BBP | MANAGING AGENTS PARTNERSHIP

MANAGING FOR ENERGY PERFORMANCE

A Guiding Framework for Property Management

NOVEMBER 2023

Contents

Opening statement

With around 40% of global emissions associated with the built environment, some of the biggest opportunities lie ahead in improving energy performance and decarbonising existing building stock. In the UK, around 80% of properties that will exist in 2050 have already been built.

However, currently there is often a gap between the specification or anticipated performance of a building, and the actual in-use operational results realised on site. The energy performance gap between the designed performance of buildings and the actual performance in use is well known and poses a challenge to Managing Agents and Property Managers (PMs) in particular, to ensure that buildings are operating as efficiently as possible given their specifications.

Property Managers have an important role to play in bridging the energy performance gap, bringing stakeholders together including property owners, facilities managers, occupiers and suppliers to ensure collaboration and optimum performance in use[1]. To support this process the BBP's Managing Agent's Partnership has developed a Managing for Performance Framework to provide a structure, setting out the steps to take, questions to ask and people to engage in order to assess the optimum performance based on an individual building's specification, and then manage and improve a building's performance to achieve the very best performance in use outcomes.

Property owners can also use this document to set the framework for co-operation towards common goals, as well as setting the basis for discussion, negotiation and agreeing performance KPI's.

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1 For more information describing different roles in supporting a MfP approach see Appendix 3

Introduction

This document is designed to provide Managing Agents and Property Managers in particular with a framework for assessing and managing buildings for performance in use and to close the performance gap by providing a consistent framework that PMs can follow to:

- Understand how the building is performing relative to benchmarks and its own specification
- Review how the building is being managed, operated and used to determine the causes of any energy performance gap
- Assess how to achieve building optimisation in the immediate term
- Identify how to maintain and improve the performance of the building going forward, including any measures that may require further capital investment in the building
- Ask the right questions in relation to their building and its performance

The document should be used in conjunction with the BBP's Responsible Property Management Tool Kit which provides practical guidance on embedding sustainability within property management.

The document can also be used by property owners to specify the standard to which their property managers are expected to operate, utilising the framework to discuss and clarify their aims and expectations in terms of the management and performance of their portfolios.

FRAMEWORK STRUCTURE

The document is focused particularly on multi-let office buildings and is structured in three phases which are intended to take property managers through the process of gathering data on the chosen building to understanding its performance, and then understanding which measures could be implemented to optimise the building's performance using a "What, Why, How and Questions" approach.

Phase 1: How is the building performing:

- relative to benchmark
- relative to its specification

Phase 2: Improving the management and operation of the building for energy performance.

Phase 3: How to improve the building above and beyond, including identifying areas to invest in to improve building efficiency.

How to use this document

This framework is set out in 3 phases

PHASE 1: HOW IS THE BUILDING PERFORMING?

This section is about understanding how a building is currently performing. This is an essential first step before making any management changes to improve operational performance. This section focuses on what data to gather on the building in order to gain an understanding of how the building is currently performing against benchmarks, as well as starting to understand how the building is performing relative to its own potential.

Sections include:

- → Understanding what data is available for the building
- → Assessing how the building is performing relative to benchmark
- → Identifying the factors determining the building's current performance and where opportunities to improve performance may lie

PHASE 2: IMPROVING THE MANAGEMENT AND OPERATION OF THE BUILDING FOR ENERGY PERFORMANCE

This section focuses on identifying key areas where the management and operation of the building can be improved and what needs to be done to implement actions to improve its energy efficiency.

The particular focus is on the quicker and easier-to-implement interventions that will optimise the operation of existing building systems.

Sections include:

- → Monitoring and Targeting
- → Communications and engagement
- → Control and operation of systems including:
  - → Building Management Systems (BMS)
  - → Heating Ventilation and Air Conditioning (HVAC)
  - → Domestic hot water systems
  - → Lighting

PHASE 3: HOW TO MAINTAIN AND IMPROVE THE PERFORMANCE OF THE BUILDING ABOVE AND BEYOND?

This section focuses on putting in place measures to further improve building performance, including identifying areas to invest in to improve building efficiency.

Sections include:

- → Energy Policy, Planning and Target Setting
- → Technical Review and Audits
- → Developing a Metering Strategy
- → Equipment Enhancement
- → Incorporating Energy Efficiency within Procurement

Phase 1: How is the building performing?

