote analytics and a cloud-based platform, which work together to offer insights and advice to customers regarding energy consumption and management.

One of these components is hardware and connectable products, such as wireless energy sensors. The solution company's most popular wireless energy sensor is known as PowerTag, which utilises wireless Zigbee technology. This wireless technology offers several key features:

Wide-ranging storage – Despite alternatives such as LoRa (which stands for Long Range) offering advantages such as long-distance wireless transmissions, wireless transmission technologies can only store data about limited parameters. In comparison, PowerTag can store all the basic requirements, such as current, voltage, energy, power, or even voltage loss alarms. PowerTag offers a wide range of capacities varying from 63M to 2500M under wireless metering, which means these products can achieve the highest and most efficient energy label.

Space-saving – Wireless energy sensors do not require significant space for installation and therefore can offer a solution to spaces which are limited in size, which is favourable for places such as Hong Kong. Other parts of infrastructure including meters and gateways can be connected to the wireless equipment, enabling the data to be transmitted to the cloud platform.

Affordable and deployable – The sensor is cheap, quick and easy to install, without requiring a physical wire infrastructure to be set up. The start-to-end process of setting up the wireless technology across ten sites would take just six months.

As the number of off-the-shelf and user-friendly energy usage monitoring tools increases, the platform offers an easy-to-understand dashboard for users and visualises and breaks down clients' energy usage, which increases awareness in identifying energy-saving opportunities.

The dashboard is customisable and customers can elect which features they want to be displayed. The remote and cloud-based nature of the platform enables more dynamic communication of data with real-time updates, which would be lacking if the structure was solely comprised of physical hardware products. Cloud-based platforms can gather and analyse quantitative data measured by the equipment and provide recommended actions to clients to support increased energy efficiency and savings.

The Digitalisation Process: Implementation

The equipment for the solution is available in varying capacities, including the simplest version of 63M, ranging to 160M, 250M, 630M, and 1000M-2500M. The equipment and gateways are available in different styles.

The process of setting up involves physical site visits (of which there are 10 existing across Hong Kong) to install electric meters and gateways. This will enable continuous communication between electric meters and the gateway to upload information. Following this, 4G modems equipped with SIM cards are connected to the cloud monitoring platform to link the site sensors to the platform.

Non-wireless installation option – Sometimes the solution will be installed in a building which already has existing wired electric meters that may have previously been provided by distributors. In this case, these can be directly connected to the solution's gateways and linked up to the platform to perform the same analysis and functions.

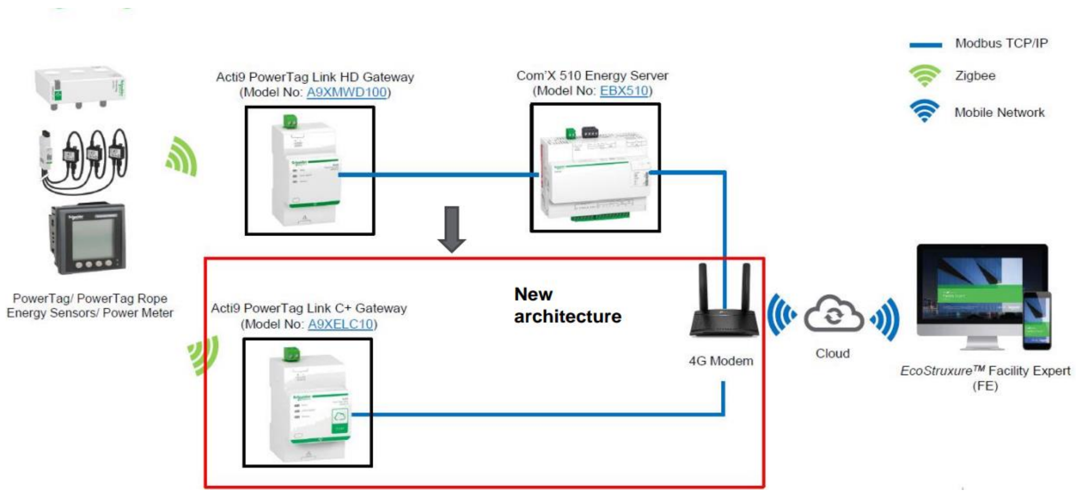


Figure 3: Solution company's energy monitoring system infrastructure of hardware and connected products

Key challenges or limitations encountered:

Cybersecurity has been the main challenge encountered during the implementation phase of this solution. To reduce the risk of this challenge occurring, the solution company operates using its network and cloud. All products will also fulfil an Operational Technology-related cyber security standard known as IEC 62443. The company also has a dedicated cyber security management platform that will communicate any cyber security issues and recommend corrective actions to customers.

Timeframe – The deployment time of this solution can take longer than initially anticipated if unexpected factors occur, such as if customers are waiting on approval to prepare the venue for installation, or if customer facilities are not ready for the installation of Internet of Things technologies, which can create a delayed starting point of implementation. On the other hand, depending on the client's needs, there can be pressure to complete the installation of the digital solution in a short period. For instance, there was an extremely tight timeframe to complete the installation of six sites across Hong Kong by the end of 2021 for one customer.

Cross-border synchronisation – Some clients would like to access information regarding their energy consumption on the same platform across different areas, such as across both Hong Kong and China. Syncing the cloud-based platform across different geographic locations will involve more discussion around logistical and technical challenges. To address this, the company can offer special arrangements and specific platform functions. For example, there were substantial challenges faced and lessons learned regarding cross-border synchronisation to install the solution across various sites for a customer, which were located across six cities.

Ageing electric meters – Many clients have aged electric meters at certain venues, which can be difficult to upgrade. This can be addressed by using wireless electric meters, which are small and do not take up much space. The wireless nature of these meters also means they can also be stored in another room or area of the site. To address this, the provider company aims to visit each site at least once, depending on time constraints, and plan contingency services or plans to upgrade meters or install wireless ones.

Global supply chain – Depending on the global market and supply chain disruptions, material shortages can pose a challenge for this solution in the short term in terms of equipment production. However, according to the solution company, the global supply chain is expected to stabilise in the medium-to-long term.

Scalability and Adaptability: Why should this case be replicated in Hong Kong?

Based on the company's experience, clients have varying opinions about this digital solution. Those who are more inclined to adopt a cloud-based platform, such as the government, may have already adopted different cloud platforms for use cases such as displays stating solar energy usage in modern government housing estates.

Meanwhile, others such as land developers hold a more traditional mindset and may be less willing to integrate centralised and cloud-based platforms for energy management. Land developers in Hong Kong have given feedback that their biggest challenge lies in the willingness and cooperation with tenants to reduce emissions and recognise the importance of improving energy efficiency to address the energy footprint of a building. Tenants have noted to the company that providing comparisons about energy usage levels are important for customers to have a better understanding of what the numbers around energy consumption mean, which could allow for higher engagement from customers and uptake.

More broadly, it depends on the organisation's structure and how much value the company places on improving sustainability. The organisational culture of a company is important – if sustainability efforts are driven internally, there will be a higher requirement to improve these measurements and therefore more demand for similar solutions to enable this.

Easy deployment – The solution is simple to install and retrofit, making it an easy solution to replicate. According to the company, by promoting ease of application such as being handy off the shelf and simple to deploy, the uptake of this solution is expected to increase.

Benefits of the digital solution

The uptake of this digital solution can offer reduced CO_2 emissions; better energy monitoring and information that can prove valuable to a company's internal sustainability strategy or in response to Government policies; improved resource allocation and energy usage visualisation. It can also offer:

Savings on costs, time and labour – The digital platform can aid savings on IT equipment investments as well as manual labour and time. For instance, if there is any kind of update required, responsibilities for maintenance or repairs will be shifted to the provider company, meaning a company can save time and labour from internal employees on this. This can help customers save on both capital expenditure and operating expenses and as a result, save costs.

Return on Investment – Energy-saving projects will increase energy efficiency. Besides this, automated meter reading can further save time, reduce labour and increase the accuracy of data by reducing the margin for human error when collecting and recording data. Monetary returns will depend on the energy consumption of the customer, as larger companies will be more likely to have higher returns due to a higher overall energy footprint.

Improved efficiency – The digital solution can help clients achieve higher operational efficiency as it supports customers to have a better understanding of their energy usage. The smart meters can calculate energy usage by each tenant, or by a group of tenants, rather than a general whole number for the floor or building. The platform can also be configured to group certain tenants by category for meaningful comparisons or to create a benchmark.

