This presentation was live at:

Smart Buildings SHOW

18-19 October 2023 • ExCel London

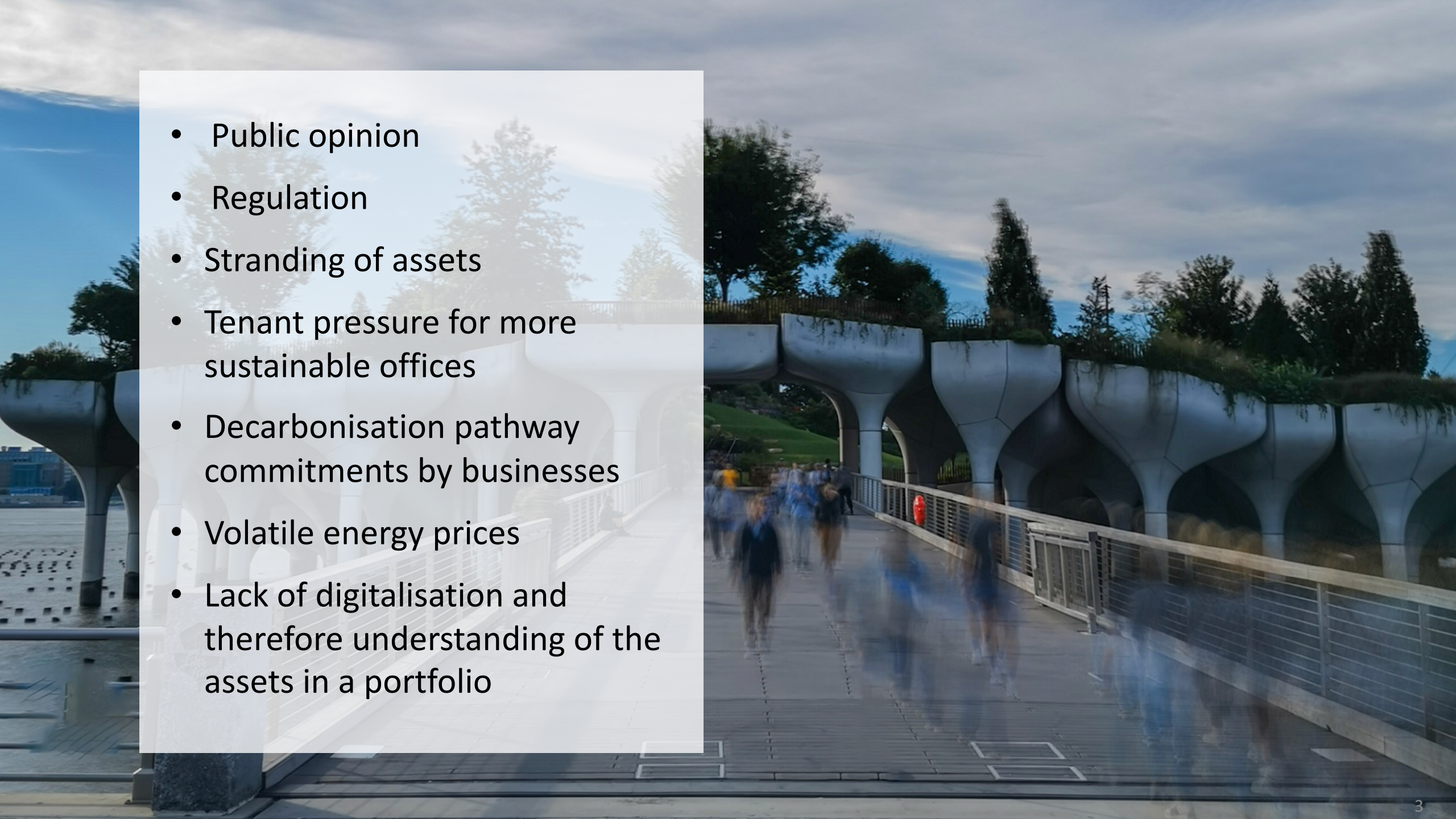
Smart Buildings Show 18th – 19th October 2023

How to optimise your building without capex to reduce carbon emissions and the risk of stranding using smart building technologies.

REsustain

TACKLING YOUR BUILDINGS CARBON CHALLENGES

The world is on fire and it is overwhelming



- Public opinion
- Regulation
- Stranding of assets
- Tenant pressure for more sustainable offices
- Decarbonisation pathway commitments by businesses
- Volatile energy prices
- Lack of digitalisation and therefore understanding of the assets in a portfolio

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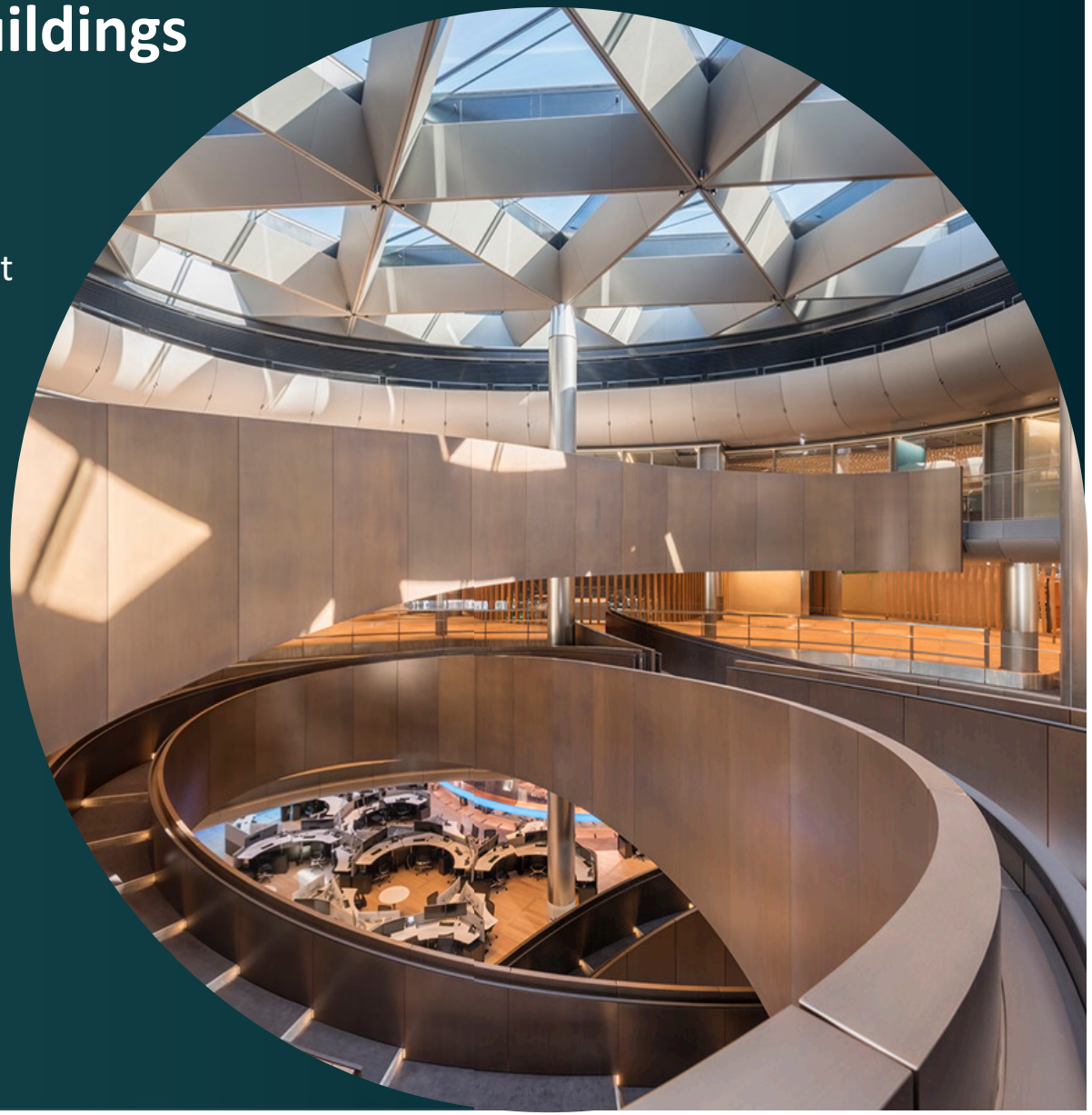
Stranded Assets and the "Difficult" Buildings

- Buildings consistently **use 10-30% more energy than they need** to through poorly controlled mechanical systems
- A study by Knight Frank published in Bisnow in 2022 showed that **more sustainable buildings attract a higher sales premium of around 8%**
- The Global Construction Review stated in 2022 that **reducing energy and therefore utility bills increases rental yields by between 16-25%**
- Currently optimising buildings to be sustainable is **cost prohibitive for 95% of buildings** with high human effort and so most buildings are ignored
- Buildings are complicated machines that are not smart and require **constant monitoring and control to achieve optimised control**
- Decarbonisation pathways mean these assets will likely become **stranded in the next 5 to 10 years** without intervention



