CAVENDISH
ENGINEERS

η-c TECH

ENERGY ENGINEERING

Cavendish Engineers is passionate about energy efficiency and using smart technology innovation to create intelligent buildings.

We're aware that the workplace environment is more important than ever in modern day buildings and our innovative approach enables less energy input and lower service charges plus better working conditions for people using the facility on a daily basis.

C-Tech was created after we identified the need for an intelligently controlled building from within by optimising energy input based on real time requirements.

Research shows that buildings dating back to 2012 have been fitted with old technology and that the control of these systems are considered simple and out of date compared to C-Tech.

The development began when Broadgate Estates, on behalf of British Land, made the decision to measure and improve the efficiency of work spaces across 16 buildings in their London portfolio.

This was inspired and driven by their 2020 vision targets for energy reduction and ESOS.

It created an opportunity to understand energy flow and workspace environments.

Addressing indoor air quality is not an easy measure but, with a fresh thinking approach, our objective of lowering energy could be achieved while controlling air quality at the same time.

With a background in space engineering, Cavendish Engineers were appointed to work with Broadgate Estates using a conjoined audit format that utilised the outputs from leading energy audits such as ISO 50001, BS EN 16247 and CIBSE TM44.

These audits provided a study of each building's system in real time via building energy and workspace data.

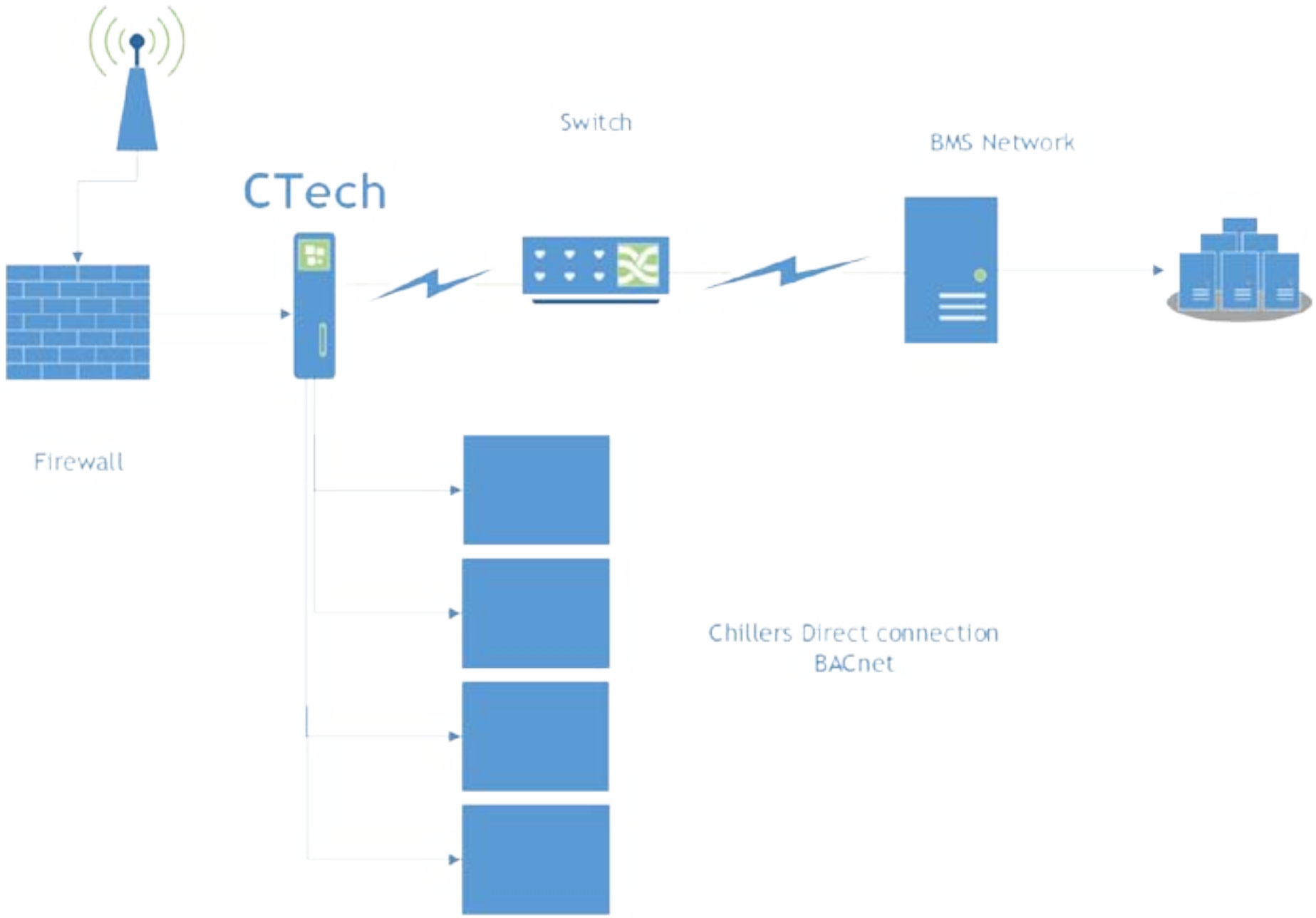
Audit compared the base build design and evaluated the effectiveness of the building's engineering in real time.

