Intelligent Cleanroom Control System

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#bioProcessUK

UK BioIndustry Association

Intelligent Cleanroom Control System

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Head of Operational Engineering at MMIC

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Agenda

1. Who am I ?
2. Why am I here ?

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2. Why am I here ?

An independent, deep-tech innovation organisation addressing global societal, environmental and industrial challenges and opportunities

We help companies to develop , prove, scale-up and commercialise disruptive and transformative innovations

Founded in 2004

800 staff

£200m of innovation facilities (~25,000 m²)

>1200 innovation projects delivered with over £600m value

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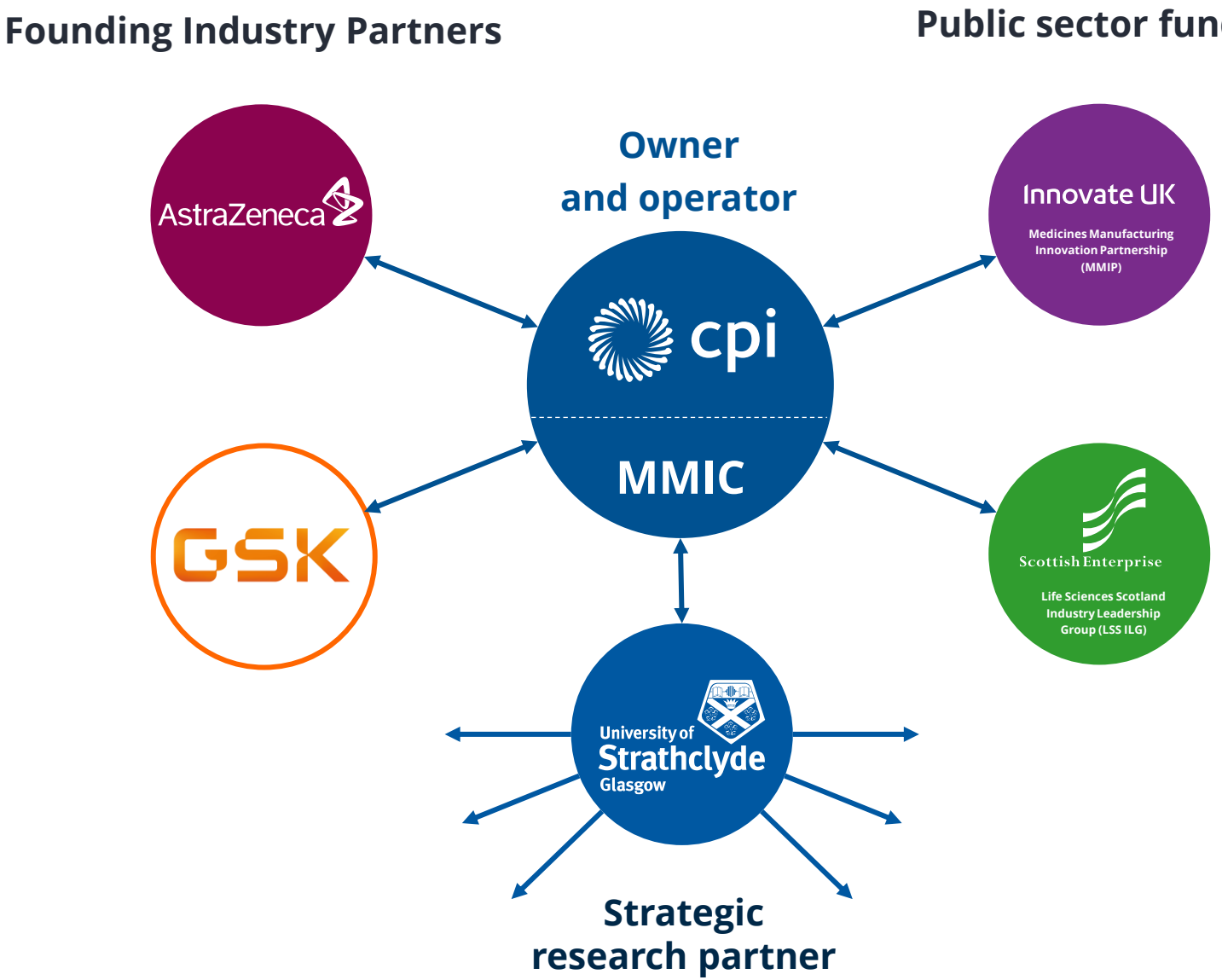
The MMIC Partnership Model



Collaboration & partnerships

Growing the MMIC partnership

Founding partners

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University of Strathclyde Glasgow

