



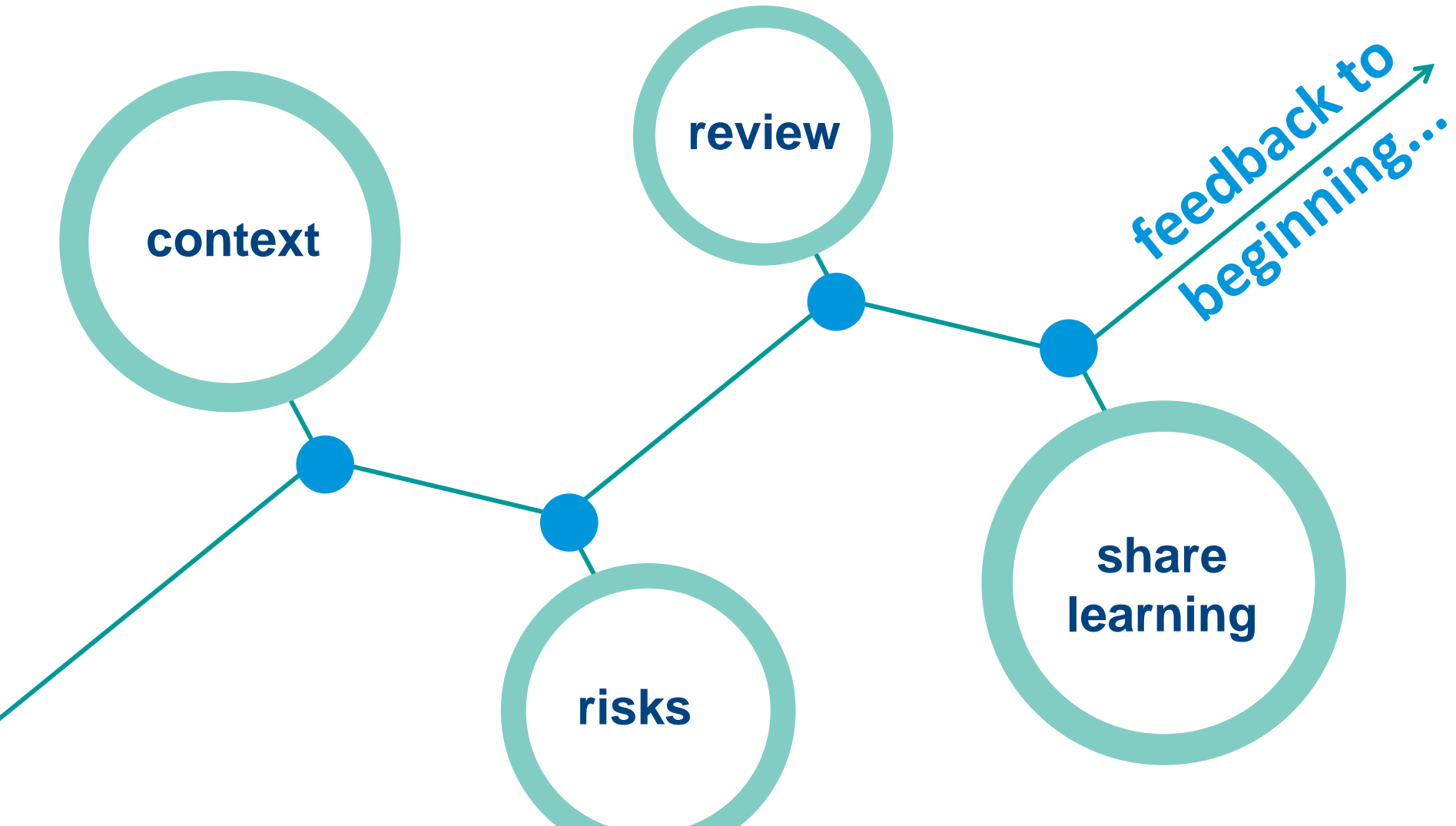
FACILITY design and construction: in NHS Scotland