Further reading

The Hong Kong Polytechnic University's Research Institute for Smart Energy, Smart Buildings and Smart Energy Systems. Available from: Link.

Foresight Climate & Energy, Decarbonisation through Digitalisation: The key role of smart city districts in boosting energy efficiency (September 2022). Available from: Link.

IEA, Energy efficiency and digitalization (June 2019). Available from: Link.

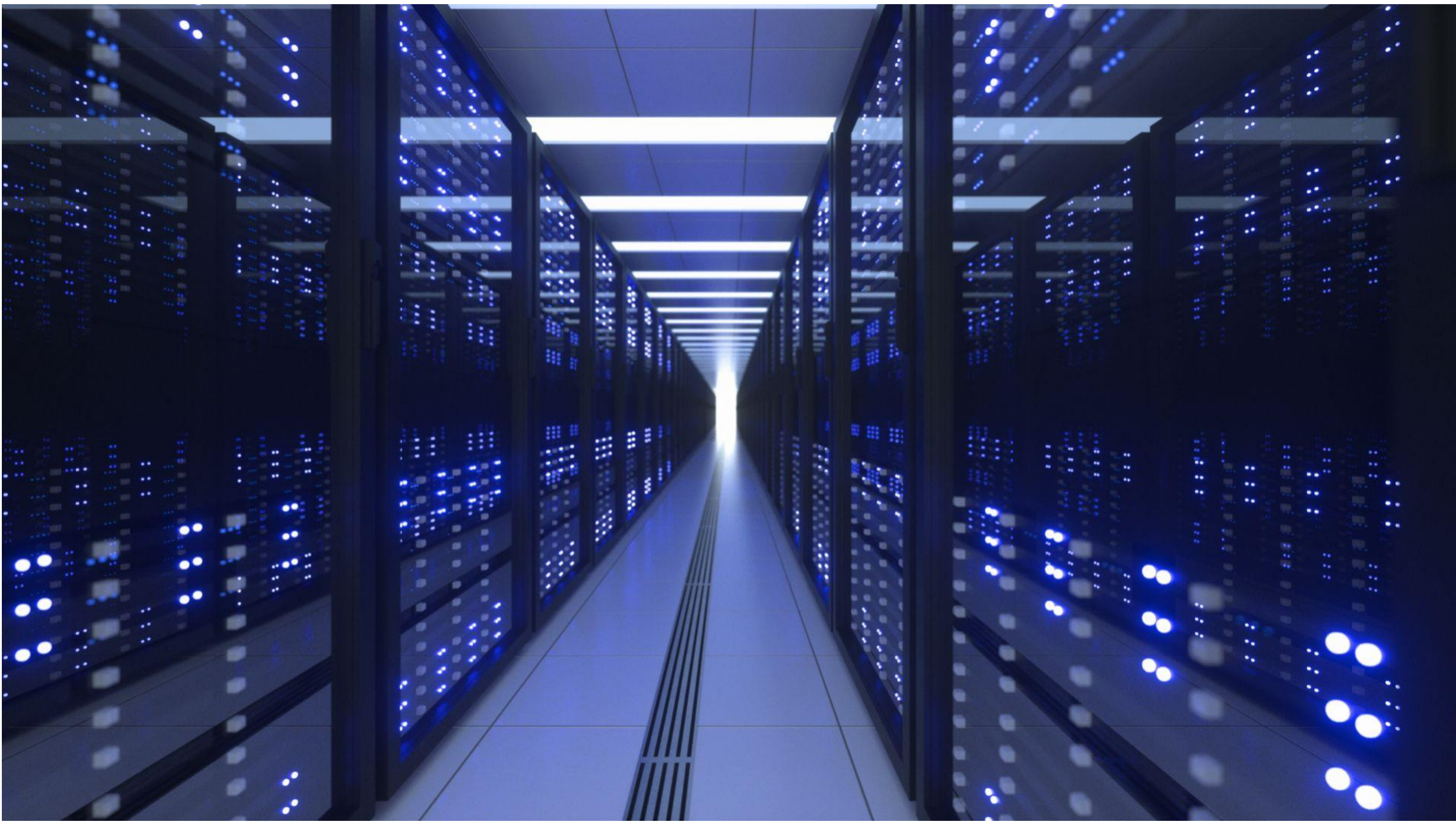
Takeaways and lessons learned

Planning is very important, particularly around the schedule of implementation. Creating contingency plans is also recommended, particularly if there are specific obstacles that can be foreseen. For example, preparing resources and equipment in advance if there is a high likelihood of upcoming materials shortages. Ensuring good cross-team communication and managing and keeping track of progress should be emphasised.

"Simple energy management for sustainable building."

Utilising AI to Optimise Data Centre Cooling

Energy Savings and Efficiency



3.1 Case Study: AI-enabled Data Centre Cooling Solution which reduces energy consumption and tackles carbon emissions

Snapshot

Hong Kong is a global trading, financial and logistics hub and home to a large number of regional headquarters and offices of multinational corporations as well as small and midsize enterprises ("SMEs"). The city is an ideal location for data centres, given its mature telecommunications infrastructure, which is known to be one of the world's most sophisticated. There is positive governmental support for the development of data centres in Hong Kong – meaning there is ample opportunity for businesses to address the decarbonisation of their data centres and to invest in ways to improve the sustainability of operations.

Data centres enable businesses to access and transfer data and are energy-intensive, requiring large amounts of electricity to keep them continually operating to ensure virtual connectivity. Data centres must be maintained at a certain temperature to ensure optimal equipment and operating performance. However, due to the quantity and density of computing equipment, data centres are susceptible to overheating – which can damage server equipment and performance.

Cooling is therefore required through Computer Room Air Conditioning ("CRAC") units to control temperature and humidity. Increasing the energy efficiency of data centres can curb energy consumption and reduce their environmental footprint. Utilising advanced innovation technologies such as remote and cloud-based computing can help to support improvements in this. This AI-enabled digital solution offers an efficient way to cool data, which can save energy and carbon emissions.

A summary of the digital solution

The average data centre is made up of 42 racks, with each rack containing around 10 computers and related equipment. With the solution's technology and the utilisation of AI, CRAC units can be adjusted to target hotspots and cool down specific overheated racks, rather than the entire area, significantly reducing the amount of energy required for cooling. During this process, the solution can confirm the location of the hotspots by matching thermostats to power supplied to the specific rack which is overheating.

The solution's AI component will analyse and determine which CRAC unit can best influence zones prone to overheating and record this data daily, continually improving hotspot management and responses. If a new computer is added to the data centre with no previous data about which CRAC unit can most efficiently cool it down, AI will use its previously recorded data to estimate and trial a response. While modern data centres have relevant measures to ensure the average room temperature remains under the threshold, this solution utilises AI to help clients target certain hotspots within the room. Additionally, the solution will predict and respond accordingly to unexpected overheating of computer equipment based on past overheating incidents.

Energy usage in data centres can be further reduced by targeting Power Usage Effectiveness ("PUE") – the metric used to measure the energy efficiency of a data centre. PUE is calculated by dividing the amount of power entering the data centre by the power required to operate the computing equipment inside it. The lower the PUE, the better the overall efficiency. The ideal PUE stands at 1.0, meaning 100% energy efficiency with no losses through power distribution. Previously, Hong Kong's PUE stood at an average of 2.2 – and since then has improved to 1.6. While this is an improvement, more can be done to go further than this. According to the solution company, a PUE of 1.4 or 1.5 is an optimal figure to aim for.