Scottish Enterprise

UK Research and Innovation

AstraZeneca

GSK

Technology partners

CMAC Future Manufacturing Research Hub

CME

PSE

Perceptive Engineering an Applied Materials company

Applied Materials

Gerlcke

SIEMENS

Stream Native

DFE pharma

Wyoming

NPL National Physical Laboratory

Atos

TULIP

eco2 Carbon | Cost | Compliance

Pharmaceutical partners

Pfizer

Novartis

Exactmer

Quotient Sciences

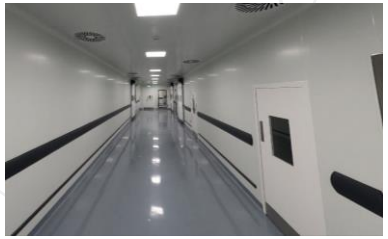
Alnylam Pharmaceuticals

Business partner

pwc

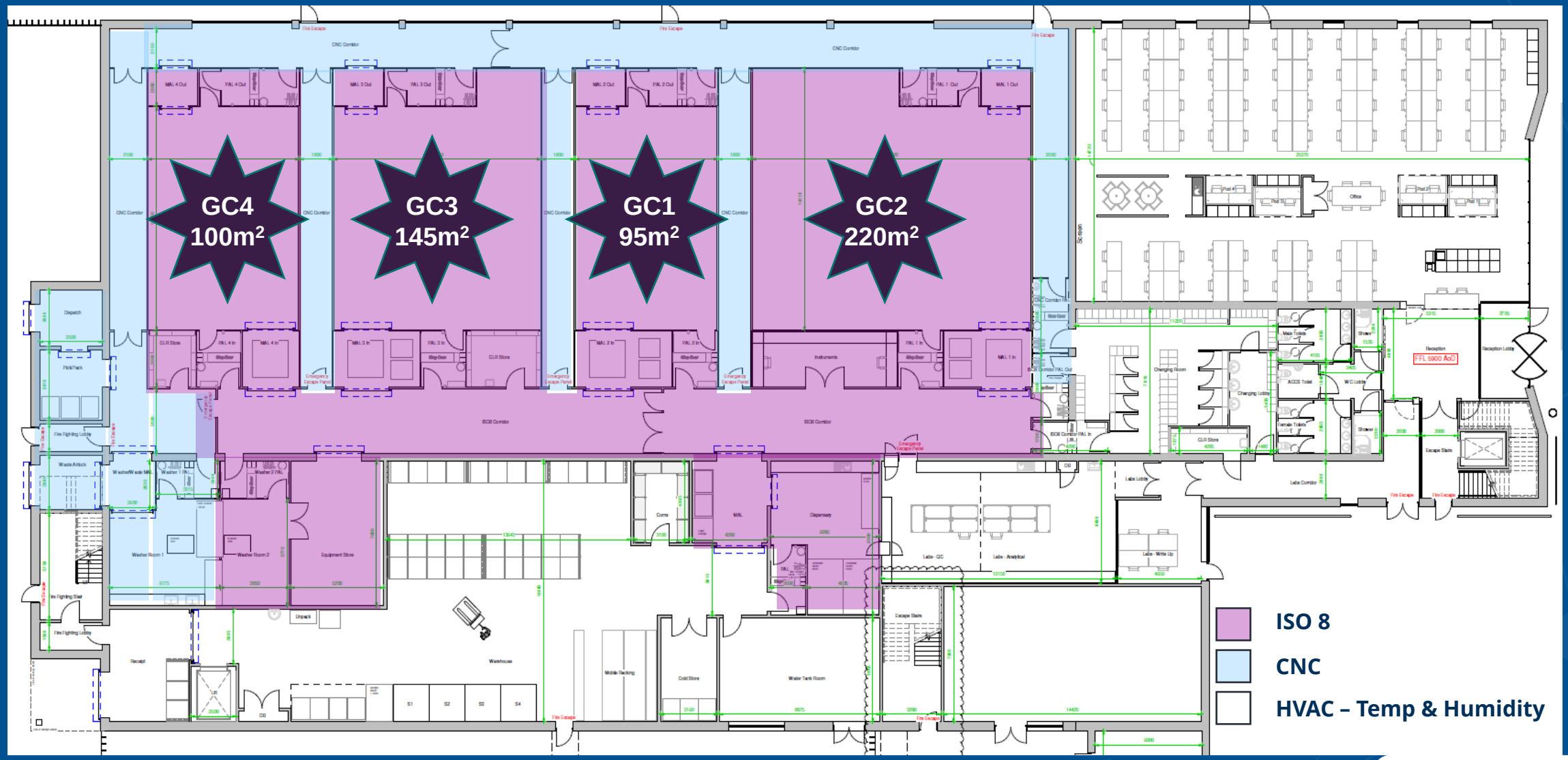
CPI's Medicines Manufacturing Innovation Centre (MMIC)

At MMIC we believe innovative technologies should be at the heart of modern medicines manufacture to reduce costs to patients & minimise environmental impact



September 2020 **May 2022**

Medicines Manufacturing Innovation Centre



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Sustainability and Cleanroom Operation

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Background and Research

EECO2 - Significant exposure in the global life sciences manufacturing industry and insights into key energy consumers.

