

# Closing the Energy Performance Gap

EAUC Webinar  
8<sup>th</sup> March 2017



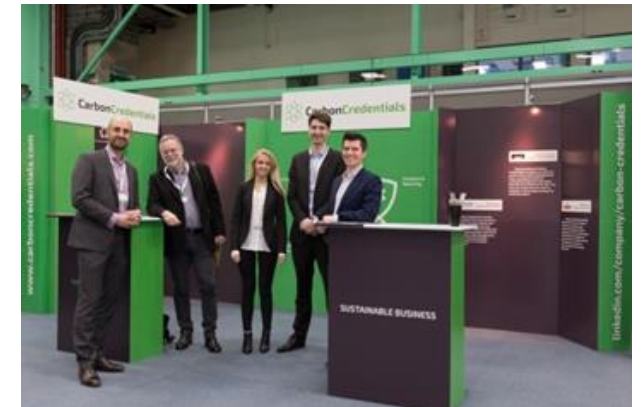
## Agenda

- Introductions
- What is the Problem?
- What is the Opportunity?
- Case Study
- How do we do it?
- 4 more Case Studies
- Q&A



# Our Engagement with the HE Sector

- Headline Sponsor at EAUC Annual Conference for the fourth year in 2017
- Keynote speakers: Paul Lewis, Chief Operating Officer, Sam Carson, Director of Sustainability Innovation and Will Jenkins, Consultant
- Presented to London University Environment Group
- Held six free carbon management workshops for the HE sector



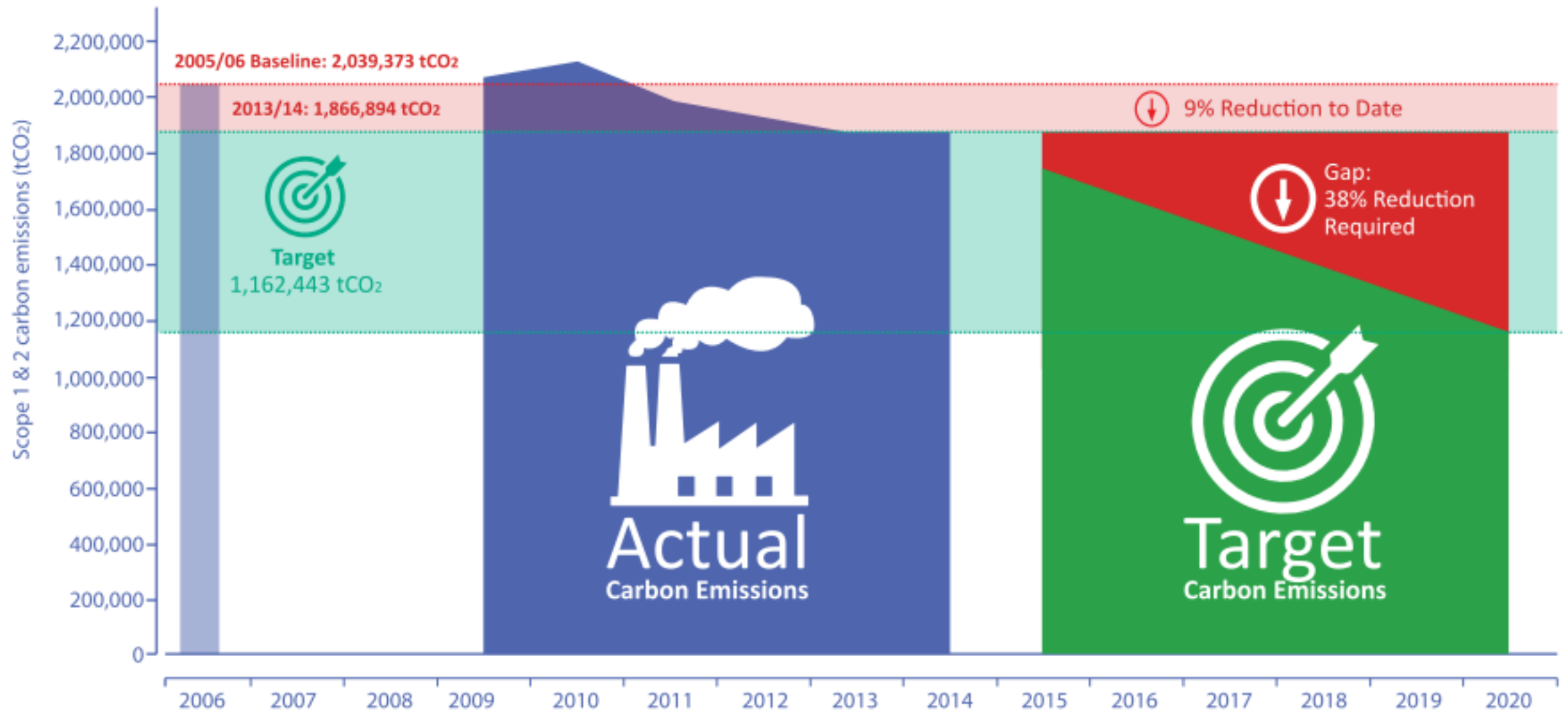
# Universities We Have Worked With

Worked with over 30 universities, from all over the UK, in the last two years





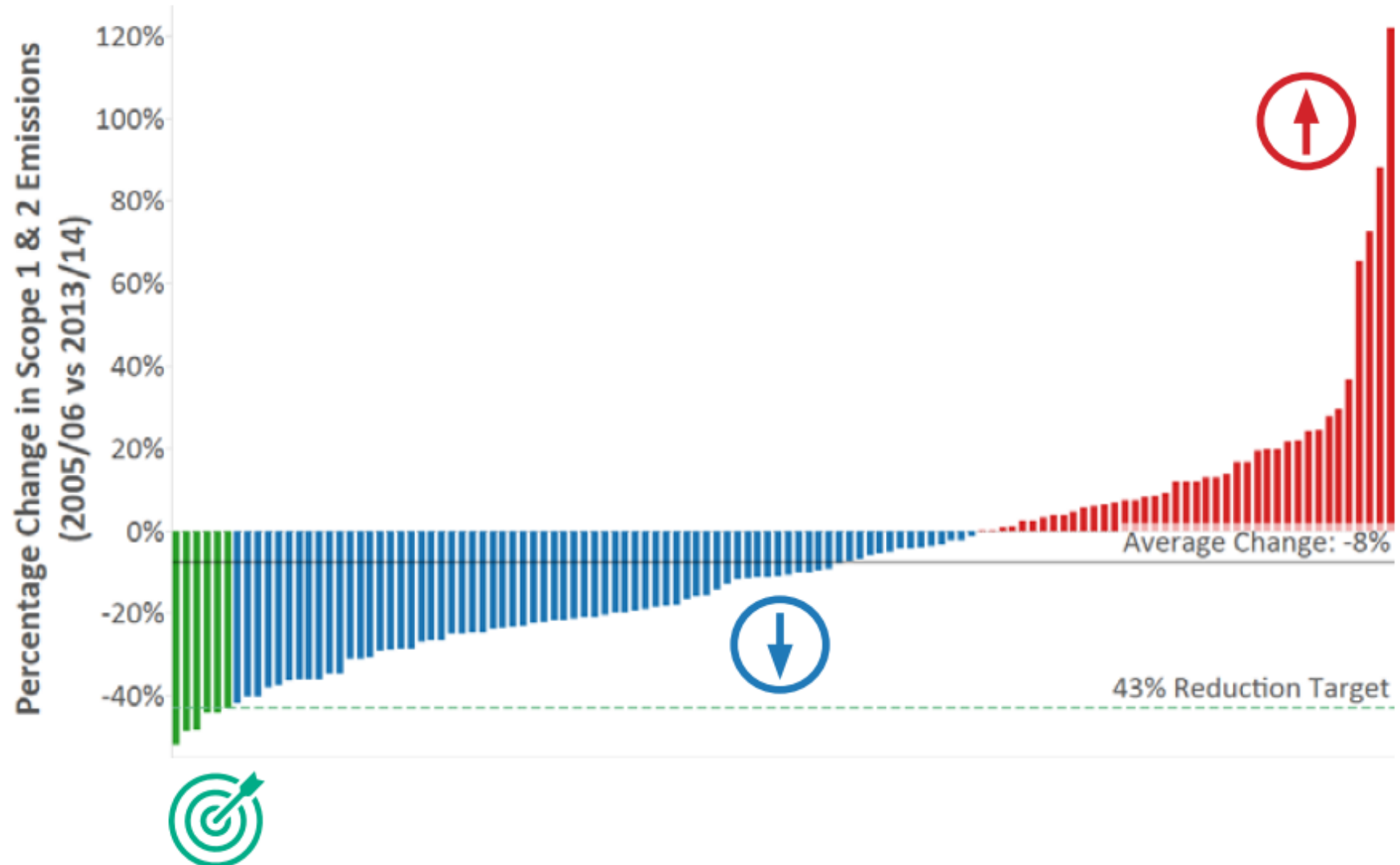
# How is the sector performing?



Data from HESA: 120 institutions

# How is the sector performing?

-  Increased
-  Decreased
-  Decreased & achieved target



Data from HESA: 120 institutions

# The Opportunity



2.26 million tonnes

IN 2014/15 ENERGY CONSUMPTION FROM UK UNIVERSITIES PRODUCED 2,259,081 TONNES OF CARBON EMISSIONS



10%  
SAVING

IN 2016 OUR COLLABORATIVE ASSET PERFORMANCE PROGRAMMES ACHIEVED SAVINGS OF AT LEAST 10% THROUGH PEOPLE, PROCESS & TECHNOLOGY



Emissions FREE

APPLYING CAPP TO THE SECTOR WOULD ACHIEVE CARBON SAVINGS EQUIVALENT TO THE TOTAL EMISSIONS FROM ENERGY USED BY THESE UNIVERSITIES

Data from HESA: 156 institutions

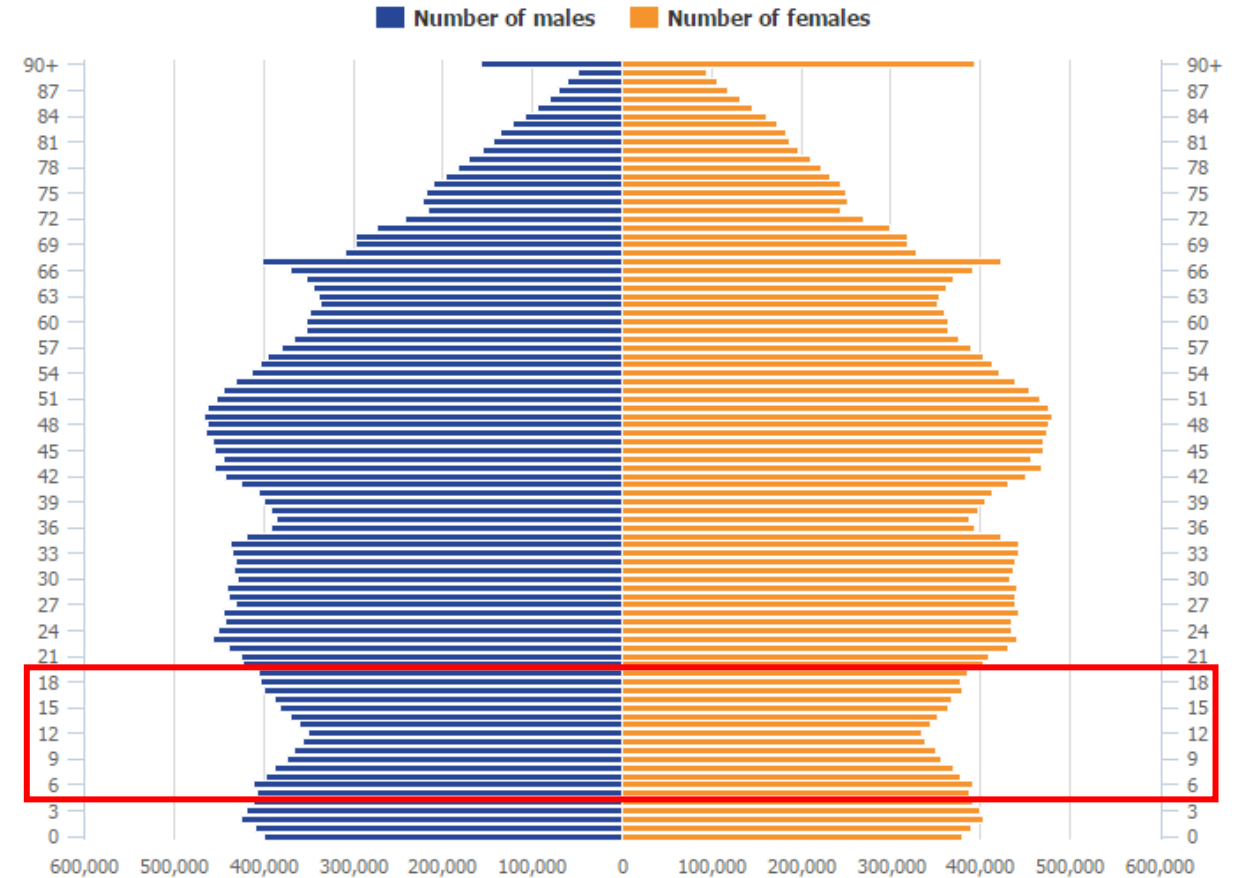
# Why Now?