Understanding how a building is currently performing is an essential first step to making any management changes to improve operational performance. By gathering data on the building, the property manager will gain an understanding of how the building is currently performing against benchmarks as well as starting to understand how the building is performing relative to its own potential.

The table below can be used as a checklist to begin gathering this key data on the building and develop an understanding of its current energy performance.

Phase 1 sections include:

- → Understanding what data is available for the building
- → Assessing how the building is performing relative to benchmark
- → Identifying the factors determining the building's current performance and where opportunities to improve performance may lie

What data is available for the building?

A critical first step in any energy management programme is the accurate measurement and monitoring of how much energy a building is using.

WHAT	WHY	HOW	QUESTIONS
Identify what energy data is held for the building. Namely energy consumption: kWh by type (electricity, gas, other fuels, thermals) as well as tenant consumption if metered separately. **Where possible, building consumption data should be split between:** • **Whole** • **Base building** • **Tenant demise***	The old adage remains very true – "if you can't measure it, you can't manage it". Splitting consumption between base building and tenant demise will enable you to identify where energy is being used. This data is also likely to be requested by owners as part of their reporting requirements, so being clear on the scope, accuracy and quality of data for their portfolios is critical to ensure that data gaps are clearly identified, and the integrity of their reporting is qualified.	By identifying what electricity and gas utility bills are available and any other fuel & thermal supply data. By identifying what main and sub metering data is available and how this will be obtained on an ongoing and regular basis. By identifying the extent to which these are AMR (Automatic Meter Read) enabled. An energy Monitoring and Targeting online portal can be used which feeds data to the system on a HH (half hourly) basis. Schematics may be required to identify the areas served by meters or sub-meters. Where schematics are not available, it may be necessary to instruct a survey to identify the areas served by each meter.	Where are the main utility meters located? Who are utility bills sent to and the information (cost and kWh) stored? Are the main and sub-meters AMR enabled? Are the bills based on actual meter readings? If not, you should consider ensuring that actual reads are submitted on a monthly basis to the energy supplier and investigate options for installing AMRs to automate this process. Which areas of the building, or building services, are fed by which meters? Are the meters compliant for billing tenants?

WHAT	WHY	HOW	QUESTIONS
		This information should be systematically documented to ensure that it is easily accessible to anyone operating within the property management teams and made available when either property managers change and/or for transactional purposes to new owners.	Are tenants billed on actual meter readings or on an alternative apportionment methodology? Note unless the tenant is billed on the actual energy they use there will be no cost incentive for them to reduce consumption. Is any of this data actively monitored? If there are no submeters what would be the cost of installing them and who would pay for this? Note: Access to AMR metering does not guarantee savings. Rather it is a tool that enables a better understanding of where and how savings can be made. To achieve actual energy and cost savings, analysis and action will be required.
Analyse available data to build an energy profile of the building.	This will enable baselining the current energy consumption of the building and monitoring of how this may be changing over time and the factors that may be driving this change, if any.	At a minimum an energy profile of the building should be created in excel. Ideally this would be split in to: • Whole building • Base building • Tenant Note: Monthly summary data is useful to give an insight into seasonal trends and may align with the energy billing cycle. However, Half Hourly (HH) data will be the preferred format for more detailed performance diagnostics.	Do you have access to 'real time' half hourly data? Note: to effectively manage performance, access to real time data will be critical to success (see section on Metering). Where HH meters are installed, it may be possible to arrange for data to be transferred automatically to an energy management platform via an API (Application Programming Interface). This will enable real-time analysis of the energy consumption of the building.

*Robust demarcation between base building and tenant energy consumption should follow NABERS guidance (see Figure 5)

How is the building performing relative to Benchmark?

