# SYNTEGRA GROUP

## Building Compliance VS Performance

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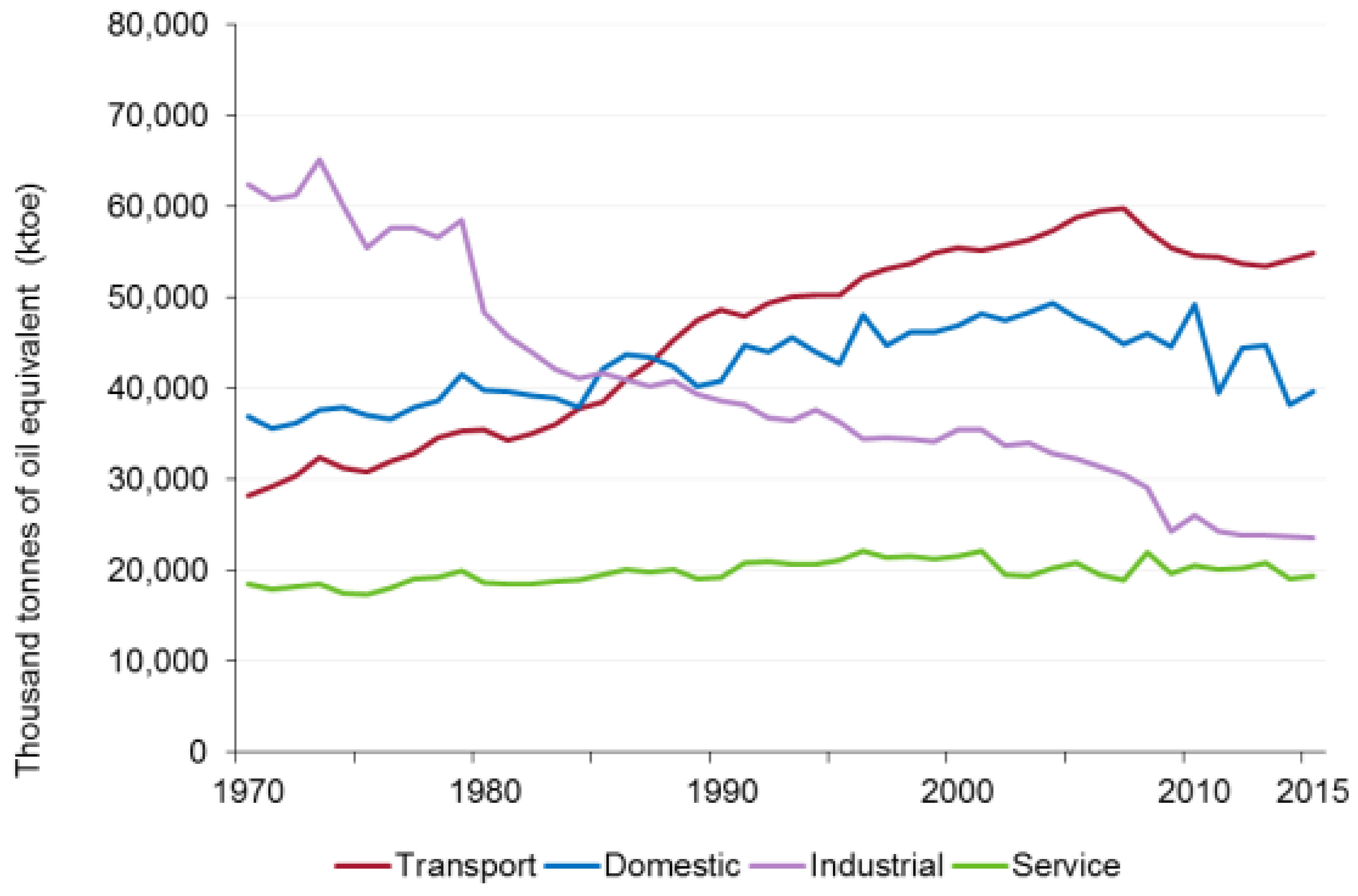
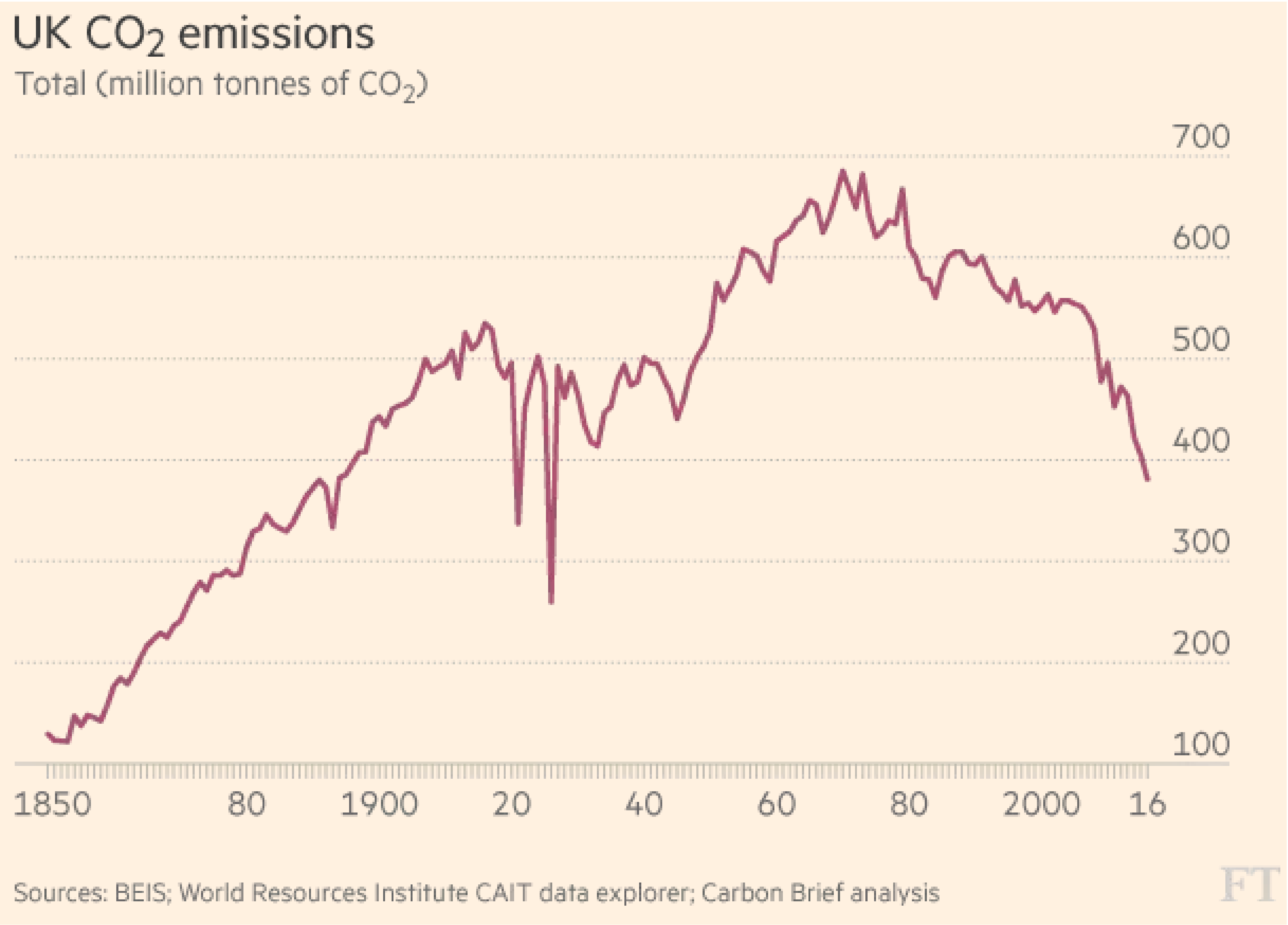
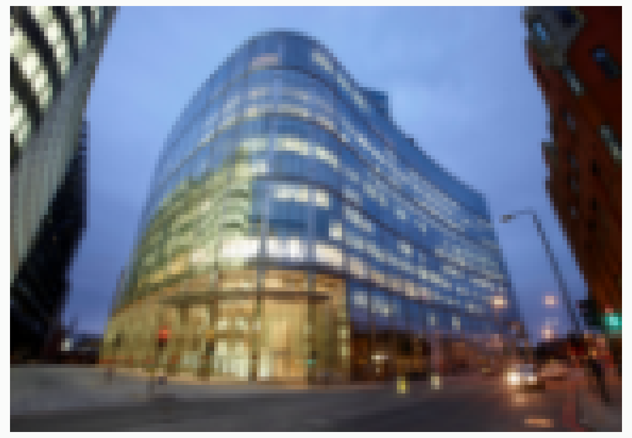
# UK Energy and Trends