Key technology attributes:

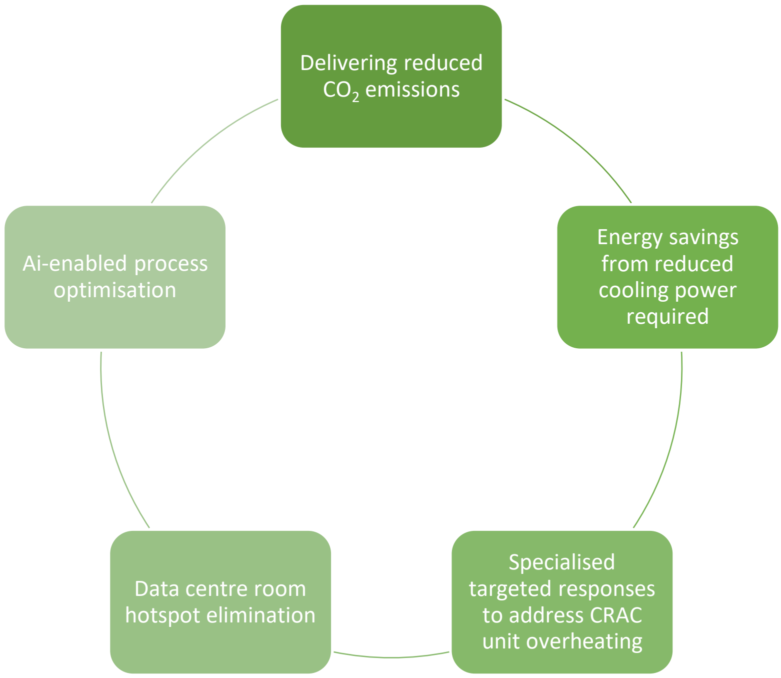


Figure 4: Key features of this digital solution

The Digitalisation Process: Implementation

For customers which have a dedicated data centre in place, the solution company will carry out a physical site visit to collect data (i) CRAC unit performance, (ii) if the centre's racks have sufficient sensors to monitor temperature and power consumption levels and (iii) if power distribution units are already installed. After evaluating all three components, AI learning and functioning to allow the solution to perform at a sufficient level will begin.

If someone is working in the data centre, the AI can automatically cool down certain parts of the centre to create a more comfortable working environment for company employees. Aside from adjusting temperatures in specific areas, the average temperature of the data centre can be increased from 18°C to 22°C to save energy usage. There is also potential to improve this further to 28°C. After the solution's implementation, CRAC unit power consumption can be reduced by 76.2%, while around 16kW of energy can be saved, resulting in a significant cooling power reduction in a matter of days following installation and AI learning completion.

Installation without disruption – Given data centres run non-stop when manual assistance is required during setting up and installation, this will be managed and monitored to ensure that customers' operations are not impacted or influenced.

Key challenges or limitations encountered:

Customer concerns around malfunctioning – Given a data centre often holds some of the most important information and documents in a business, one major concern clients have is distrust and fears regarding the potential collapse of the data centre if the solution fails or malfunctions. To address this concern, the solution company has prepared backup plans and manual interventions, if needed, to reduce the risk of breakdowns. There will also be a specialist stationed to monitor operations and progress in case of any issues, particularly during the first few days of implementation.

Sudden temperature spikes – Some customers also expressed concerns about whether they would be notified in case of sudden spikes in temperatures. This challenge is addressed by creating a heatmap from data collected on temperatures across the data centre and notifying customers accordingly in such cases to keep them updated in real time.

Further power usage savings – The company has set itself a target that it believes it can reach of reducing power usage by an additional 30% on existing CRAC units compared with current levels.

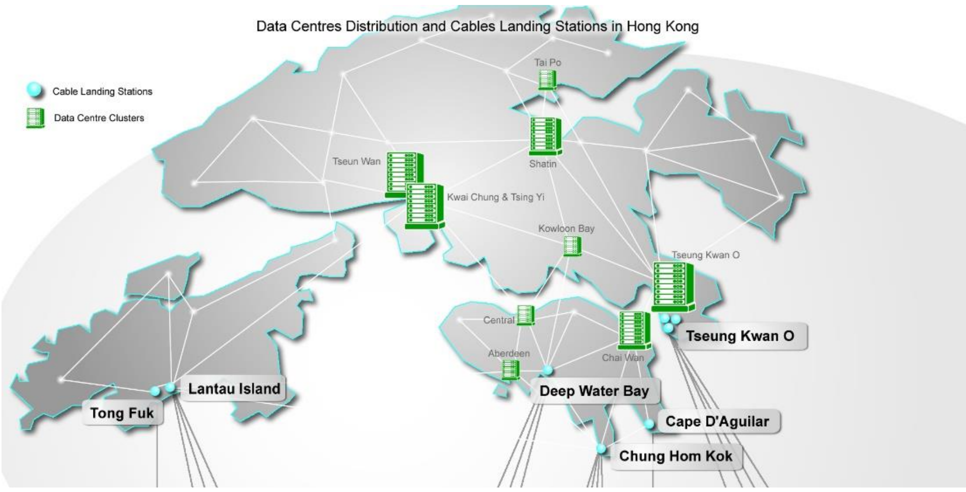


Figure 5: A visual map of Hong Kong's data centre distribution. Source: Data Centre Development in Hong Kong

Scalability and Adaptability: Why should this case be replicated in Hong Kong?

The technology enabling AI-assisted data cooling centres is relatively new – however, the adoption rate of this in Hong Kong specifically is predicted to increase rapidly.

In the context of Hong Kong, this digital solution is quite important, as it offers a sustainable way to address electricity usage and reduce CO_2 emissions – particularly given plans to boost the presence of data centres across Hong Kong, the need to optimise and improve existing data centres and Hong Kong's 2050 carbon neutrality commitment.

Due to characteristics including high ceiling heights and flexible and spacious floor layouts, buildings in unused industrial areas offer ideal conditions for data centres and have been earmarked for conversion. Such areas include Kwai Chung, Tsuen Wan and San Po Kong, while an industrial estate in Tseung Kwan O is predicted to contain over 100 data centres.

Hong Kong has established existing infrastructure, due to the city's previous position as a cable landing station, making the process of data centre conversion more streamlined. Physical factors and geography also increase the feasibility of developing data centres in Hong Kong – and resulting opportunities for this solution's implementation.

The city has annual seasonal typhoons but has a relatively low risk of earthquakes, meaning the growth of large-scale data centres will have a lower risk of physical disruption or damage from extreme weather events or environmental conditions. Hong Kong's electricity power supply is also very stable, with a reliability level which surpasses 99.997%.

Benefits of the digital solution

This solution is versatile, flexible and can be used to support both the modernising of existing data centres and the development of new data centres.

Savings and return on investment – According to the solution company, under one scenario, the solution achieved annual energy savings of 140,160 kWh and CO_2 emissions savings of 114,048kg of CO_2 equivalent after the implementation of the solution. The return on investment is also relatively high, as total power consumption from cooling units can deliver a reduction of approximately 76.2%, which is quite significant.

The overall temperature of the air supply from the cooling units can also be increased to an average of 22°C from 18°C after the solution is implemented. Raising the average air supply temperature to 22°C enables operations to continue as usual without disruption or raising the risk of overheating or hotspot formation while saving excess energy consumption.

AI-enabled efficiency – The integration of AI in this solution increases general efficiency on several fronts. The AI learning period allows for a fast response to unexpected equipment overheating incidents, for instance, and can make a smart prediction on how to address the issue, such as cooling down specific areas or zones within the data centre. It also increases hotspot elimination and can support a high density of IT and computing equipment. The AI solution can take just 1 to 2 months to learn from the data required to sufficiently function.

Reduced downtime – This digital solution can limit the amount of downtime associated with unplanned reboots, system crashes and power outages from equipment failure, which can incur expenses and result in a loss of revenue to the client.

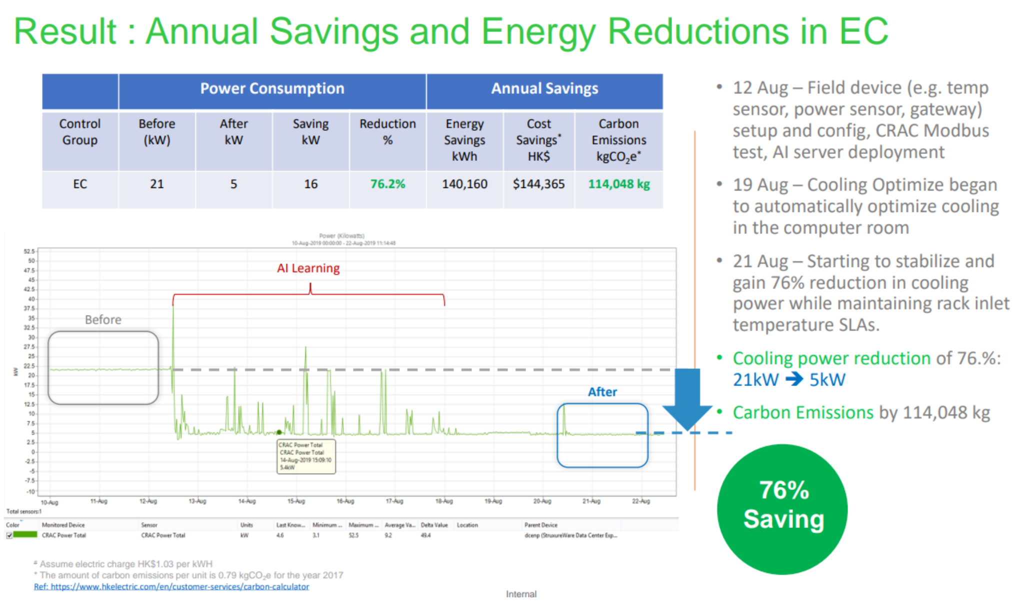


Figure 6: Annual savings and energy reductions after implementing the digital solution

Further reading

IEA, Data Centres and Data Transmission Networks. Available from: Link.

