

CLIMATE-RESILIENT PUBLIC BUILDINGS

Preventing the unintended consequences of
net zero



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Why this matters now

Hotter summers

Longer warm periods expose weaknesses in buildings designed around historic conditions.

Scotland experienced its **hottest June on record in 2026**, with temperatures reaching 30°C and widespread heatwave conditions.

Scotland record high: 34.8°C at Charterhall (July 2022)

Average summer temp of 32 °C in Glasgow by 2050

Net zero delivery

Heat pumps, fabric upgrades and electrification are changing how buildings behave.

Ageing estates

Legacy plant, mixed controls and limited data make performance harder to predict.

Around 80% of the buildings we'll be using in 2050 have already been built today.

Service continuity

Schools, offices, care and health settings must keep operating during extreme weather events.

SHOW OF HANDS: How many councils have assessed overheating risk across the estate?

We design for winter

THEN

Keep heat in

- Insulation
- Airtightness
- Efficient heating
- Reduced draughts

NOW

Manage heat both ways

- Overheating
- Indoor air quality
- Solar gain
- Cooling demand
- Occupant comfort
- Health risks

A building that performs well in January may perform badly in July.

The future climate is already testing buildings



Listen for the early warnings

Persistent comfort complaints
Portable fans and heaters
Windows opened against controls
Plant running longer

The weather changes first. Building use and service impacts follow.

Good intentions can create new risks

Heat pumps

Lower-carbon heat, but performance depends on emitters, temperatures, zoning, controls and competent design.

Fabric and airtightness

Lower heat loss, but greater overheating and air-quality risk if ventilation is not addressed.

PV and electrification

Strong carbon and cost saving measures, but they do not by themselves resolve comfort or operational problems.

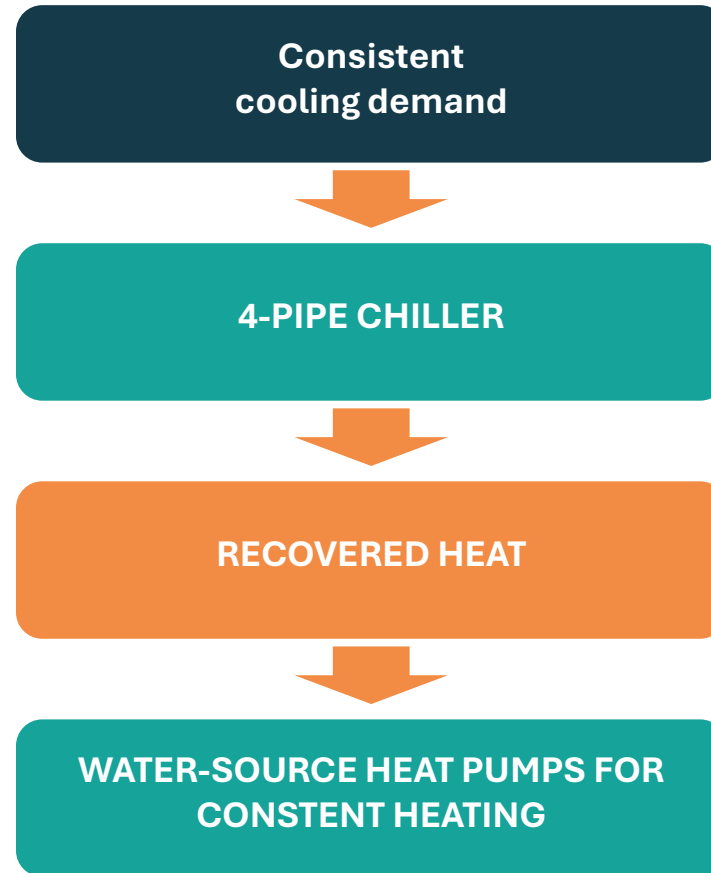
Decarbonisation is an opportunity to improve the internal conditions of buildings



Leisure Centre: turning cooling demand into useful heat

THE CHALLENGE

- Ice-rink, gym and theatre require cooling
- DHW and pool plant has consistent heating demands
- Separate systems would produce heating and cooling independently
- Heat removed during cooling could otherwise be rejected



THE USEFUL OUTPUT

- Chilled water at approximately 7°C serves the ice-rink AHU
- 4-pipe chiller recovers heat from cooling process
- 4-pipe chiller produces hot water at approximately 50°C
- Water-source heat pumps raises the temperature to approximately 70°C
- Useful heat serves the pool-plant loads

One process provides cooling and creates a useful source of heat.