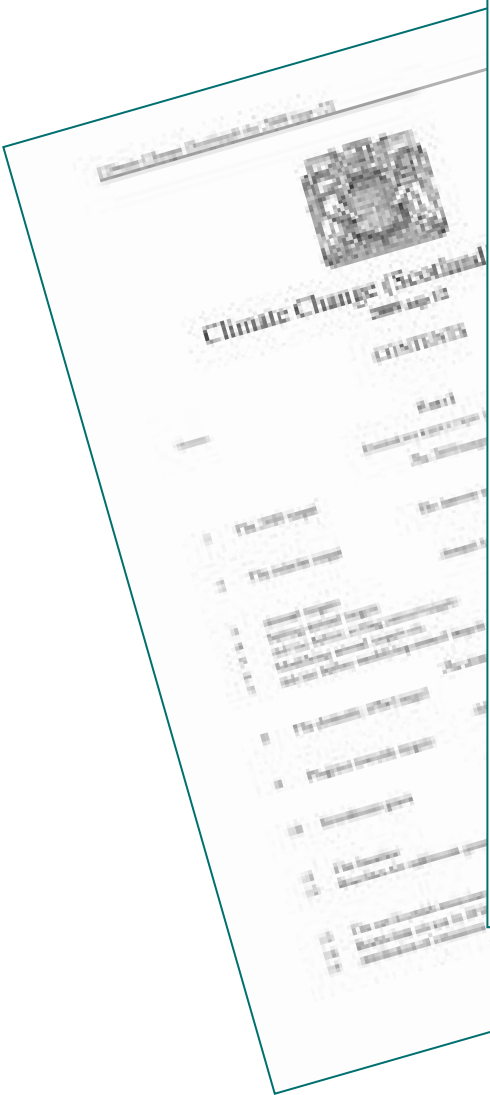
**shared
learning**

Susan Grant & Ian Storrar
Principal Architect & Principal Engineer

a circular path to success



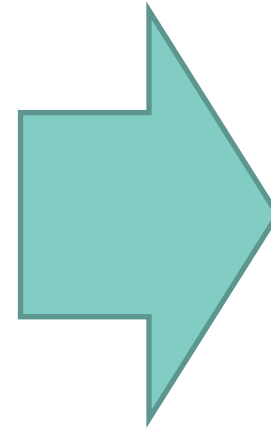
Context : legislation & policy



DRAFT CLIMATE CHANGE PLAN
The draft third report on policies
and proposals 2017-2032
January 2017

A central illustration consisting of four horizontal, rounded rectangular sections, each containing different icons representing sustainability and climate action. The top section shows wind turbines, solar panels, and trees. The second section shows a person on a bicycle, an electric car, and a house with solar panels. The third section shows a power line tower, a factory, a person walking, and a dog. The bottom section shows a cow, a tractor, and a field.