***Source; BEIS ECUK Table 1.01***

CarbonBuzz an RIBA CIBSE platform



**201 Bishopsgate**

| Design data | Actual data |
|---|---|
| 35.7 kg $CO_2/m^2/yr$ | 160.1 kg $CO_2/m^2/yr$ |

**450003: Crawley Library**
Sector: Office
Benchmark category: General Office
Sector: Sport & Leisure
Benchmark category: Cultural activities

| Design data | Actual data |
|---|---|
| 20.0 kg $CO_2/m^2/yr$ | 61.2 kg $CO_2/m^2/yr$ |

**450028: Woodland Trust Headquarters**
Sector: Office
Benchmark category: General Office

| Design data | Actual data |
|---|---|
| 70.7 kg $CO_2/m^2/yr$ | 68.4 kg $CO_2/m^2/yr$ |

**450035: Castle Hill Primary School Assembly / Dining Hall**
Sector: Education
Benchmark category: Schools and seasonal public buildings

| Design data | Actual data |
|---|---|
| 58.9 kg $CO_2/m^2/yr$ | 92.2 kg $CO_2/m^2/yr$ |

**450088: Ore Valley Business Centre (Lochgelly Business Centre)**
Sector: Office
Benchmark category: General Office

| Design data | Actual data |
|---|---|
| 26.1 kg $CO_2/m^2/yr$ | 43.2 kg $CO_2/m^2/yr$ |

MIND THE PERFORMANCE GAP

# What is Performance GAP?


**Buildings rarely perform as well as their designers predicted – energy consumption can be as much as double what was expected, so annual energy costs can also be doubled. This difference has become known as the performance gap.**


***Dr. Andy Lewry- BRE Global Bridging the Performance Gap***

**There is a mismatch between the expectations around the performance of new buildings and the reality of the utility bills.**

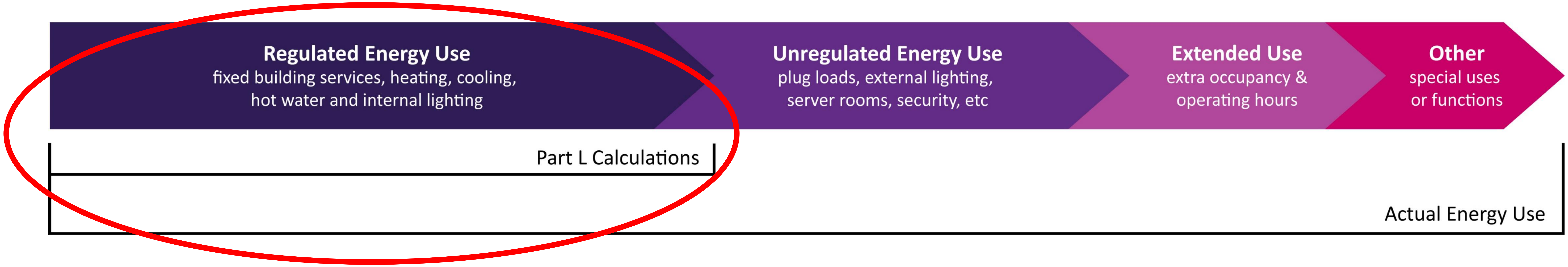
**This difference between expected and realised energy performance has come to be known as the 'performance gap'**

***CIBSE TM54***

# Energy Modelling Compliance Parameters

Energy models are generally used at the **design stage** to compare design options and to check compliance with **Building Regulations**. These energy models are not intended as **predictions of energy use**, but are sometimes mistakenly used as such.