Trusted by Key global Pharma clients

Cleanroom HVAC energy is a substantial consumer due to safety margins involved and impact of Environmental Deviation

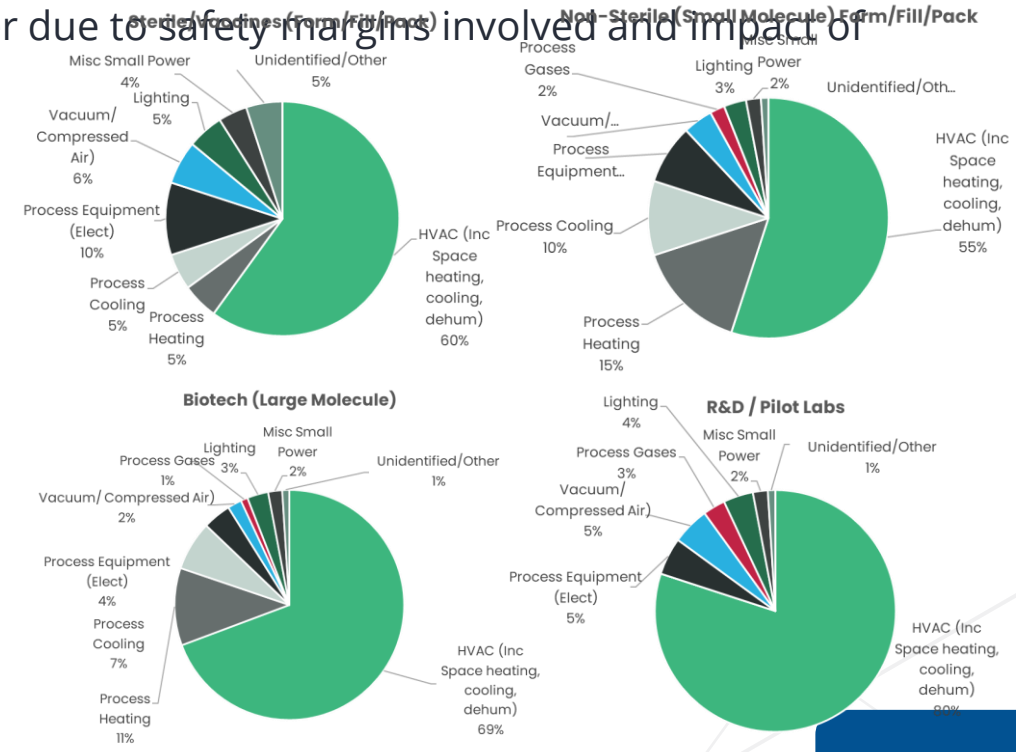
In 2012 EECO2 collaborated with GSK and AstraZeneca to conduct research into Air Change Rates and the impact on Cleanroom environmental conditions

Experiment conducted at AZ Macclesfield

Simulated operation in grade B, C and D environment using AZ gowning and SOPs

Environmental monitoring regime using

- Settle plate
- Active air sampling
- Contact samples



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Intelligent Cleanroom Control System

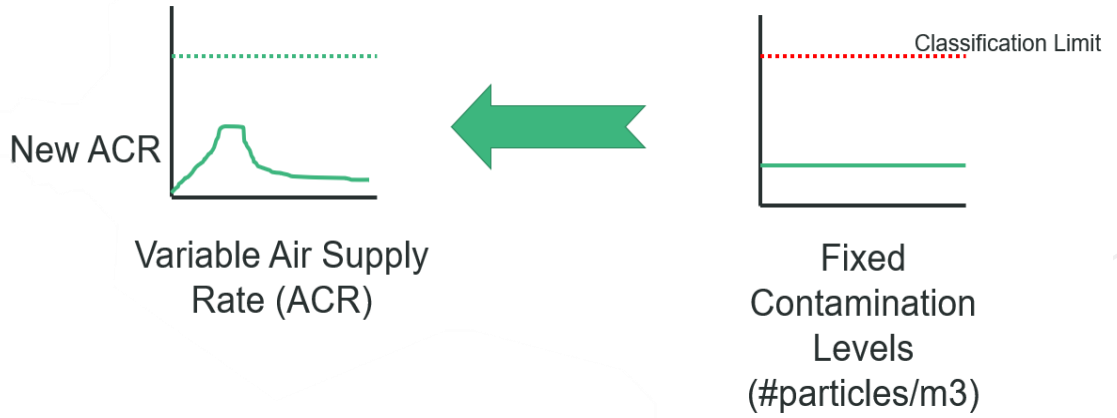
ICCS®
INTELLIGENT CLEANROOM CONTROL SYSTEM