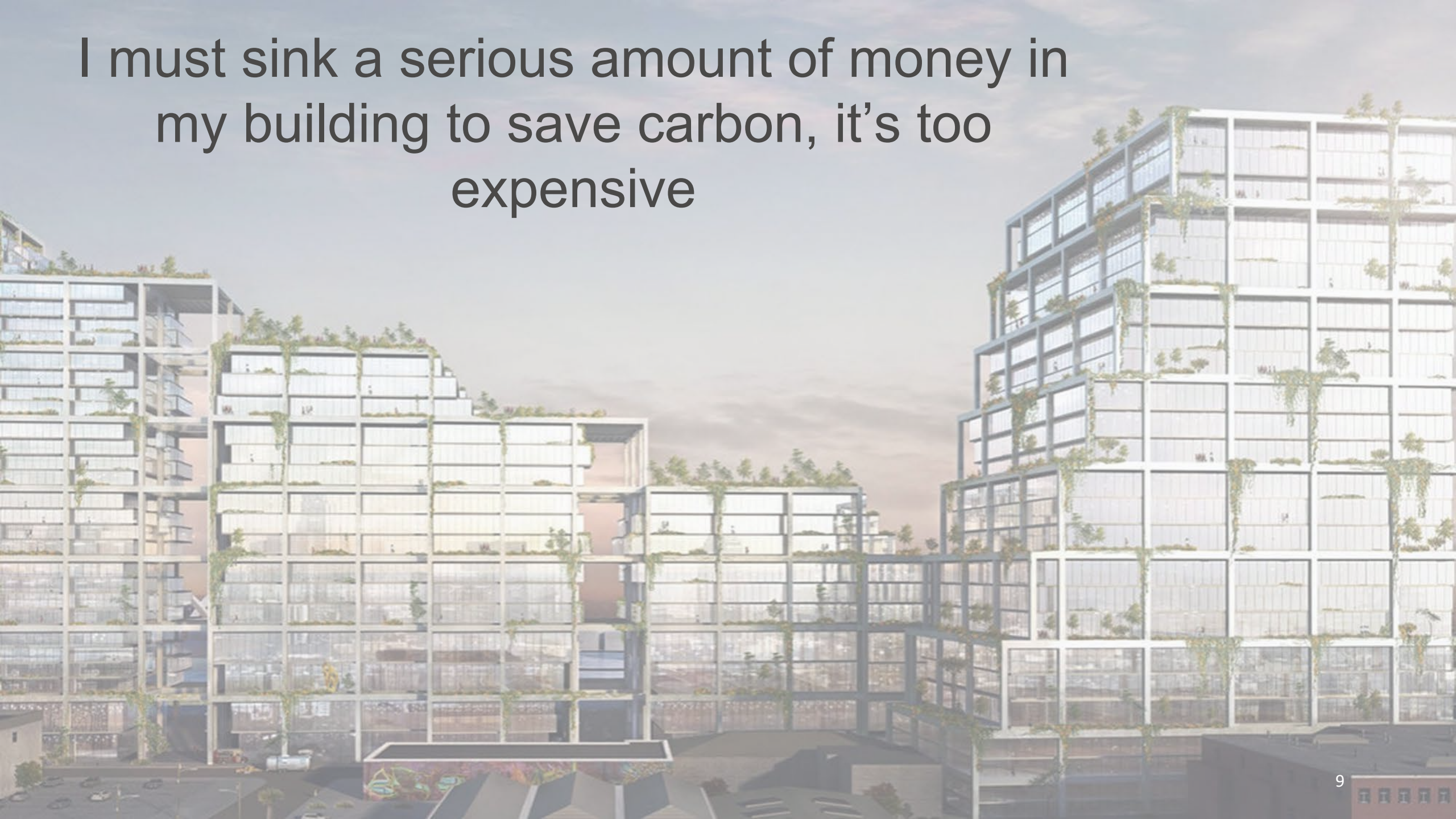
Common Misconceptions

It’s the tenant's fault there is nothing we can do

Buildings are static concrete structures, once they are built, they don’t need any more attention

If we put a BMS in, then the building is controlled

I must sink a serious amount of money in my building to save carbon, it’s too expensive



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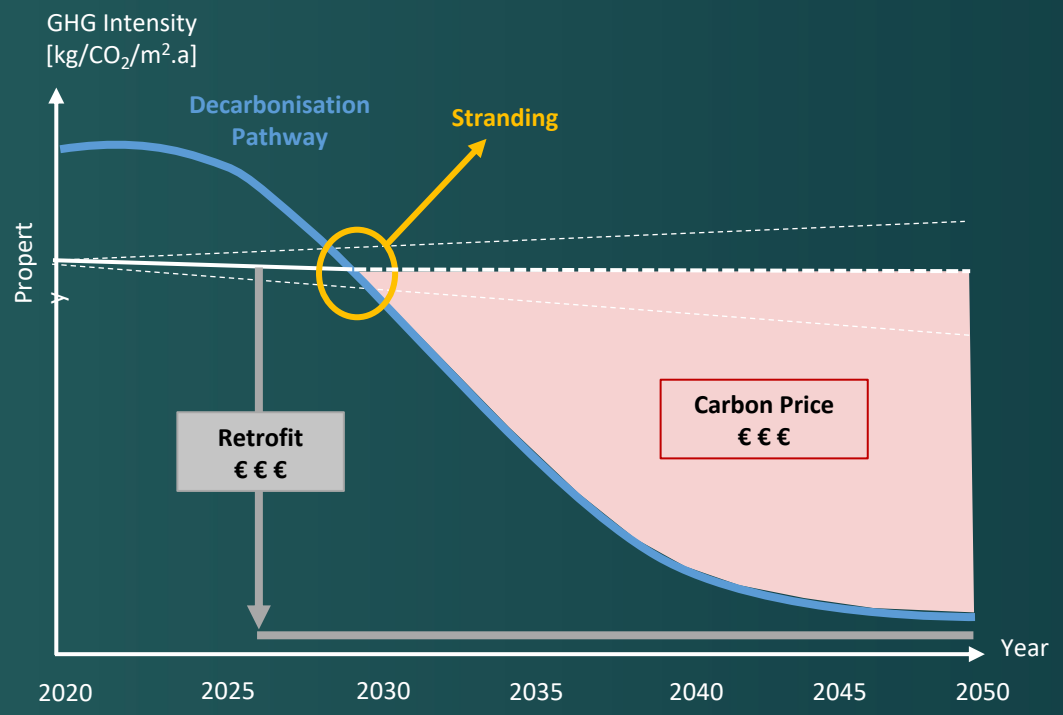
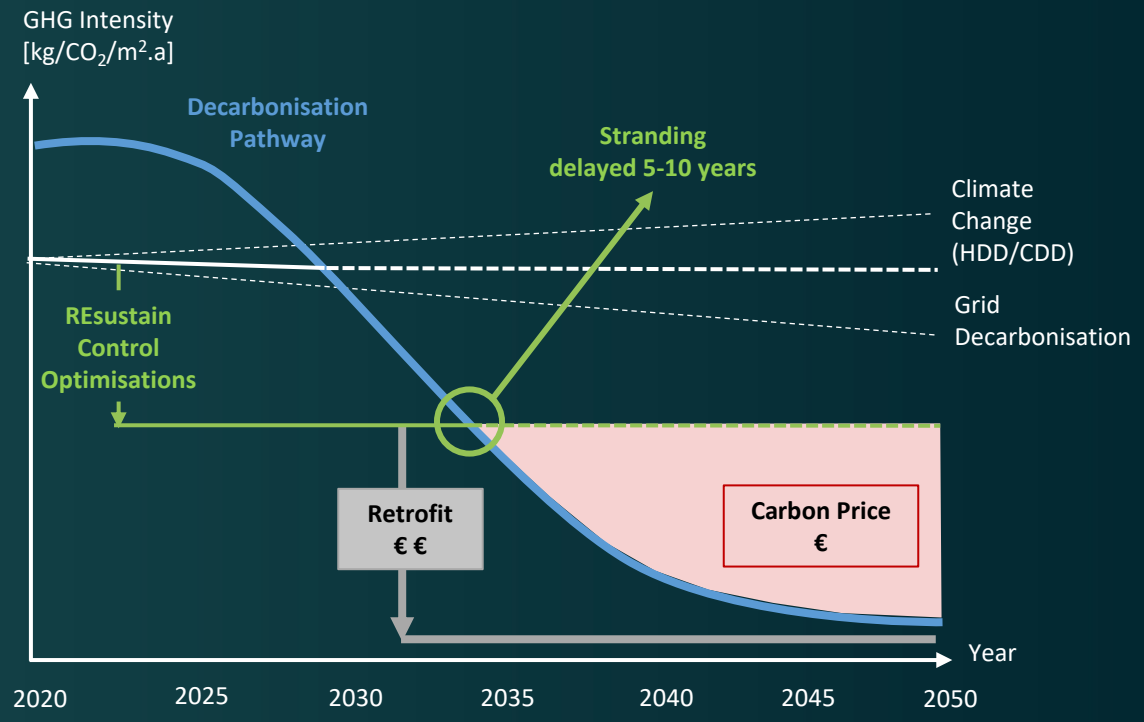
Decarbonisation Pathways – REsustain delays stranding by 2-10 years

Traditional approach



- High retrofit costs to avoid stranding
- Capital expenditure to be spent in the next 1-4 years
- High carbon penalties on fuel costs
- Building underperforming

REsustain Controls Optimisation Approach



- Stranding delayed 2-10 years
- Capital expenditure reduced and delayed
- Lower carbon penalties on fuel costs
- Optimised and performing as it should pre and post retrofit