**The reality of predicted and actual energy consumption**



# Part L Energy Modelling Compliance or Performance

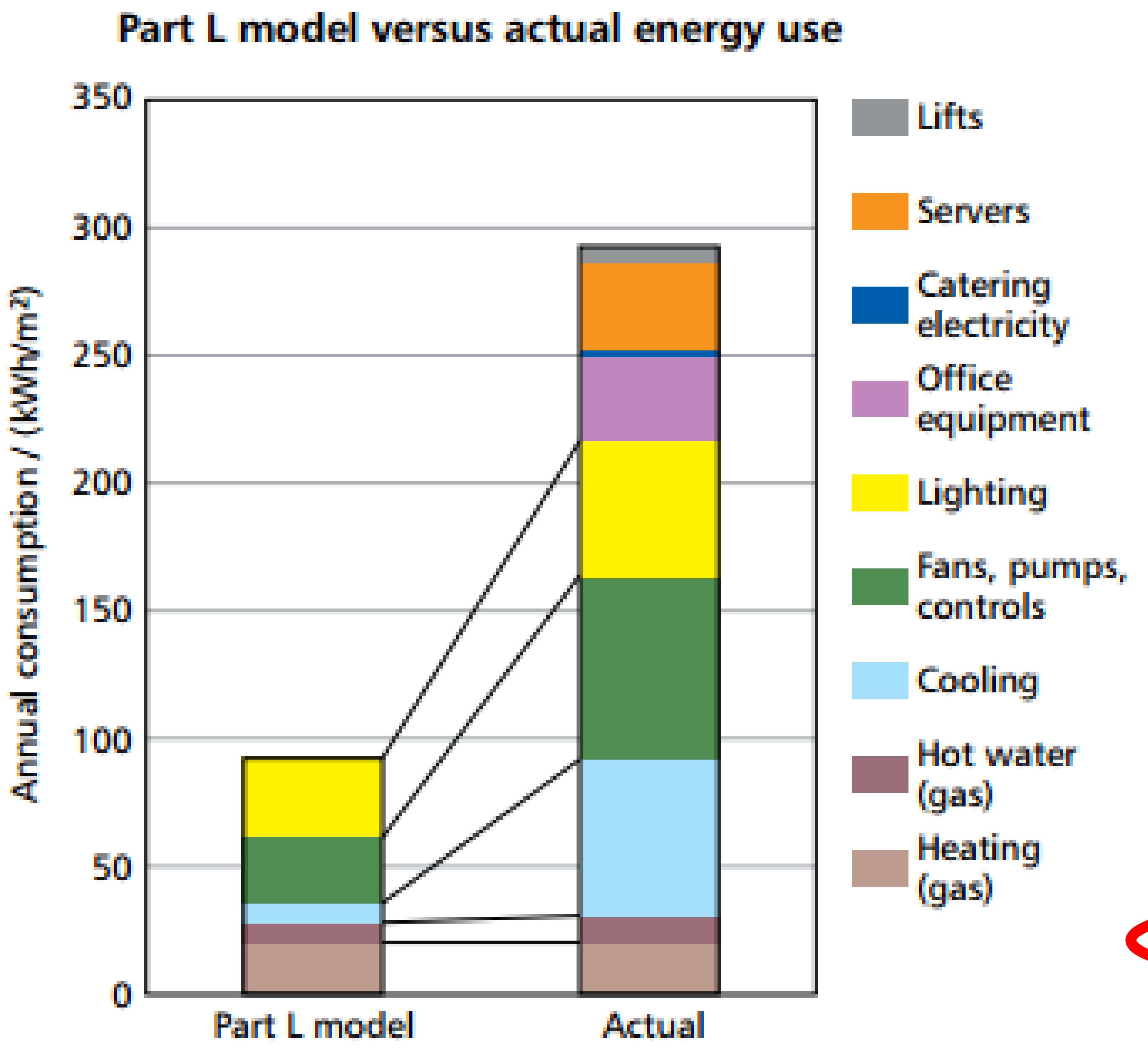



**Figure 1** Comparison of ADL2A calculations and operational performance for a case study

**Energy Consumption by End Use [kWh/m²]**

| | Actual | Notional |
|---|---|---|
| Heating | 28.31 | 38.34 |
| Cooling | 0 | 0 |
| Auxiliary | 5.89 | 7.44 |
| Lighting | 39.37 | 11.81 |
| Hot water | 192.62 | 127.2 |
| Equipment* | 12.31 | 12.31 |
| **TOTAL**** | **199.42** | **184.8** |