Adaptive (demand based) control of HVAC made possible by:

- EECO2 Patented Model Predictive Controls algorithm
- Integrated room particle counters
- Control on particle concentration not ACR

Other benefits

- Continuous monitoring and recording of particle concentration
- Differential pressure cascade
- Alarm monitoring
- Cleaning cycle (activation from User Interface).
- Failure mode to revert back to main BMS



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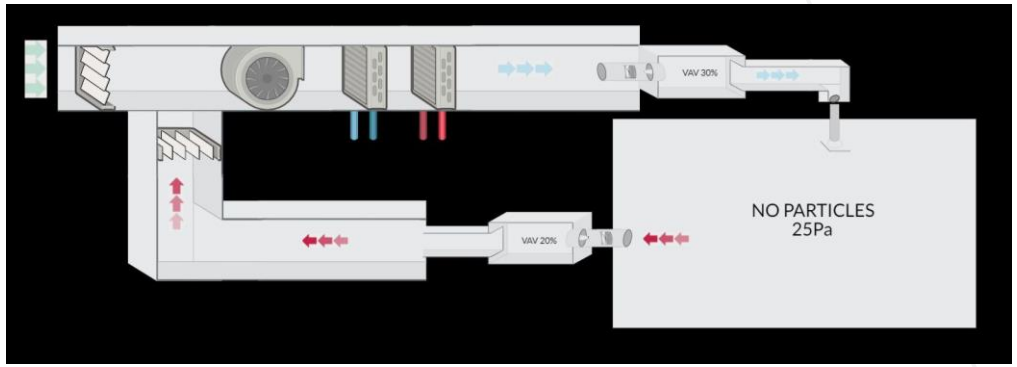
Controls Operation - Actuation

VAV Control

1.Supply VAVs control Airflow to the room which equates to Air Change Rate
2.Return VAVs control Room Pressure
3.Dynamic ACR drives a need to control the Return VAV Dynamically to sustain a constant pressure
4.To enable this we use a high speed Industrial PC and our patented Model Predictive controller to drive smooth actuation