HKTDC Research, The Road to Net Zero: Delivering a Sustainable Data Centre Future (November 2022). Available from: Link.

Yelong Zhang, Yanqi Zhao, Siyuan Dai, Binjian Nie, Hongkun Ma, Jianming Li, Qi Miao, Yi Jin, Linghua Tan, Yulong Ding, Cooling technologies for data centres and telecommunication base stations – A comprehensive review, Journal of Cleaner Production, Volume 334 (February 2022). Available from: Link.

Optimising Data Centre White Space Cooling

Energy Savings and Efficiency

4.1 Case Study: Utilising a White Space Cooling Optimisation System to reduce the energy footprint of data centres

Snapshot

There are around 60 data centres in Hong Kong concentrated across areas such as Tseung Kwan O, Kwai Chung, Tsuen Wan and Sha Tin. Given Hong Kong's positioning to advance its digital and technology industry, demand for computing capacity will need to increase in line with this – and as a direct result, a greater need to cool data centres.

Data centres generate substantial quantities of heat from cooling infrastructure, also known as Computer Room Air Conditioning ("CRAC") units. Airflow management in data centres – to keep hot and cool air streams circulating separately and avoid mixing – is crucial to ensure the centre continues to operate smoothly and avoids overheating.

However, current or traditional design standards over-provision cooling at a steady rate which largely exceeds the actual amount of cooling required. For instance, IT activity or load can have variations and spikes – and the resulting cooling does not necessarily have to always have a consistent output at the same level. Mismatched cooling output and IT load results in wasted energy and a higher energy consumption footprint, which highlights an area of improvement that should be addressed within an organisation's operational sustainability strategy.

To address this, this solution's White Space Cooling Optimisation System uses AI to improve temperature control and air distribution, dynamically matching cooling output with IT loads based on data in real time. Together with smart data analytics, this solution works to minimise the energy consumption of data centres and reduce emissions.

<u>Technology attributes and features:</u>

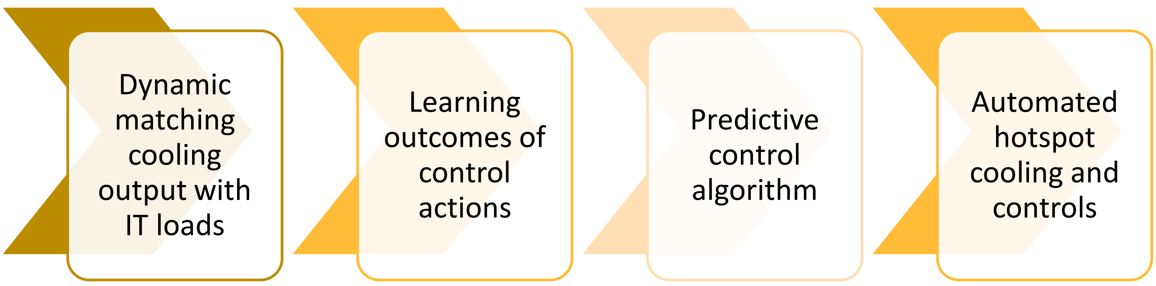


Figure 7: Key technology features of the digital solution

A summary of the digital solution

Sometimes, airflow within data centres can be complex and not intuitive. Rather than rising to the top, warm air can infringe on cool aisles or currents. Warm air can also get drawn back into servers, which increases the chance of short-circuiting. This can waste energy and pose risks such as server capacity loss or overheating. Along with other factors and IT variations, this makes it difficult to optimise this process manually or make improvements by adjusting basic cooling unit functions. So, implementing this solution can help.

The solution's infrastructure comprises of the deployment of a network of sensors, cooling unit controls, an AI engine and a user interface. Working in tandem, this allows improved and optimised cooling distribution, which functions automatically based on the solution's predicted cooling load and applies enough cooling required to target IT racks across the data centre.

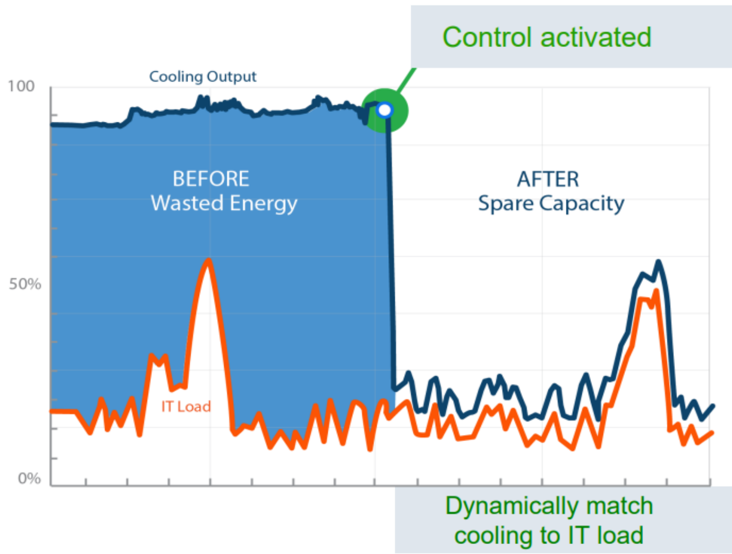


Figure 8: Graph by solution provider illustrating solution's dynamic control

Dynamic matching – In a traditional cooling scenario, the cooling output in a data centre stays relatively high and constant, despite variations in the actual IT load – as well as the average IT activity level sitting much lower than the cooling output level. In comparison, after implementing this solution, the cooling output can be dynamically matched to the IT load level and spikes. This creates a large volume of available spare capacity for the cooling output, which can allow for more racks to be installed in the same area.

Predictive control algorithm – The solution's machine learning algorithm controls the cooling unit functions, such as fan speed and starting and stopping. The algorithm also monitors how efficient the cooling equipment is through temperature sensors. This creates a heatmap – a visualised map of actual temperatures across the data centre, highlighting which areas have variations. This can identify hotspots and determine cooling airflow influence and where it needs to be deployed.

With the help of wireless sensors, which identify the cooling loads required for CRAC units, the algorithm predicts how best to optimise cooling. The algorithm also learns the effect of the control actions to improve future responses. For example, utilising the most effective combination of cooling units to reach optimal temperatures.

In comparison, controlling data centre cooling on-site by an engineer using basic CRAC unit or Building Management System controls is difficult and cannot achieve accurate predictive control responses. The solution's automated machine learning algorithm allows increased preciseness in controlling the cooling infrastructure.

Sensors are deployed at the air inlets of the IT equipment. The data collected can be used to compare rack temperature versus return air temperature (temperature that has been cooled and re-circulated back into the racks). Without the localised data provided by these sensors, it is not possible to create a visualised map of temperatures, nor is it possible to identify rack temperatures.

Real-time airflow modelling – Typically, simulations are used to predict the airflow inside a data centre. This relies largely on assumptions and is not always accurate, as it cannot predict the dynamic fluctuations of IT activity. In comparison, temperature sensors enable live, real-time data on airflow so the temperature of each area can be known. This can also aid the accuracy of predicted responses.

The Digitalisation Process: Implementation

Wireless sensors are installed on racks to monitor air temperatures. This sends temperature data to the network manager, which manages wireless communication and works in line with the AI engine to aggregate data and issue control commands. Control modules perform functions such as starting, stopping and fan speed while monitoring CRAC power consumption and temperature data. This is again fed back to the network manager. The customer-facing user interface visualises this data and creates easy-to-understand insights and reports for the client for further analysis. Depending on the case, additional sensors are deployed to detect humidity levels.