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

TM54 – Figure 1 – Part L Vs actual Energy Use

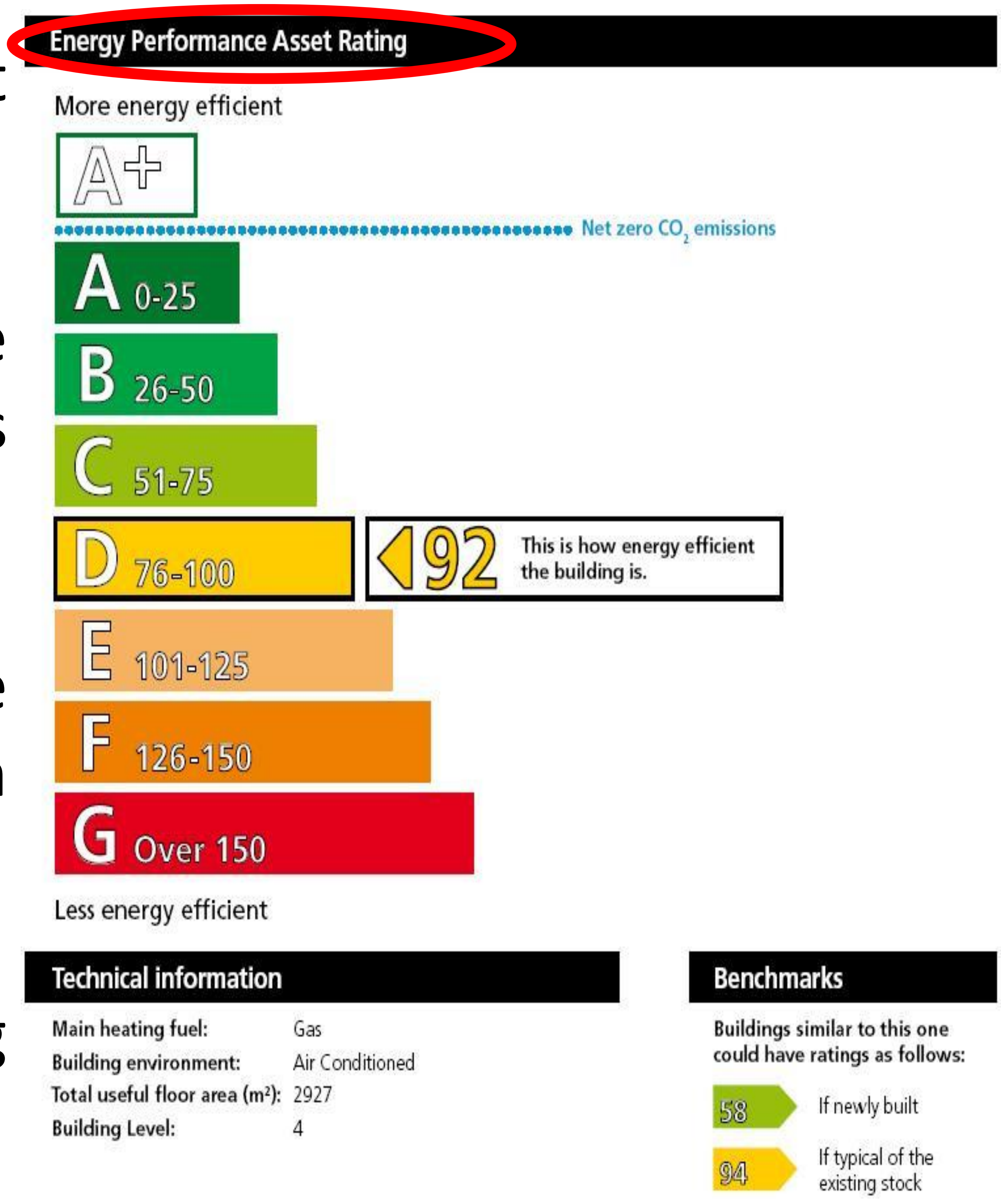
# EPC Compliance or Performance

EPC provides a theoretical reflection of energy performance of the asset at standardised conditions.

It demonstrates energy efficiency of a particular building, based on the performance potential of the building fabric and its associated services such as heating, cooling, ventilation and lighting.

Annual energy use for a designed building is estimated and compared with the energy use of a comparable 'notional' building on the basis of pre set design conditions.

Energy modelling for level 3 and 4 buildings are based upon Simplified Building Energy Modelling (SBEM) Methodology.



# BREEAM Compliance VS Performance

Table 4 Minimum BREEAM standards by rating level

| | Minimum standards by BREEAM rating level | | | | |
|---|---|---|---|---|---|
| BREEAM issue | Pass | Good | Very Good | Excellent | Outstanding |
| Man 03: Responsible construction practices | None | None | None | One credit (Considerate construction) | Two credits (Considerate construction) |
| Man 04: Commissioning and handover | None | None | None | Criterion 10 (Building User Guide) | Criterion 10 (Building User Guide) |
| Man 5: Aftercare | None | None | None | One credit (Seasonal commissioning) | One credit (Seasonal commissioning) |
| Ene 01: Reduction of energy use and carbon emissions | None | None | None | Five credits | Eight credits |
| Ene 02: Energy monitoring | None | None | One credit (First sub-metering credit) | One credit (First sub-metering credit) | One credit (First sub-metering credit) |
| Wat 01: Water consumption | None | One credit | One credit | One credit | Two credits |
| Wat 02: Water monitoring | None | Criterion 1 only | Criterion 1 only | Criterion 1 only | Criterion 1 only |
| Mat 03: Responsible sourcing of materials | Criterion 1 only | Criterion 1 only | Criterion 1 only | Criterion 1 only | Criterion 1 only |
| Wst 01: Construction waste management | None | None | None | None | One credit |
| Wst 03: Operational waste | None | None | None | One credit | One credit |
| LE 03: Minimising impact on existing site ecology | None | None | One credit | One credit | One credit |

# SKA Compliance VS Performance

## Good Practice Measures for Offices

**Energy & $CO_2$**

| | | |
|---|---|---|
| 1 | P10 | Reduce lighting energy in use |
| 2 | P11 | Reduce small power in use |
| 4 | D01 | Energy efficient lighting |
| 5 | D02 | Lighting controllability |
| 6 | E01 | Lighting controls |
| 10 | E02 | Energy efficient lamps |
| 18 | E05 | Energy efficient heat pumps |
| 27 | E07 | Pipework insulation |
| 28 | E08 | Tenancy sub-metering |
| 29 | E04 | Energy efficient light fittings |
| 30 | E06 | HVAC zone controls |
| 41 | E09 | End-use sub-metering |
| 44 | E22 | IT and comms room energy consumptior |
| 48 | D03 | Energy efficient HVAC |
| 49 | D66 | Energy modelling |
| 59 | D53 | Electrical management |
| 68 | E11 | Efficient boilers |
| 69 | D04 | Daylighting |
| 70 | E24 | Energy efficient hand-dryers |
| 71 | D05 | Energy efficient DHW |
| 86 | P01 | Reduce fit-out energy use |
| 105 | P09 | Display Energy Certificates (DECs) |