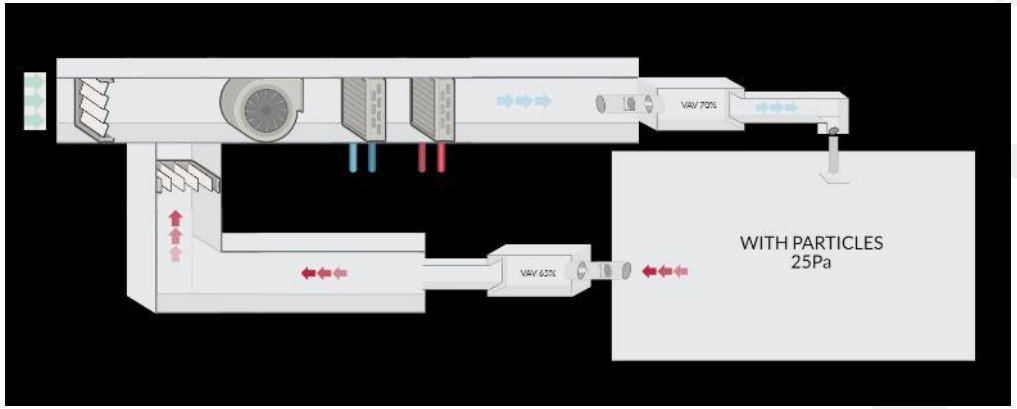


Fan Controls Approach

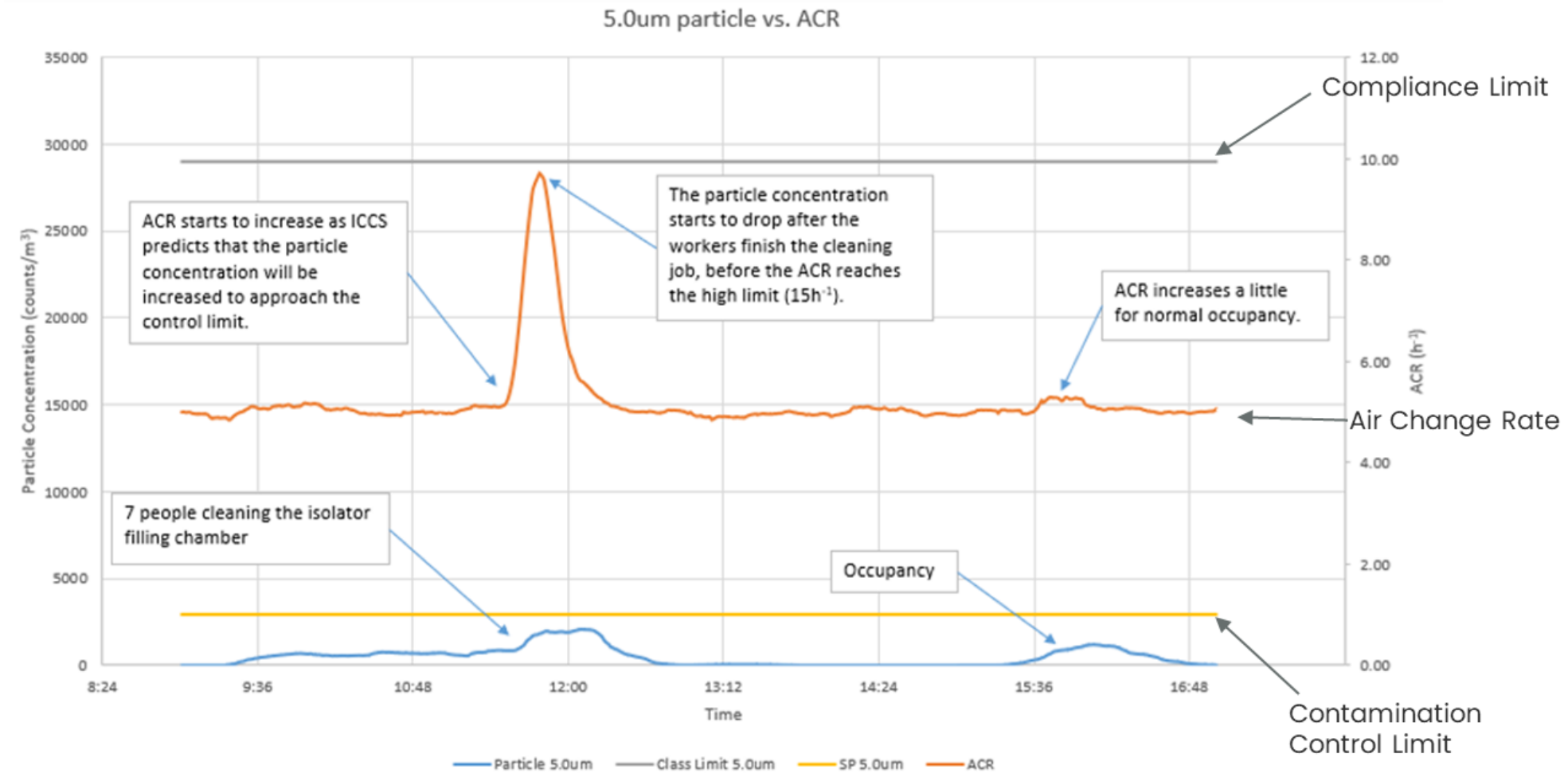
1.To enable the VAVs to control dynamically we need to control the HVAC Supply Pressure
2.ICCS includes a controls loop linked to the ICCS controller
3.We maintain a steady supply duct static pressure by adjusting the supply fan speed
4.As the VAVs open, more flow demand is created, to cope with this, the fan speed increases to sustain the supply duct pressure.

If the VAVs are out of range, we can employ variable supply duct static pressure to run minimum pressure until demand increases

5.For maximum efficiency we operate on the low set point value
6.If demand is high across the system and the supply VAVs are approaching the 75% of the range, we increase supply duct pressure to increase supply flow to the rooms.
7.The rooms that don't need this extra supply will close down vav to ensure the room supply airflow is sustained.



Real World Trends – Particle Concentration and Airflow



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VAV Assessment carried out at feasibility stage to assess the operating envelope, upgraded if required

AHU

Supply VAV

BMS Panel

BacNet Interface

Extract VAV

ICCS Panel

Additional Particle counters and Room Beacons over IP

Use of existing Room Sensors for Temp, Hum, Pressure, Door switch and occupancy Via Bacnet Interface

OSI PI Interface under development to enable read only data transmission to support remote maintenance