A majority of the buildings benefited from energy data on the HVAC system for 15 minute intervals which was via the existing EP&T metering platform.

Tracked thermal loading and how the plant setup dealt with the load, calculating chiller, boiler, pump and inverter efficiencies.

We set about creating a plan to develop an intelligent system, now known as C-Tech, that would be piloted at 2 Kingdom Street (Broadgate Estates HQ) and guarantee energy reduction using an innovative approach in a real workspace across a large glass building that had been recently constructed.

The deep dive revealed that the base build ventilation system was not effective in CO2 reduction - our data highlighted that the supply air was not reaching the workspace making the fans, chillers and boilers inefficient.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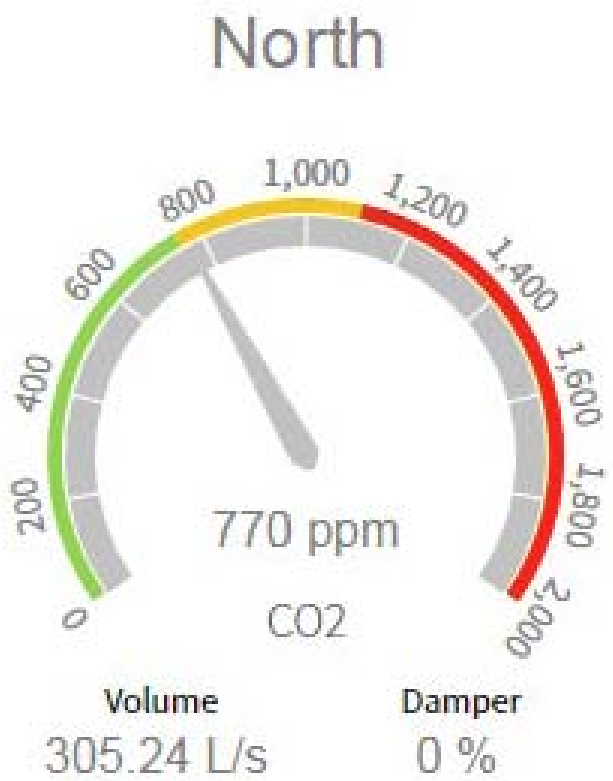
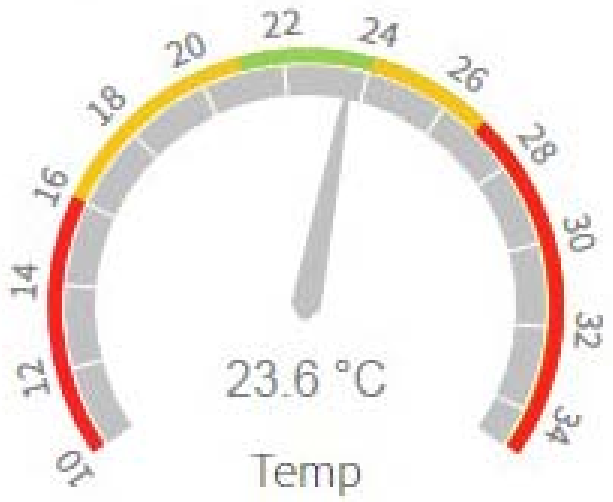




We created a (independent from the BMS) floor-by-floor workspace spine, populating information to central intelligence which allowed real time 24/7 evaluation of the workspace in a 3-D way via the C-Tech system.