## Good practice measures for retail

**Energy & $CO_2$**

| | | |
|---|---|---|
| 1 | D49 | Lighting controllability – front of house |
| 2 | D50 | Lighting controllability – back of house |
| 3 | E01 | Lighting controls |
| 6 | E02 | Energy efficient lamps |
| 7 | E04 | Energy efficient light fittings |
| 8 | D52 | Customer entrance |
| 23 | E05 | Energy efficient heat pumps |
| 24 | E07 | Pipework insulation |
| 25 | E06 | HVAC zone controls |
| 27 | D03 | Energy efficient HVAC |
| 29 | E11 | Energy efficient boilers |
| 32 | D51 | Energy efficient kitchen ventilation |
| 34 | D05 | Energy efficient DHW |
| 37 | E25 | Sub-metering for commercial kitchens |
| 41 | E09 | Electricity sub-metering |
| 43 | E08 | Thermal sub-metering |
| 46 | E26 | Energy efficient commercial service cabinets |
| 48 | E10 | Component AMT |
| 66 | D67 | Display glazing |
| 67 | D53 | Electrical management |
| 69 | P01 | Reduce fit-out energy use |
| 71 | D65 | External signage |
| 85 | D66 | Energy modelling |
| 99 | E24 | Energy efficient hand-dryers |
| 103 | D54 | Energy efficient lifts |
| 107 | D55 | Energy efficient escalators |
| 111 | P09 | Display Energy Certificates (DECs) |

## Good Practice Measures for Higher Education

**Energy and $CO_2$**

| | | |
|---|---|---|
| 1 | P10 | Reduce lighting energy in use |
| 2 | P11 | Reduce small power energy in use |
| 3 | D01 | Energy efficient lighting |
| 4 | E04 | Energy efficient light fittings |
| 5 | D02 | Lighting controllability |
| 6 | E02 | Energy efficient white LEDs |
| 7 | E01 | Lighting controls |
| 8 | E28 | Secondary window treatments |
| 9 | E05 | Energy efficient heat pumps |
| 10 | E06 | HVAC zone controls |
| 11 | D05 | Energy efficient DHW |
| 12 | E11 | Sources of primary energy |
| 13 | E22 | IT comms room energy consumption |
| 14 | D51 | Energy efficient specialist ventilation |
| 15 | E30 | Fume cupboard selection and operation |
| 16 | D52 | Energy efficient entrances |
| 17 | E26 | Energy efficient commercial service cabinets |
| 18 | E29 | Passive design approach |
| 19 | E24 | Energy efficient hand-dryers |
| 20 | D54 | Energy efficient lifts |
| 21 | E09 | End-use sub-metering |
| 22 | E25 | Sub-metering for specialist areas |
| 23 | D04 | Improvement in daylighting |
| 24 | E08 | Thermal sub-metering |
| 25 | D03 | Energy efficient HVAC |
| 26 | D66 | Energy modelling |
| 27 | P01 | Reduce fit-out energy use |

# WELL Compliance VS Performance

| | |
|---|---|
| Light | |
| 53 | Visual lighting design |
| 54 | Circadian lighting design |
| 55 | Electric light glare control |
| 56 | Solar glare control |
| 57 | Low-glare workstation design |
| 58 | Color quality |
| 59 | Surface design |
| 60 | Automated shading and dimming controls |
| 61 | Right to light |
| 62 | Daylight modeling |
| 63 | Daylighting fenestration |
| Fitness | |
| 64 | Interior fitness circulation |
| 65 | Activity incentive programs |
| 66 | Structured fitness opportunities |
| 67 | Exterior active design |
| 68 | Physical activity spaces |
| 69 | Active transportation support |
| 70 | Fitness equipment |
| 71 | Active furnishings |
| Comfort | |
| 72 | Accessible design |
| 73 | Ergonomics: visual and physical |
| 74 | Exterior noise intrusion |
| 75 | Internally generated noise |
| 76 | Thermal comfort |
| 77 | Olfactory comfort |
| 78 | Reverberation time |
| 79 | Sound masking |
| 80 | Sound reducing surfaces |
| 81 | Sound barriers |
| 82 | Individual thermal control |
| 83 | Radiant thermal comfort |

MIND THE PERFORMANCE GAP



# How to Bridge Performance GAP?

# Complex Energy Modelling

Adopt more complex energy modelling such as dynamic simulation models at early design stage,

1. Part L Compliance Energy Model on the basis of NCM methodology and normal weather profiles
2. Design Model on the basis of future occupancy profiles, operating hours and complex weather profiles.

Review controls strategy including

1. Lighting
2. Ventilation
3. Heating
4. Comfort Cooling/ Air Conditioning
5. Mixed Mode Operation
6. Night Time Cooling

Unregulated Loads (Misc.)