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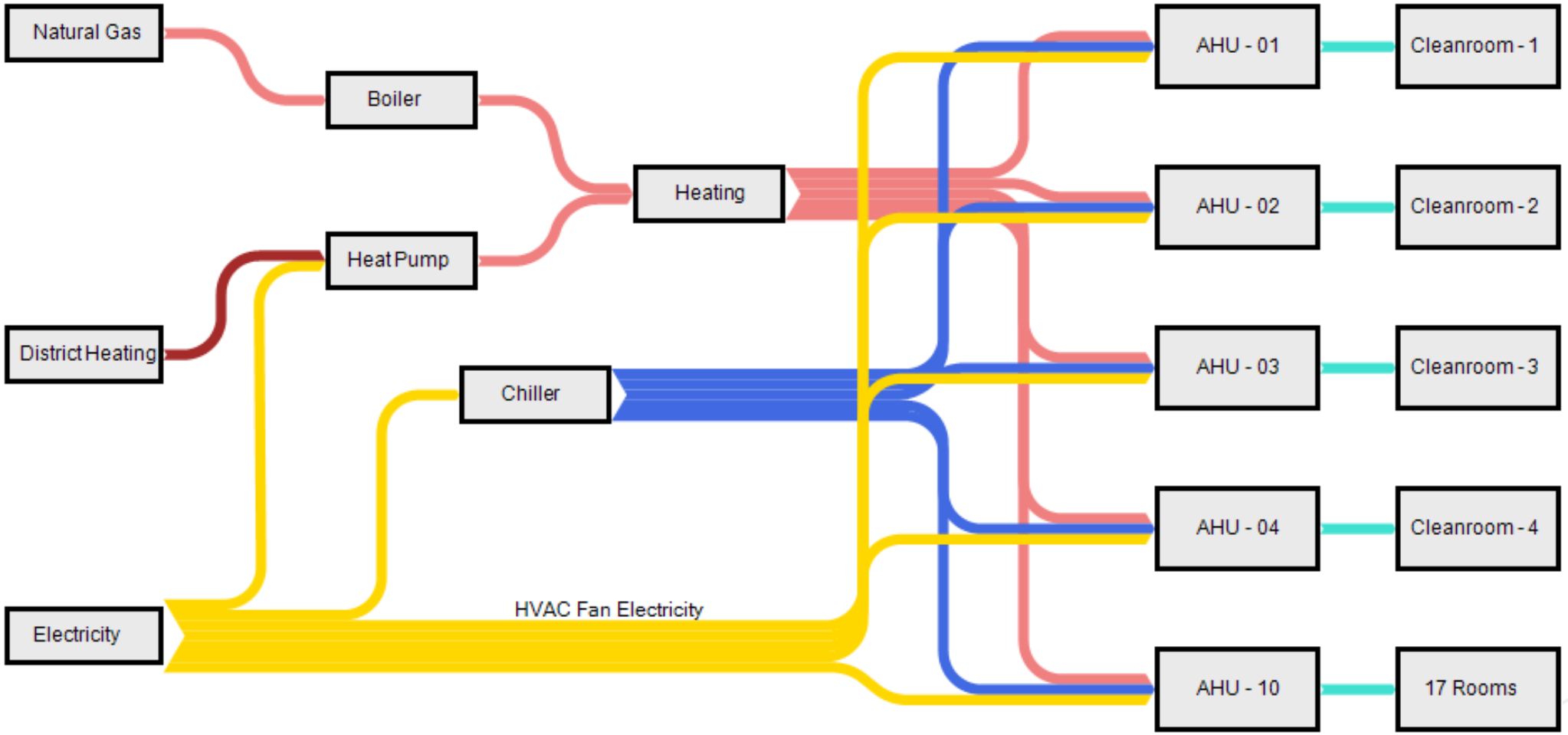

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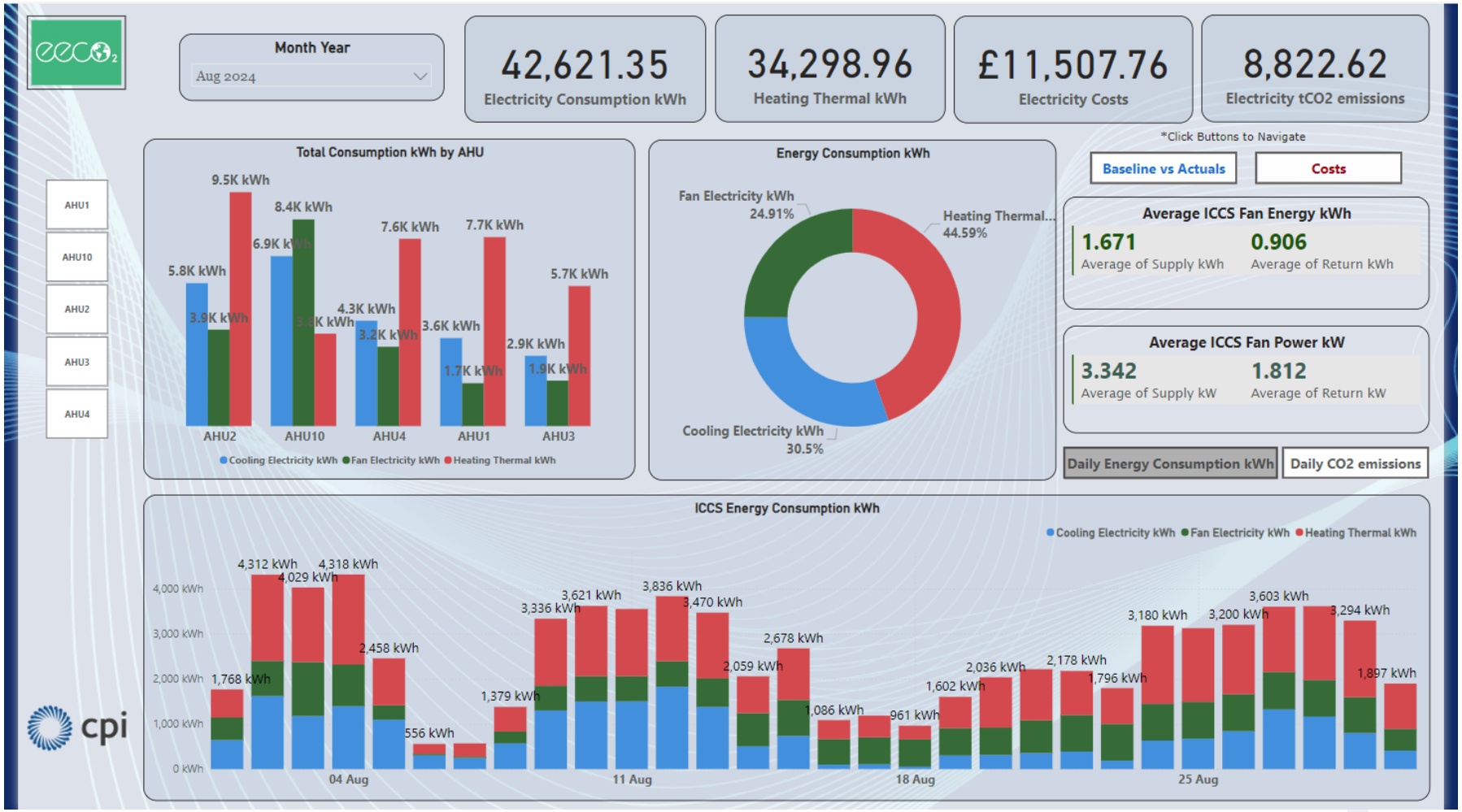