Uncertainty, reducing applications and funding constraints means that now is the right time to focus on the quick-win and low-cost projects



Figure 5: UK population by single year of age

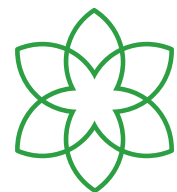
2014





## Carbon Credentials: Why do we exist?

**To enable a global  
low-carbon economy**



**Carbon**Credentials

# What we do?

Assured Performance



**We Optimise  
Energy &  
Carbon  
Performance**

ASSURED  
PERFORMANCE

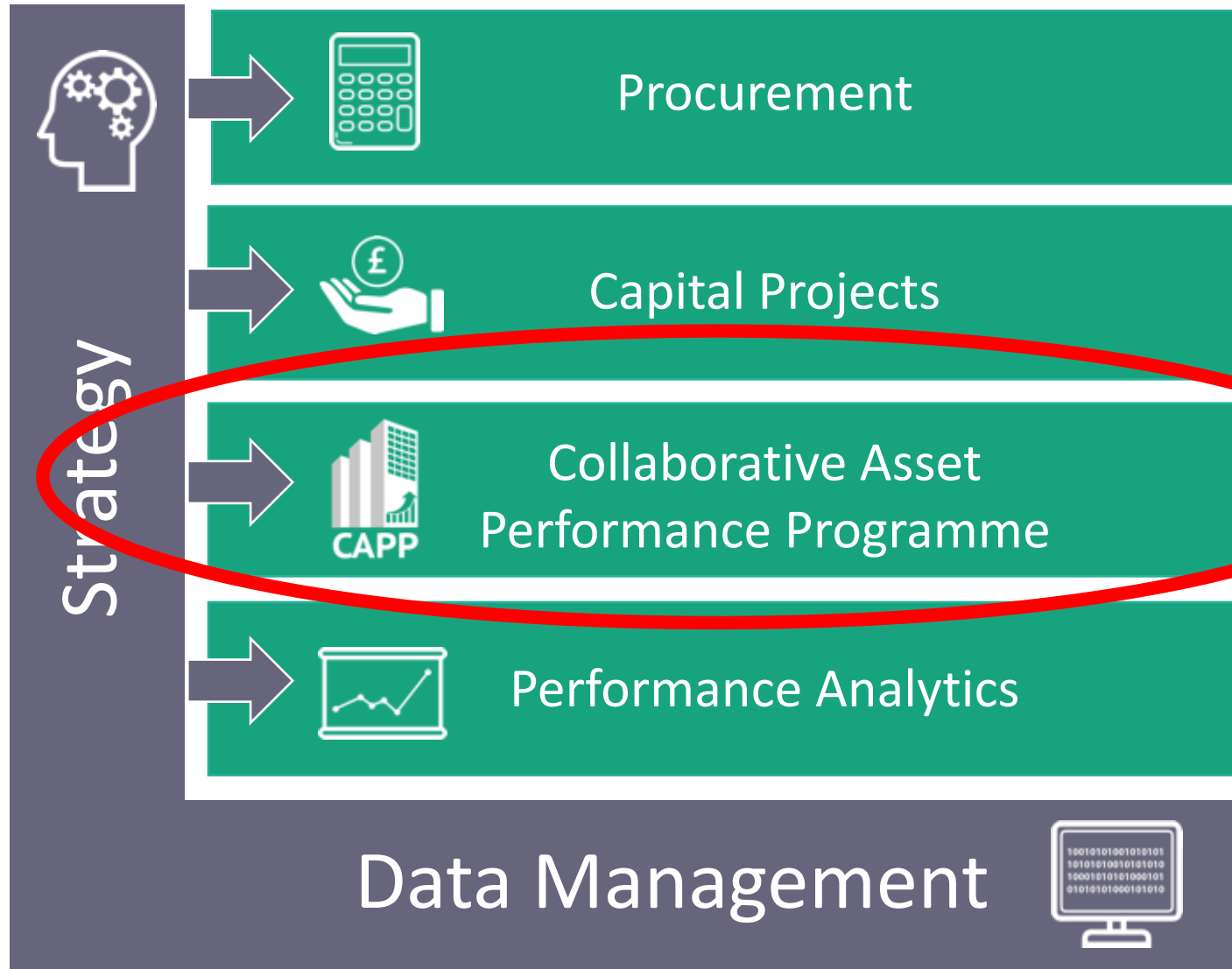
Assured Risk Management




**We Manage  
Energy &  
Carbon Risks**

ASSURED  
RISK MANAGEMENT

# Assured Performance Roadmap



Powered by  
**ADAPT**  
ASSURED DATA ANALYTICS PLATFORM



# What is the Problem?

# What is the current problem across the UK?

## Building Energy Performance Gap

Modern and older buildings are performing well below their potential.

Due to **commissioning, maintenance, controls or operations** and **misalignment** of incentives for the key stakeholders.

***“Average building emissions are 3.8 times higher than design estimate”***

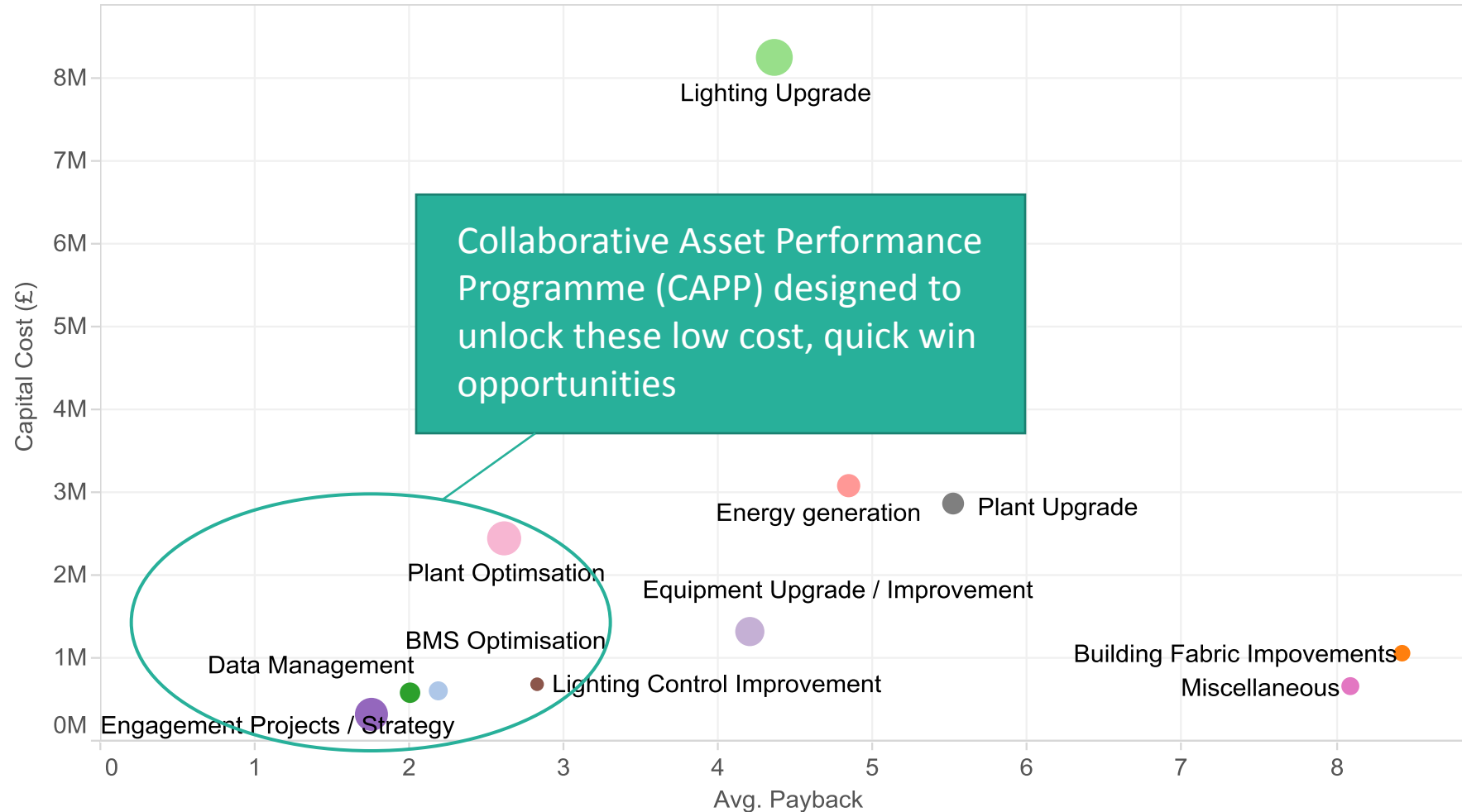
Source: Innovate UK - [www.innovateuk.gov.uk](http://www.innovateuk.gov.uk)

**Innovate UK**



# Evidence Based on Our ESOS Programme: 49 clients, 300 audits

Analysis of cost and payback; size of circle denotes annual cost saving



**At a recent workshop, we asked delegates**

**“what are the key inhibitors to bridging  
the energy performance gap”**



# The problem

As described by



## Key Questions we are often asked:

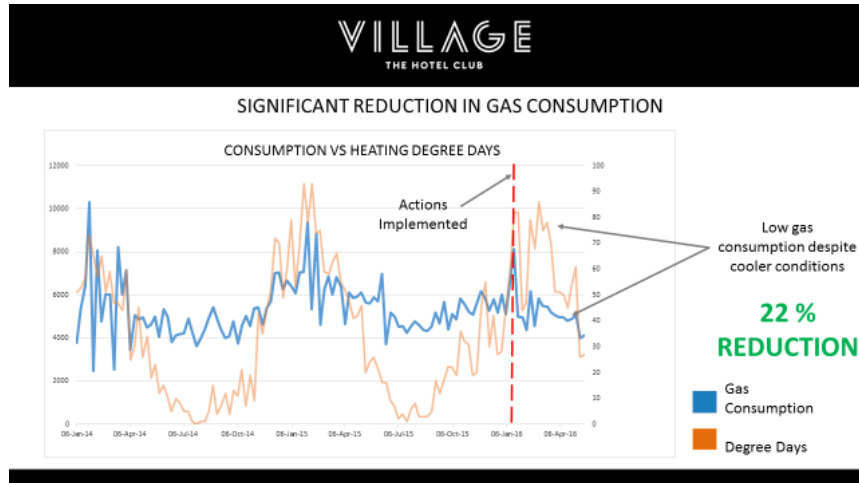
- We've already done our 'low hanging fruit opportunities' – can we really get another 10% or more in cost savings?
- Can you help me reduce the complaints I get about the buildings being too hot/cold/stuffy?
- Can you help my building management team (engineers, BMS contractors, maintenance etc) be more effective?
- Can you help us identify problems with our equipment faster and prove the problems have been resolved?