1. Other Systems energy load
2. Lifts/ Escalators etc.
3. IT/Data centres

# CIBSE TM54 – Design Stage Extensive Modelling

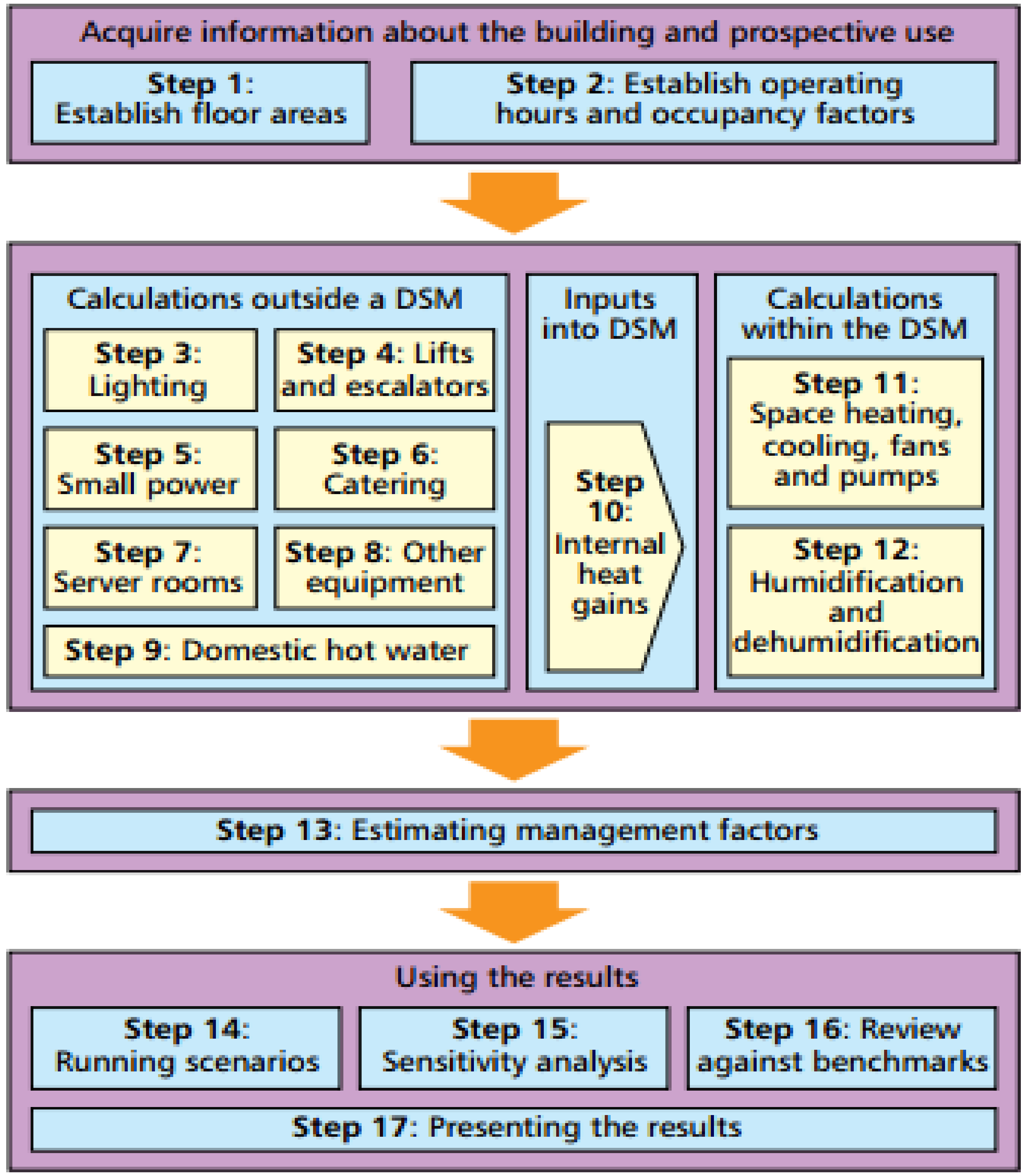



**Figure 5** Methodology for evaluating operational energy use at the design stage

The following questions are suggested to help to structure the interview:

— What are the intended hours of operation of the building?
— Are existing occupancy profiles available for the current workplace?
— Will there be requests for extended hours of operation?
— What happens on long holidays e.g. Easter weekend?
— When will the building be cleaned?
— If the building is cleaned in the evening, will the cleaners be responsible for turning the lights off?
— Are there any out-of-hours operational requirements?
— Can the energy use be reduced during out-of-hours operation (e.g. night set-back, turning-off display lighting when shelf-stacking etc.)
— Will the security arrangements require lights on and plant/equipment to be running?
— Will process equipment that is not required (e.g. it equipment) be switched off outside of occupancy hours?
— Will the building use require re-stocking, preparation for catering, maintenance etc., which would require plant to be running outside regular occupancy hours?