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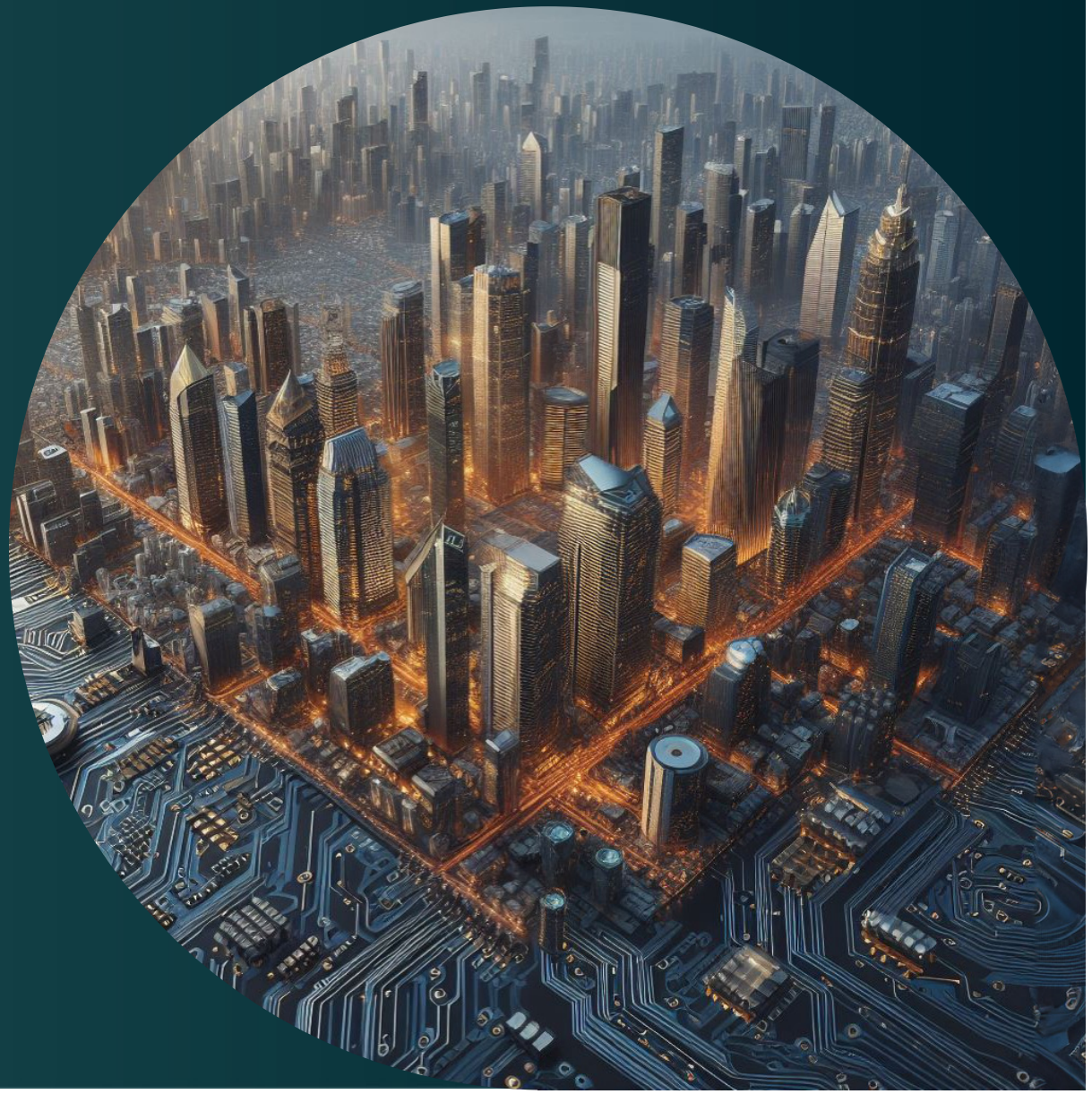
What can we do?

- Learn for each other
- Trust our architects and engineers
- Look for the root cause of inefficiencies
- Analyse the data, don’t just collect it
- Build on the work of others rather than starting from scratch
- Share our data
- Enable communication so we can all work towards a common goal



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Controls Optimisation: Making the building smart through the BMS.

A case study

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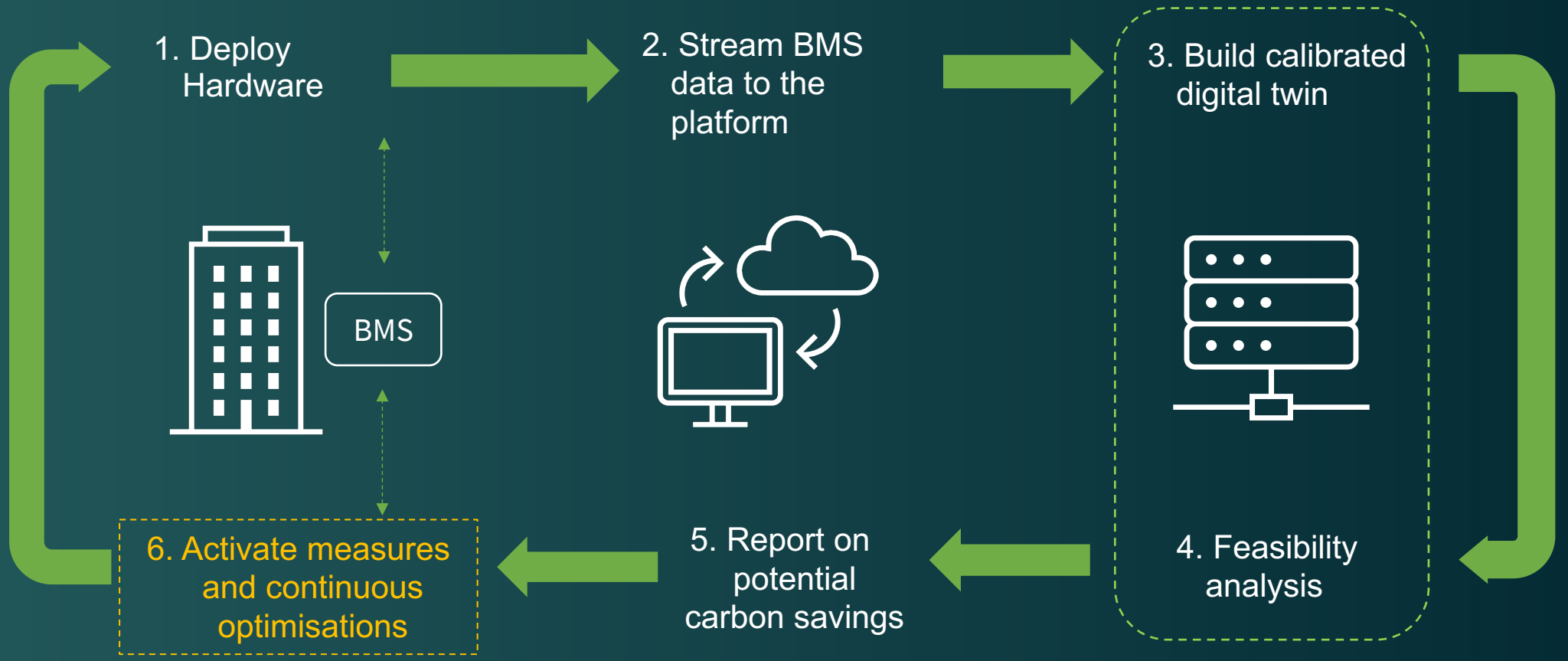
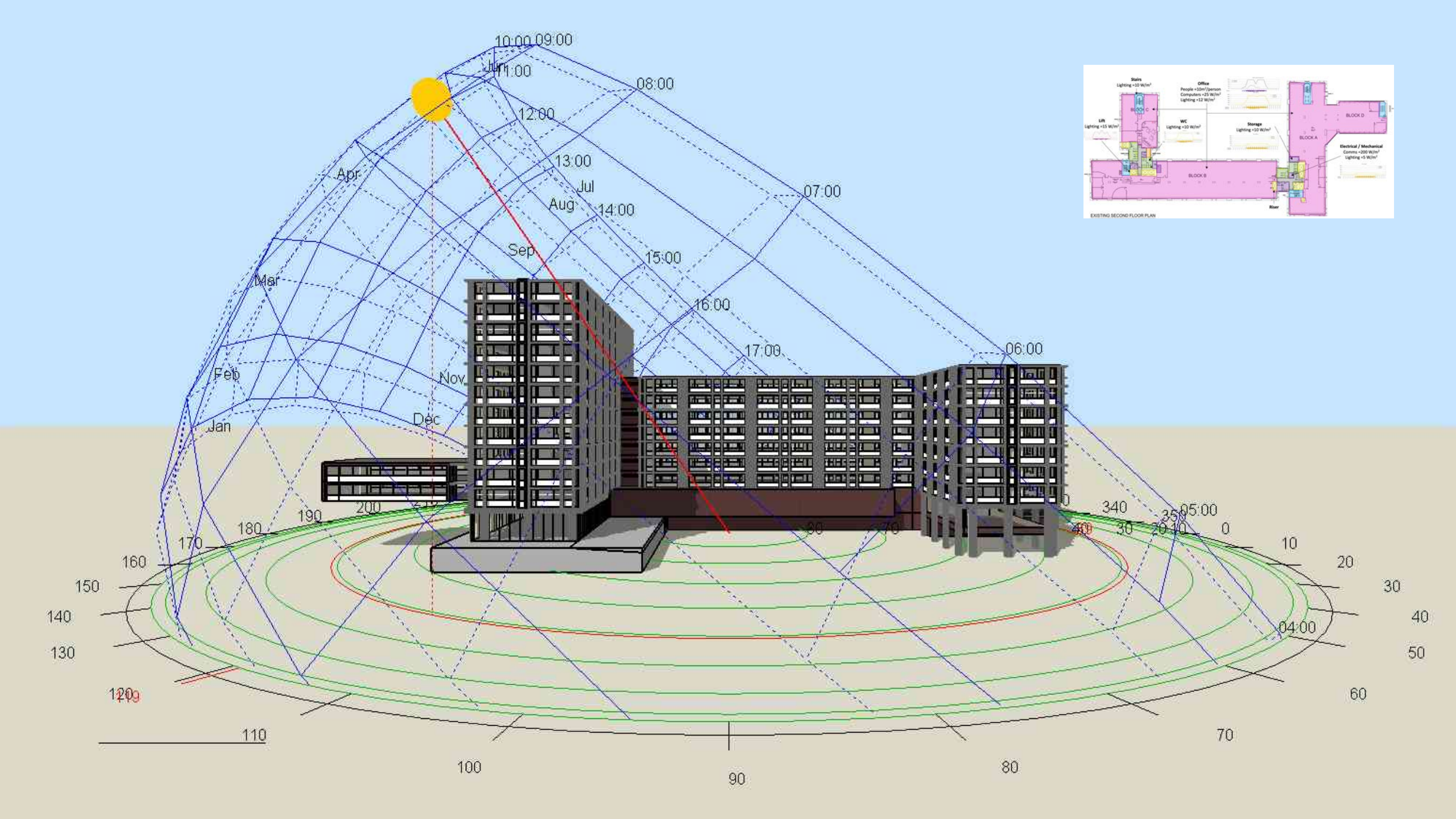
How it Works | Path to an Optimised Building Within One Quarter



*In order to connect our system to your building and to control it, we require the building to have a BMS, the building to be over 5,000m², some form of internet connection and some centralised plant such as central ventilation and/or central chillers/boilers

Deployment – Streaming data from the BMS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0
340
350
Stairs
Lighting =10 W/m²
Office
People =10m²/person
Computers =25 W/m²
Lighting =12 W/m²
Lift
Lighting =15 W/m²
WC
Lighting =10 W/m²
Storage
Lighting =10 W/m²
Electrical / Mechanical
Comms =200 W/m²
Lighting =5 W/m²
BLOCK C
BLOCK D
BLOCK A
BLOCK B
Riser
EXISTING SECOND FLOOR PLAN