Scottish Government
Riaghaltas na h-Alba
gov.scot



Context : geography & climate

2050s Medium Emissions UKCP09 projections

NORTH SCOTLAND

Winter

Mean Temp Increase: **1.6°C** (0.6°C – 2.8°C)

Mean Precipitation increase: **13%** (3% – 24%)

Summer

Mean Temp Increase: **2.0°C** (0.9°C – 3.4°C)

Mean Precipitation Increase: **-11%** (-24% – 2%)

EAST SCOTLAND

Winter

Mean Temp Increase: **1.7°C** (0.7°C – 2.9°C)

Mean Precipitation increase: **10%** (1% – 20%)

Summer

Mean Temp Increase: **2.3°C** (1.1°C – 3.9°C)

Mean Precipitation Increase: **-13%** (-27% – 1%)

WEST SCOTLAND

Winter

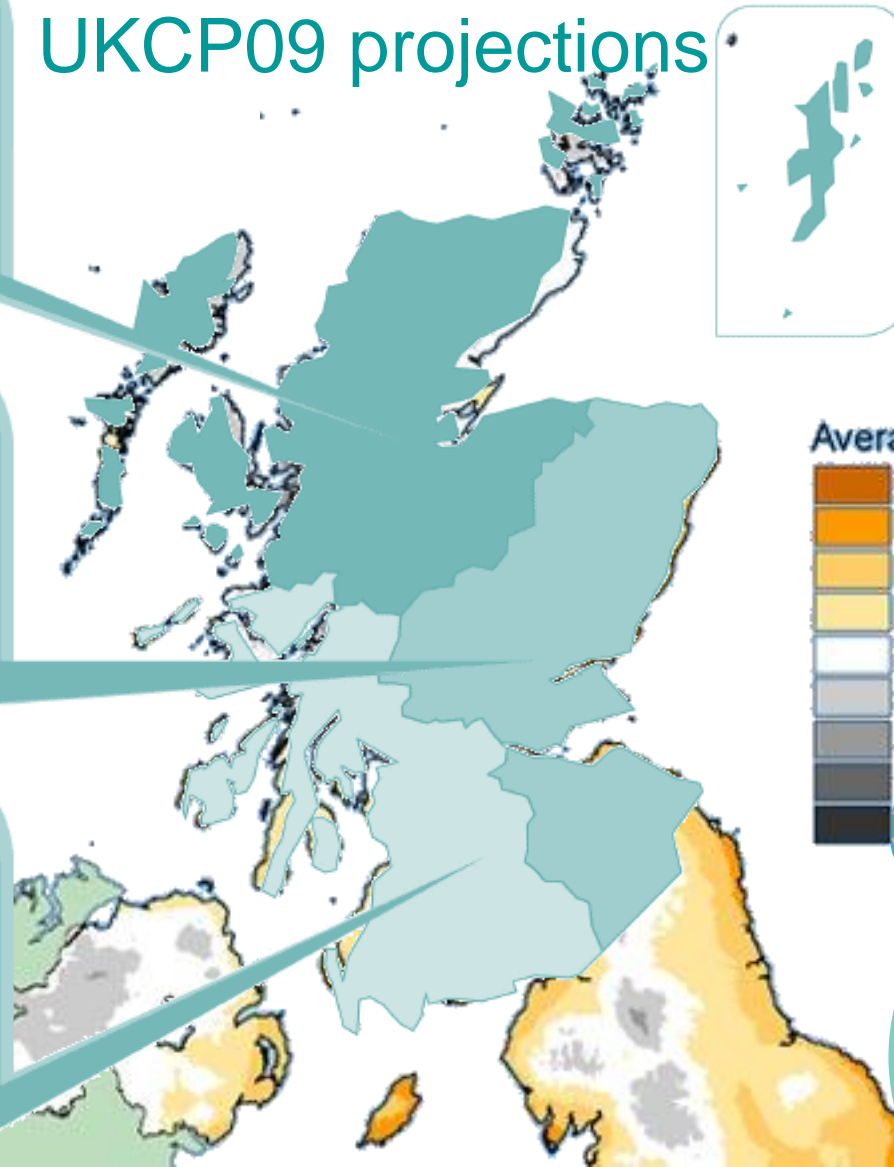
Mean Temp Increase: **2.0°C** (1.0°C – 3.0°C)