# CIBSE TM54 – Design Stage Extensive Modelling

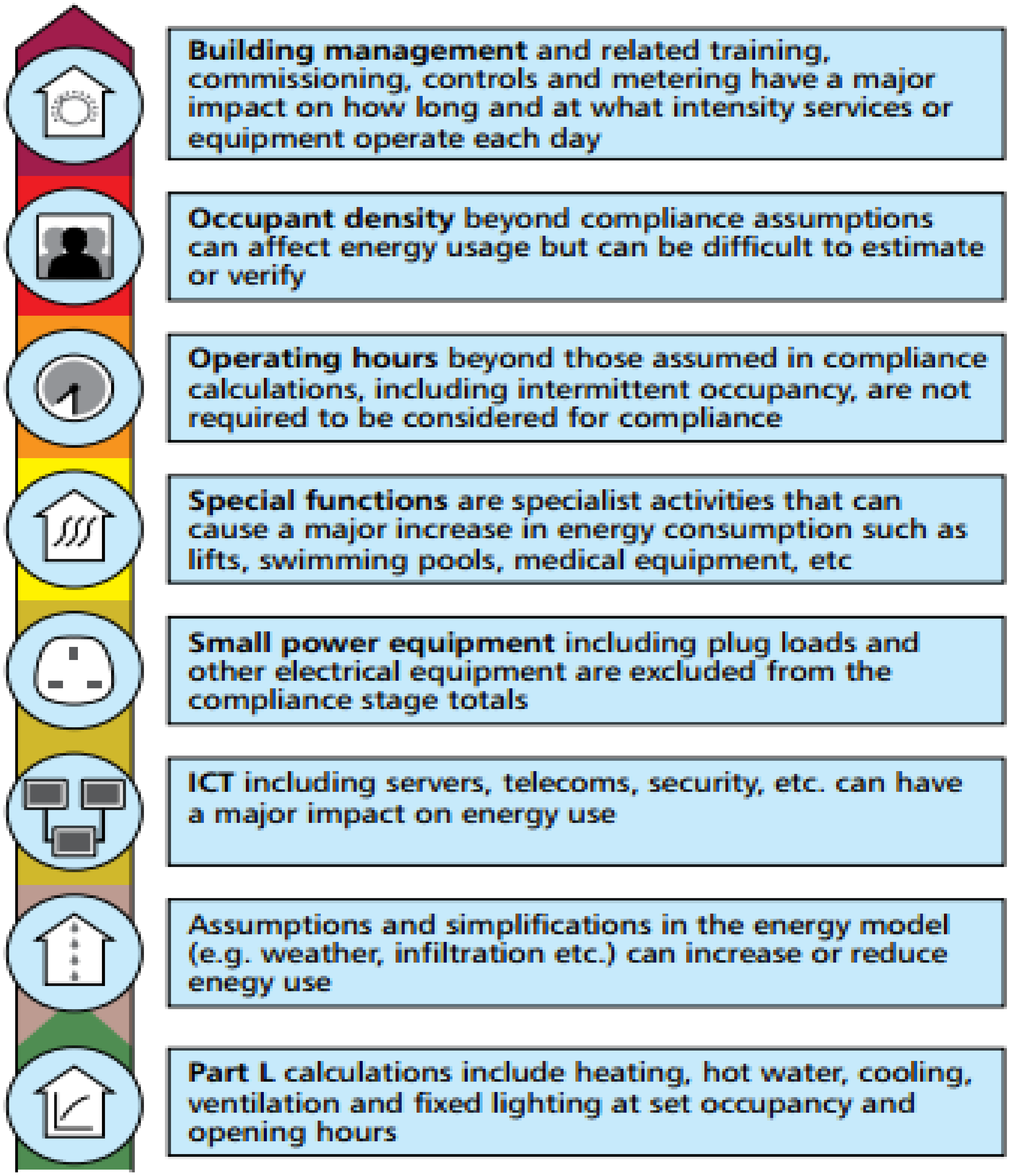



**Figure 2** Reasons why Approved Document L2A compliance calculations differ from operation energy use (based on a CarbonBuzz diagram (http://www.carbonbuzz.org))