The solution's installation follows a standardised process and is not overly complex, with minor adjustments made based on the data centre's layout and infrastructure.

Typical deployment will begin with planning and site preparation, which involves collecting information on the data centre's layout plan and rack infrastructure. This can take between 2 to 4 weeks. Following this, components of the system will be developed offsite, which will include connecting each sensor to the network gateway, so that once the system has been installed on-site, the company can locate each sensor within the data centre. This can take between 1 to 2 weeks. Next, the system will be shipped to the site, where it will take 2 to 4 weeks to complete installation, collect initial live data for baseline monitoring and undertake customer training.

Once the system has been deployed, it will be continuously monitored for improvements. The operator will have direct access to the system, meaning they will be notified if there are any alarms in case there is a malfunction, or follow-ups if any components require replacing. The solution company will continue to do regular half-yearly checkups.

User interface – Customers will have access to a graphic interface or dashboard, which visualises the data and displays it in various formats. Firstly, the heatmap is displayed to highlight hotspot areas at risk of overheating, according to the layout of the data centre. The interface also points out areas where temperatures have already been optimised by the solution. Customers can track trends over periods, allowing for comparisons of temperatures before and after the solution has been installed according to baseline data. Finally, the user can view real-time updates and has access to controls through the dashboard.

Statistical evidence or a comparison of the results before and after the implementation

On average, the solution has achieved energy savings of between 15% to 25%, while airflow within the data centre has been increased by approximately 1.8%. Meanwhile, any extra airflow – regarded as waste or excess – can be reduced to zero, saving more energy. An improvement in Power Usage Effectiveness ("PUE") has been reported to increase from 5% to 13%, according to the solution company.

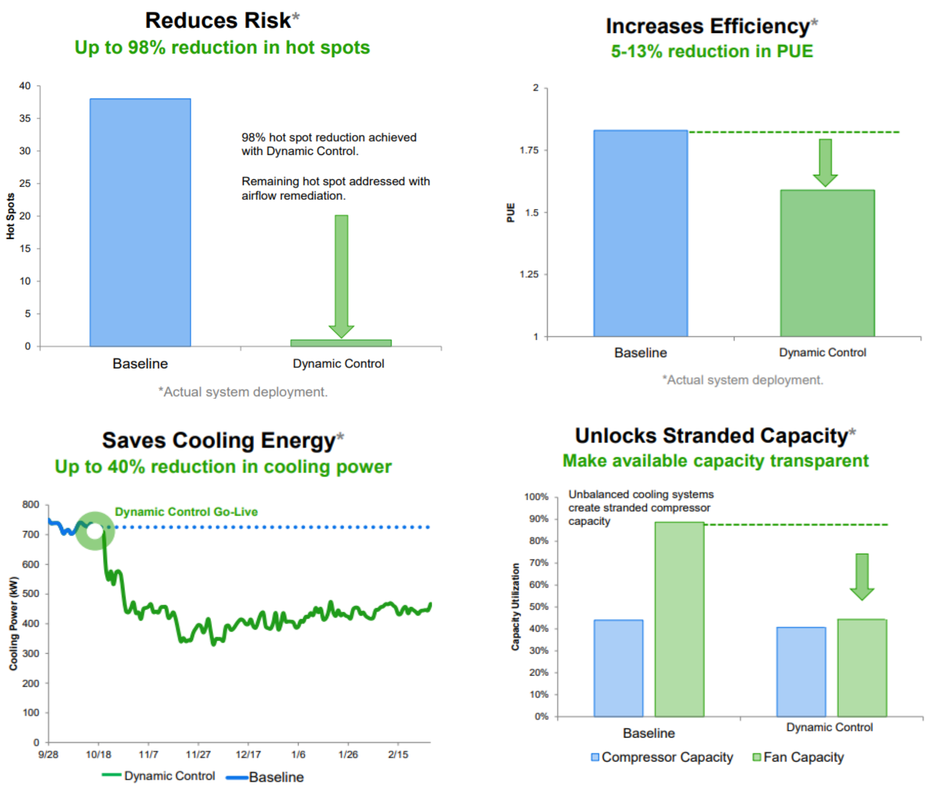


Figure 9: Key savings and benefits of the solution, based on actual system

Key challenges or limitations encountered:

Sometimes, certain areas or floors of a data centre can be used by tenants who may not be interested in the uptake of this solution. This can pose a limitation, as this solution cannot be implemented if there is no physical boundary separating the areas of the data centre belonging to those who want the solution from those with areas that do not want the solution.

Scalability and Adaptability: Why should this case be replicated in Hong Kong?

Initially available in the US, this solution was introduced in Hong Kong in 2018. In the last five years, uptake and interest have been relatively low, particularly during the years affected by the pandemic. However, in the last year, the company has seen a significant increase in interest in digital solutions for thermal optimisation in data centres from different data centres in Hong Kong.

Interest has stemmed from companies which have designated internal data centres as well as tenants of data centres which rent certain sections or floors of data centres.

The company noted that generally, a lot of people may not be aware that this solution exists, presenting a scalable opportunity for the solution provider in Hong Kong. Most data centres have not yet optimised energy usage through a digital solution, while some may have used traditional mechanical methods, such as installing physical boundaries within the data centre aisles to isolate and separate the hot and cold airflows from circulating separately and prevent mixing.

The company expects a continued upward trajectory for the uptake of this solution in Hong Kong, particularly amid increased business focus on ESG and corporate emissions targets to reach net zero by 2050 in line with the city's emissions targets. Hence, this solution presents an opportunity for businesses to accelerate the reduction of their operational emissions.

Existing Hong Kong-based customers have expressed positive feedback. For instance, one of the solution company's customers won the Grand Energy Saving Performance Award under the CLP Smart Energy Award 2021 and reported financial savings of over HKD$ 2 million after implementing this solution.

Benefits of the digital solution

Aside from improved airflow and airflow management, energy savings and increased cooling capacity, other benefits include:

A more comprehensive insight into data about temperatures at server racks compared with temperatures at the cooling units. Automating the control of cooling fans improves thermal reliability, reduces the risk of overheating and maintains consistent air temperatures among server racks and white space of the data centre. It also reduces wasted energy by dynamically matching cooling to the IT activity, automatically responding to temperature changes and preventing overcooling.

The autonomous response and control function goes beyond alerting the operators to temperature fluctuations or risks of overheating and automatically adjusts based on previous control actions and their effects. The digital solution helps customers understand the cooling load and how much cooling is available, which can aid future capacity planning, as facility managers can identify new IT capacities and install more racks within the same area of the data centre if they want to.

In terms of return on investment, the solution offers significant savings on energy usage. According to the company, the solution can offer a simple payback in less than three years from the solution's implementation.

Unexpected benefit – The solution provider also noted customers reported positive feedback regarding the ability to monitor the whole data hall to give a more comprehensive view, compared with a traditional system, which has been helpful for operations.

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Siemens, How artificial intelligence is cooling data center operations. Available from: Link.

Takeaways and lessons learned

According to the company, after the overall energy efficiency of specified server racks has been completed and evaluated, the solution can easily be scaled up to other server racks within the data centre. The deployment of the solution to other areas is immediately compatible with an existing system and requires simple on-site configuration and set-up. The solution's wireless architecture means installation is largely non-disruptive and flexible to different environments. Large sites can also be operating within weeks, without the need to install a large mass of physical cables.

"Digitalisation is an aid to help engineer and collect information from the site to support effective and efficient decision-making to reduce a company's resources."

Platform To Access Live Waste Intelligence

Waste Reduction

5.1 Case Study: A cloud-based smart waste intelligence platform to improve organisational waste management and circularity

Snapshot

Waste is a major environmental challenge in both Hong Kong and across the world.

Globally, there are a lot of big firms implementing strategies around zero-waste-to-landfill efforts, with many outlining medium-term and interim targets for 2025, 2045 or 2050, depending on operations. At the same time, some frameworks or certifications focused on circularity and waste reduction are increasingly demanding more transparency and disclosure from businesses on organisational waste.

Given Hong Kong's position as an international business hub, a company's internal waste management practices forms an important component of its sustainability strategy which should be explored for improvement.