Mean Precipitation increase: **15%** (5% – 29%)

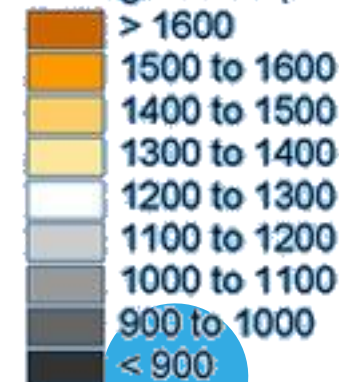
Summer

Mean Temp Increase: **2.4°C** (1.1°C – 3.8°C)

Mean Precipitation Increase: **-13%** (-27% – 1%)



Average Value (hours)



Context : resource & capacity

FTX-systemet återvinner värmen ur inomhusluften och återför den via den inkommande friska luften

Frisk luft

Använd luft från kök och badrum

Den heta sommarsolen skärmas av medan den svagare vintersolen får stråla in och värma

Takets isolering är 50 cm

50 cm

Väggens u-värde är låga 0,08 och har 50 cm isolering

50 cm

Tilluft till vardagsrum och sovrum

FTX system

Spillvärme från hushållet

Sommarsol

Vintersol

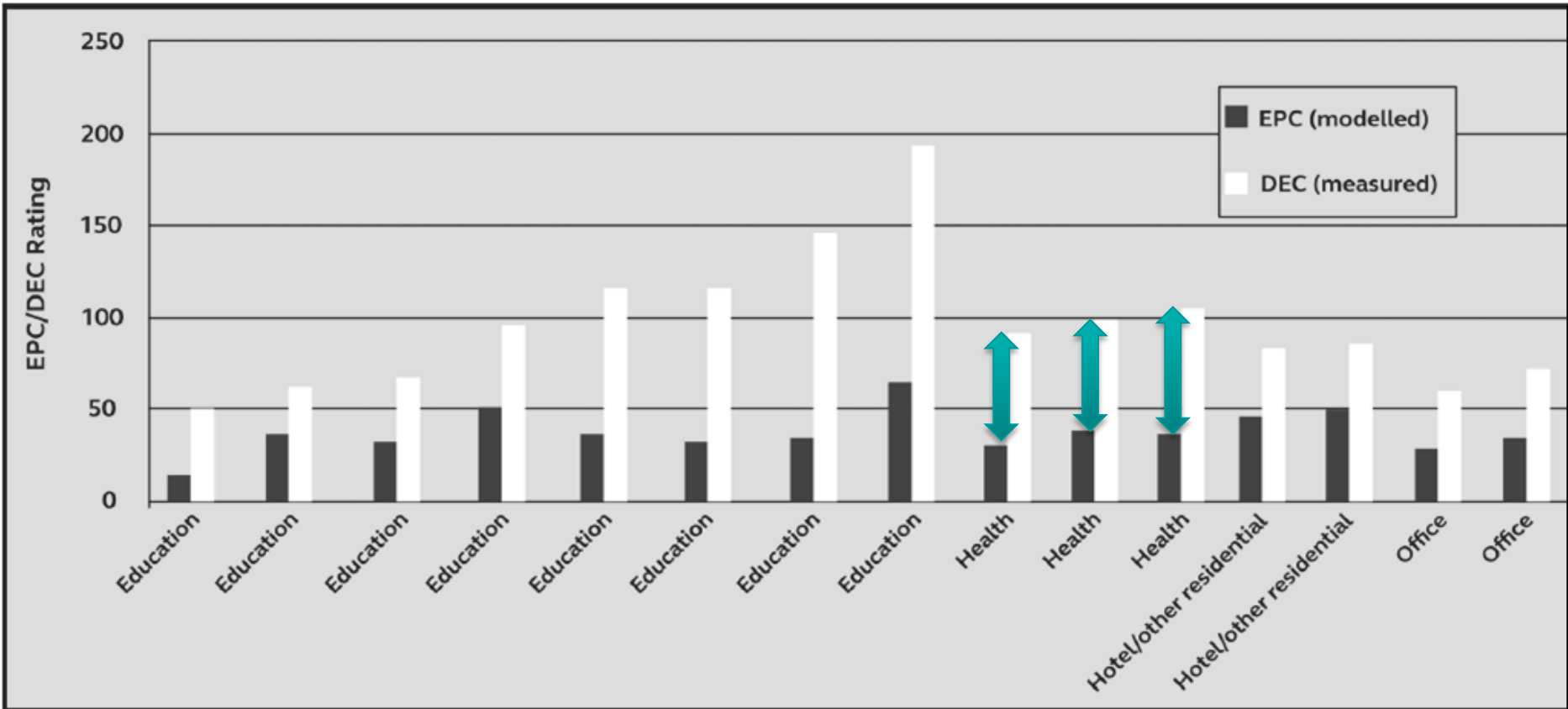
Grundens isolering är 40 cm

40 cm

Fönstren är energieffektiva < 0,80 W/m K

För varmvattenberedning och eventuell extra uppvärmning i ditt hus när det är som kyligast ute finns flera alternativ. För den som vill ha så lite underhåll som möjligt rekommenderar vi en kompaktvärmepump. Om du hellre vill vara mer eller mindre självförsörjande så föreslår vi en kombination av solfångare och vattenmantlad kamin. Om du vill bo i ett nollenergihus rekommenderar vi vårt solcellspaket.

Context : performance & gap



finds actual carbon 'used' can be 3.5x 'notional' EPC
[Innovate UK: Building Performance Evaluation Study 2016](#)

What are key risks ?

- legal compliance
- safety risks
- comfort risks
- operational risks
- cost risks
- systemic problem

‘duty holder’/ director may
‘GO TO JAIL’



Where are highest risks?

- water
- electrics
- service voids
- corridors
- offices
- inpatient rooms

vulnerable populations
and regions



When do risks occur ?

- overnight
- over weekend
- all year round
- vulnerable people
- systemic failing