WHAT	WHY	HOW	QUESTIONS
Collect data in relation to the building size. **e.g. Gross Internal Area (GIA) m^2: This is the total enclosed area of a building within the external walls, including internal walls and partitions.** **e.g. Net Internal Area (NIA) m^2: This is all lettable or rentable space (excluding car parks) in the whole property. This should include all available lettable space, even if vacant.**	This will enable a comparison of the energy intensity of the building (kWh/m^2/yr.) to other buildings of a similar sector/ building category.	This data will be available from: measured survey reports conducted at point of marketing, agents' particulars, valuation reports or service charge apportionment schedules etc. Note: Different types of buildings use different methods of measurement. You should be aware of the relevant use of GIA or NIA to ensure a like for like comparison with other properties.	Are you using GIA, NIA or another apportionment methodology? Do base and tenant floor areas add up to the whole building GIA/NIA?
Calculate the Energy Use Intensity (EUI) of the building and compare this against industry benchmarks, such as The BBP's Real Estate Environmental Benchmark (See Figure 1) **The EUI normally expresses a building's energy use as a function of its size. EUI is typically expressed as energy per m^2 per year.**	By using an EUI, a building's energy performance can be benchmarked against comparable and/or average buildings.	Divide the whole building's total energy consumed (kWh of gas, electricity & other fuels) in a year, by the building's total floor area. e.g. Electricity kWh/m^2, Gas kWh/ m^2. These two inputs can be combined into a single EUI based on available conversion factors (see REEB benchmarks p.8 'adjustments'); providing your total energy use in kWh/ m^2. Ideally you will then repeat this calculation at base build and tenant demise level to give a separate EUI for each element. Once a building's EUI has been established, it can be compared to industry benchmarks such as REEB.	What is your benchmark for the building? e.g. Electricity kWh/m^2, Gas kWh/ m^2, Electricity equivalent kWh/m^2.
Consider providing floor areas for different areas to show different activities being performed on the building to provide a more accurate site-specific benchmark.	Different areas of a multi-let office will have different energy use intensities.	Obtain floor areas for different areas detailing: • General office space • IT rooms • Canteen • Gyms • Carparks • Retail on site	How much of the building is being utilised by other ancillary activities such as Catering or IT? What areas are monitored? E.g. Comms Rooms. How is this data accessed?

WHAT	WHY	HOW	QUESTIONS
EPC: Understand the current and potential Energy Performance Certificate (EPC) rating for the building. (See Figure 2)	The EPC will identify the current and potential rating for the building. This will enable you to understand how energy efficient the building is currently assessed to be (based on building fabric and plant/ equipment on site) and what measures have already been identified to improve the building's performance.	Locate the EPC for the building via the public register. Note: An EPC only measures the "theoretical" performance potential of a building. It does not account for how the building is being used and managed. In addition you should consider commissioning a Display Energy Certificate (DEC) assessment or a NABERS Energy for Offices assessment as this will provide detail of actual energy performance of the building.	What EPC rating is the building currently achieving? When was the EPC lodged? Note: it is advised to obtain a draft EPC report that reflects the current EPC methodology, particularly the relative impact of gas consumption on EPC rating. Are there multiple EPCs for the site, e.g. a base build EPC, with subsequent office fitout EPCs for parts of the building? What recommendations does the report make on how to improve the EPC? Note the recommendation list comes from a pre-defined list of recommendations and may not be accurate or bespoke to the building. It should be noted that it doesn't replace an energy audit recommendation list. Is the current EPC rating based on actual individual building data, or estimates? Note: Estimated data will not be as accurate for your building and could adversely impact the EPC rating. However, how much of the assessment data is based on estimates may not be clear from the EPC and it will be important to ascertain how much of the data in the BRUKL report held by the EPC assessor was based on 'defaults'.
Ensure that the building owner is aware of how their building is performing against benchmark.	To support the owner in understanding any potential risks and opportunities in relation to the environmental and commercial performance of their buildings.	By regular dialogue and quantifiable data on how the building is performing against benchmarks.	How is the building performing compared to Net Zero Targets for commercial buildings? (e.g. CRREM or UKGBC targets). Is there a risk of stranding?

So, what will this tell you?

This will provide you with a clear understanding of the building's baseline, and whether it needs to improve compared to industry benchmarks. However, this will not tell you why the building compares favourably/unfavourably against a benchmark, what is driving this, or what steps need to be undertaken to improve the performance of the building.

FIGURE 1: THE REAL ESTATE ENVIRONMENTAL BENCHMARK (REEB)

The Real Estate Environmental Benchmark (REEB) is a publicly available operational benchmark of environmental performance for commercial property in the UK. It is one of the only benchmarks based on the performance of buildings 'in-use' and is increasingly becoming the 'industry standard' used by investors, fund managers and property owners to compare the performance of their assets with other similar assets from portfolios across the UK.