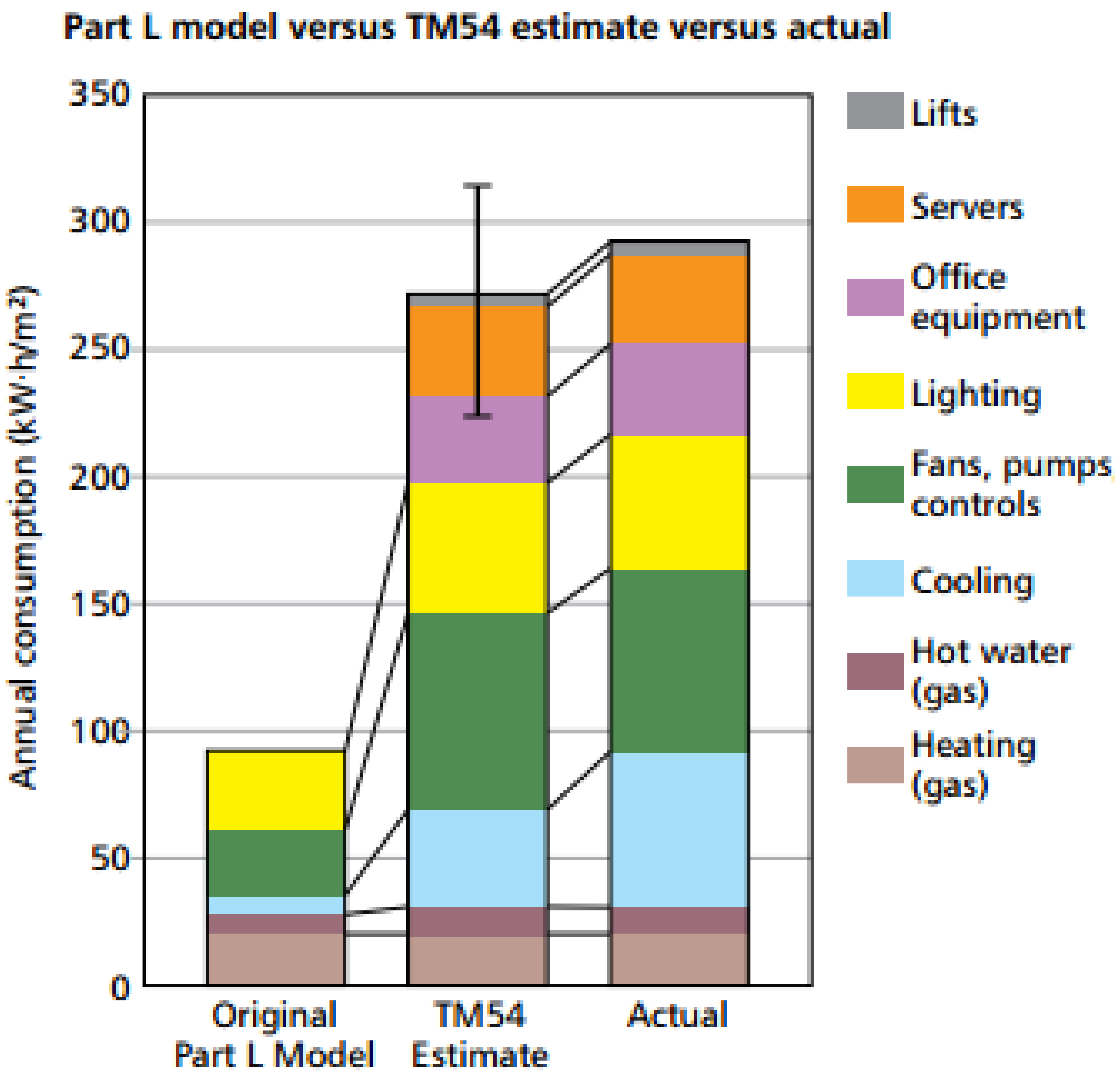



**Figure 3** Results of applying the methodology to the case study building

# EPC/ DEC Performance Rating Tool

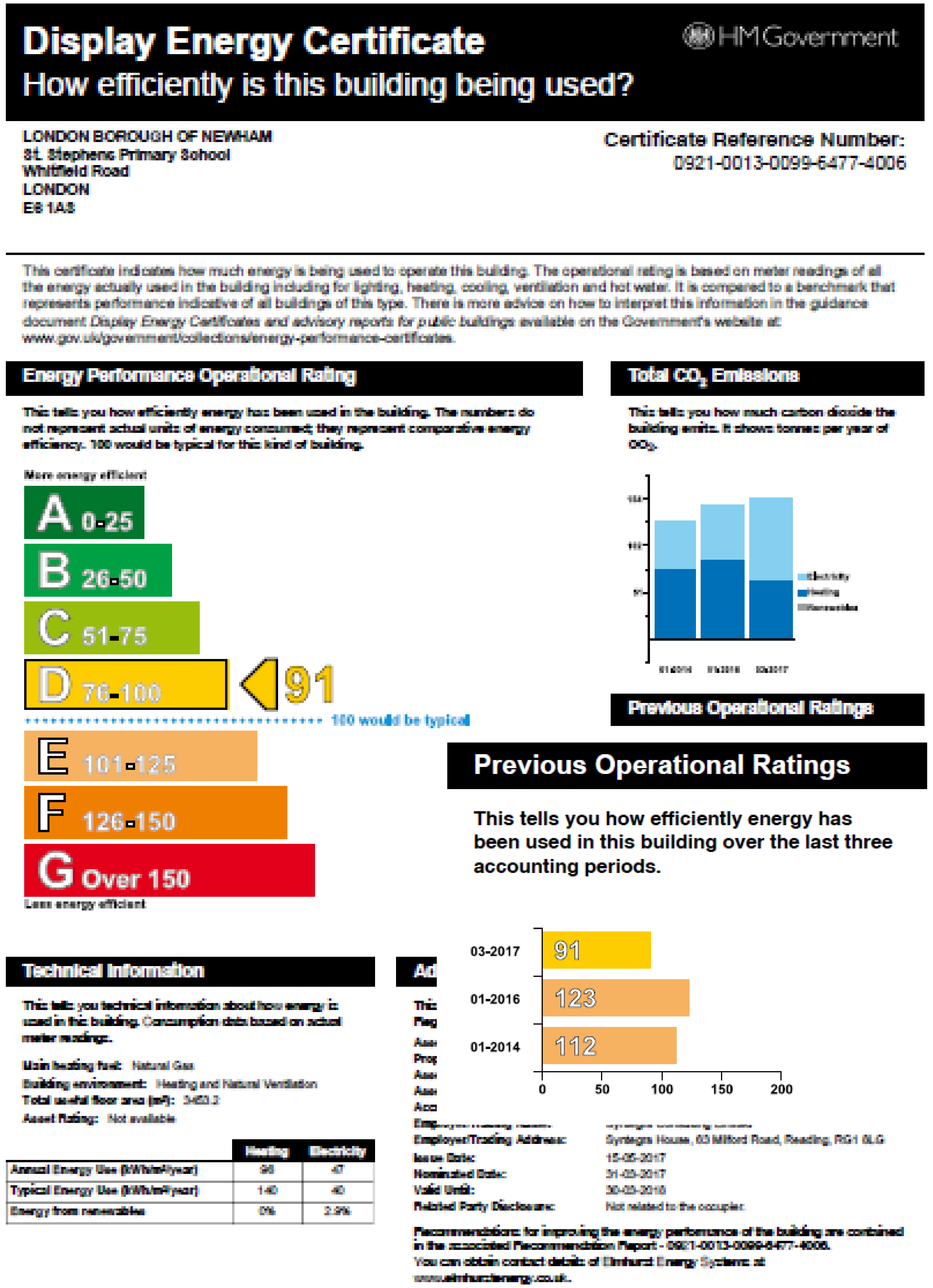
Major Differences between EPC & DEC?

Display Energy Certificate (DEC) is based upon operational rating of assessed building, records the actual energy usage from a building over the course of a year, and benchmarks them against buildings of similar use.

The two ratings presents different aspects of a building's total energy performance, however both of them has significance.

The anticipated design quality of the building at EPC stage has large impact on the carbon emissions identified under DEC. However, DEC also includes unregulated energy such as lifts, actual behaviour of building users, impact of weather profile of assessed year, occupancy profiles, management and maintenance of building systems and controls.

In reality the difference between EPC and DEC is the indicator of Performance Gap. This is where the real building performance differs from the anticipated one.



# Useful Thoughts of bridging the Performance Gap

- Undertake Complex Energy modelling including Part L Compliance modelling as well as Dynamic Simulation Modelling to identify compliance vs performance gap at early stage.
- Early engagement of end user to identify the intended use of the building.
- Identify type of occupants who will be using the building, their likely energy demands and typical behaviour towards building controls.
- Practical analysis of the design building by using TM54 or other guidance tools.
- Work closely with M&E designers to synchronise the modelling parameters with the proposed design, especially the integration between sensors and manual overrides.
- Review of as built performance through Display Energy Certificate or simply energy auditing tools. The use of these tools showcase the Energy (KWh) use of the building alongside with Carbon (CO2) emissions.
- Highlighting the importance of building maintenance to the end occupier (if known) and it is really important to monitor, review and maintain the features to shrink the performance gap.

*Thank you for listening*

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