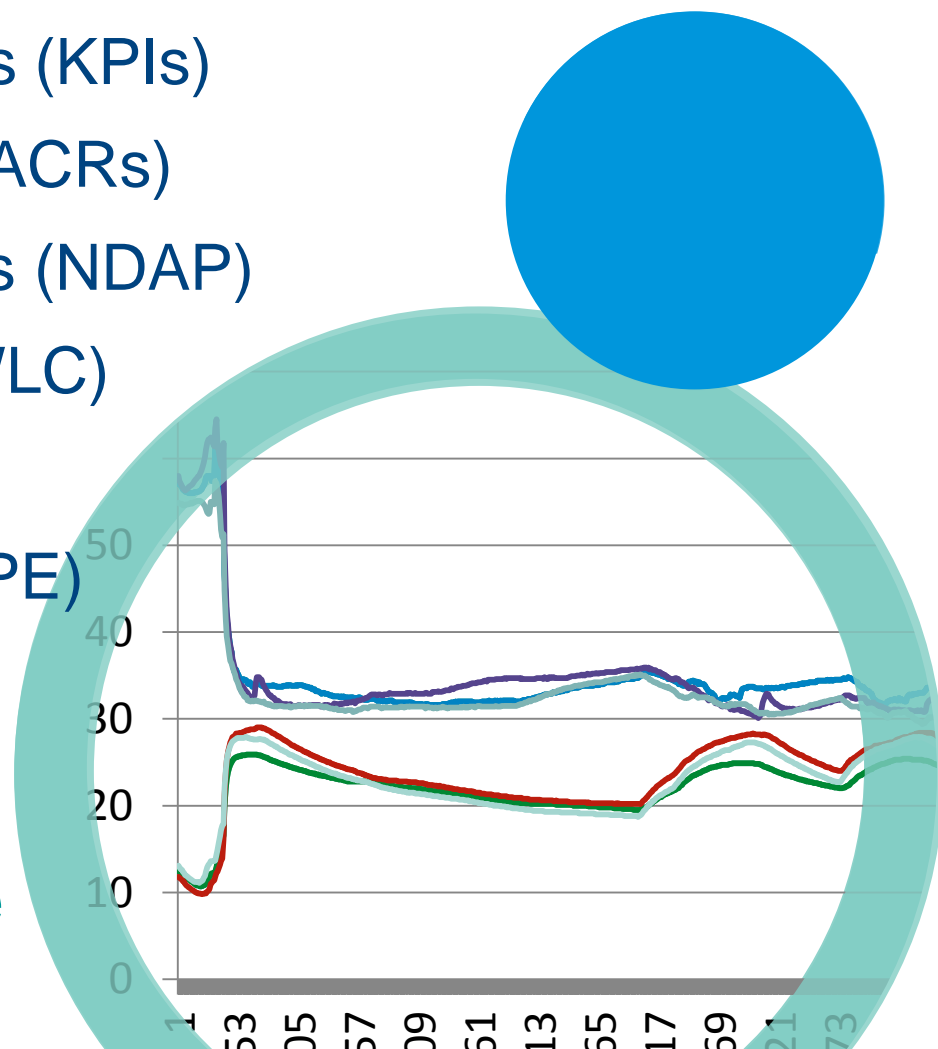
vulnerable facilities
and systems



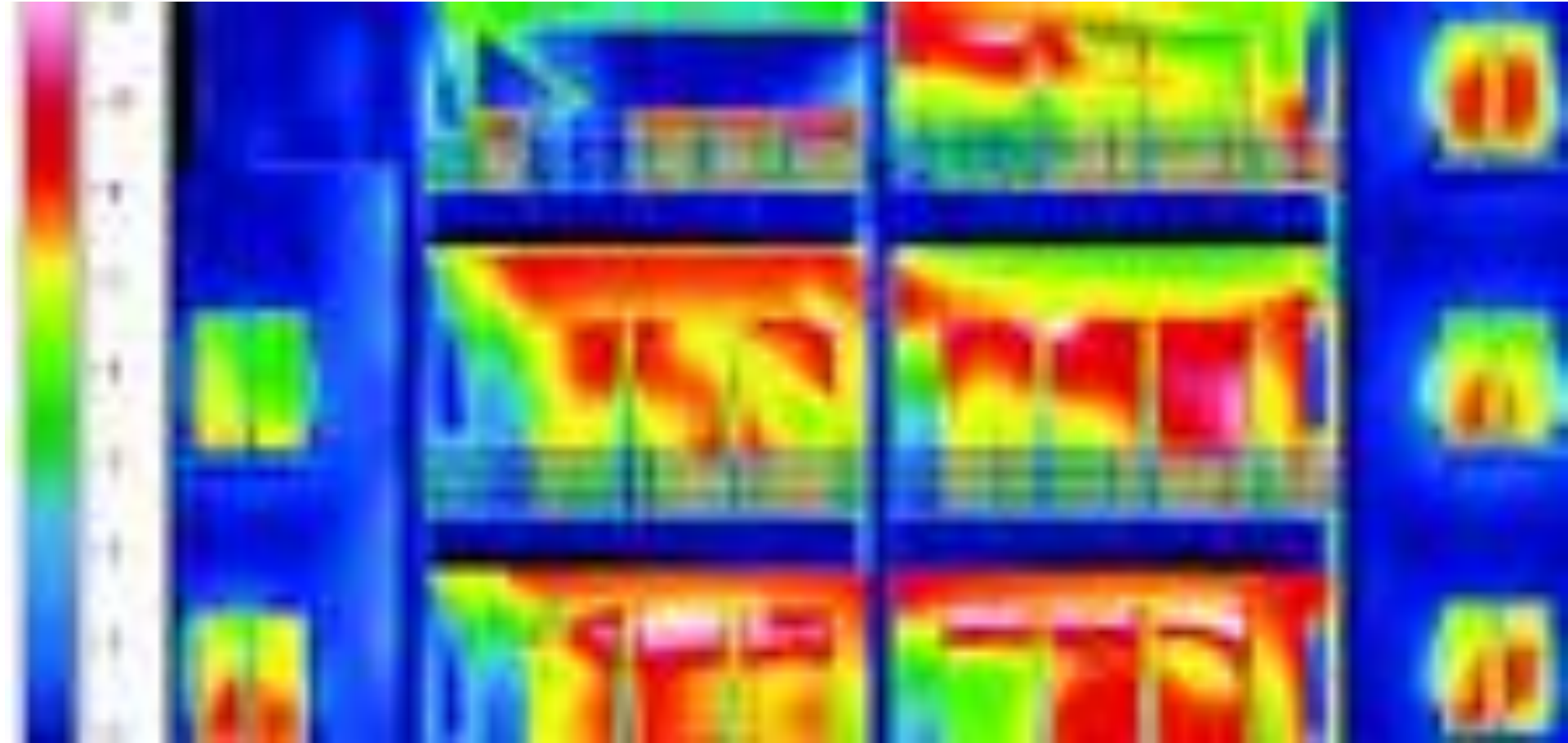
What are we doing ?