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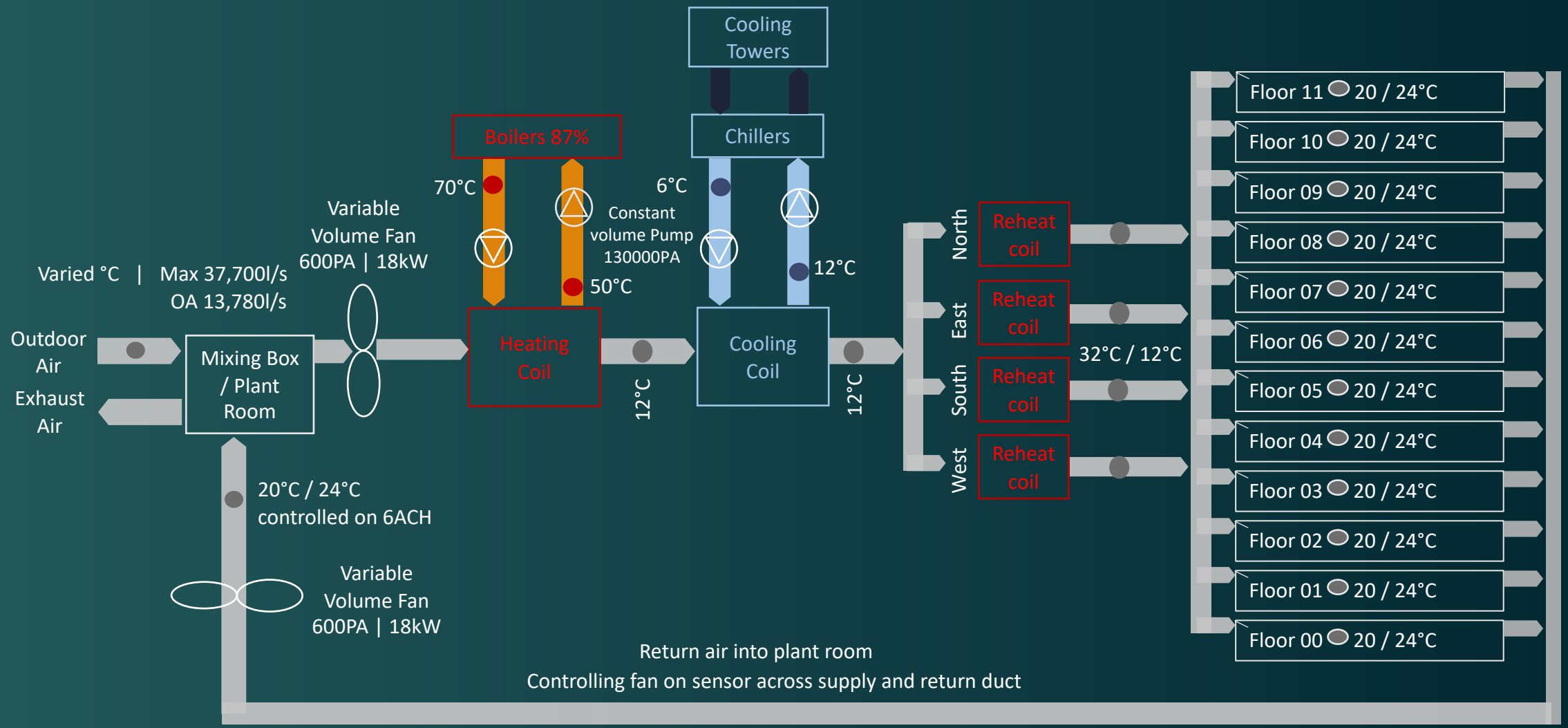

Original System | VAV reheat

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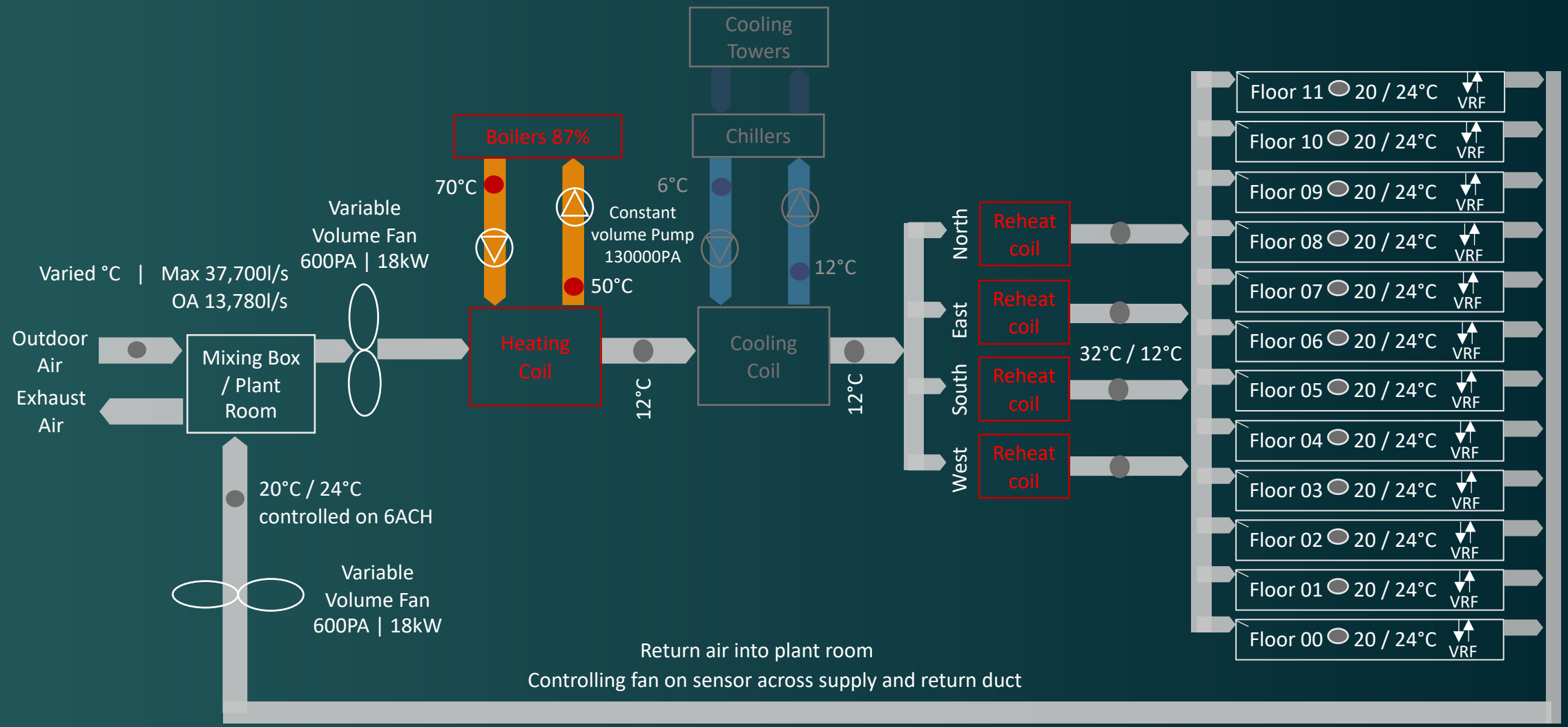

Current System| Cooling plant decommissioned VRF added in tenant spaces

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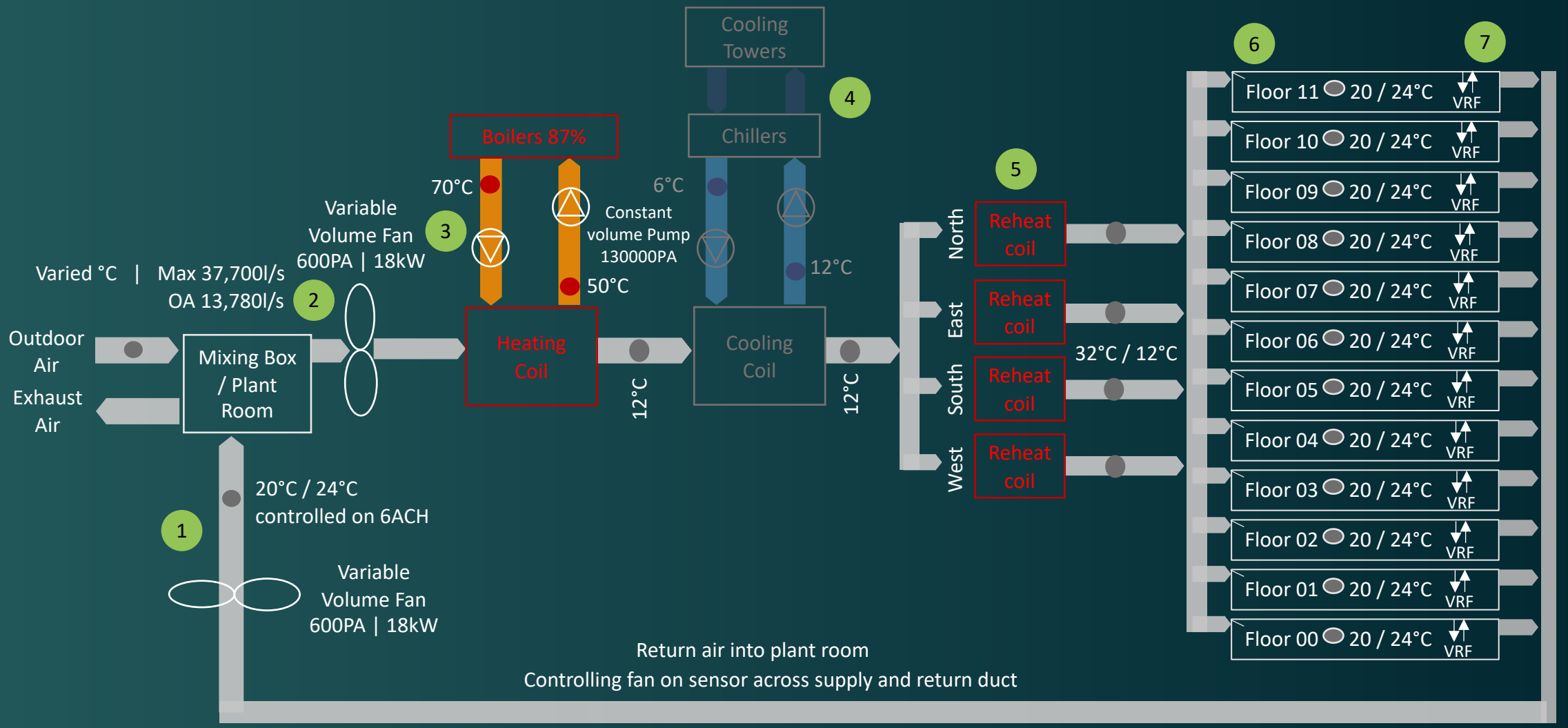