Leisure Centre: benefits of simultaneous heating and cooling

IMPROVED EFFICIENCY

- Heating and cooling can be produced simultaneously where thermal loads overlap.

USEFUL HEAT RECOVERY

- Heat from the cooling process is captured rather than simply rejected.

LOWER SEPARATE HEAT DEMAND

- Recovered heat provides the source for water-source heat pumps.

OPERATIONAL RESILIENCE

- The existing chiller serving the ice-rink AHU is retained as backup.

Integrate loads where temperature and demand profiles align, without compromising specialist refrigeration.

Primary School: the design worked, but operation did not

REPORTED EXPERIENCE

- Classrooms reported at 8–10°C in winter
- Reception reported at up to 36°C in hot weather
- High utility bills following move to new build school
- Staff had limited control and no formal operator training

VENTILATION FAULTS

- Music Room supply fan not operating
- Extract ductwork disconnected from the grille
- Windcatchers not functioning



HEATING + CONTROLS

- BMS clock approximately 2 hours ahead
- Heating turned on over summer, during a heat wave with temperature at 35 °C, and TRV's turned down.
- Heavy glazing on southern façade with no openable windows.

Modern technology cannot compensate for disconnected ventilation, misaligned schedules, incomplete commissioning and not understanding controls

Primary School: lower energy use, but higher cost and avoidable operation

19% lower

TOTAL ENERGY USE COMPARED
TO OLD SCHOOL

38% larger

FLOOR AREA

ONLY 9%

DECREASE IN HOLIDAY VS
TERM-TIME ENERGY USE

ENERGY BILLS INCREASE FROM

£6,935 →

£14,720

~£4,500

EXTRA ANNUAL IN AVAILABLE
CAPACITY COST

WHAT DROVE THE BILLS

- The move from low-cost gas to an all-electric building
- Electricity cost materially higher per unit than former-site gas
- Standing and metering charges around 10.7 times higher
- VAT and Climate Change Levy not applied at old school but applied at new school

WHAT ADDED AVOIDABLE COST

- Holiday weekday schedule remained close to term-time levels
- BMS schedules were misaligned with actual time
- Heating appeared active during summer conditions
- Ventilation and controls faults contributed to poor comfort

“Heat pumps are rubbish!?”