- research and training
- revise performance targets (KPIs)
- IA briefing improvement (ACRs)
- OBC / FBC design reviews (NDAP)
- whole life cycle costing (WLC)
- integrated commissioning
- post project evaluation (PPE)
- shared learning

better briefs, performance
review and mitigate gaps



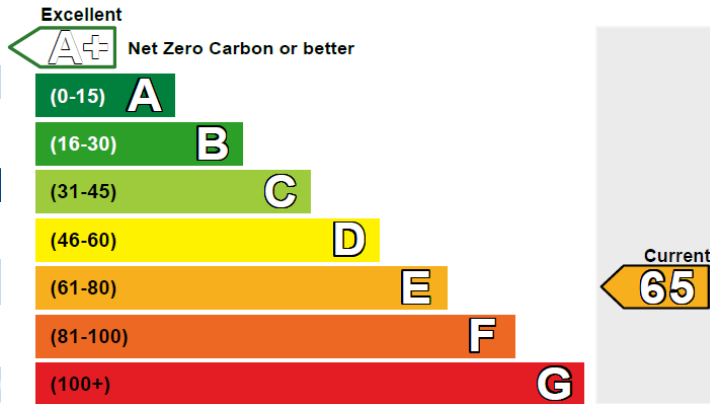
What are we doing ?



research and training

What are we doing ?

Building Energy Performance Rating



Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	16.53	0
Wind turbines	0	0
CHP generators	13.08	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

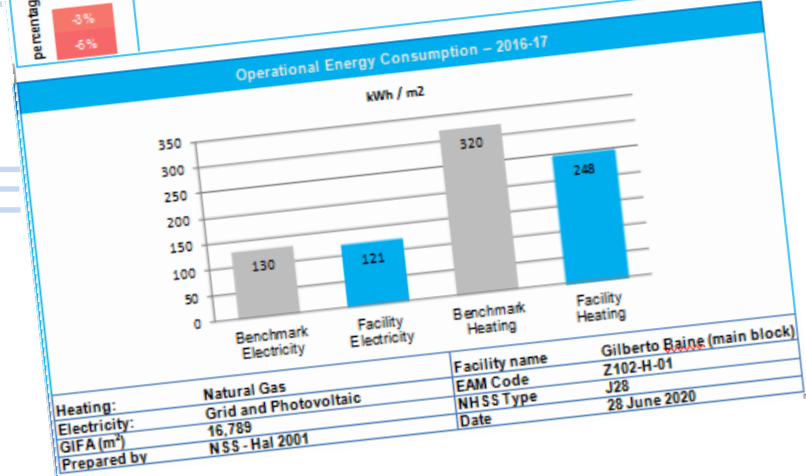
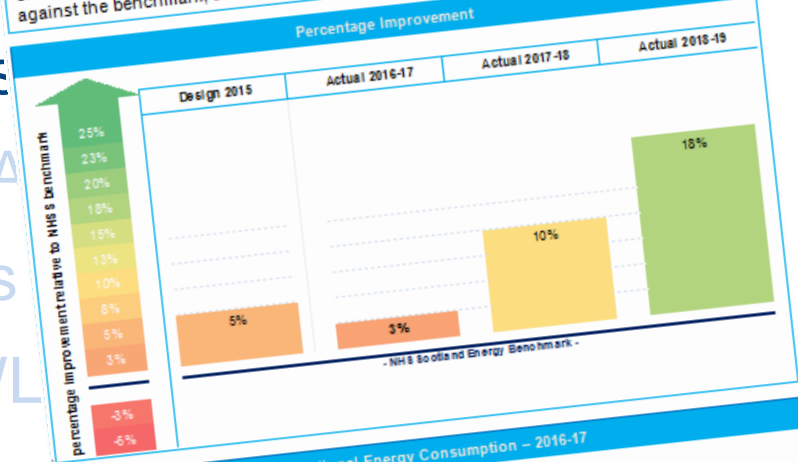
	Actual	Indicative
Heating + cooling demand [MJ/m ²]	83.22	67.75
Primary energy* [kWh/m ²]	167.37	159.02
Total emissions [kg/m ²]	21.6	28.8

NHSScotland Display Energy Performance

This document indicates the annual amount of energy used to operate this facility.

Operational Energy Performance

The facility energy consumption is compared to a NHSScotland benchmark that is indicative of buildings of this type. The diagrams below show the historical percentage improvement against the benchmark, and the operational energy consumption.