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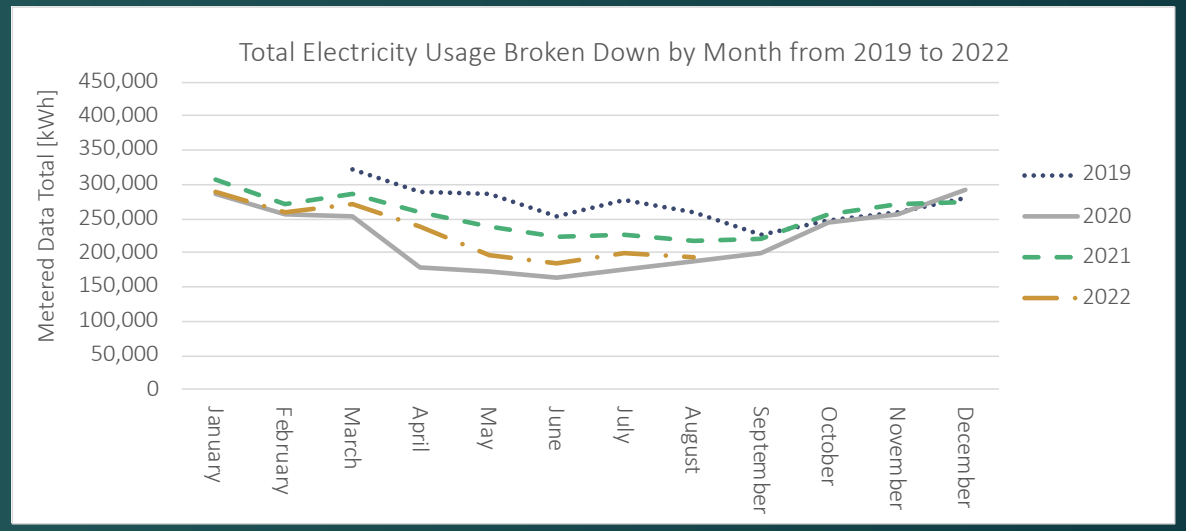
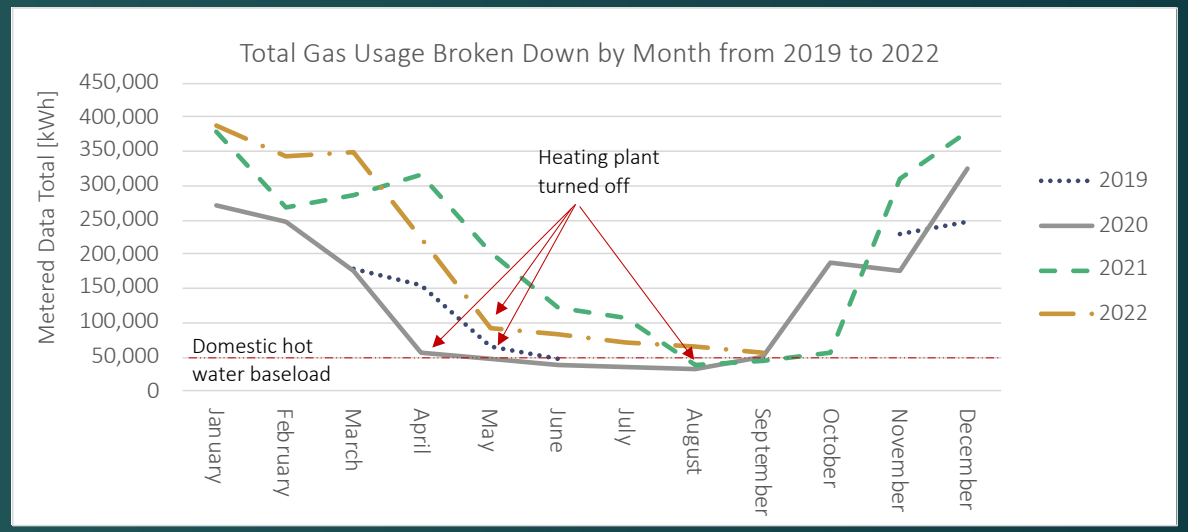
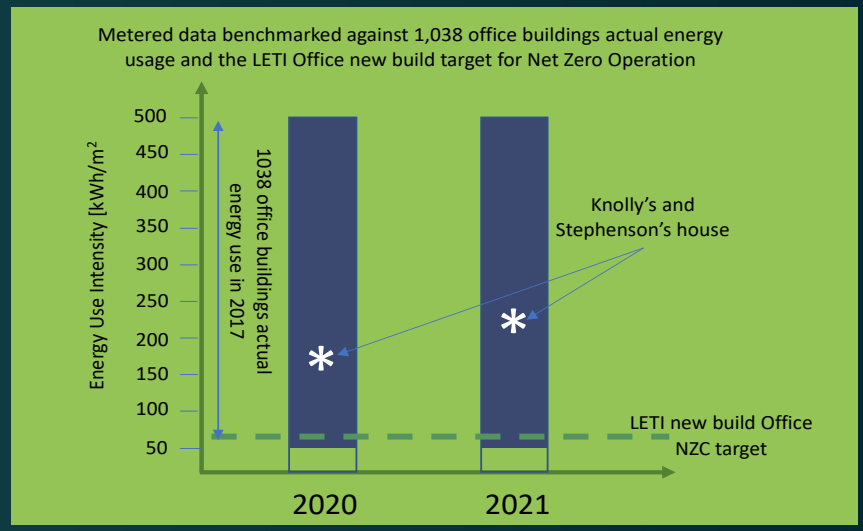


- *EUI for the building of 214.7 kWh/m²*
  (gas and electricity added together for benchmarking)
- *Carbon Dioxide emissions annually for the building is 1,118 tCO_2 (47.6 $kgCO_2$/ m^2)*
- *Operational energy costs of £585,000 (£26.2/m^2)*





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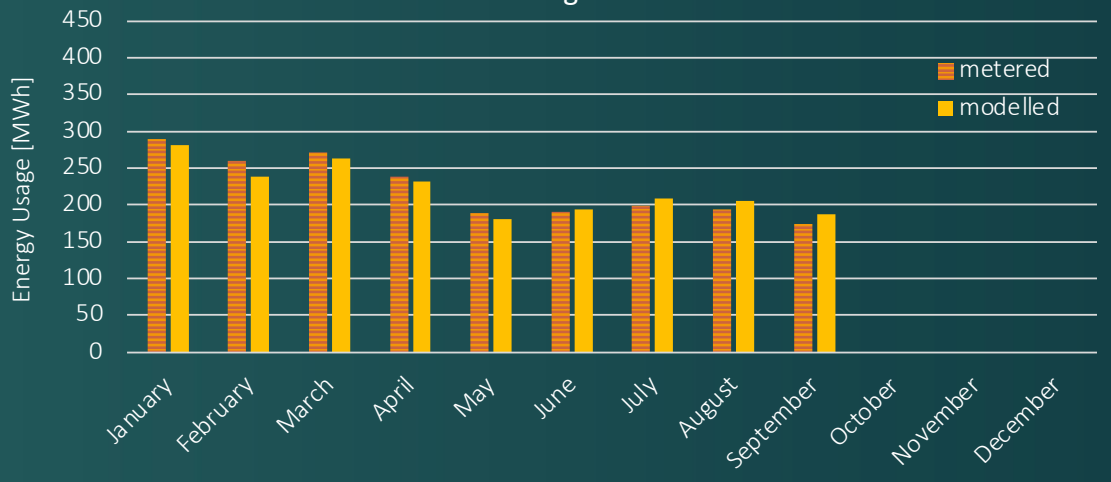
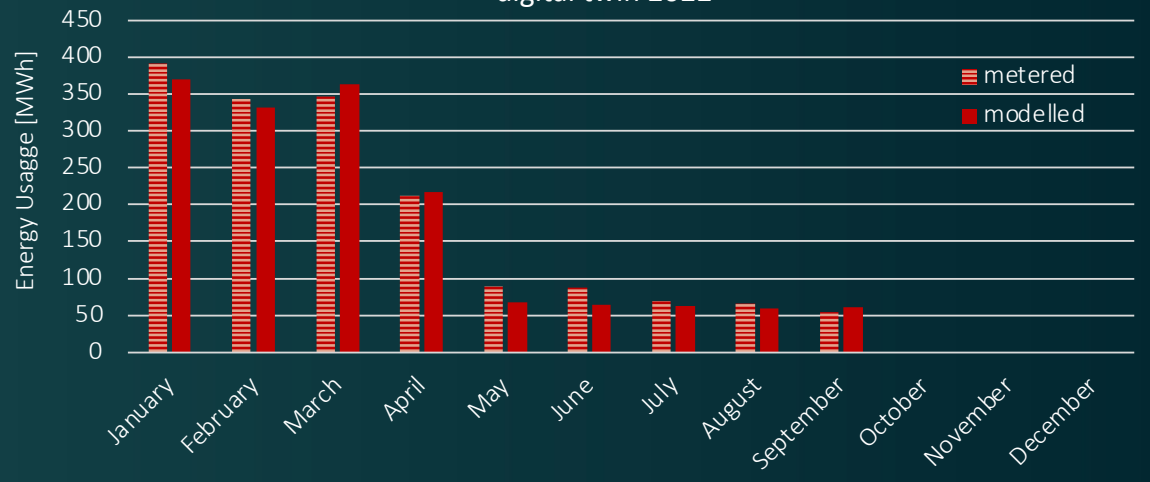
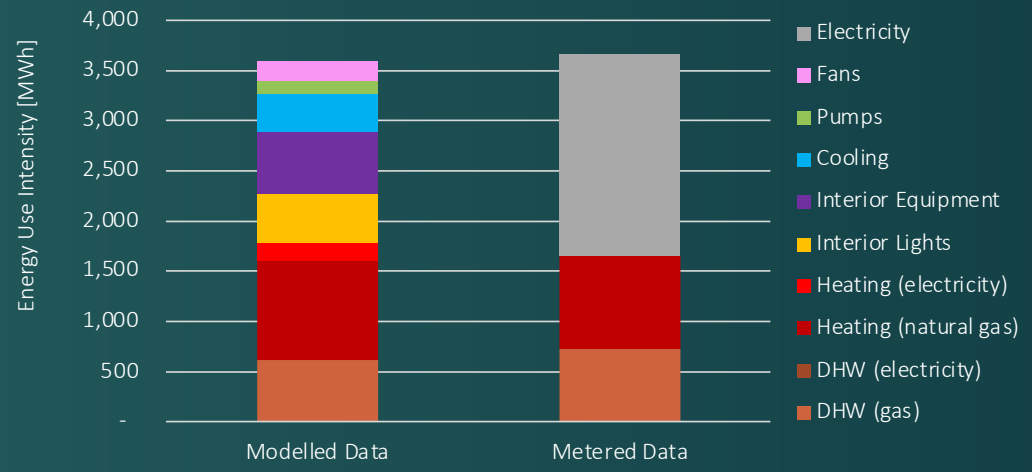
Comparison between the ELECTRICITY from the metered data and the REsustain digital twin 2022