Allowed interface with the existing BMS and plant controllers directly plus the internet at the same time.

Our app allowed us to observe every tenancy and its workspace well-being environment at any time across multiple platforms while Green, Amber and Red level conditions flag up elevated levels of CO2/ Humidity / Environmental Temperature.

Optimised plant and equipment to respond directly to building demand using the incumbent BMS as the means to operate devices.

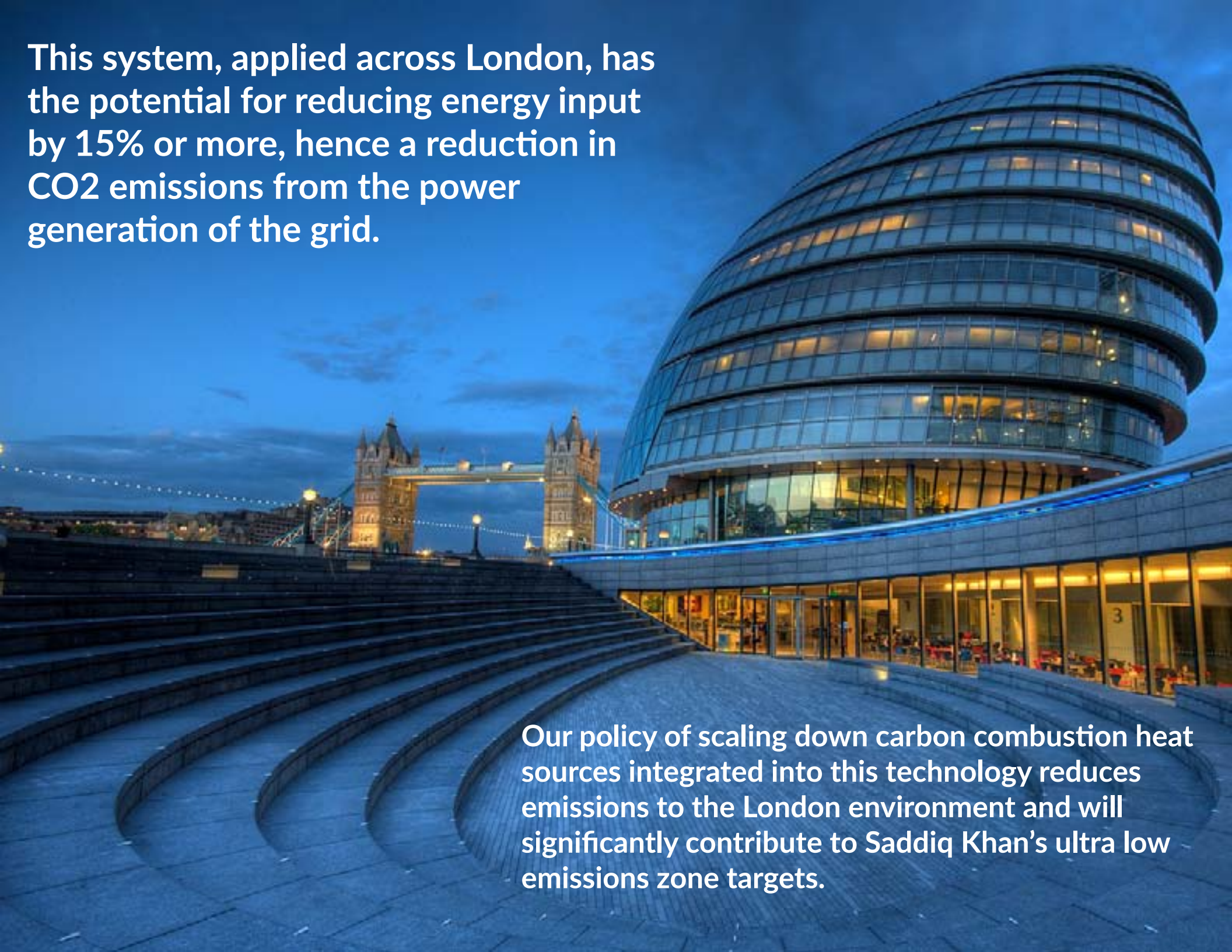
Instead of outside air driving the plant we have a 365/24/7 watchdog making intelligent decisions via the workspace spine and our C-Tech system prevents the building from supercooling or overheating and using large amounts of energy in recovery.