The performance gap



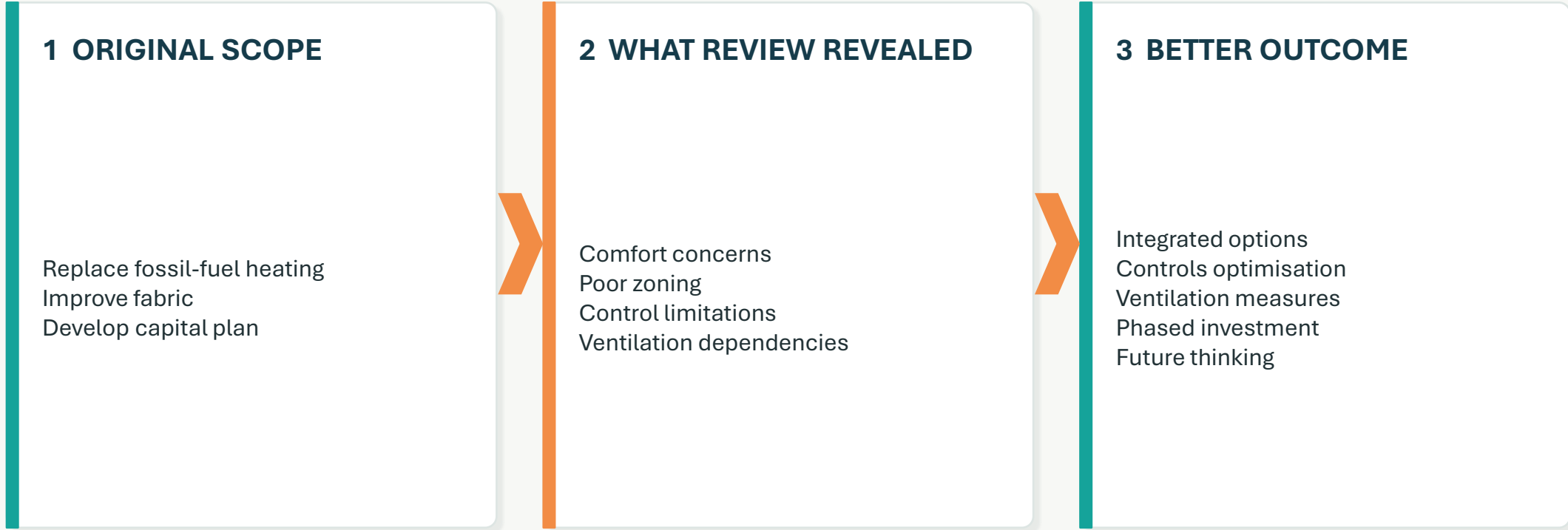
Intended

- Lower carbon
- Lower cost
- Better comfort
- Predictable operation

Experienced

- Overrides and workarounds
- Savings below forecast
- Complaints persist
- Facilities teams firefight

Project lesson: broaden the brief before fixing the solution



Technology alone does not solve a building-performance problem.