# What is the Opportunity?



# Expect 10% savings at a minimum...



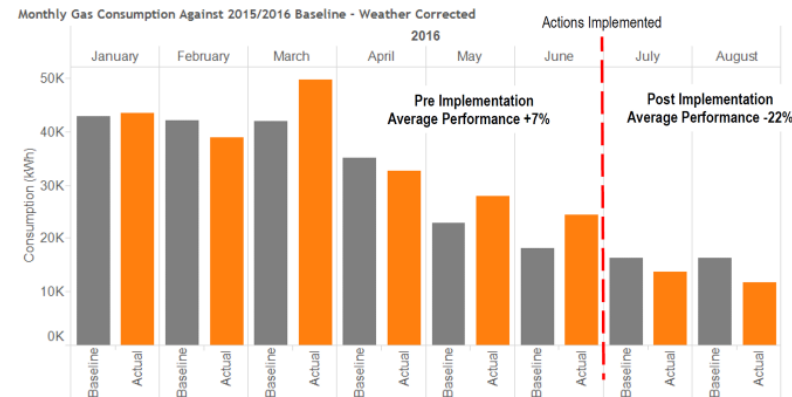
Results: 32% and 42% savings in months 1 and 2 post implementation



Automated monthly Measurement and Verification reports augment standard site level consumption reports

These become a key driver for additional or different action

## The results: 29% reduction in gas consumption



# Co-benefits of an energy efficient building

## Maintenance

- Reduced costs, extend life

## Optimise Cap-Ex budgeting

- Data-driven capital expenditure

## Wellbeing

- Happier staff and students
- Increased productivity
- Increased cognitive scores
- Lower complaints

## Real Time Identification & Rectification



PROJECT LED BY:

CAMPAIGN SPONSORS:



ARUP

B+H



LandSecurities



M&S

SAINT-GOBAIN

SKANSKA

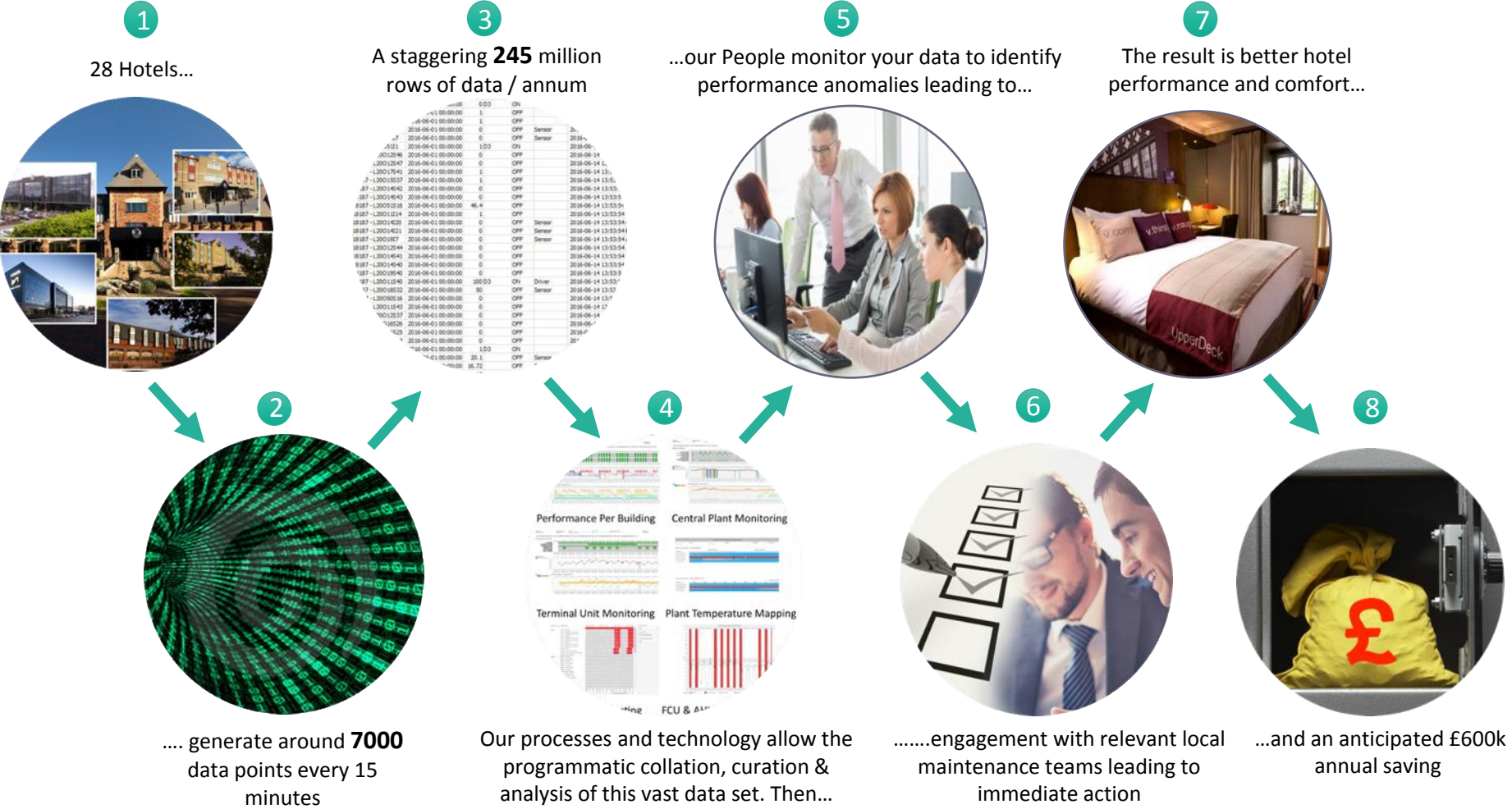
uponor



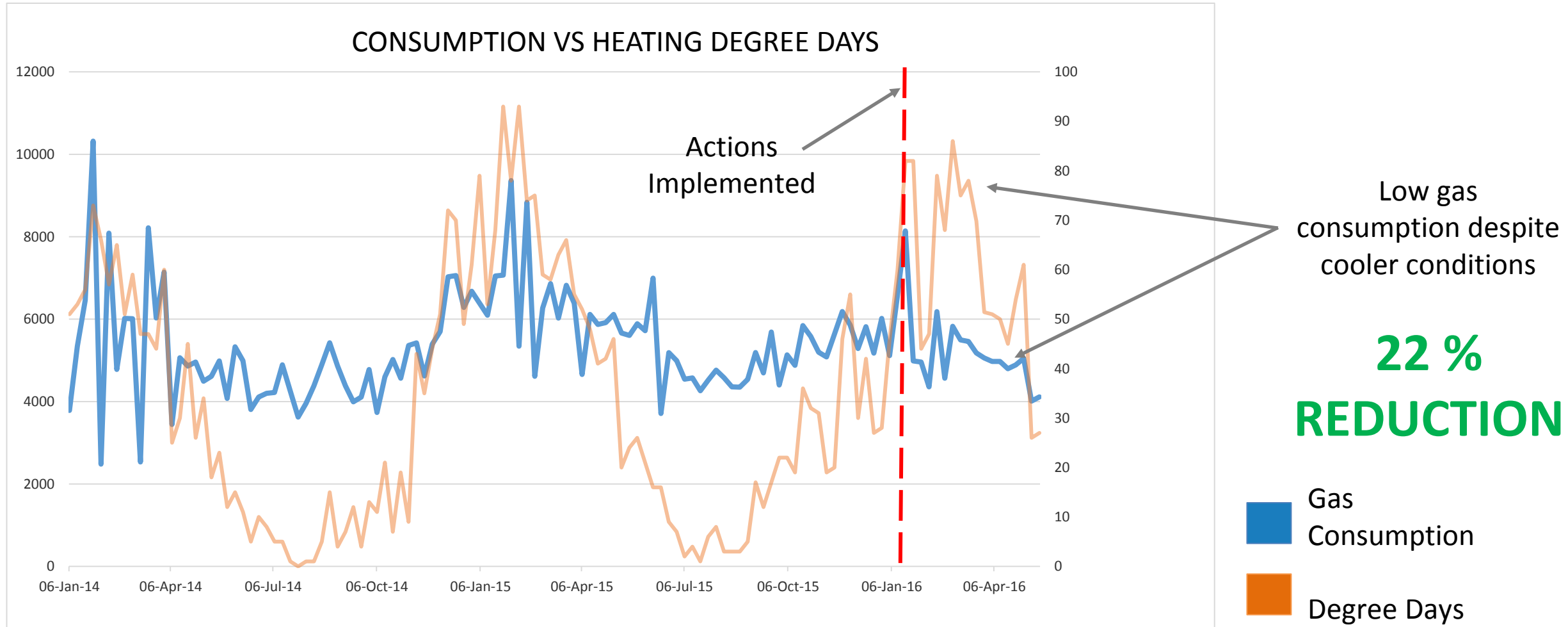
# Case Studies

Collaborative Asset Performance Programme

# At a client – Village Hotels – acquiring existing data, performing analytics, engaging teams



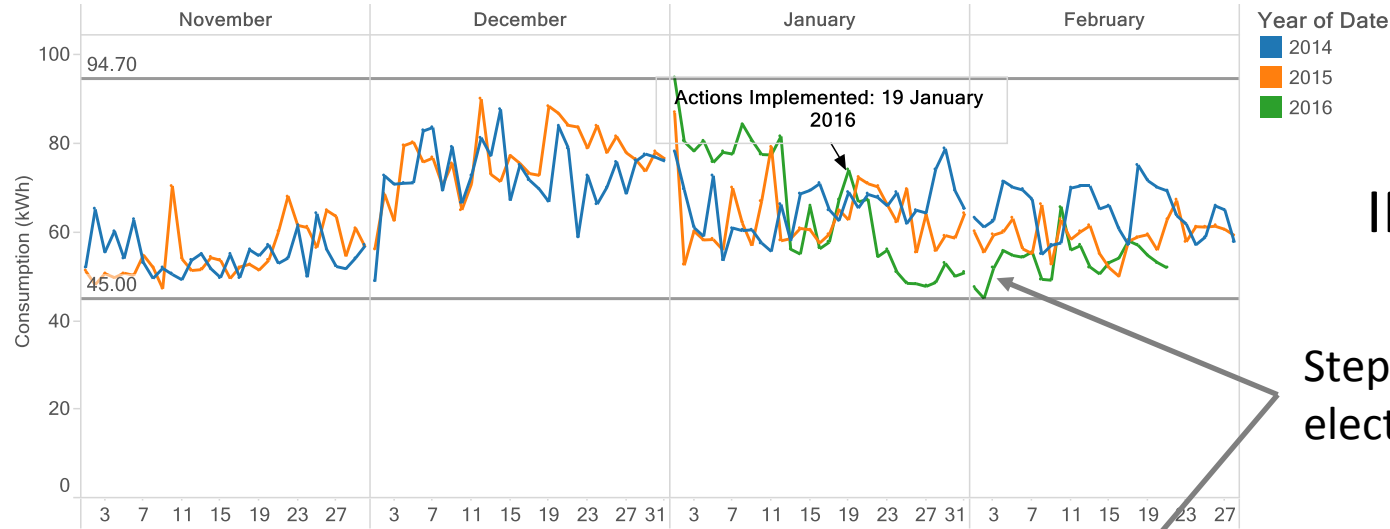
## SIGNIFICANT REDUCTION IN GAS CONSUMPTION