Based on the annual consumption data of BBP members property portfolios REEB provides energy, carbon, water and waste performance benchmarks for offices, shopping centres and retail / leisure parks which you can use to compare the performance of your own buildings.

Those seeking to understand the performance of their assets relative to the REEB benchmark can use the publicly available methodologies to calculate their performance and compare it to the benchmarks. To compare your building click here: The Real Estate Environmental Benchmark (REEB) .

FIGURE 2: EPCS

The decarbonisation of existing buildings forms a critical part of the Government's Net Zero Strategy. Via their Minimum Energy Efficiency Standards (MEES) consultation the Government proposes a phased implementation of EPC 'B' Standard and an interim milestone of 2027 for a minimum standard of EPC 'C'. Responses to the consultation have highlighted that the Government should also consider the diverse nature of the UK commercial real estate market and that each individual building is different.

An EPC is intended to allow the energy performance of different buildings to be compared to allow tenants, investors, and building users to make informed choices.

However, the nature of EPCs means that MEES alone will not achieve the impact required in reducing emissions associated with the built environment, unless it is accompanied by measures that address actual operational energy performance. As can be seen by the chart below, there is a clear disconnect between the theoretical performance of the building (assessed at a point in time via an EPC), and the actual performance in use and operation.

Office Energy Intensity (Electricity Equivalent) by EPC Rating 2021/22

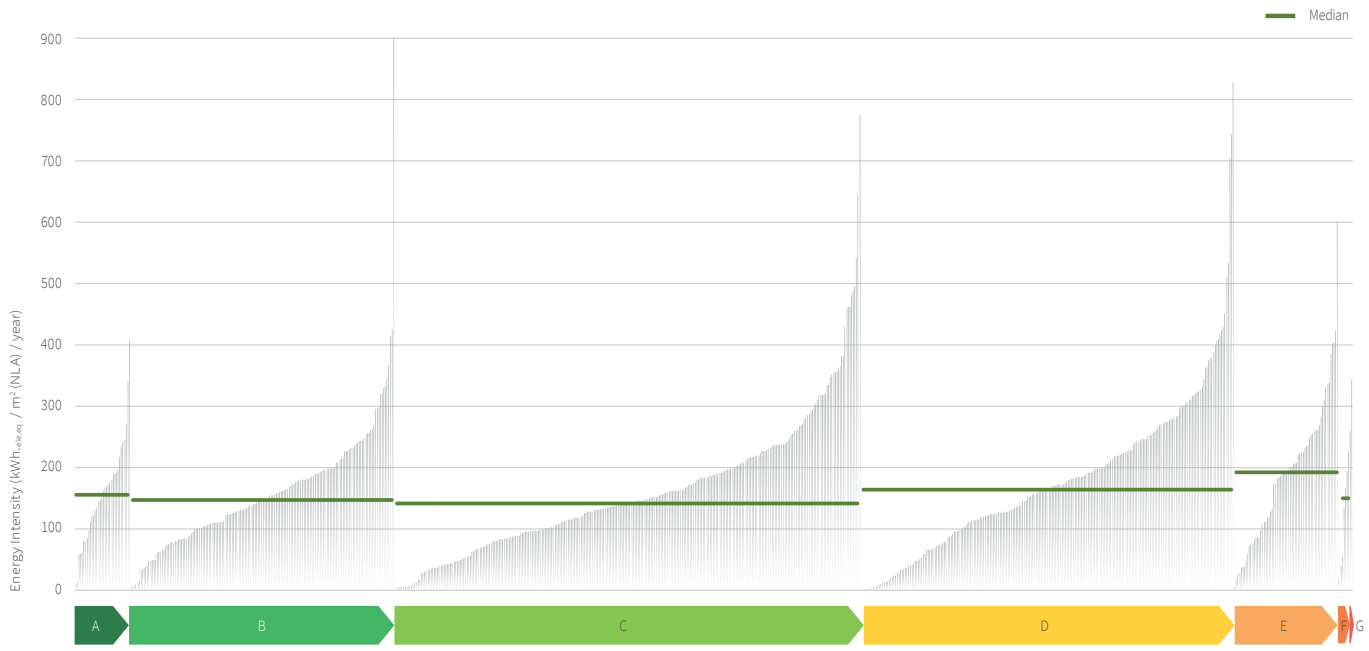
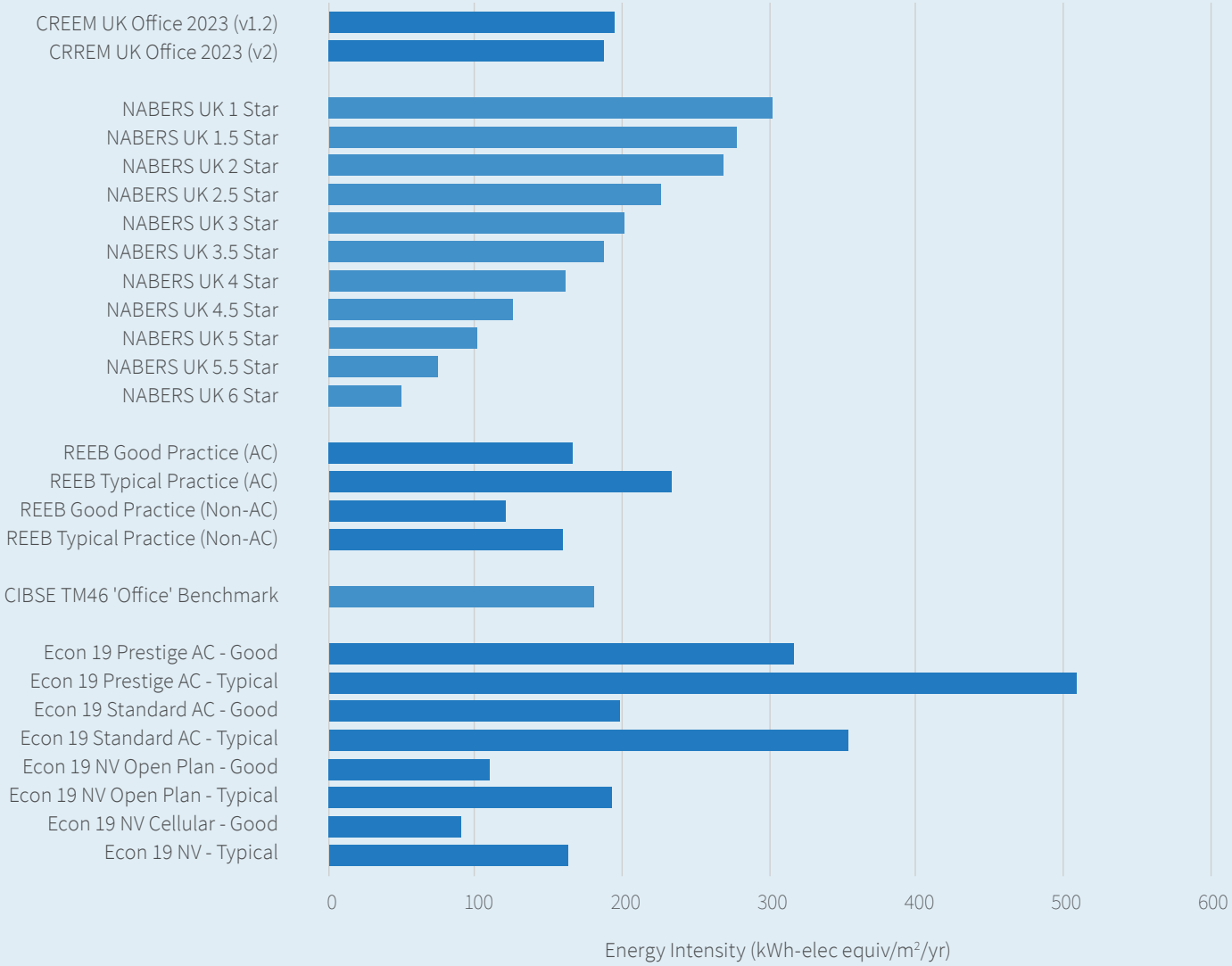