The technology is not time clock driven but physics based and gives 24/7 visibility to the space environment for facility management teams.

Robotic maintenance was the obvious next step and, using industry protocol across all systems, connectivity to pumps, boilers and chillers allowed loading instructions to be robotic as well as creating amber conditions for predictability of failure/ condition based maintenance.

The AHU energy usage dropped by over 1500 kWh per week, or 49%, an annual saving that equates too 78416 kWh.

The system is also reducing the heating and cooling demand by a reduction in fresh air to condition - A February day with similar OAT profiles showing a reduction of 15% in gas usage.



This system, applied across London, has the potential for reducing energy input by 15% or more, hence a reduction in CO2 emissions from the power generation of the grid.

Our policy of scaling down carbon combustion heat sources integrated into this technology reduces emissions to the London environment and will significantly contribute to Saddiq Khan's ultra low emissions zone targets.

C-Tech brings long term benefits in financial savings with occupants seeing a reduction in their energy output at almost £8,000 a year (circa £22 a day) which equates to £40,000 over a five year period. See Fig 1 below.

It's important to recognise that this is a minimum saving for C-Tech users as this doesn't take into account the positives around gas usage on the boilers and electrical usage on the chillers as their usage is brought down due to the reduced amounts of pressure running through the AHU system.

Fig 2 below shows the building output a year before C-Tech was installed while Fig 3 shows real time activity with the system in place.

The reduction in KW/h is plain to see and the peaks and troughs show building usage with inevitable dips as C-Tech reacts to occupants arriving and leaving the workplace environment while factoring in departures across the lunchtime window.