As a digital solutions provider, this company aims to provide access to live waste intelligence to aid workplace waste management, provide actionable insights and offer a holistic approach to helping businesses achieve a more sustainable work environment. The digital solution can offer actionable data to clients on the amount of waste they are producing, which areas they are producing the most waste, how they are producing this waste and how they can make changes to improve to boost circularity and the overall sustainability of their operations.

<u>Technology attributes:</u>

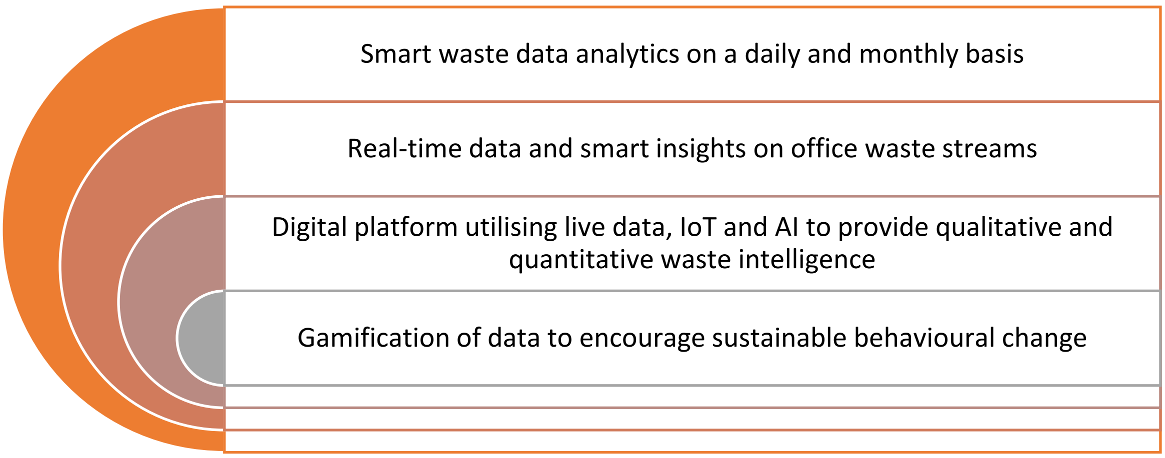


Figure 10: Key features of this digital solution

IoT utilisation – Smart sensors are deployed under waste bins to enable a seamless integration of the existing premises of the customers (office environments) to track and understand waste behaviour. TVs and display devices are also installed to enable feedback and real-time updates of information back to the customer.

Waste contamination identification – The company has developed an app that can detect and collect data on waste contamination and correlate this with different waste streams to identify the waste contaminants in an office environment, indicating key areas of opportunity for improvement.

Gamification – To leverage natural inclinations of competitiveness, gamification is integrated into the solution by enabling competition between different workplaces, teams or departments, encouraging staff to engage in sustainable behaviour. Examples of data shown include the highest waste diversion rate, lowest waste contamination rate and the least waste produced per employee.

A summary of the digital solution

This digital solution can gather, process and display smart insights to help companies achieve their waste reduction goals or achieve waste management certifications, alongside creating a roadmap for customers to reduce waste, increase diversion and avoid contamination.

Plug and play – Smart sensors are deployed to track the amount of waste produced at the office, forming the solution's "plug" element. Data is then gathered and sent to the cloud for processing. The processed information is sent back to the customer as the solution's "play" component. The play component aims to target two entities, (i) employees and (ii) sustainability and facility managers.

Figure 11: A photo of the solution's smart sensors once deployed

For employees, the smart waste data can help to raise awareness around daily actions that can curb waste production. Based on such data, an overview of insights and practical suggestions is displayed through dashboards and digital engagement materials. Statistics are presented in a simple and easy-to-understand format and the dashboards connect to an educational programme to support behavioural change.

For sustainability and facility managers, this solution can provide accurate data for understanding the quantity and location of waste production, which can shape waste reduction strategies and drive sustainability efforts more broadly. Monthly and daily dashboards are created to offer a more in-depth, detailed breakdown of data for deeper analysis. For instance, data is given to highlight comparisons between waste collected in different locations, waste streams and bin stations with the highest opportunity for improvement. The solution company also engages with its clients monthly to assist in near-to-medium target setting and roadmaps they can collaborate on together.

The company has developed a waste contamination app to educate general misunderstandings customers may have had while trying to recycle waste. A photo is first taken from the top of each bin, which the solution company uploads into its system to detect visible waste items and classify them into waste categories.

Next, this data is compared with the waste stream the bin is designated for, determining the nature of the contaminants. Through the utilisation of AI, the solution company aims to detect the most frequent opportunities for employees to improve waste sorting and provide actionable solutions to address waste from the source. For example, by analysing the makeup of the waste, the application will be able to determine which materials are the biggest contributors, thus, enabling customers to create strategies to tackle waste from sorting.

The Digitalisation Process: Implementation

The solution company believes in working hand-in-hand with facility managers responsible for operations to best understand practices happening downstream or specific constraints or challenges. Monthly progress meetings are held with customers to assist in the setting of goals within different periods, such as every six months or every year so customers can break down longer-term waste reduction goals into smaller, actionable goals. Data will be analysed to calculate the percentage of waste reduction necessary per interval on a case-by-case basis.

The solution provider has done extensive work to simplify its solution and estimates the initial set-up phase to take around 2 weeks. The implementation process can start by setting up a technical site visit during the first week to allow the solution company to understand the workplace environment and layout; decide where they deploy certain equipment such as network devices and scales; take count of rubbish vents and their locations; and consider any other technicalities. The second week will involve equipment preparation and physical deployment at the site.

The company will run the solution for 1 month. During this initial month, the solution will not be announced to employees excluding facility managers or staff to establish a data baseline without influence. This baseline will be used as a comparison point for setting targets or tracking progress later. Following this, they will announce an official kickoff to let employees understand the solution and to support further progress.

Figure 12: Results achieved by the solution after its implementation

Statistical evidence or a comparison of the results before and after the implementation

In Hong Kong, the solution provider has been working collaboratively with a property developer for the last two years. At the start of the partnership, 15 tenants of the property developer – including banks, consulting companies and luxury brands. This has now grown to 25 – with the number of employees under the tenant companies doubling from around 2000 to over 4000.

Under this partnership, the solution has helped to consistently reduce the amount of waste sent to landfills year-on-year by 20%, while waste contamination has been cut by 40% year-on-year. As a result, the diversion rate – the amount of waste diverted from disposal at landfills – increased by around 60%.

INITIAL PROGRAMS RESULTS		REDUCED WASTE Waste to Landfill	IMPROVED SORTING Reduce contamination
BIOTECH Y1 Boston / Norwood, March to December	350 employees	-50%	-60%
OFFICE OWNER Y2 Hong Kong, July to December	4000 employees	-20%	-40%
FINANCIAL INST. Y1 Boston, June to December	900 employees	-24%	-25%

Figure 13: Initial programme results after implementing the digital solution

Key challenges or limitations encountered:

Understanding organisational culture – According to the company, a main challenge is understanding each company has its own distinct culture and way of working, which inherently influences how they view and work on sustainability issues, including waste management. The provider recognises the need to first understand the internal culture before trying to drive behavioural change and the company's internal agenda.

Mistrust about downstream processes – Some customers have concerns about downstream processes relating to the supply chain or government infrastructure on recycling processes. The provider aims to be transparent and disclose as much information as possible to the customer. For instance, the company shares information on what the government is doing to improve responsibility for downstream waste management and what building owners are doing to facilitate better downstream practices in Hong Kong.

Scalability and Adaptability: Why should this case be replicated in Hong Kong?

The company currently operates in New York City, Boston, San Francisco and Hong Kong, but there are ongoing efforts to expand the business further regionally. There is a high likelihood that deployment of this solution will begin across locations in Southeast Asia or East Asia from next year. While Hong Kong has some catching up to do in terms of prioritising sustainability across business agendas, the company notes improvements that it has seen gradually increase in recent years which will continue to grow – and therefore, has ample opportunities to address this issue.

Space limitations – A prominent issue in Hong Kong is the lack of space; and is a main concern that customers have when approaching the provider. In terms of installing the smart sensors, this requires no extra space in the workplace environment, given the physical sensors are placed under existing waste bins. In this context, the company has also adapted to Hong Kong's environment by creating smaller sensors that take up less space and can be placed under smaller bin compartments.