Comparison between the GAS from the metered data and the REsustain digital twin 2022



Comparison of Energy Usage between the REsustain digital twin and the metered data



	Electricity Metered MWh	ASHRAE guideline 14-2014 = 15% Cv(RMSE) (<15%)	Gas Metered MWh	ASHRAE guideline 14-2014 = 15% Cv(RMSE) (<15%)
January 2022	289	3%	391	5%
February 2022	260	8%	343	3%
March 2022	271	3%	347	5%
April 2022	239	3%	212	2%
May 2022	189	4%	90	25%
June 2022	190	2%	87	26%
July 2022	199	5%	69	11%
August 2022	193	6%	65	8%
September 2022	173	8%	55	12%
TOTAL	2,004	5%	1,661	8%

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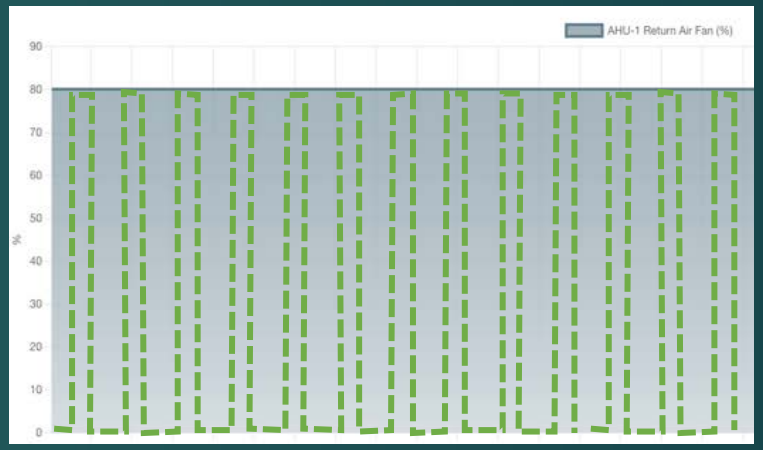
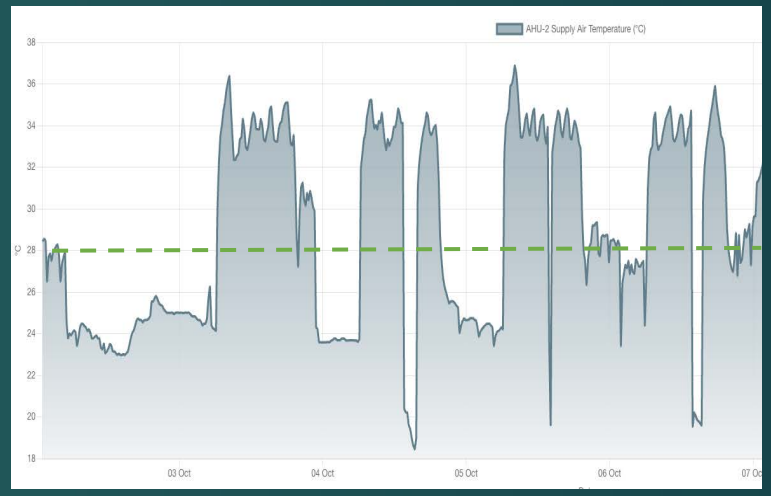
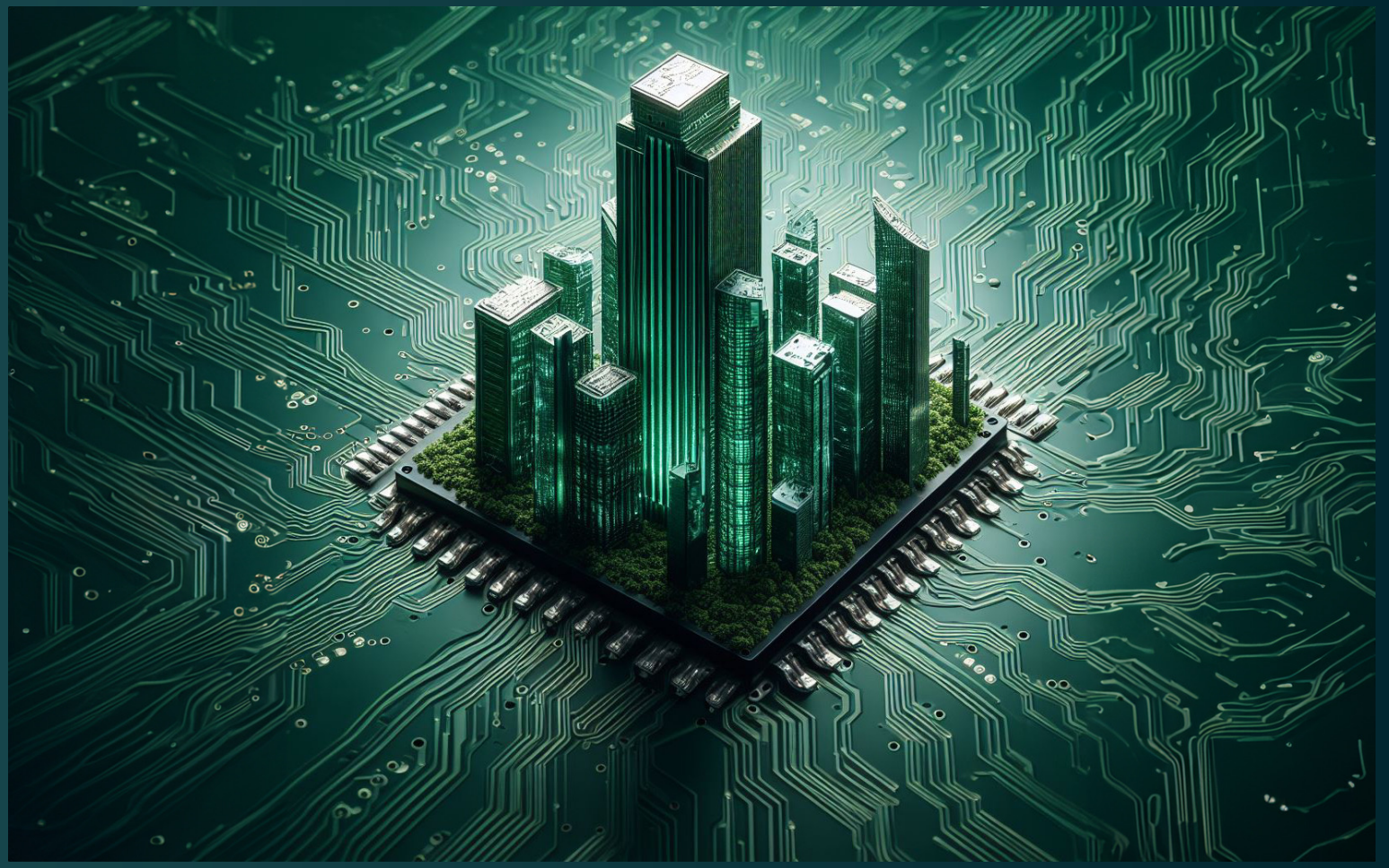
The Engine | Identifying all the control issues







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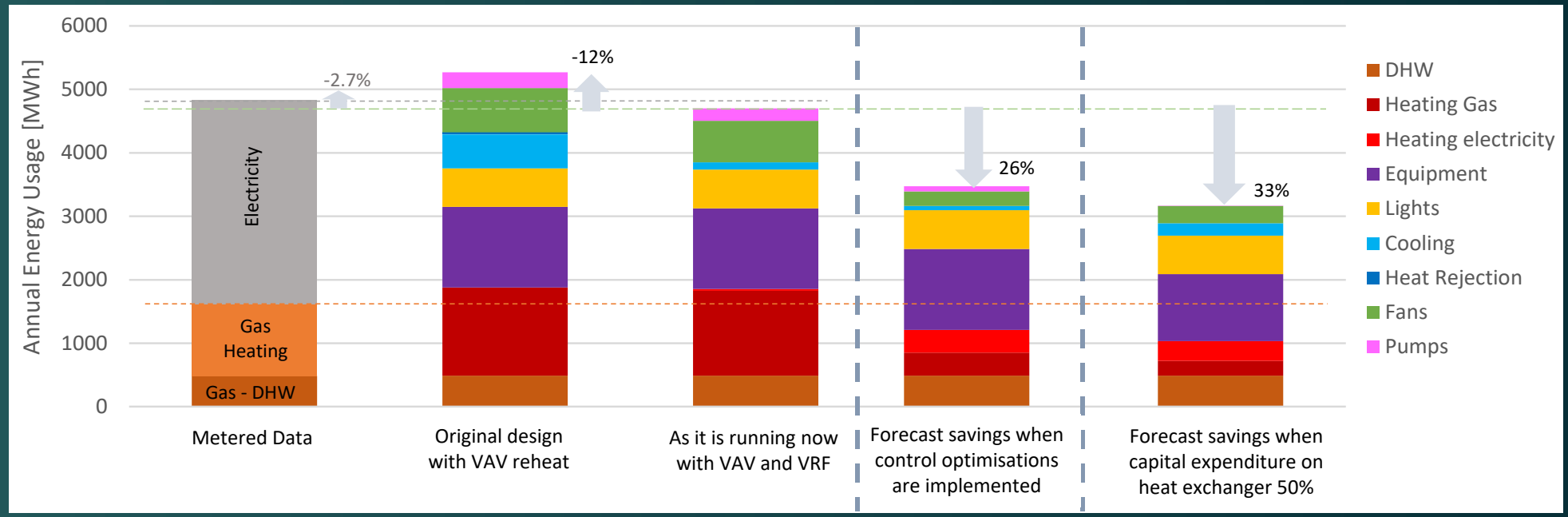