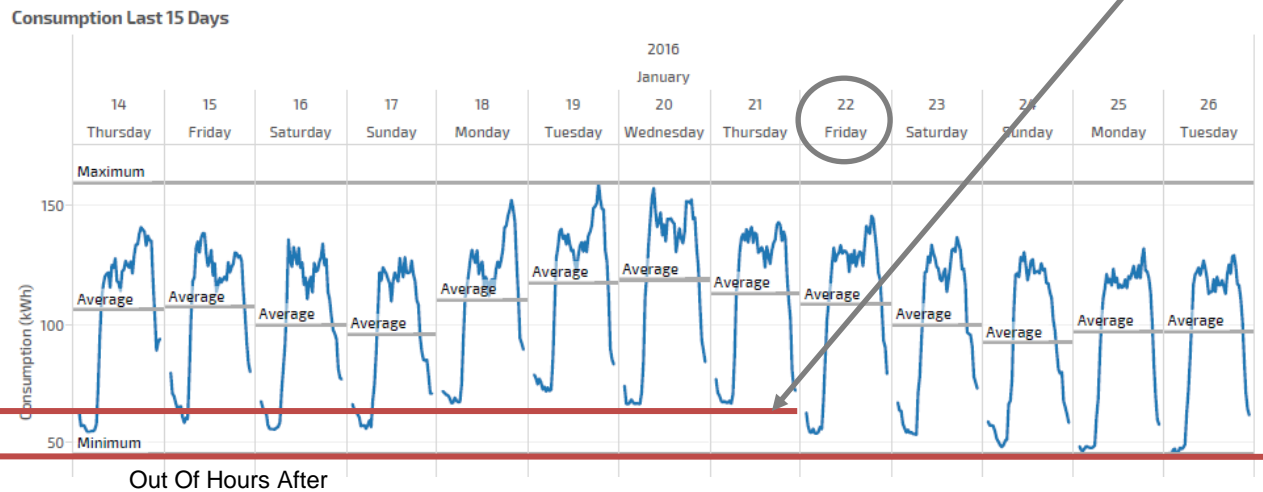


# VILLAGE

THE HOTEL CLUB



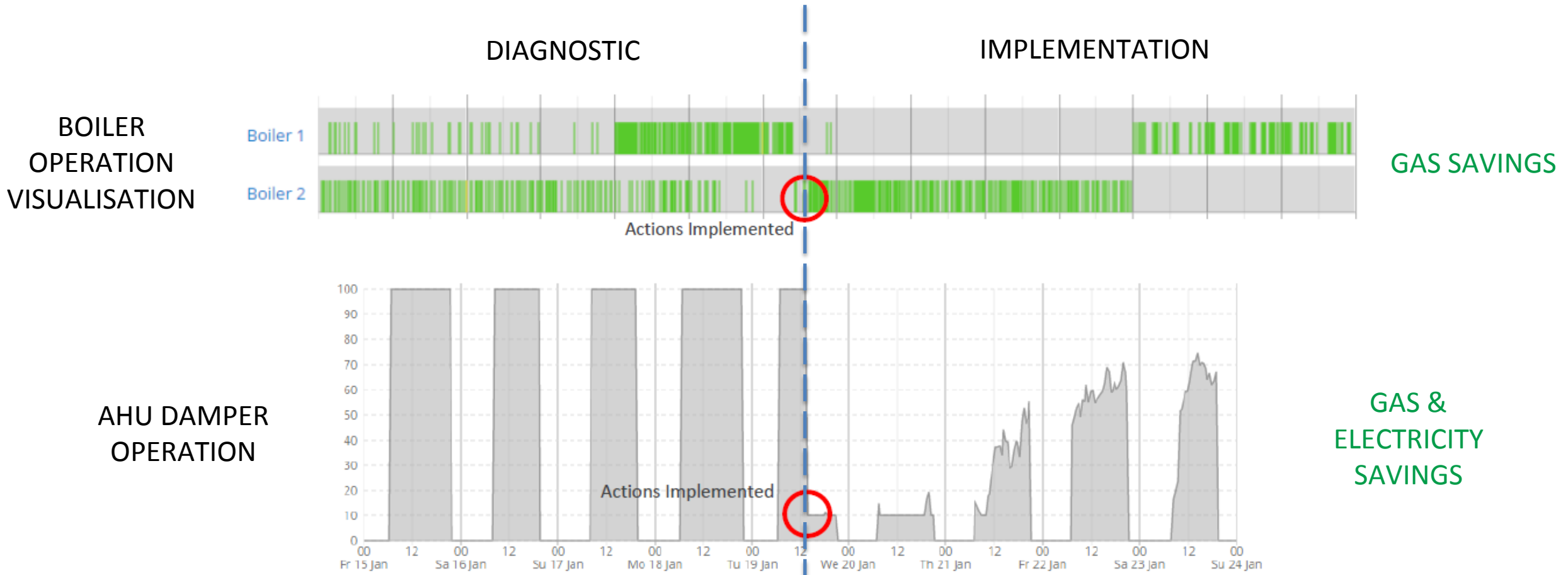
SIGNIFICANT REDUCTION  
IN ELECTRICITY CONSUMPTION



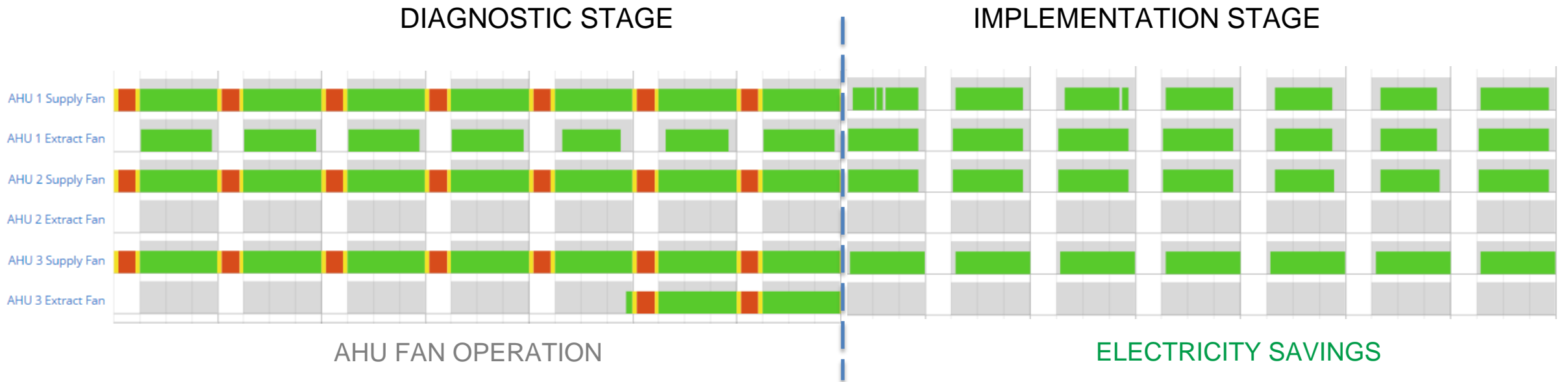
9%  
REDUCTION

Significant reduction in out-of-hours  
consumption

The following visuals show savings that have been achieved at asset level. The opportunity is highlighted at diagnostic stage and savings are seen after implementation.



## LARGE AIR FANS RUNNING 24/7 UNNECESSARILY

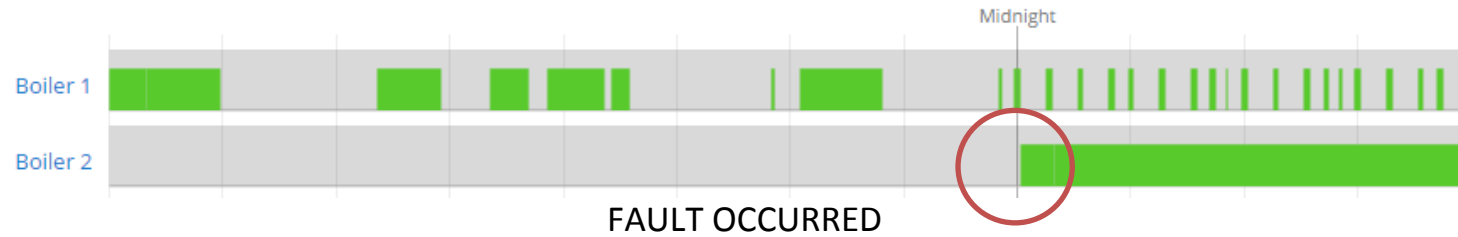


*“I did not realise so much energy intensive plant was running for extensive periods of time”* Maintenance Manager

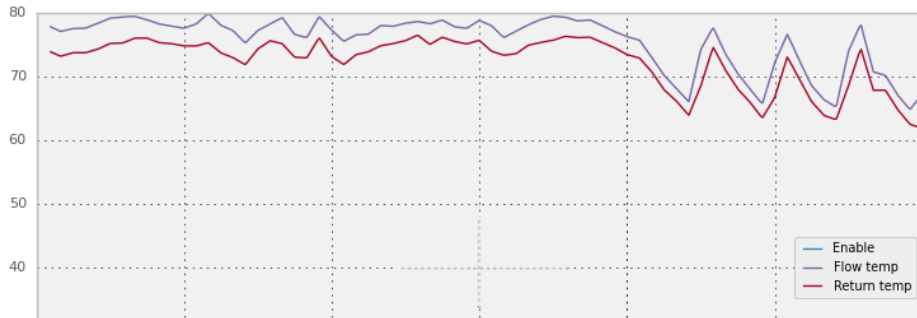
## ADDITIONAL BENEFITS

The date range for this view is limited to 14 days

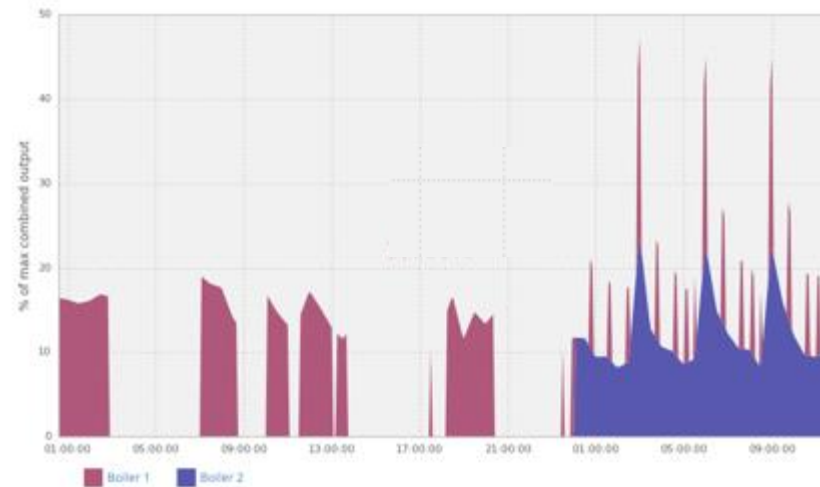
Start  End  [Change](#) [Live](#)



On a Monday morning Carbon Credentials identified a fault through the platform



BOILER FLOW & RETURN TEMPERATURE



BOILER VIRTUAL ENERGY METER

Boiler 2 has been permanently enabled and the fault was causing significant temperature & consumption fluctuations



## ADDITIONAL BENEFITS

- **The Carbon Credentials team attended site on that day and rectified the fault**
- This would not have been identified at site because of another fault
- **This could have cost over £1,000 in energy, caused occupant discomfort and may have damaged the plant**
- The platform allowed Carbon Credentials to identify further mechanical issues
- Staff had also put another AHU back into hand as a work around for an issue



# How do we do it? People, Process & Technology

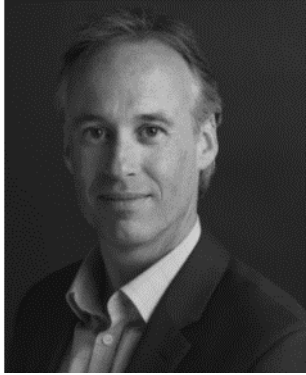


# People



# People – variety of skillsets required for project success – core team

**Cian Duggan**  
Chief Technical Officer



**John Taylor**  
Associate Director



**Andy Mazzucchelli**  
Consultant Energy Engineer



**Roochi Solanki**  
Energy Engineer



**James Woodhead**  
Energy Engineer



**Will Jenkins**  
Engagement Consultant



**Natasha Allard**  
Senior Analyst



**Adrian Shelley**  
Data Integrity Analyst



# Carbon Credentials – Skills Required

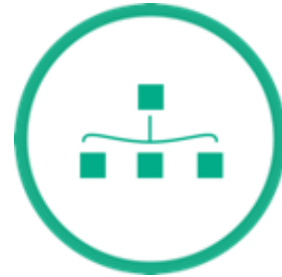
## Project Management



## Energy Performance



## Strategy



## Technical BMS



## Data Management



## Finance



## Analytics



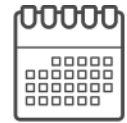
## Engagement



# Process



# CAPP: An End-to-End Process for Building Optimisation & to unlock savings



Months



## Diagnostic

- Engage with stakeholders
- Determine opportunities and desired outcomes
- Understand the 'size of the prize'



## Implementation

- Energy-saving interventions
- Establish review parameters for remote monitoring
- Main savings that pay for the programme



## Visibility & Control

- Measurement & Verification
- Exception reporting on energy and comfort issues
- Fault diagnostics and operational monitoring
- Comfort and wellbeing management