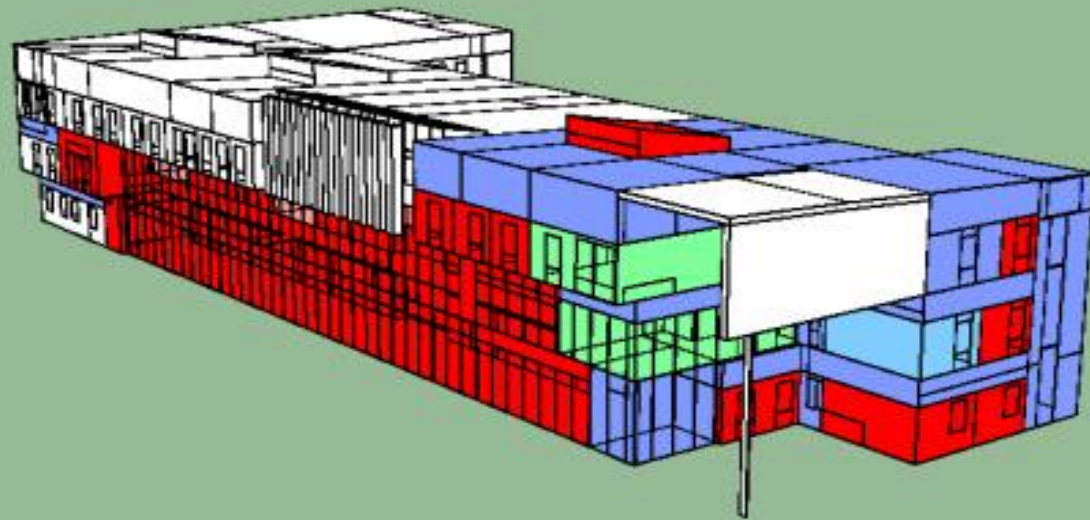
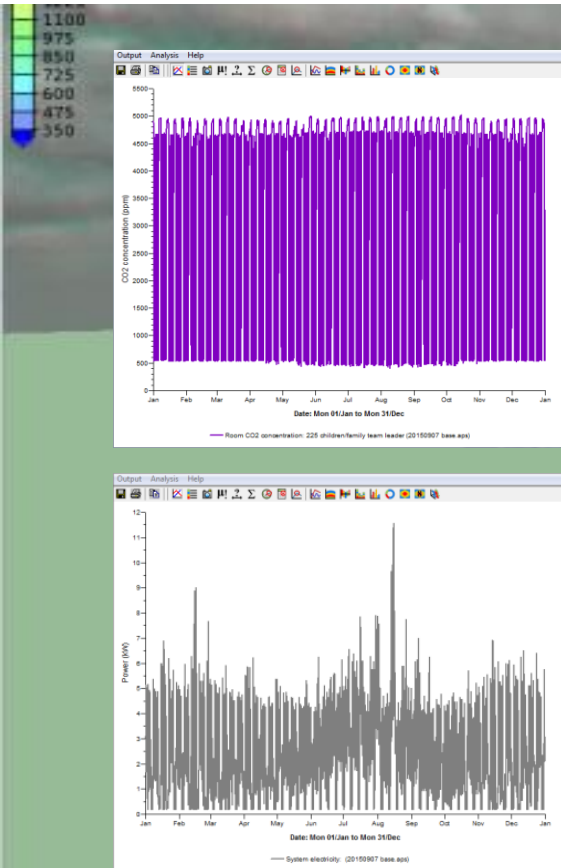
revise performance targets (KPIs)

What are we doing ?

Location	CIBSE Guide A						TM52			
	Number of Occupied Hours > 25°C	Percent of Occupied Hours > 25°C	Number of Occupied Hours > 28°C	Percent of Occupied Hours > 28°C	Hours Above 30°C	CIBSE Guide A	Criterion 1	Criterion 2	Criterion 3	TM52
03 - 14-GPB-003 - Consultant	132	5.6	12	0.5	0	Pass	3.8	8	3	Fail
03 - Office 12	162	6.9	11	0.5	0	Pass	4.3	9	2	Fail
03 - 14-GPB-002 - Consultant	132	5.6	10	0.4	0	Pass	3.8	6	3	Pass
03 - Office 5	159	6.8	10	0.4	0	Pass	4.2	9	2	Fail
03 - SCS Agile Working	161	6.2	10	0.4	0	Pass	3.7	8	2	Fail
03 - 11-GPLW-001 - Consultant	107	4.6	8	0.3	0	Pass	2.9	5	2	Pass
03 - 11-GPLW-002 - Consultant	106	4.5	8	0.3	0	Pass	2.9	5	2	Pass
03 - 11-GPLW-004 - Consultant	100	4.3	6	0.3	0	Pass	2.4	5	2	Pass
03 - 12-GPM-002 - Consultant	99	4.2	7	0.3	0	Pass	2.7	5	2	Pass
03 - 14-GPB-005 - Nurse Consultant	106	4.5	7	0.3	0	Pass	2.9	5	2	Pass
03 - Staff Area	112	5.4	6	0.3	0	Pass	4.6	8	2	Fail
01 - 01-ADC - Reception	161	6.2	5	0.2	0	Pass	3.1	10	2	Fail
03 - 11-GPLW-003 - Consultant	92	3.9	5	0.2	0	Pass	2.5	4	2	Pass
03 - 16-GPGAW-003 - Practice Manager	140	6	5	0.2	0	Pass	2.5	6	2	Pass

IA briefing improvement (ACRs)

What are we doing ?