Forecast Annual Savings

£140k (£8/m²)

210 tCO_2

26% (1000MWh)

	Gas %	Electricity %	Energy Savings %	Total [£]	Savings [£]	cost savings %	Gas tCO_2	Electricity tCO_2	Total tCO_2	Carbon Savings %
0 Metered data	15.8%	-10.0%	**-2.7%**	£ 597,117		**-7.9%**	243	862	1,105	**-3%**
1 Original Design | VAV wReheat	-4%	-15%	**-12%**	£ 633,099		**-14%**	300	903	1,204	**-12%**
2 As it is running now | VAV with VRF	0%	0%	**0%**	£ 553,517	£ -	**0%**	288	783	1,072	**0%**
3 Controls Optimisation	73%	7%	**26%**	£ 482,296	£ 141,220	**20%**	78.5	725	803	**25%**
4 CapEx - Heat Exchanger 50%	82%	13%	**33%**	£ 450,352	£ 173,165	**29%**	51.3	682	733	**32%**

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Office Building London

30 Day View

View Period

1. Gateway installed and BMS data streaming

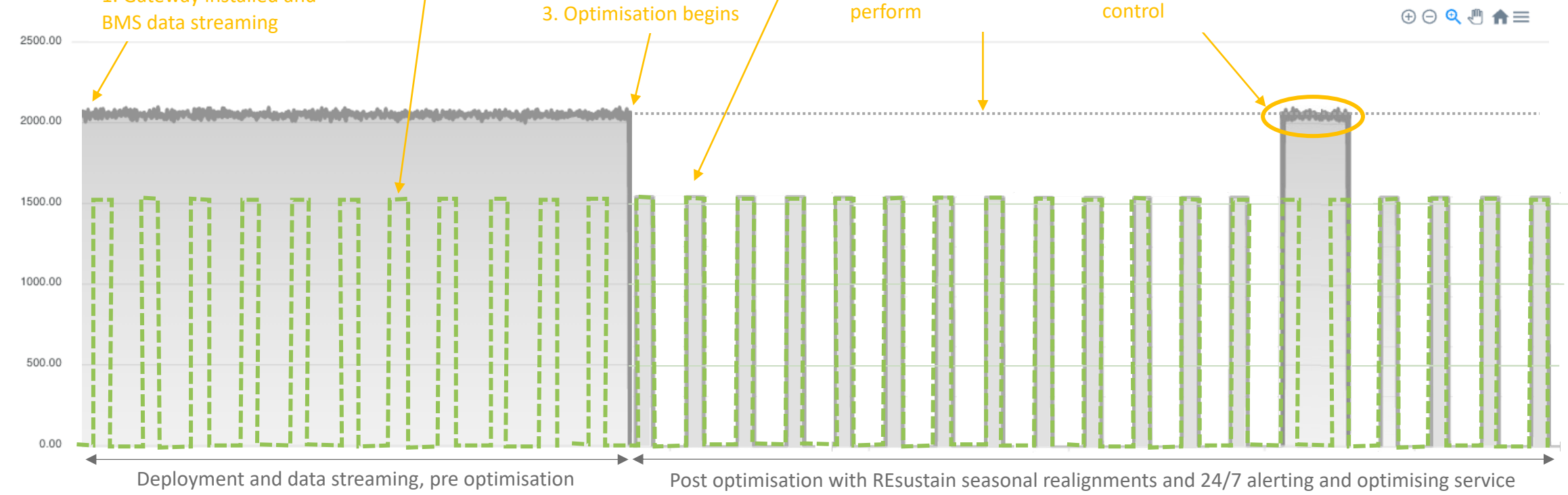
2. Correct control operation patterns from the engine
   a. AHU on 24hrs a day
   b. Air flow rate through AHU too high

3. Optimisation begins

4. Control optimised, BMS data shows the AHU is now following the correct optimisation pattern

5. The baseline control pattern / how it used to perform

6. Fan was tested at fully power and not turned back, alert sent and two-way control implemented to put the fan back to optimised control



Supply flow rate from AHU-01
last measured at: 2023-06-22 11:26:02.978

2060.80

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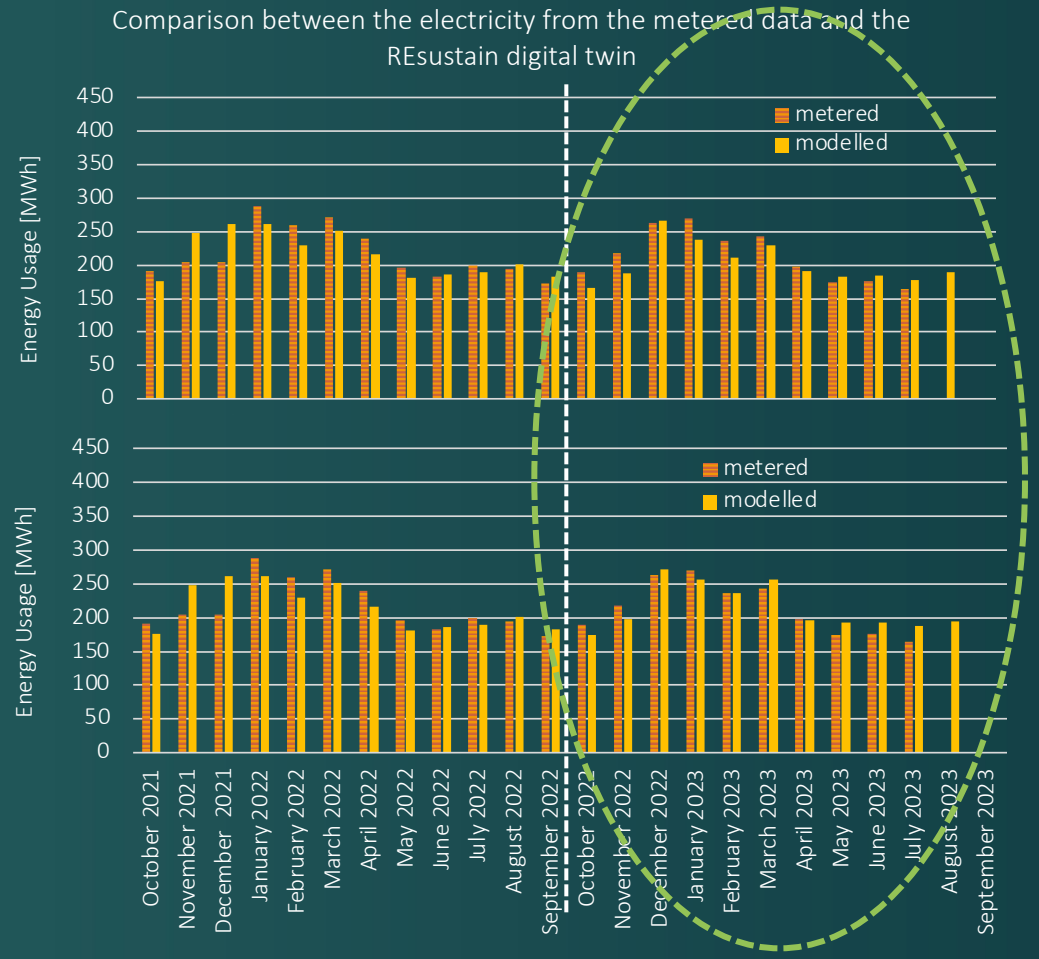
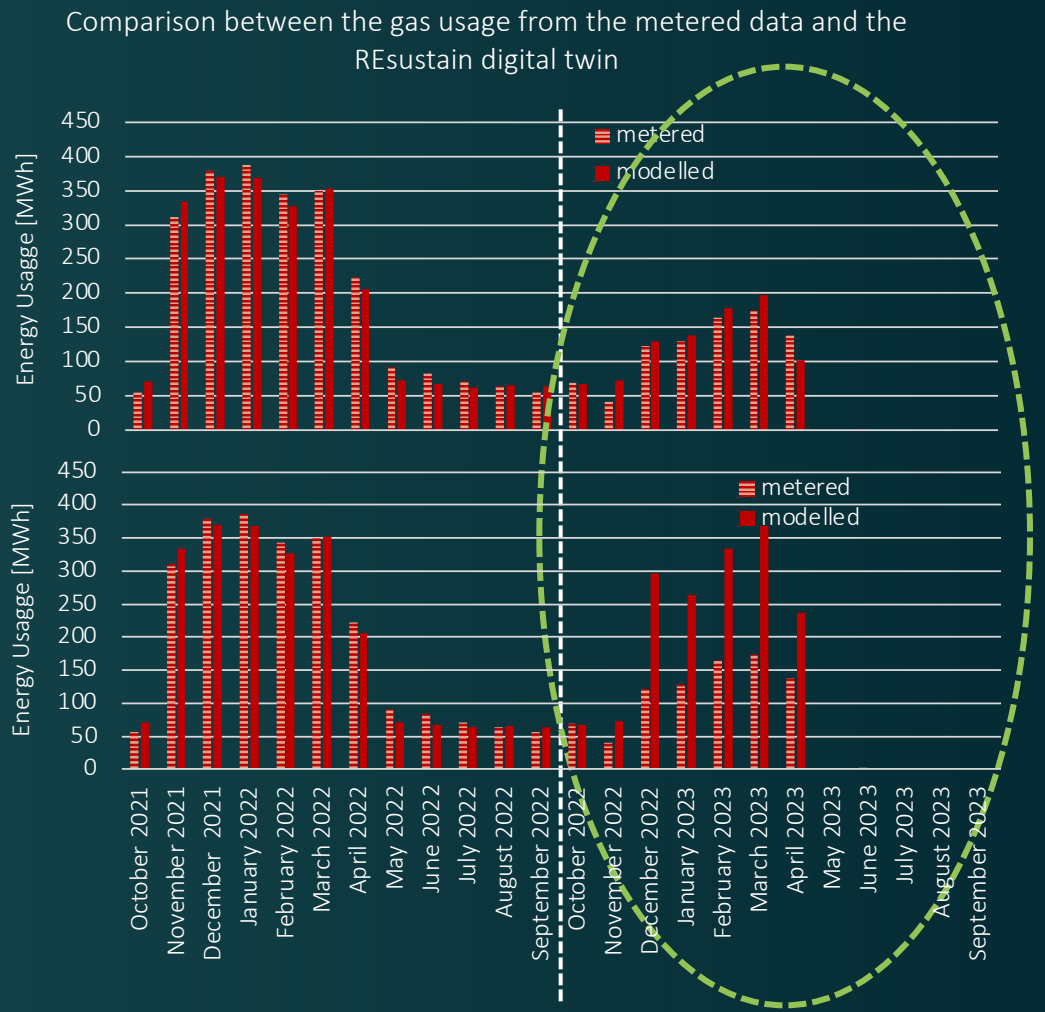
The performance of the building with the optimised controls