# Process to maximise savings

Diagnostic

Implementation

Ongoing

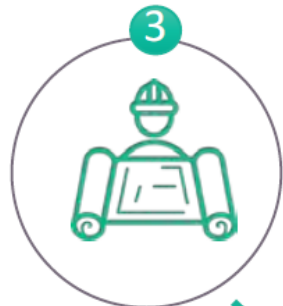
Stakeholder kick  
Off Meeting

Site Audit- Commercial  
& Technical plan

Implementation of  
Optimisation measures

Measurement &  
Verification reporting

Prevent slippage,  
unlock more savings



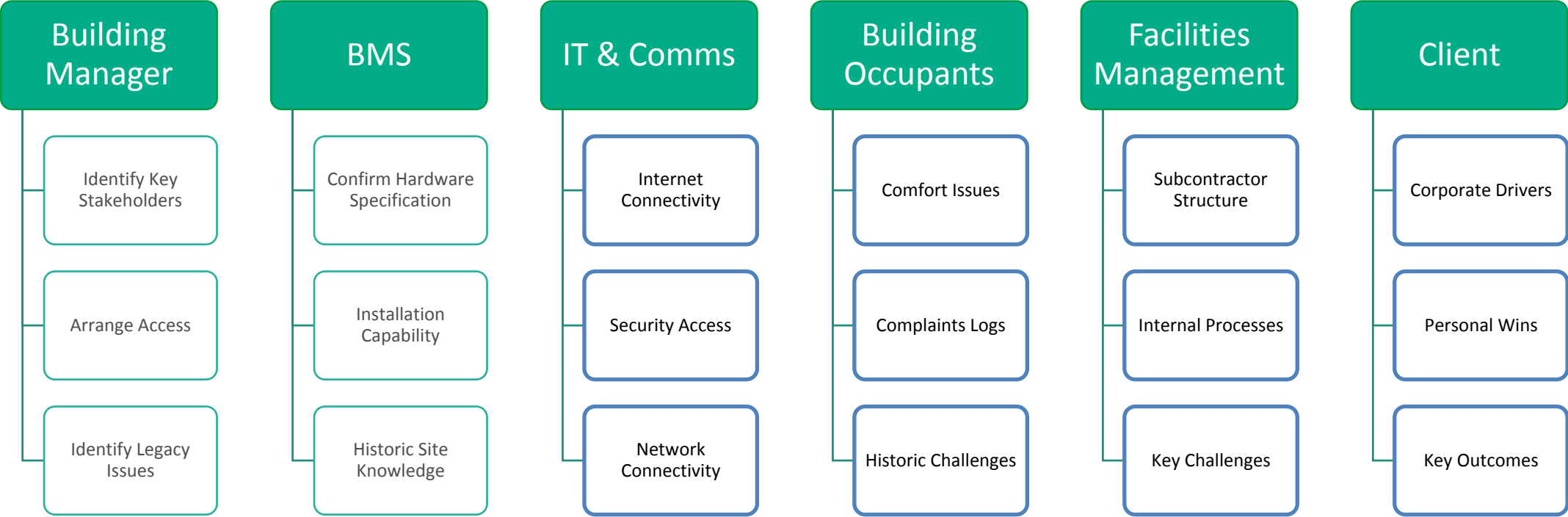
Installation of data  
Acquisition device

Initiatives workshop  
With stakeholders

Savings begin

Optimal Cap-ex  
recommendations

# Example of the Required Collaboration – Diagnostic Phase



By providing the People, Process AND Technology,  
Carbon Credentials remove the complexity and **make things happen**

# Examples of FM and BMS service companies We Work With

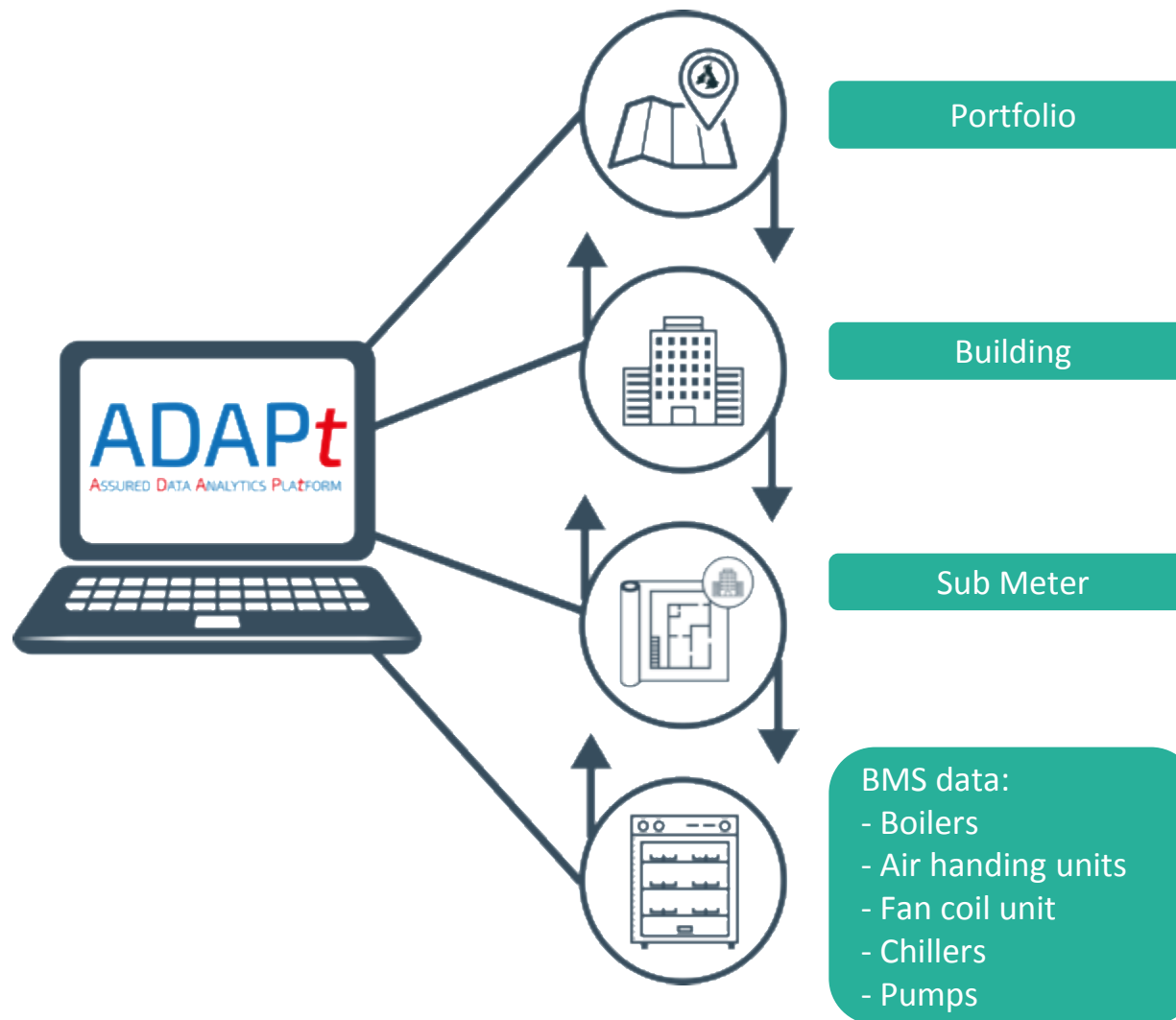


# Technology



# The ADAPt Platform – One Version of the Truth

One version of the truth at all levels of building energy data



# Visualisation of Asset-Level Data

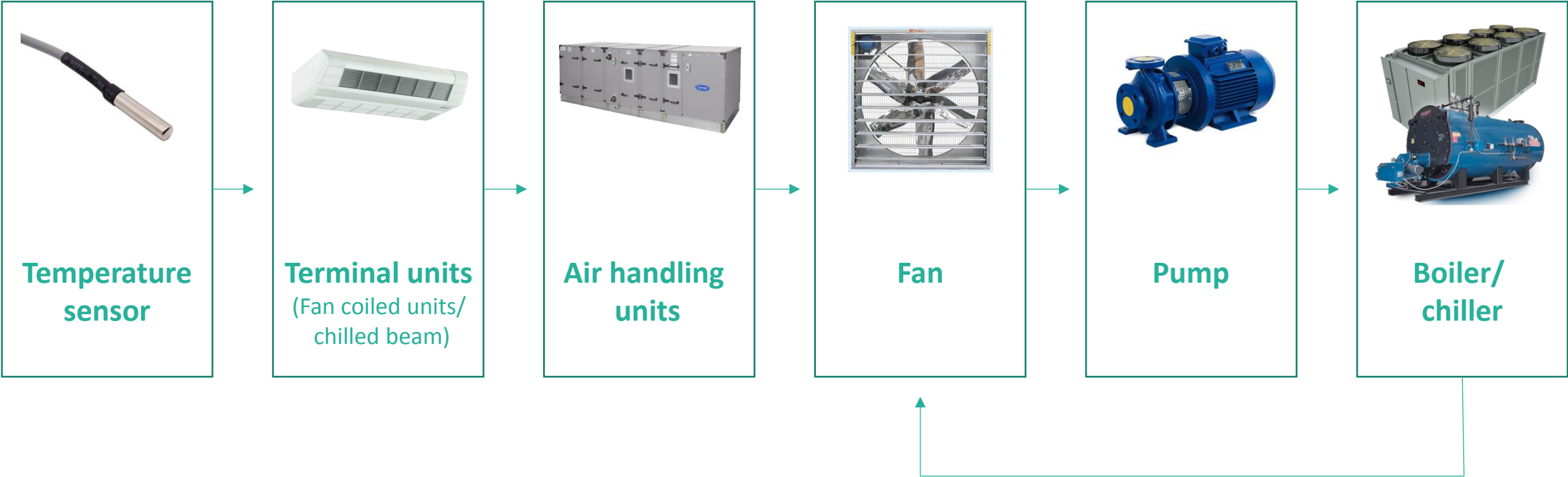
Visualisation of asset-level data enables managers to prioritise actions for implementation



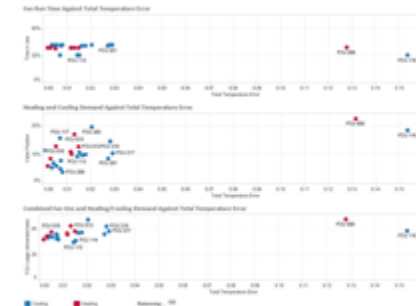
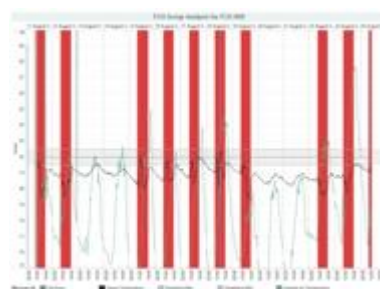
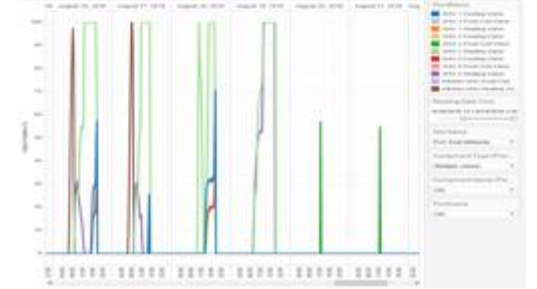
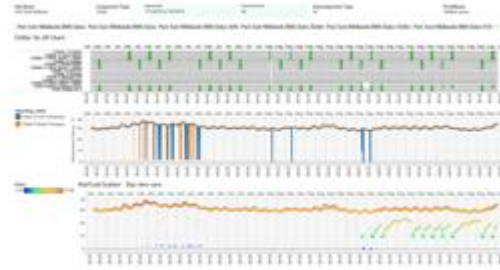
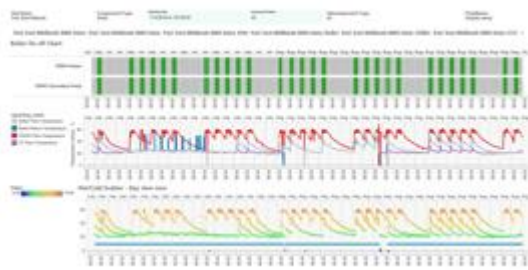
The same technology is used for measurement & verification of savings.