OBC / FBC design reviews (NDAP)

What are we doing ?



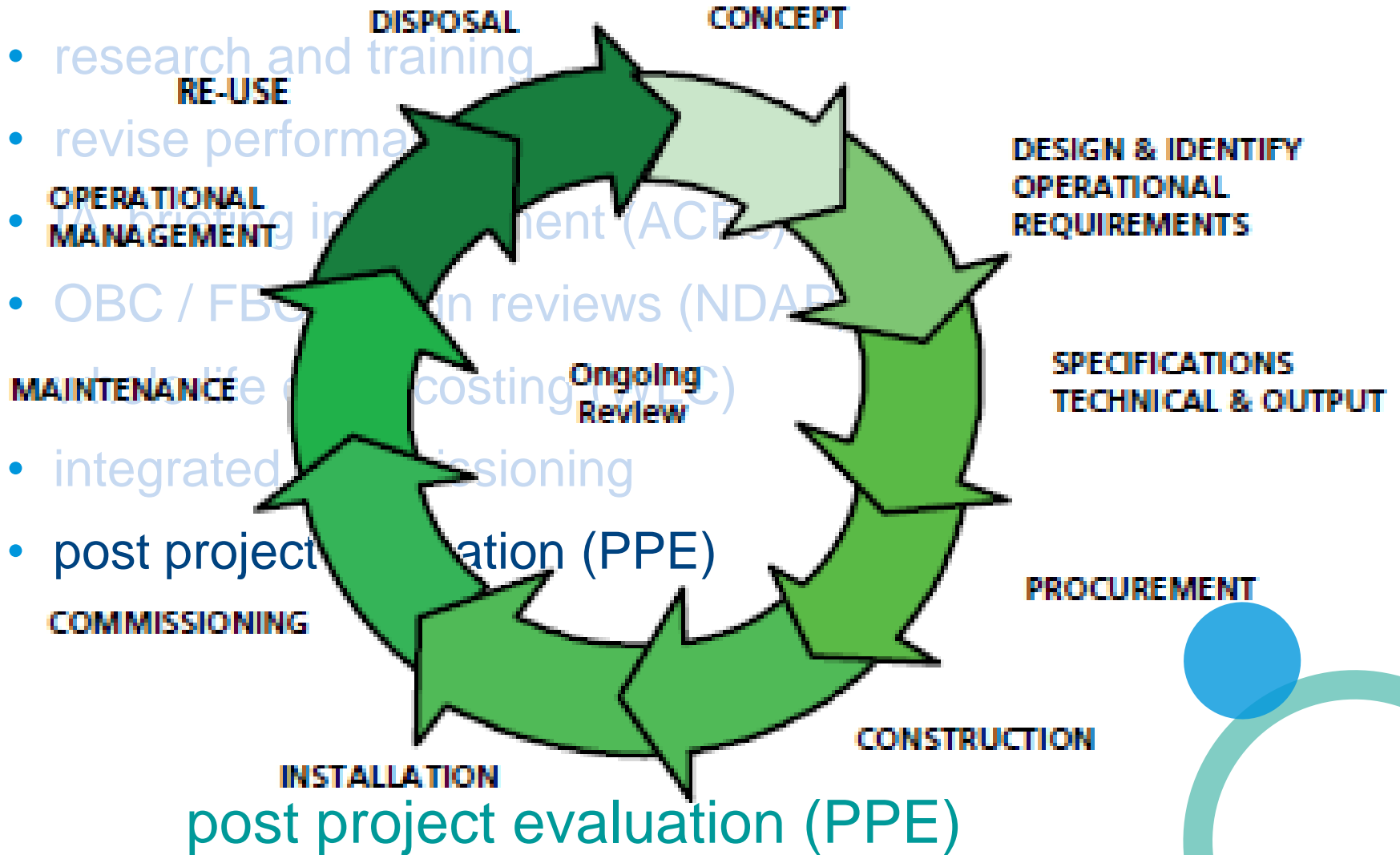
whole life cycle costing (WLC)

What are we doing ?



integrated commissioning

What are we doing ?



Shared Learning



know what you are
buying

Balanced solutions...



balance: 'not risk averse', but "stay out of Jail"