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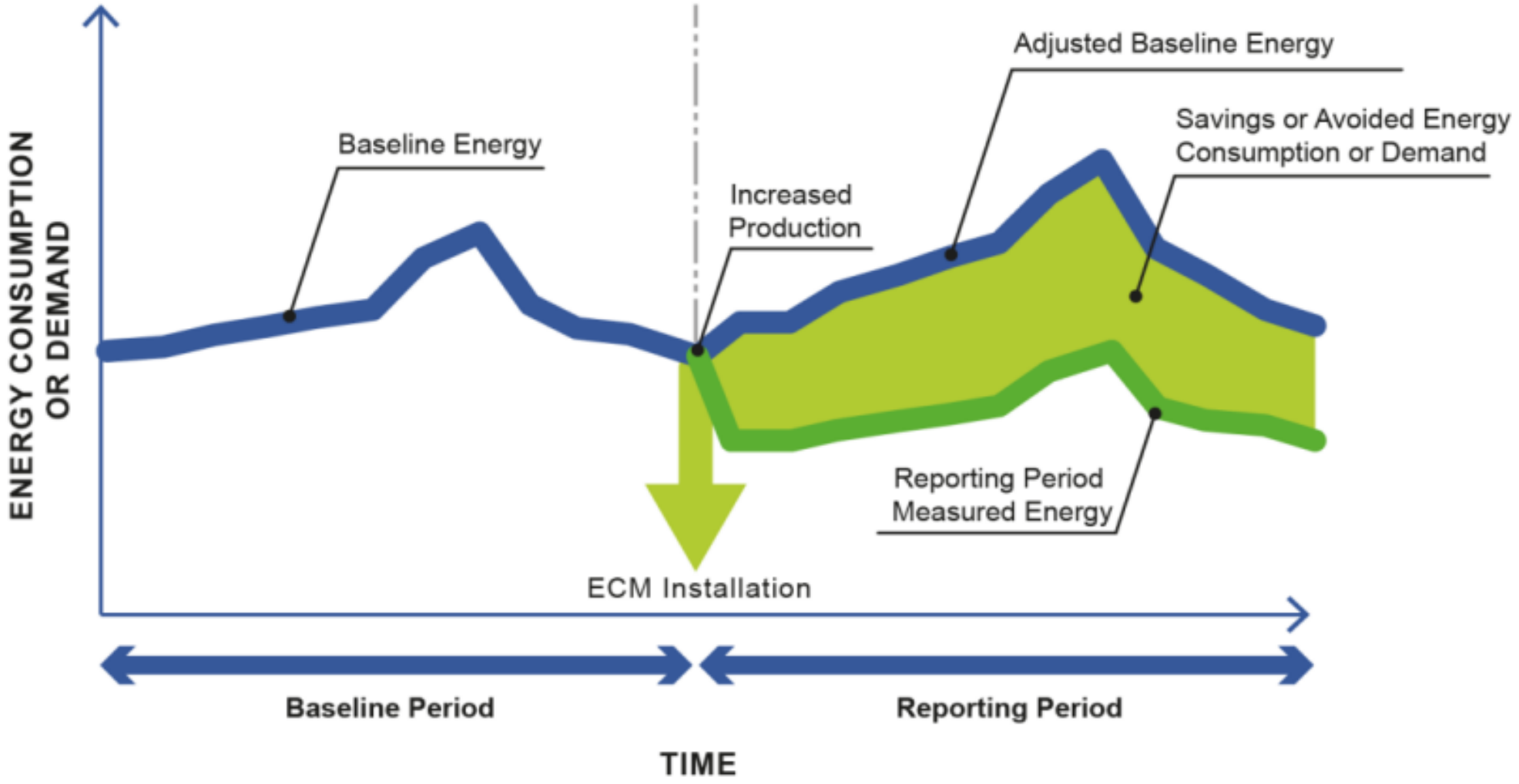