# Analyse BMS data from sensors and equipment to identify savings opportunities



# Analytics lead to visibility and control



PointName	5 AM	6 AM	1							
Chiller 2 Flow Temperature	1.15	11.05	11.03	10.61	10.46	10.43	10.85	10.78	10.74	10.7
Chiller 2 Return Temperature	2.77	12.32	12.29	12.29	12.19	12.15	12.19	12.16	12.11	12.11
Chiller Space Temperature	6.06	16.06	16.15	16.15	16.16	16.15	16.16	16.25	16.25	16.2
MCR Space Temperature 1	19.86	22.07	21.89	21.76	21.87	21.78	22.16	21.96	21.83	21.82
MCR Space Temperature 2	20.51	21.39	20.92	20.77	20.29	20.54	21.18	20.54	20.62	20.23
Outside Air Temperature 1	16.91	16.72	16.63	16.64	16.64	16.48	16.54	16.89	16.84	16.8
MCR Space Temperature	9.78	16.92	20.14	20.27	20.36	20.42	20.52	20.54	20.24	19.98
Space Temperature 1	17.1	21.34	22.99	22.46	22.46	22.41	22.41	22.43	22.47	22.68
Space Temperature 2	9.77	20.78	20.76	20.76	20.66	20.63	20.67	20.55	20.55	20.53
Space Temperature 3	12.07	21.23	21.76	21.76	21.66	21.66	21.64	21.67	21.61	21.61



# Case Studies

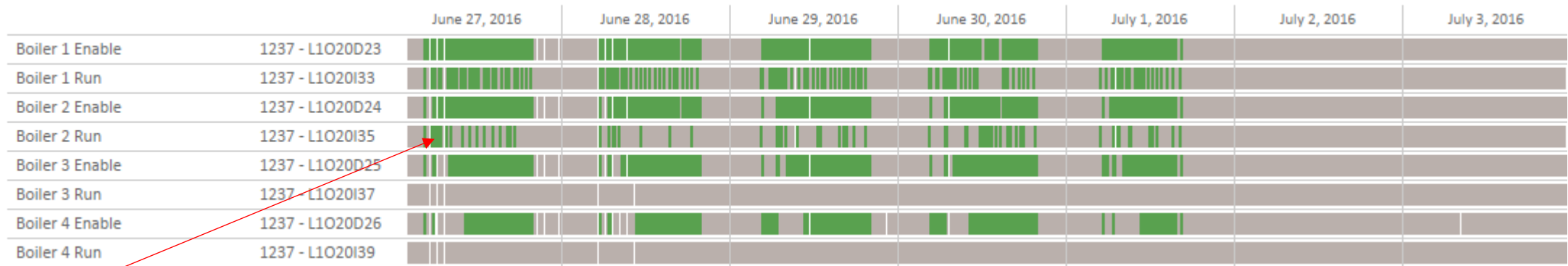
Collaborative Asset Performance Programme

# Office building, 29% gas savings

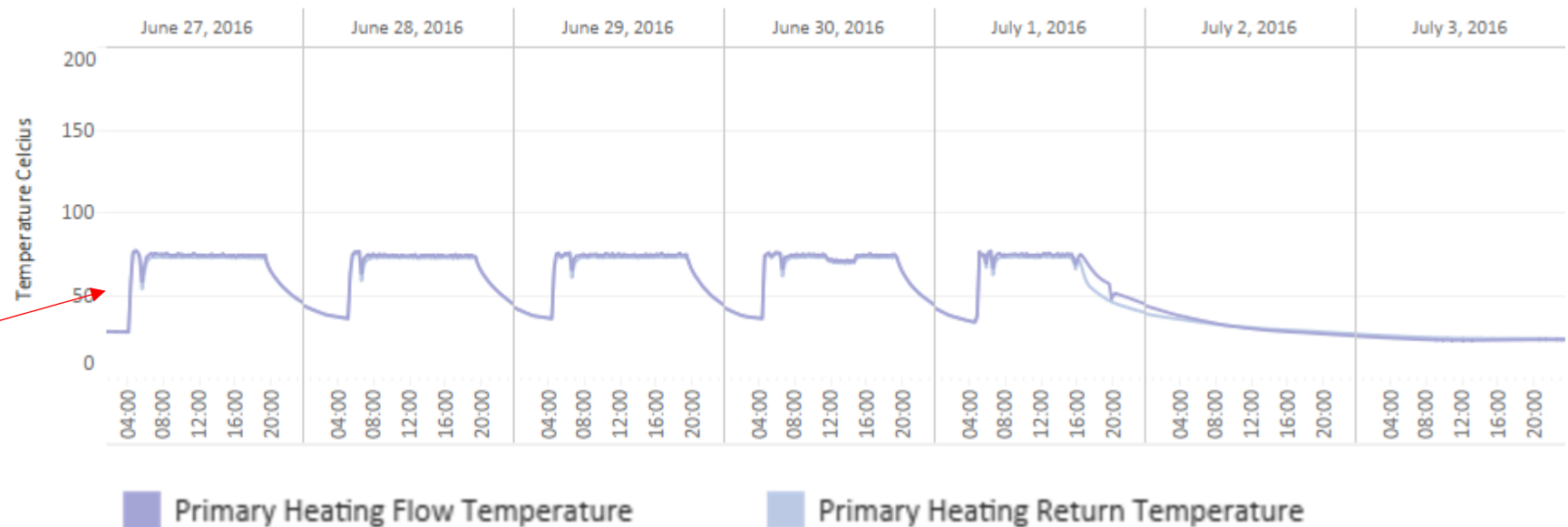




# Data Findings – Overcoming lack of visibility: Boilers



Data shows all four boilers enabled and two boilers running simultaneously

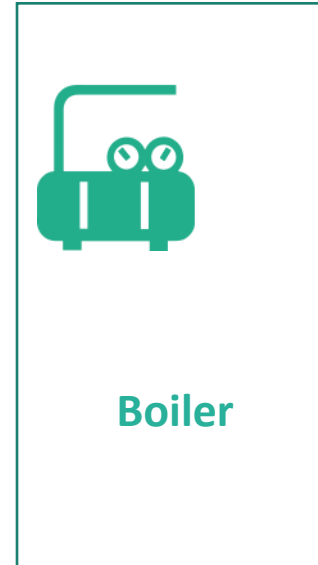
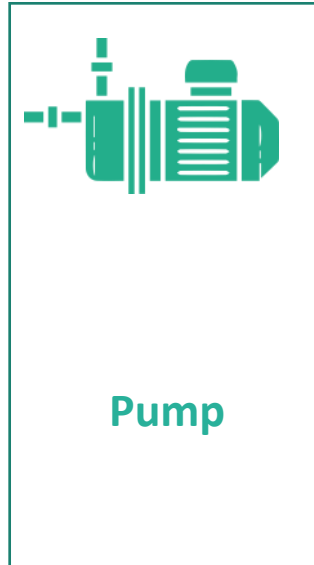


Flow and return temperature are high with a small difference in temperature

# Site Audit Findings – Overcoming multiple stakeholder challenges: Boilers

The Cause

**Incorrect BMS strategy**



The Effect

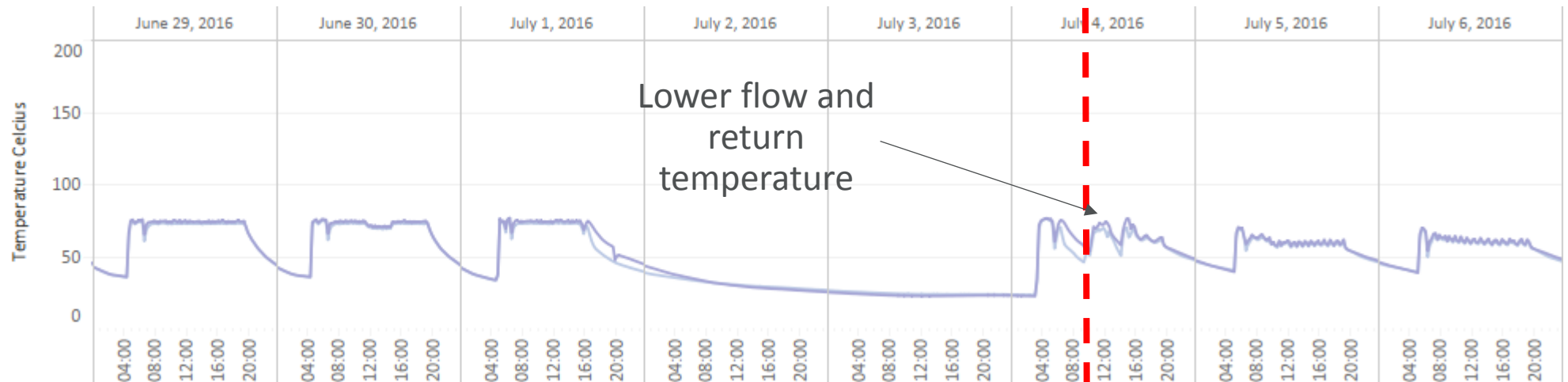
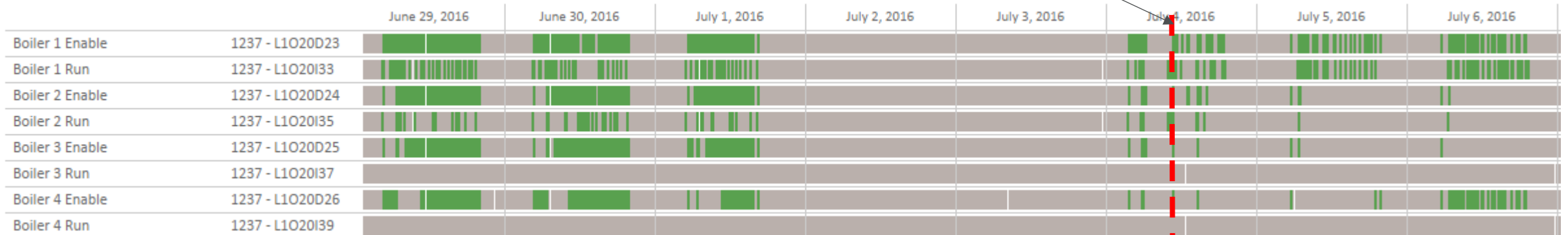
**All boilers enabled and  
two running**

- Carbon Credentials identified the cause during the site audit
- **We were able to rectify this with the incumbent BMS immediately**



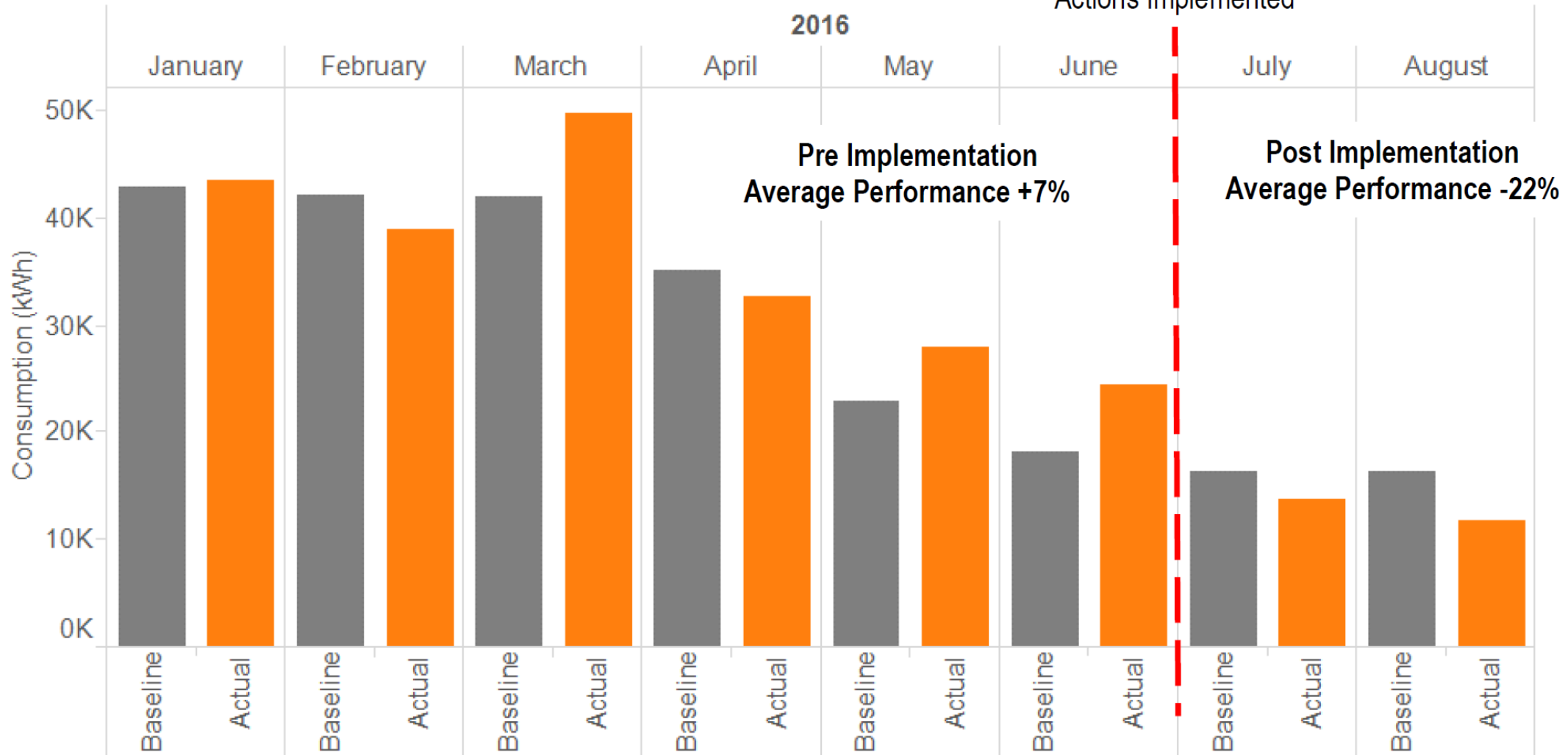
# The Results: energy saved, Better comfort levels