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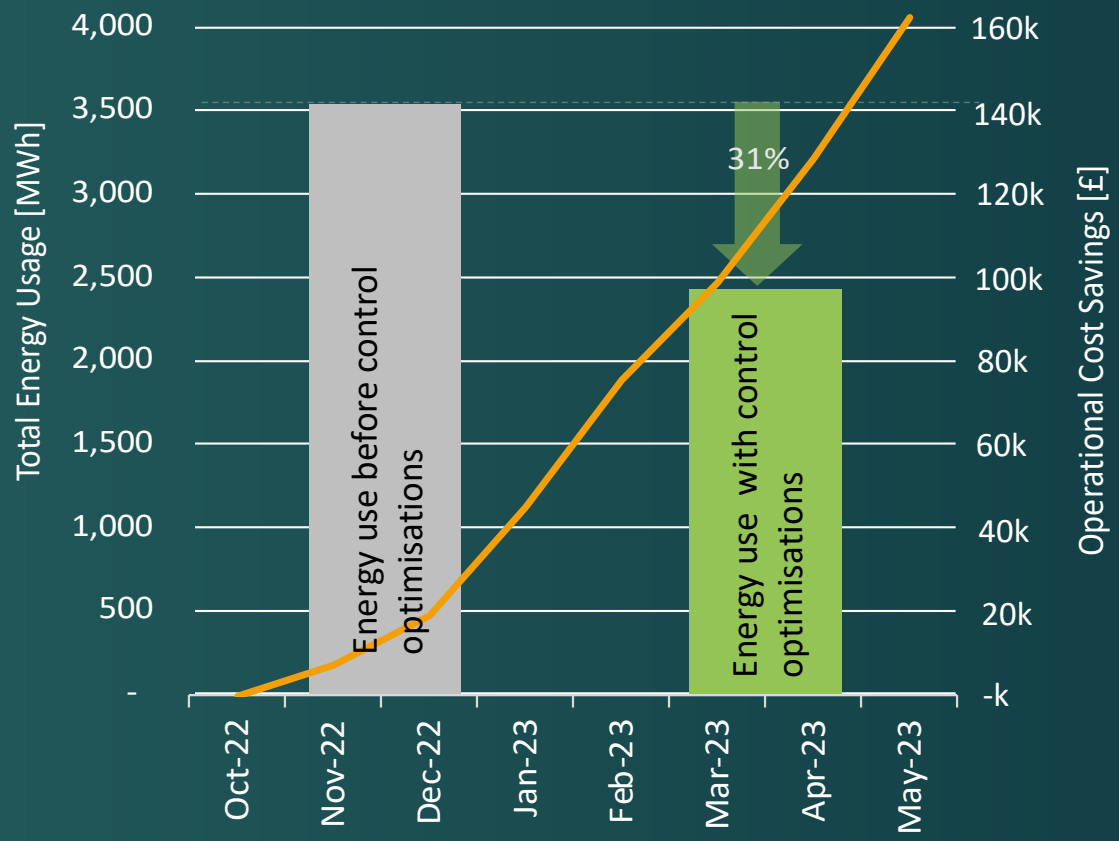
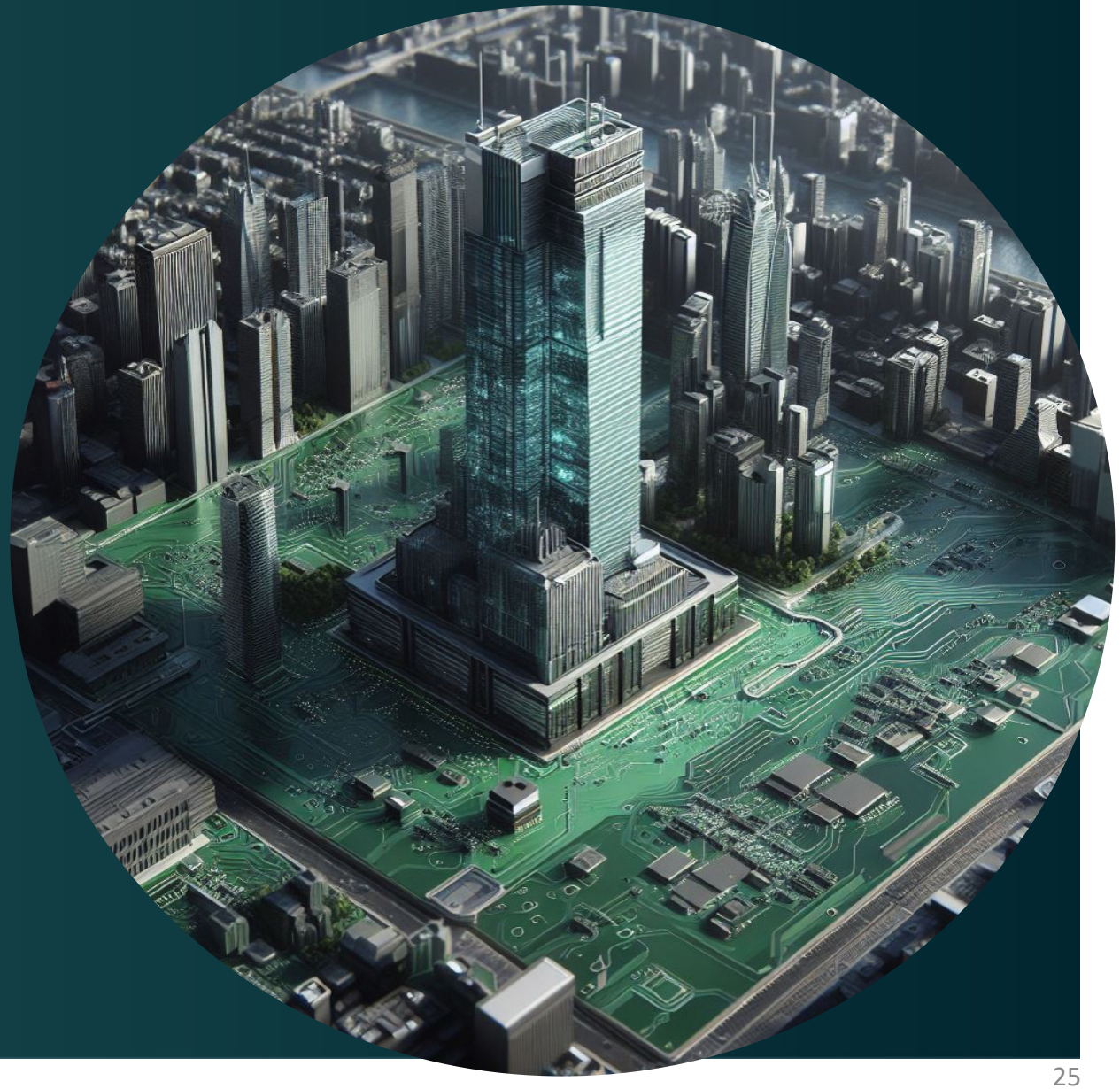
Results 9 months into optimisation

£9.3/m²

220 tCO_2

62 kWh/m²





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This isn't a one off | other case studies

	Floor area m^2	Forecast energy savings	Annual forecast CO_2 savings (tonnes)	Annual forecast cost Savings*		
The Hague	17,400	28.0%	272	€109,359	(€6.3/m^2)	35%
Manchester	22,850	65.5%	172	£116,860	(£5.1/m^2)	65%
Madrid	18,000	26.2%	157	€53,675	(€3.0/m^2)	14%
Croydon	17,600	26.5%	210	£140,000	(£8.0/m^2)	19%
Edinburgh	5,595	44.6%	65	£21,000	(£3.8/m^2)	26%
London	21,200	17.1%	110	£75,000	(£3.6/m^2)	12%
Cardiff	4,800	24.6%	58	£30,700	(£6.4/m^2)	20%

*Annual savings forecasts are based on the cost of electricity, gas and district heating from the most recent energy bill received from the site. It is then assumed for the forecast that these utility prices will not change for the projected year.

Conclusions

Significant carbon and cost savings can be found through controls optimisation:

- 30% of the building's energy saved. Tenants made no changes and suffered no disruption to their spaces – haven't even noticed other than paying lower energy bills!
- The building is a 'living organism'. Multiple changes have been made to the building since construction. The building is far from static and requires constant monitoring to ensure it works to its optimum
- This building had a relatively new BMS; however, a BMS isn't intelligent it just controls the building according to its programming.
- No capital expenditure was required for this, and the cost savings are significant.

Thank You.

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9-10 October 2024 • ExCeL London

We look forward to seeing you in 2024