FIGURE 3: OVERVIEW OF EXISTING OPERATIONAL RATINGS AND BENCHMARKS

EXISTING RATINGS AND BENCHMARKS	WHAT IS IT?	WHAT IT ISN'T...	WHAT'S NEXT?
ECON 19 (Energy Consumption Guide 19)	A well-known office energy benchmarking guide first produced in 1991 regularly updated until 2003. It sets benchmarks for four common office typologies: 'Naturally Ventilated Cellular'; 'Naturally Ventilated Open Plan'; 'Standard Air Conditioned'; and 'Prestige Air Conditioned'.	As up to date as other benchmarks. It is based on data from the mid-1990s, and the last version was published in 2003. The typologies may also be less relevant for more modern offices.	Econ 19 evolved into the CIBSE TM46 energy benchmarks for a range of building types, that underpin the methodology for producing Display Energy Certificates (DECs) CIBSE benchmarks can be found here
CIBSE TM46 (Underpins the methodology for Display Energy Certificates (DECs)	A 2008 CIBSE publication presenting energy benchmarks for a range of building types, drawing on the existing guidance available at the time. For office buildings, the Econ 19 benchmarks were used, and consolidated into a single 'office energy use' benchmark. A tailored version of this benchmark produces the Display Energy Certificate (DEC) rating for an office, which is a regulatory requirement for public buildings.	A detailed energy benchmark suitable for separating tenant and landlord aspects of responsibility and control. The data is not as up to date as some other external benchmarks. DECs last for 1 year for buildings larger than 1,000m^2. For buildings over 250m^2 but less than 1,000m^2 they last for 10 years.	UK government has consulted on proposals to introduce a framework for rating the energy and carbon performance of commercial and industrial buildings, potentially extending the reach and scope of DECs.
BBP Real Estate Environmental Benchmark (REEB)	Annual energy benchmarking guide made publicly available by the BBP using data provided by its Members, covering a range of asset types (including offices and retail). The dataset expands annually and includes over 10 years' worth of operational data. It includes 'good practice' and 'typical practice' benchmarks for 'Air Conditioned' and 'Non-Air Conditioned' offices.	It does not provide a detailed breakdown of energy end-uses to facilitate targeting of interventions. It does not breakdown tenant vs landlord usage or distinguish multi use buildings, e.g. ground floor retail in large multi-tenant offices.	Ongoing annual improvements / expansion in line with the REEB data collection and analysis cycle. Public insights into the relationship of the benchmarks and net zero trajectories.
NABERS UK Energy for Offices	A detailed operational energy rating scheme for offices, taking into account tenant usage and equipment, enabling the landlord services and energy management regime to be compared on a fair and meaningful basis within the commercial office market. The scheme fully launched in April 2023 with the release of 'whole building' and 'tenancy' ratings, in addition to the 'base building' ratings initially available.	The Scheme is not yet as well established in the UK as it is in Australia. It will take some time to build capability and for the industry to calibrate their expectations about the potential performance of assets. Ratings do not cover multi use sites where there may be retail units served off the same incoming utility meters.	Embedding the ratings in the UK market, comparing lessons learnt and sharing best practice.

EXISTING RATINGS AND BENCHMARKS	WHAT IS IT?	WHAT IT ISN'T...	WHAT'S NEXT?
Carbon Risk Real Estate Monitor (CRREM)	The Carbon Risk Real Estate Monitor (CRREM) is a top-down tool created for investors to assess future 'stranding' risk to assets from the net zero transition. It can be used globally to assess various asset types and portfolios against science-based reduction pathways. It includes an assessment of where an asset should 'currently' be performing (i.e. an operational benchmark for an asset in use).	A comprehensive climate change risk assessment of individual assets from the 'bottom-up' with improvement recommendations. Neither does it reflect any specific interventions at an asset level.	CRREM has recently published updated reduction pathways with new current and long-term targets.

The below table shows the range of EUI benchmarks available to Property Managers.



Please note: CRREM UK Office values taken directly from CRREM tool without conversion to electricity equivalent. (CRREM unit is kWh/m²/yr).
NABERS UK EUIs are indicative-only, based on WB Reverse Calculator (Central London postcode; 40 hrs per week operation; 1 workstation per 20m2 density; 75%-25% ratio of electricity-gas). REEB benchmarks are originally produced in electricity equivalent, and show 25th percentile as Good Practice and 50th percentile as Typical Practice. CIBSE TM46 'Office' benchmark has been represented here by converting gas/oil value to electricity equivalent using a factor of 0.72, with reference annual operating hours of 2040. Econ 19 benchmarks have been represented here with conversion to electricity equivalent using a factor of 0.72 for gas/oil values.