Boilers operate  
based on demand



# The results: 29% reduction in gas consumption

Monthly Gas Consumption Against 2015/2016 Baseline - Weather Corrected



# Success recognised!



*Hermes Responsible Property Investment Awards*  
**CAPP: Winner of Best Environmental Sustainability Initiative**



# Central London building, 42% electricity savings



# Space Temperatures – 12pm to 7pm

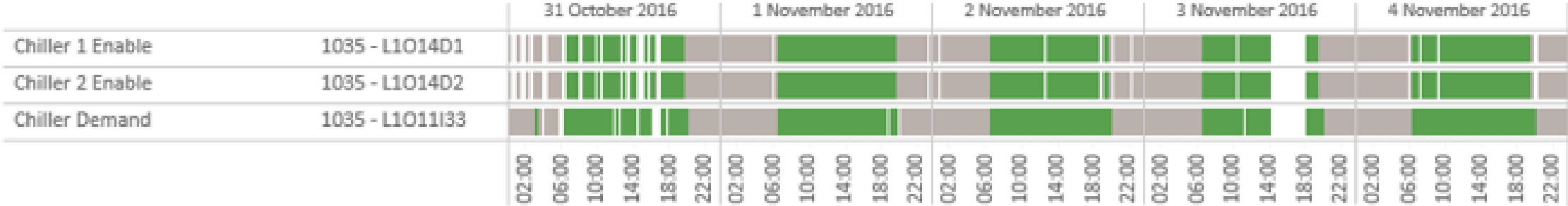
21 November 2016

Reporting Name	Min..	Max..	12 PM	1 PM	2 PM	4 PM	5 PM	6 PM	7 PM																						
Average Room Temp From Osn12	20	23	41	21.46	21.51	21.51	21.54	21.63	21.65	21.69	21.76	21.85	21.87	22.00	22.00	21.95	21.93	21.93	21.93	21.78	21.65	21.51	21.39	21.27	21.18	21.09	21.00	20.88	20.82	20.72	
Average Building Temperature	20	23	04	21.07	21.12	21.15	21.18	21.22	21.28	21.31	21.34	21.46	21.50	21.53	21.55	21.57	21.52	21.52	21.56	21.46	21.36	21.22	21.10	21.00	20.90	20.85	20.77	20.68	20.55	20.47	
B Block 1st Floor Temperature	20	23	62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62
B Block 3rd Floor Temperature	20	23	62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62
B Block 5th Floor Temperature	20	23	32	20.32	20.41	20.46	20.50	20.50	20.58	20.59	20.59	20.74	20.77	20.68	20.68	20.74	20.68	20.68	20.77	20.74	20.68	20.59	20.50	20.45	20.32	20.32	20.24	20.14	20.02	19.88	
Block B & C Average Temperature Av..	20	23	40	21.43	21.47	21.50	21.53	21.58	21.62	21.67	21.72	21.82	21.87	21.96	21.98	21.98	21.94	21.94	21.96	21.84	21.69	21.53	21.40	21.28	21.19	21.11	21.04	20.94	20.83	20.76	
Block B & C Minimum Temperature ..	20	23	02	20.11	20.19	20.29	20.33	20.38	20.47	20.55	20.55	20.73	20.77	20.68	20.68	20.76	20.68	20.68	20.77	20.72	20.64	20.47	20.29	20.11	19.96	19.84	19.76	19.62	19.49	19.40	
C Block 2nd Floor Temperature	20	23	53	22.53	22.53	22.53	22.53	22.61	22.61	22.70	22.79	22.89	22.97	23.06	23.06	23.10	23.15	23.24	23.24	23.06	22.89	22.70	22.53	22.35	22.26	22.17	22.08	21.99	21.91	21.91	
C Block 4th Floor Temperature	20	23	74	22.79	22.74	22.74	22.74	22.83	22.91	22.84	22.95	23.00	22.91	23.10	23.19	23.10	23.00	22.91	22.91	22.74	22.56	22.38	22.28	22.25	22.21	22.12	22.10	22.02	21.93	21.86	
C Block Ground Floor Temperature	20	23	02	20.11	20.19	20.29	20.32	20.38	20.47	20.55	20.55	20.64	20.82	21.00	21.07	20.91	20.91	20.91	20.91	20.82	20.64	20.47	20.29	20.11	19.99	19.84	19.76	19.65	19.49	19.40	

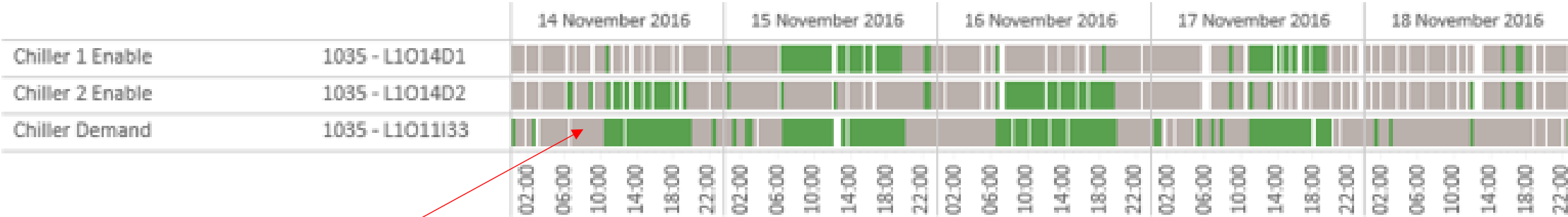
B Block 1<sup>st</sup> and 3<sup>rd</sup> floor temperature sensors thought they were above 40°C