The company has also modified its display devices, and in addition to offering standard-size 32" TV displays, it can now integrate to show content 15" smart displays. Aside from this, just a small space is required for the solution's network gateway.

Lack of awareness – From a general perspective, many employees in Hong Kong lack knowledge about downstream waste management as well as efforts made to address waste management either by their own companies or by the government. This directly influences behavioural habits and attitudes toward waste and sustainability more broadly. The company tries to provide information and incentives to ensure employees are aware of what different stakeholders are doing to increase transparency and awareness.

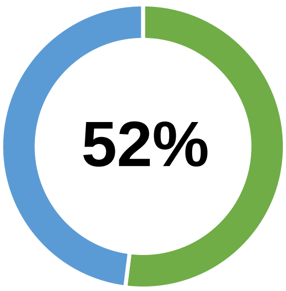
Benefits of the digital solution

The solution is comprised of its tech-enabled service of aiding better waste management, but it also encompasses a more holistic and comprehensive approach to the problem.

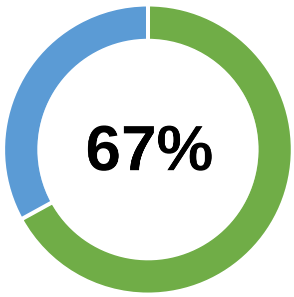
Return on investment – Waste reduction and subsequent environmental impacts can be more difficult to put a monetary value on and can appear more intangible in comparison to other resources. In this sense, the solution provider advocates for a more holistic approach to understanding the returns on investing in this solution for the customer. Particularly in city environments, it can be easy to think that waste disappears when we dispose of it – but the environmental impacts of waste are very significant and are present in greenhouse gas emissions such as CO_2 and methane, alongside water pollution and contamination.

Meanwhile, the solution company also acknowledges that by empowering firms with smart waste data and tracking, costs can be saved in other ways outside of financial savings. Reduced operating costs can be achieved by optimising waste management practices to reduce waste collection time or regain physical space for office use. The majority of the solution company's customers have shifted their waste management practices from auditing waste manually to managing this automatically through their system, saving time, resources and labour.

Estimated costs of the solution – The solution provider calculates costs based on square footage, and therefore varies depending on the customer's office environment.



Over half of employees expressed strong interests in learning how to analyse waste data



Of employees want to obtain actionable insights and practical advice to trigger more sustainable daily behaviour, based on the data

Figure 14: Statistics based on a survey conducted by the company this year asking about general feedback from users and what aspects its users want more assistance with

Further reading

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Swire Properties, Digitalising and gamifying waste data. Available from: Link.

Takeaways and lessons learned

Growing the influence – Within a company, there will always be employees less enthusiastic about sustainability and changing habits. The company approaches this by focusing on employees who are interested in taking action for the environment, empowering them with the information and tools they need to become change-makers and promote sustainability agendas within their organisations. By doing this, a more sustainable culture overall can be achieved.

The company believes the private sector, public sector, and broader society must work together to achieve true sustainability and tackle climate change. In this sense, the company aims to engage the whole supply chain to work with property developers, employees, the government and downstream recyclers. The company believe this can bring a more transparent and powerful network from start to end in terms of sustainability and waste management.

Looking forward – Part of the company's roadmap is focused on achieving remote deployments of the digital solution. This will involve shipping the sensors and network devices to customers in the region, where internal technical teams will be able to remotely install the solution. This will significantly reduce the costs associated with setting up – which allows for reduced customer costs.

Looking forward, the company is working to embed and link its solution into different recognized industry sustainability frameworks and certified standards. Currently, it has ongoing work with the TRUE Zero Waste certification system to use the solution as a tool for companies wanting to achieve this certification. The company is simultaneously working with other frameworks such as the RESET Standard and certifications recognised under the UN Sustainable Development Goals and the Global Reporting Initiative.

"Together for more impact"

Cloud-based Smart Energy Management

Green Buildings

6.1 Case Study: A cloud-based smart energy management platform offers a solution to address energy consumption in buildings

Snapshot

The built environment sector accounts for 40% of global CO_2 emissions. In Hong Kong, there are over 42,000 private buildings and more than 8,000 government-owned buildings. In-use operational emissions can contribute between 60% to 70% of a building's lifetime emissions, including lighting, powering ventilation and air conditioning, and lift and escalator services which all require energy.

This digital solution utilises several technologies including cloud computing, artificial intelligence, smart data analysis and the Internet of Things to generate energy-saving insights and energy management from a building's management system. The platform bridges the gap between the building management system ("BMS") of existing buildings and the cloud to enable remote data processing. The data is visualised and presented to the customer in the form of dashboards, reports and charts to enable a better overview of the energy performance of individual buildings and whole portfolios.

Through this solution, customers can track targets and view smart analytics to make operations more efficient and contribute to longer-term goals of energy saving and decarbonisation of buildings.

Technology attributes and features

- Internet of Things, AI, cloud computing and smart analytics
- Automated and optimised calculations and reporting
- Smart diagnosis through AI Rule-Based Expert System
- Machine learning-enabled predictive responses

Figure 15: Key technology features of this digital solution

A summary of the digital solution

The platform collects real-time data from a building's BMS and electricity metering system, sending the data to a centralized cloud platform. Data extracted includes temperature, flow, energy, frequency, and control points.

Based on this data, the platform conducts analysis and identifies gaps for improvement through big data analytics and AI. The equipment (BMS, energy and power meters) required for this digital solution are normally part of existing infrastructure in buildings and properties. However, in some cases where this equipment is not present or insufficient, the company will arrange installations.

The solution offers five main functions:

Automated KPI setting – Once data has been sent to the cloud, the platform will perform initial pre-processing to check for any missing data or anomalies which need fixing or flagging for staff to investigate. Data analysis and calculations will then be carried out, such as analysing data from electricity meters. The platform can automatically combine these data and group them into various system categories such as air conditioning, lighting and lifts to determine each system's energy performance.

Meanwhile, other Key Performance Indicators ("KPIs") based on operational efficiencies – such as Coefficient of Performance ("COP") to measure the efficiency of chiller plants or the approach temperature of different equipment – can be analysed to identify inefficiencies. Once calculated, the KPIs will be displayed on the platform's dashboards for management or operations teams to monitor performance.

Smart diagnosis – The solution has a digitalised AI rule-based module which uses different logic to analyse and compare data based on certain parameters. Through operational experience, the company will set thresholds for the logic, such as an optimal temperature for air conditioning. If this is exceeded, this triggers an alarm for a follow-up. The logic can also be set for more complex analysis. For example, the logic can be set to have multiple layers to analyse different parameters of an air handling unit, including temperature sensor, valve control and fan control, which can be combined to help pinpoint which part of the equipment has an issue. This saves time and resources by speeding up the diagnosis and repair process.

Automated reporting – The platform offers automated, custom calculations and displays them on dashboards and downloadable spreadsheet reports. There is also a chart-building function, under which data analysis can directly be conducted on the platform.

Machine learning – The platform utilises AI to enable cooling load predictions (the rate at which heat must be removed from a space to maintain a steady temperature) and chiller plant optimisation. Based on recent cooling load trends and weather conditions, the AI predicts the cooling load for the next 24 hours, allowing operators to better prepare equipment sequencing across different points of the day. Cooling load prediction is integrated into another AI module known as chiller plant optimisation where the model suggests optimal chiller, cooling tower and pump control for the future 24 hours.