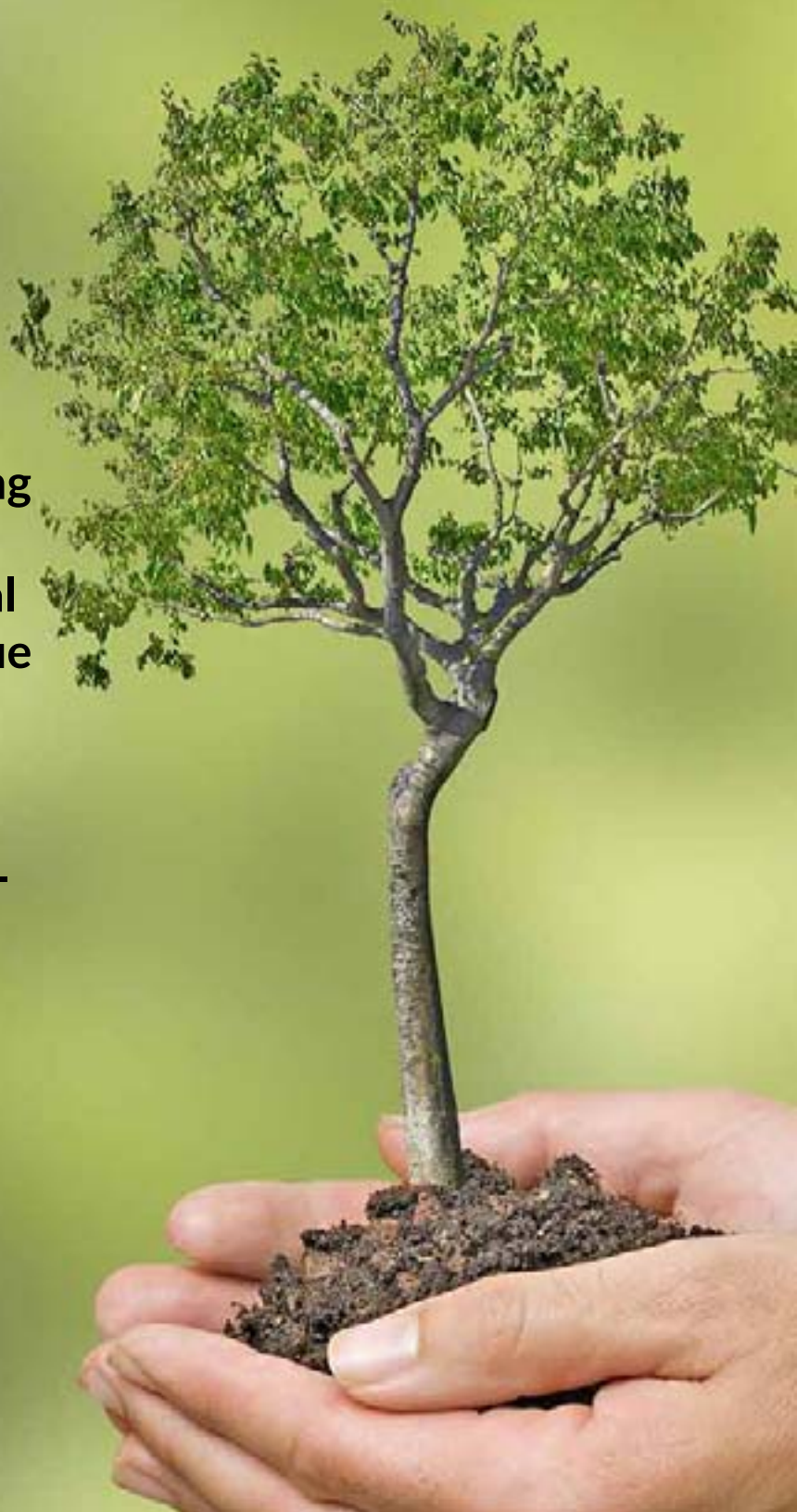


FIG 1


4.89k
3.91k
2.94k
1.96k
979
0
89.93
71.95
53.96
35.97
17.99
0
kWhTotal
kW
Thu, 24/Aug/2017 12:00 A
17. Aug Thu
18. Aug Fri
19. Aug Sat
20. Aug Sun
21. Aug Mon
22. Aug Tue
23. Aug Wed
06
12
18
Thu, 24/Aug/2017 12:00 AM
E-kW
E-kWhTotal
PV00050 VM Elec Shared Services - AHU Total
2.06
2,929.4
Thu, 25/Aug/2016 12:00 AM
E-kW
E-kWhTotal
PV00050 VM Elec Shared Services - AHU Total
0.13
4,437.7