Controls: the lowest-cost place to look first

HEATING + COOLING

Operating at the same time

SCHEDULES

Plant on when the building is empty

SETPOINTS

Drifted, duplicated or contradictory

SENSORS

Poor location, calibration or visibility

OVERRIDES

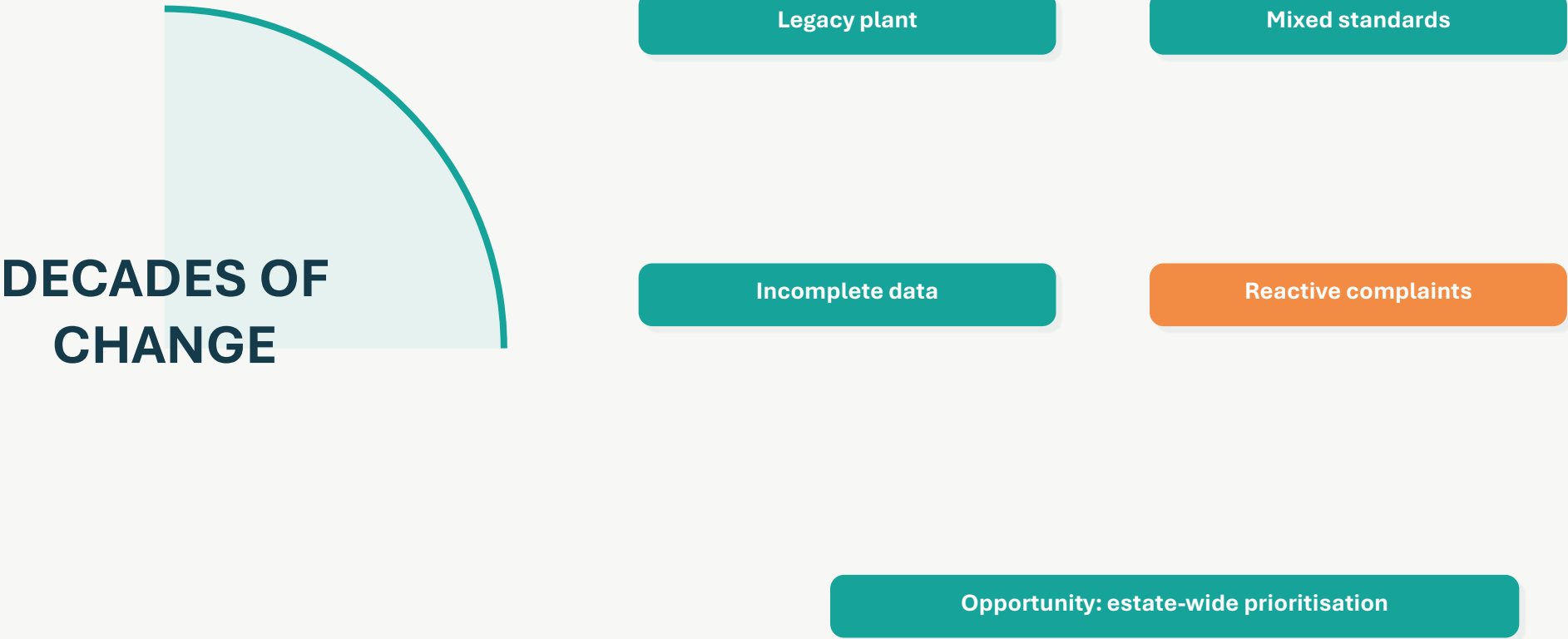
Temporary changes become permanent

ZONING

Control does not follow actual occupancy

Before major capital investment, confirm that existing systems operate as intended.

Complex estates amplify the integration challenge



Overheating is a service risk, not just a comfort issue



SCHOOLS

Learning and concentration

OFFICES

Productivity and attendance

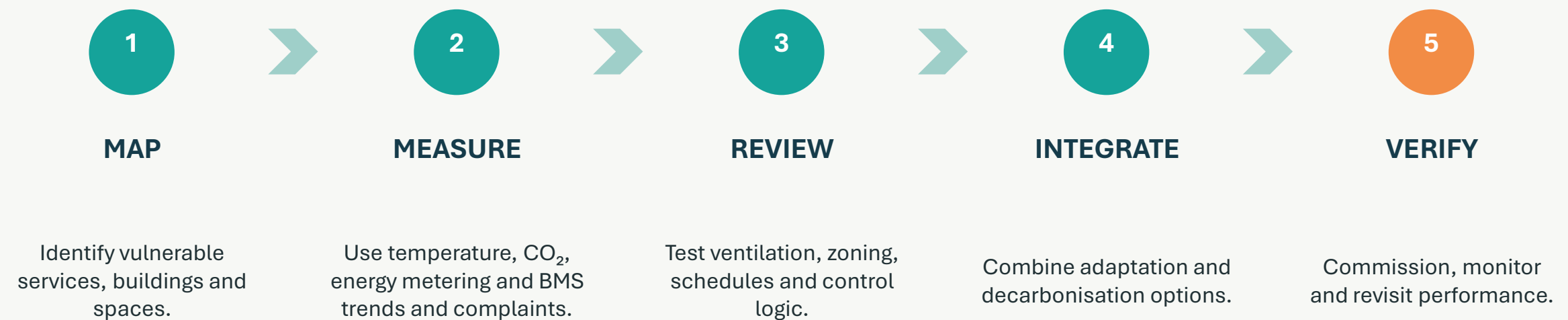
CARE

Vulnerable occupants

HEALTH

Clinical and operational continuity

Five practical steps councils can start now



Start with evidence. Sequence low-cost measures. Protect the capital programme with better information.

A climate-resilience checklist

☐

Have we assessed current and future overheating risk?

☐

Do we understand actual occupancy and operating hours?

☐

Is ventilation adequate in normal and extreme conditions?

☐

Are controls documented, visible and optimised?

☐

Will the proposal work in winter and summer?

☐

How will performance be monitored after handover?

If these questions are not answered, the project is not fully defined.

The future public building



LOW CARBON

COMFORTABLE

ADAPTABLE

HEALTHY

AFFORDABLE

OPERATIONALLY ROBUST

Can this building continue to support public services in 2050?

NET ZERO IS NOT THE DESTINATION

The successful public building is low carbon, climate resilient, comfortable and affordable to operate.

1

Which buildings generate most complaints?

2

Is the BMS operating as intended?

3

Are decarbonisation projects also adaptation projects?

“The next generation of building failures may come from poor integration, not poor intentions.”

Questions & discussion

Next Steps

Ready to take action?

Contact Phil Brennan for further details on delivery of projects

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