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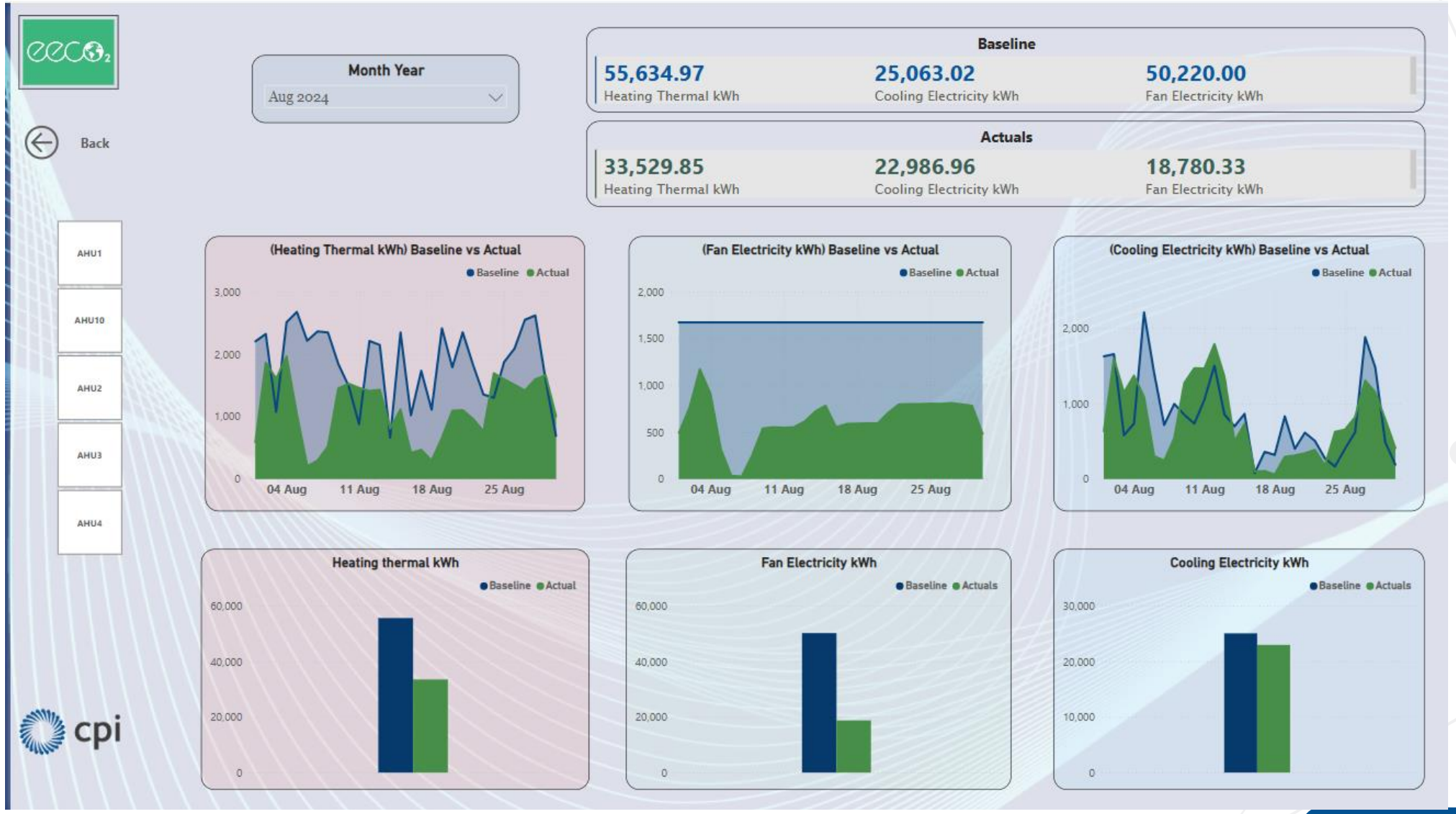

Thank you

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