# Issue 1: Chillers creating unnecessary cooling

## Before



## After



Chillers now operate based on demand



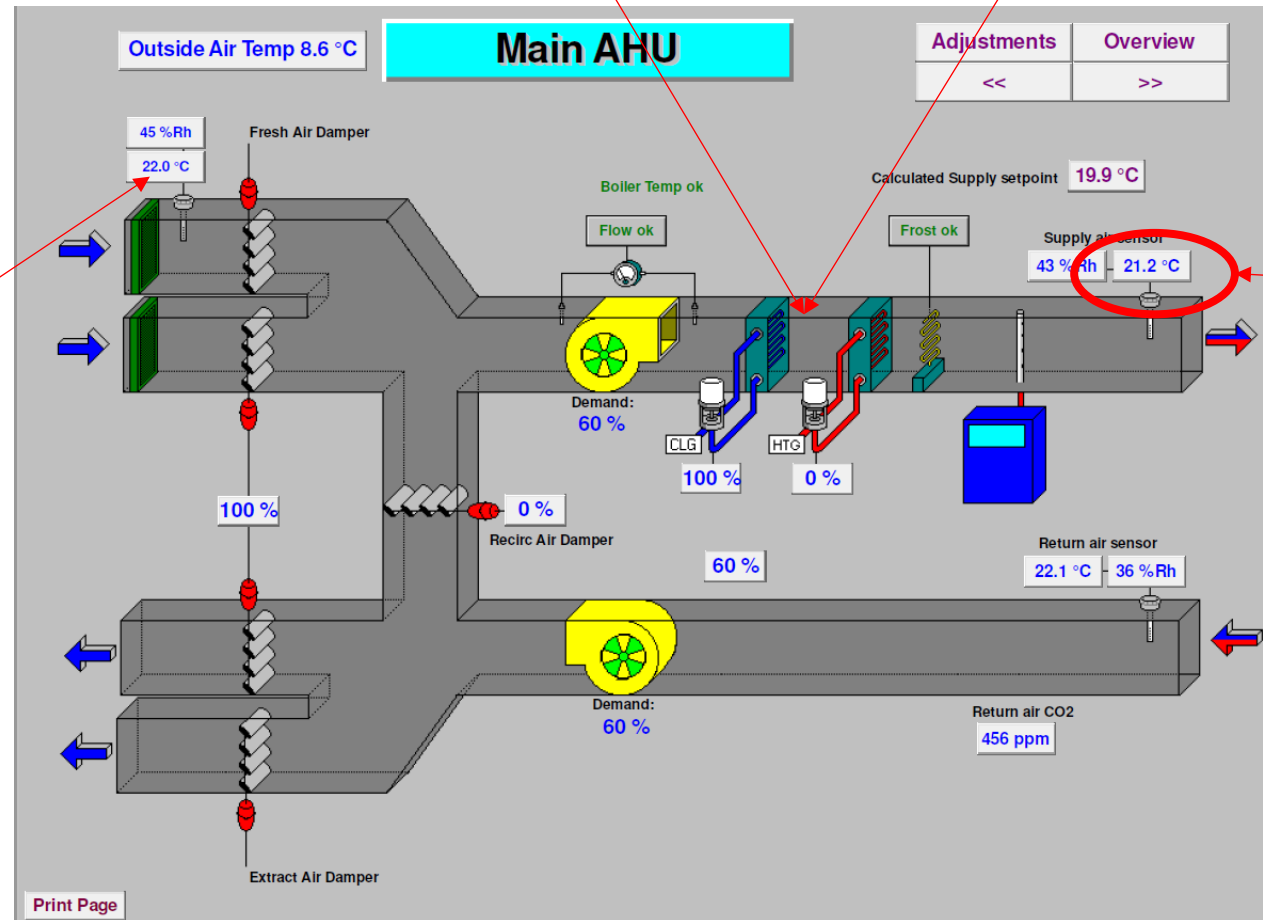
# Issue 2: faulty sensor

## The Cause

Faulty Sensor

Faulty Valves

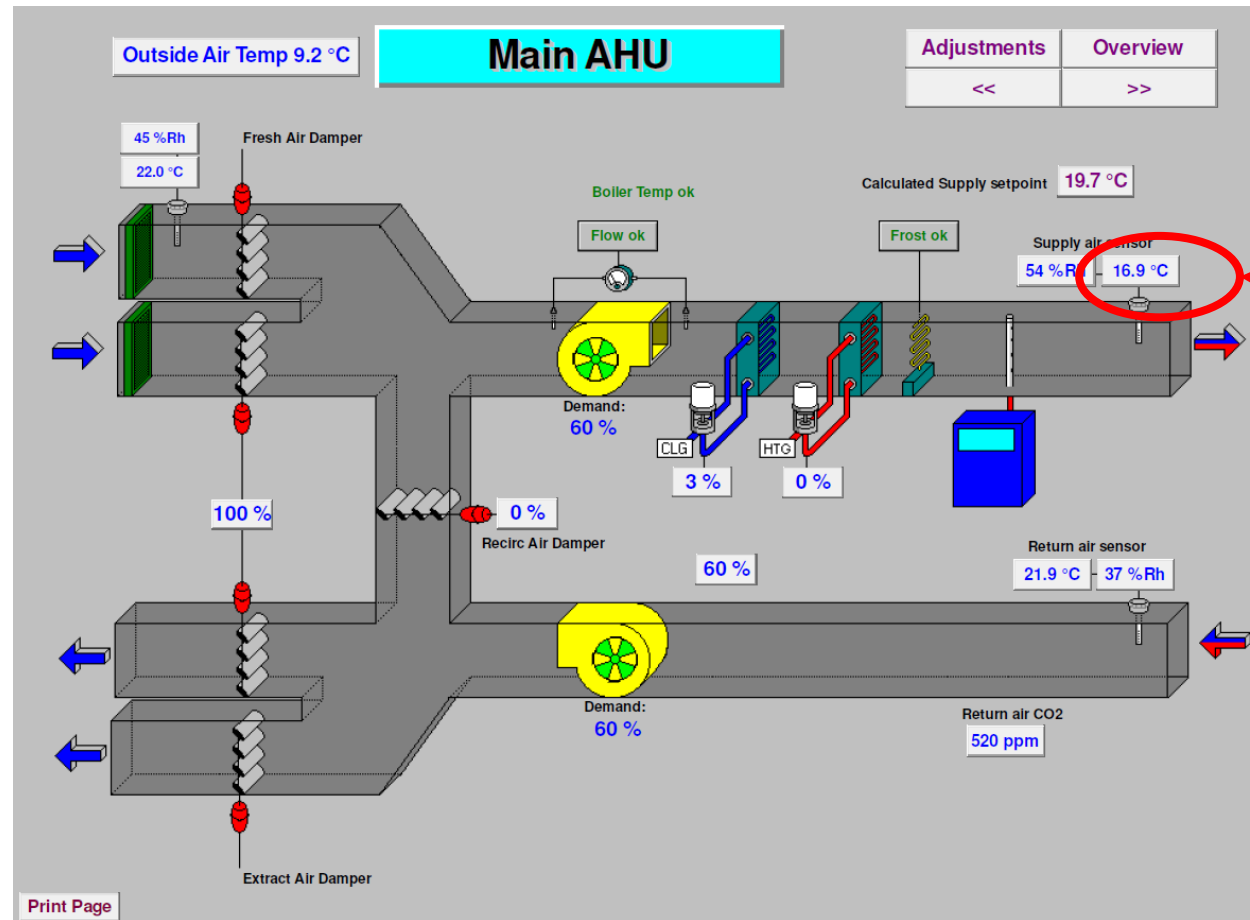
Pumps in hand & chillers off



The Effect – Supply temperature too hot

- Carbon Credentials identified the cause during the site audit
- We were able to rectify pump issues with BMS incumbent whilst on site

# Issue Resolved



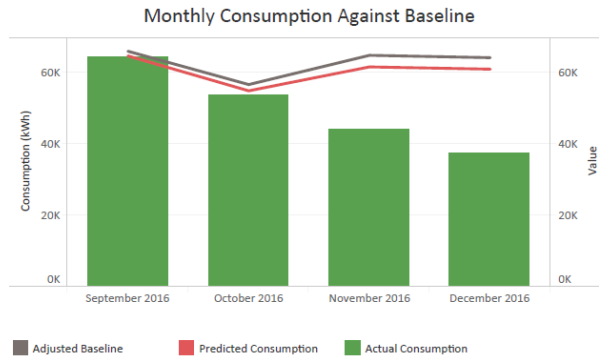
The Result – Reduced Supply Temperature

- The pump issue was rectified and supply temperature decreased whilst on site
- Carbon Credentials also detailed further works including replacing sensors and fixing heating and cooling valves

# Results: 32% and 42% savings in months 1 and 2 post implementation



**Measurement and Verification Report**  
 Site: 501310, 8-10 Great George Street  
 Fuel: Electricity  
 Report Date: 13/01/2017



**Project Details**

**Summary Of Baseline Methodology:**  
 No degree day correlation found. Used the average of actual data from January 2014 excluding any points which had a deviation from the average usage.

**Baseline Methodology Signed Off By:**

**Project Start Date:** 01/09/2016

**First Intervention:** 01/11/2016

**Engineers Estimated Savings by:** Andy Mazzucchelli

**Date of Estimate:**

Automated monthly Measurement and Verification reports augment standard site level consumption reports

These become a key driver for additional or different action

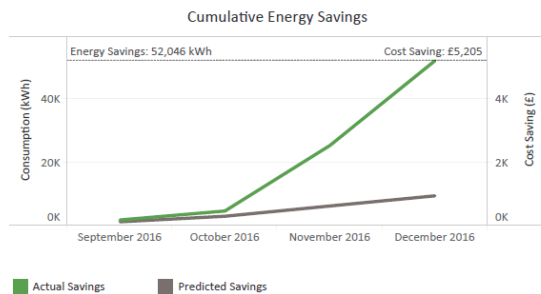
**Monthly Performance**

	September 2016	October 2016	November 2016	December 2016
Baseline	65,805	56,512	64,670	64,010
Baseline Adjustment				
Adjusted Baseline	65,805	56,512	64,670	64,010
Engineers Estimated Savings	1,293	1,746	3,233	3,201
Predicted Consumption	64,512	54,766	61,436	60,810
Actual Savings	1,867	2,827	20,650	26,702
Saving Percentage vs Predicted	44.38%	61.89%	33.61%	43.90%
Percentage Saving vs Baseline	2.84%	5.00%	31.93%	41.72%
Actual Consumption	63,938	53,685	44,000	37,308

31.93%

41.72%

**Cumulative Performance To Date**



**Energy Savings Since Project Start - 01/09/2016 to 31/12/2016**

Engineers Estimated Savings To Date	9,473 kWh
Achieved Savings To Date	52,046 kWh
Difference From Estimate	42,573 kWh
Percentage Difference	549.39%

**Commentary**

**Commercial building in  
the Midlands – annual  
savings: 16%**

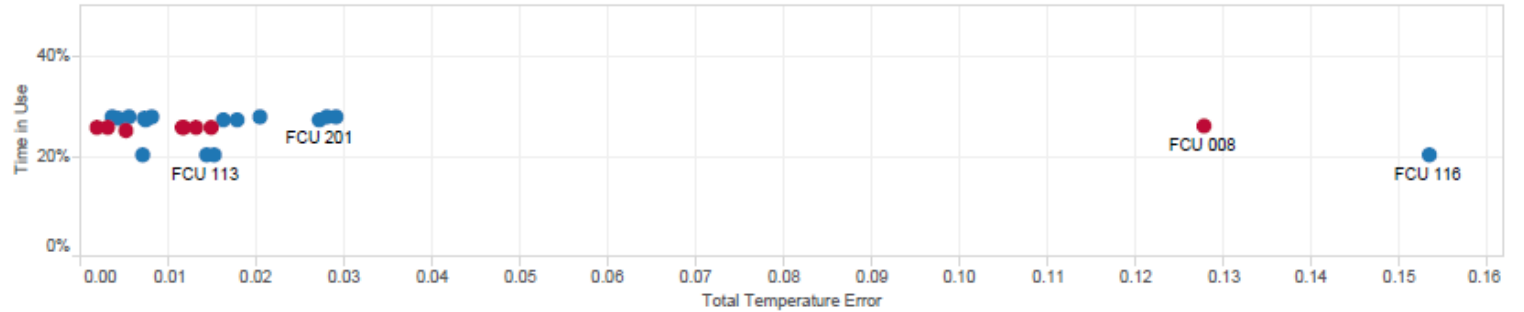


# Data Review – 16% savings

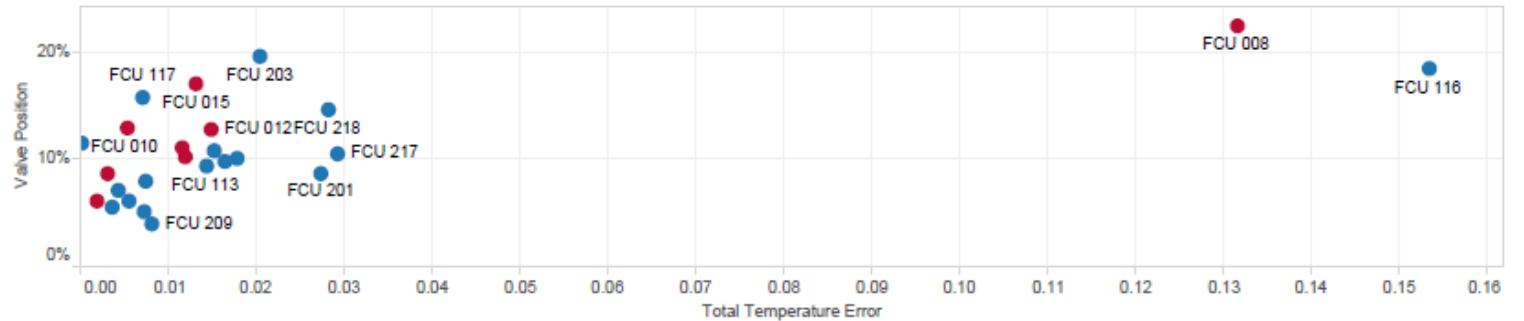
## Fan Coil Unit Overview

Scatter graph highlights outliers and areas for focus – energy reduction and targeted maintenance

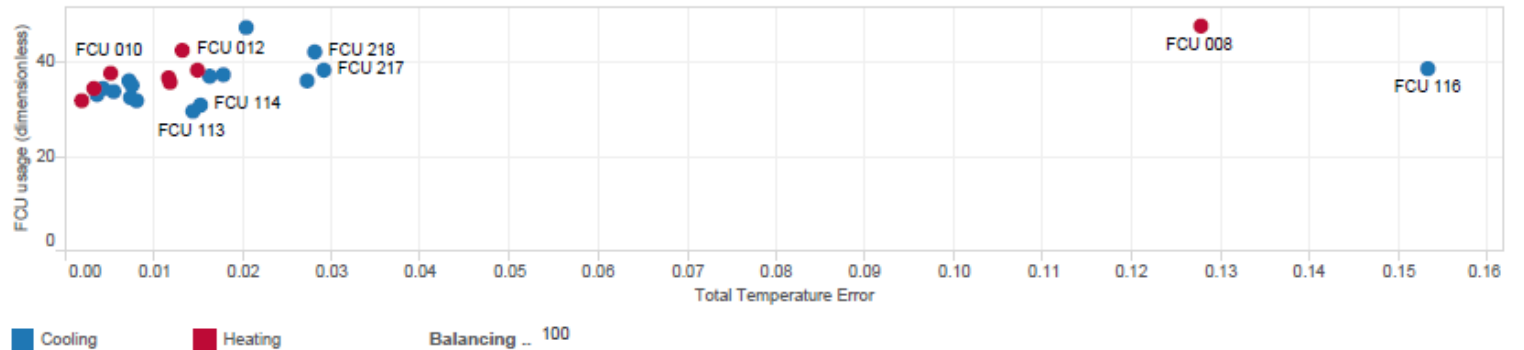
Fan Run Time Against Total Temperature Error



Heating and Cooling Demand Against Total Temperature Error



Combined Fan Use and Heating/Cooling Demand Against Total Temperature Error



# Data Review

## FCU Floor Plan

Larger circles denote significant energy usage of Fan Coil Units

Red indicates unit mostly heating

Blue indicates unit cooling



**If you are interested  
in conducting a trial in  
one of your  
buildings...**





# For a trial building - Information required

- **Energy Spend: over £200k/annum (for sub 1 year ROI)**
- **Building details**
  - Address
  - Sq Footage
  - Energy Spend (gas and elec)
  - Tenants (who/how long there for, how much space do they have – or % of total)
  - How do they pay for their energy e.g. service charge, direct payment, meter based billing

## Other technical details that we need

- What type/age/complexity of BMS do you have (e.g Trend, Honeywell, Siemens etc)
- Who is the BMS maintenance company
- Who is the FM provider
- Who is the building manager
- Who is the landlord

# Q&A





# CarbonCredentials



[www.carboncredentials.com](http://www.carboncredentials.com)



[info@carboncredentials.com](mailto:info@carboncredentials.com)



0203 053 6655



[Linkedin.com/company/carbon-credentials](https://www.linkedin.com/company/carbon-credentials)



@CCESLtd



**Cian Duggan**

Chief Technical Officer

[cian.duggan@carboncredentials.com](mailto:cian.duggan@carboncredentials.com)



**Will Jenkins**

Senior Consultant

[will.jenkins@carboncredentials.com](mailto:will.jenkins@carboncredentials.com)