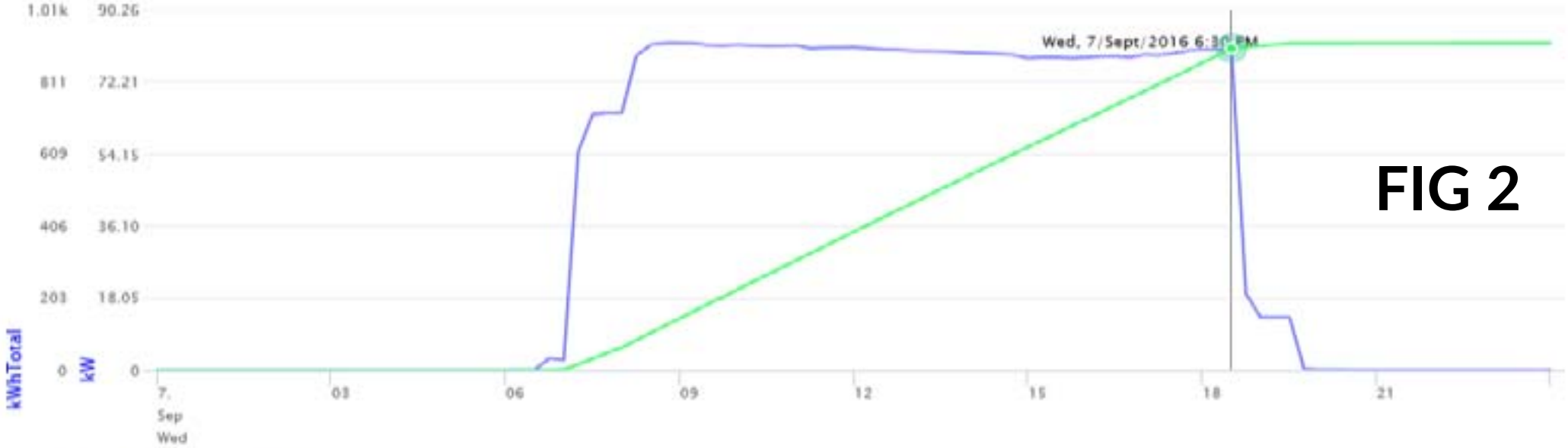


FIG 2

Wed, 7/Sept/2016 6:30 PM

E-kW E-kWhTotal

PV00050 VM Elec Shared Services - AHU Total

80.60 904.55

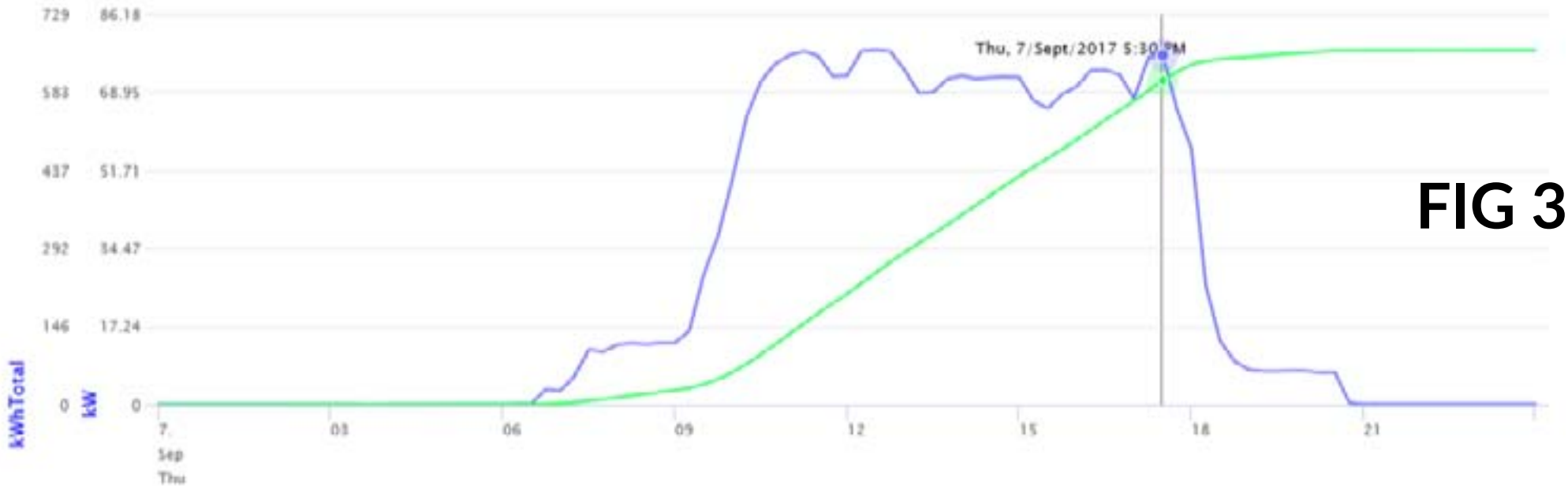


FIG 3

Thu, 7/Sept/2017 5:30 PM

E-kW E-kWhTotal

PV00050 VM Elec Shared Services - AHU Total

77.09 604.62

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