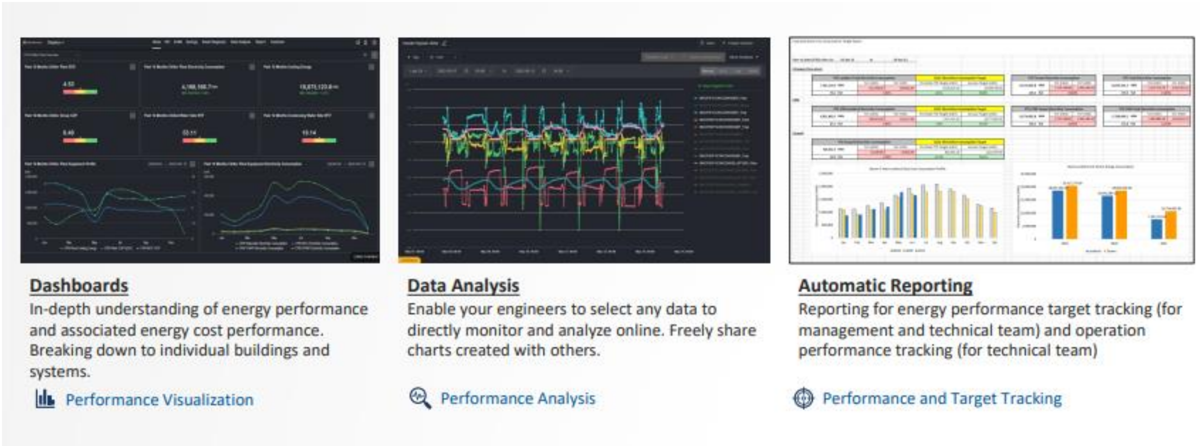

Figure 16: Base features of the solution's digital platform

The Digitalisation Process: Implementation

The implementation of the digital solution usually takes around a year after kick-off with the client. During this time, on-site visits will be conducted to link up the network connections, install hardware and conduct point mapping to synchronise the building's BMS with the solution's cloud platform.

A cybersecurity investigation will conducted to ensure the operation of the building's local system will not be affected, particularly for systems that have not been previously connected to the internet.

The setting up of various processes will follow, including building dashboards and setting AI rules and logic for the platform to follow, which can all be done remotely. Regular checks will be made during this time to check whether data on the cloud aligns with the data recorded.

Key challenges or limitations encountered:

Digitalising old buildings – Older buildings may lack the baseline infrastructure required to deploy this digital solution, such as BMS. Financial investments may be required to upgrade the BMS system, depending on how old it is. Meanwhile, other infrastructure may be lacking and may need to be installed, such as the installation of smart energy meters to meter major equipment and enable the separation of consumption down to different systems, such as HVAC, lighting and escalators. Additional sensors or meters may need installation if there are not enough existing data points for comprehensive analysis.

Cybersecurity concerns – The network of the building needs to be well-established to minimise the risk of cybersecurity issues, particularly as the implementation of this solution requires opening a connection of local systems to the internet. This will require team collaboration with the customer's internal IT department and could require investment in additional hardware such as installing firewalls.

Seamless communication – Given this is a digital-based solution, there may be a fundamental gap between the solution provider and the building operations team, as the solution provider will approach gathering data and analysis from an IT perspective while the building management team will focus on an operational perspective. To address this, regular communication between the two parties will be needed to ensure the solution can run as seamlessly as possible and integrate operation expertise with digital expertise.

Statistical evidence or a comparison of the results before and after the implementation

Generally, the solution has delivered improvements observed in air conditioning systems in certain buildings, as well as the enhancement of the COP of chiller plants. The platform also identifies areas for further improvement, such as optimising temperature setpoints and heating, ventilation and air conditioning ("HVAC") equipment sequencing. According to the company, the solution is expected to save at least 10% of energy consumption from HVAC through its monitoring, data analytics and AI analytics.

One location where the solution is deployed in Hong Kong is at a shopping mall. Following general feedback from shoppers that the mall's central bridge is very cold, the company used its platform to track real-time data and trends to identify 10 air handling units which are always switched on and supplying air at a relatively low temperature. Relevant data was extracted and analysed to understand whether some air conditioning units could be reduced but still result in sufficient space cooling. It was suggested only six air conditioners would be enough to do so. After the adjustments, the platform continued to monitor the situation. As a result, around 50% of energy was reduced, while providing a more comfortable environment for mall visitors.

Scalability and Adaptability: Why should this case be replicated in Hong Kong?

The digital solution is currently deployed by a property developer across 10 of its buildings in Hong Kong and 10 buildings in China, connecting to the BMS and power metering systems in the buildings. Subsequent rollout of the solution in other buildings are underway. As a centralized cloud platform, a standardized template for data collection and analysis can be created for quick adoption at multiple buildings. The platform also allows for comparison between multiple buildings within one's portfolio.

The platform not only collects landlord energy consumption but also tenants. In Hong Kong, the company has installed electricity meters metering the block load of tenants, which is then sent to the platform for monitoring and analysis. The company is now installing individual smart meters for each tenant, increasing the granularity of tenant energy and enabling better transparency between landlords and tenants. This enables better analysis of the energy use of individual tenants and comparison across tenants of the same type.

The platform is able to connect to different IoT sensors, including water meters and IAQ sensors to enhance the platform data set.

Uptake – Currently, the majority of companies review their energy consumption by looking at their own electricity bills, which is only available monthly, or by manually downloading data from their own electricity metering systems, which is labour-intensive. Analysis of building operations and identification of optimization opportunities normally require a dedicated team or external consultant to carry out. The analysis would also need to be done manually and can only be done periodically, meaning energy-saving measures are not quickly identified nor maintained.

The company suggests that to improve the adoption rate of this solution, implementation can be done by phase. Customers can first start by reviewing the electricity metering systems they have in place are comprehensive, and then connect the system to the cloud platform. This first step enables the creation of dashboards to display energy consumption, energy usage trends and other energy statistics in real-time. The next step can be to connect to the BMS system to gather operation data for monitoring, analysis, and operation optimization.

The solution can be utilised for individual building operation management, portfolio-level energy management and corporate management to monitor energy targets and performance.

Benefits of the digital solution

Savings – The solution can contribute to electricity savings and as a result, cost savings. The platform can also help customers identify and quantify the electricity and cost savings, alongside offering analysis to track energy consumption levels before and after implementing the digital solution.

Fully customizable – This platform is flexible as it is customizable, allowing the company to design layouts for dashboards, build their own charts and establish their own AI rules. Through this platform, they can transform their experience in operation and retro-commissioning into automatic logic for analysis.

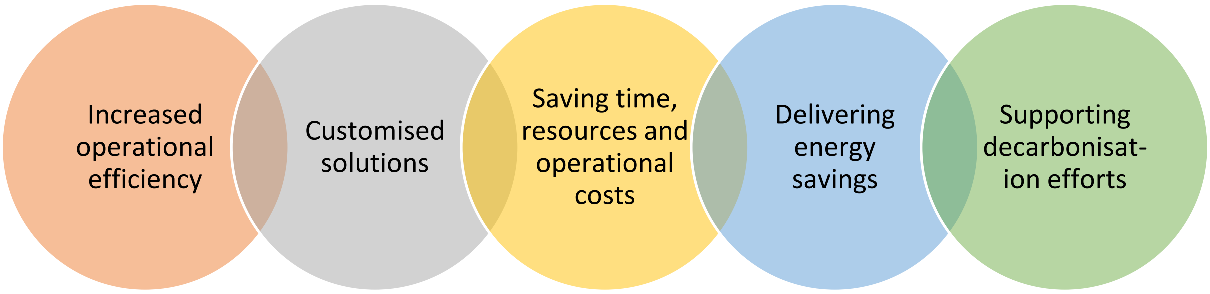

Figure 17: Benefits of the digital solution

Versatility – This digital solution can be deployed across one building or multiple buildings. The cloud connection to the platform also enables remote monitoring and tracking of energy consumption and usage.

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Takeaways and lessons learned

The company made several improvements to its digital platform since it started operating. Compared to initial versions in 2019, the platform's AI functionality nowadays is more detailed and in-depth. For instance, functions such as cooling load prediction and chiller plant optimisation have been slowly developed and did not exist initially. The company has also done work to finetune smaller details, such as enhancing visualisations to present data in a more accessible way.

Collecting and gathering data is key to understanding energy consumption and setting standards for comparison or setting targets to improve. With a high-quality data set, companies can easily and efficiently identify energy performance and highlight gaps for improvement.

A centralised cloud platform can collect and analyse relevant real-time building energy and operation data. The deployment of advanced technologies can make this happen seamlessly – the addition of an AI Rule-Based Expert System can assist in identifying further opportunities for energy savings, while machine learning enables cooling load prediction and chiller plant optimisation for the next 24 hours.

"Digitalising energy management, driving energy efficiency"

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Interviewees

(By company name, listed alphabetically, followed by the cases provided)

Schneider Electric (Centralised Remote Energy Monitoring case and Utilising AI to Optimise Data Centre Cooling case)

Siemens Limited (Optimising Data Centre White Space Cooling case)

Spare-it Limited (Platform to Access Live Waste Intelligence case)

Swire Properties Limited (Cloud-based Smart Energy Management case)

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