FIGURE 4: OPERATIONAL DECARBONISATION PATHWAYS AND NET ZERO TARGETS

Many Property Owners are analysing the performance of their assets in the context of anticipated future performance requirements and how these align to Net Zero ambitions for real estate. There are a number of publicly available tools and roadmaps to help you do this. These include:

The UK Green Building Council (UKGBC) Net Zero Whole Life Carbon Roadmap for the Built Environment. The Roadmap includes a carbon footprint for the UK built environment, a trajectory to Net Zero Carbon by 2050, and a series of policy recommendations and action plans.

The Science Based Targets initiative (SBTi) defines and promotes best practice in science-based target setting. A science-based target is a net zero target that has been verified as being aligned with the latest climate science to keep warming well below 2°C above pre-industrial levels, and ideally limit it to 1.5°C, in line with the Paris Agreement. In order to have a recognised science-based target, an organisation's net zero pathway and targets must be submitted to the SBTi for approval.

The Carbon Risk Real Estate Monitor (CRREM) provides science-based pathways aligned with SBTi and the Paris Agreement, and the CRREM tool supports companies in assessing the emissions reductions required at an asset level.

The UK Net Zero Carbon Buildings Standard is currently being developed by leading industry organisations. This will set targets for buildings in all sectors of the built environment to be classified as 'net zero'.

FIGURE 5: NABERS UK

NABERS UK is a scheme that aims to close the performance in use gap in offices. It is a national rating system for buildings, it measures operational performance using a star rating system, with 6 stars being the highest possible rating measured via a year-on-year annual assessment. There are two market offerings:

NABERS UK Design for performance (DfP) has been established to ensure new office developments deliver on their sustainability design intentions. It allows developers to target a NABERS star rating for their building at the design stage and use this as a key performance indicator from the design stage through to completion. As part of this process advanced simulation modelling is used to transform service design, with an Independent Review Panel reviewing designs to verify that the designs are robust. The performance of the building is then verified in the first year of operation to certify it meets the targets set in the design stage, thereby overcoming the common problem of performance gaps between design and operation.

NABERS UK Energy for Offices rating enables the assessment of a buildings actual 'in use' energy efficiency performance. The annual rating system is based on energy consumed in that period, which enables a detailed understanding of the performance of the asset and the on-site equipment and energy-use patterns. NABERS UK Energy for Offices offers three different ratings schemes, enabling ratings to delineate whether they cover the base building, tenancy, or whole building.

- Base building energy rating: covers central services like heating and cooling systems, lifts and lighting in common areas.
- Tenancy rating: covers the energy consumed by occupants within their specific office space. It typically includes lighting, power for equipment, and any tenant-controlled air conditioning.
- Whole building rating: includes the base building and tenant occupied space. With all market offerings that actual 'in-use' performance of buildings is critical to success.


BCO

British Council for Offices
Briefing Note
February 2023

BCO GUIDE TO SPECIFICATION KEY DESIGN CRITERIA UPDATE 2023

The BCO's mission is to research, develop and communicate best practice in all aspects of the office sector.

The BCO *Guide to Specification*[1] is its most recognised publication, providing expert best practice advice on how to specify office space. The *Guide* comprises three parts: the first sets out the key influences on design thinking, the second gives specification guidance, and the third provides supporting reference material. It covers the base build design and development of new and major refurbishment projects, delivering workplaces to a shell and core, shell and floor, or Category A level of completion. Its aim is to inform clients and their designers of how best to specify the performance of new speculative workspace when the end occupier is not known.

Tailoring the space to meet an occupier's bespoke requirements is usually undertaken as part of a fit-out project, which is covered by another best practice guide – the BCO *Guide to Fit-Out*.[2] This guide was last published in 2021 and is currently being rewritten, with the new version planned for release in 2023.

The *Guide to Specification* was last published in 2019 and has generally been updated every 5 years. However, since 2019 the sector has been subject to unprecedented influences affecting building design. Some of the metrics previously used to inform office performance need to be revised, and so this interim update to the *Guide*'s recommended design parameters has been prepared ahead of the normal review schedule.

The BCO has produced this briefing note to explain which criteria have changed and why, so that members can use the guidance for their current projects. These changes will be added to the on-line version of the 2019 document and will be incorporated in the next formal update of the *Guide* itself.

Introduction

The Key Criteria in the 2019 BCO *Guide to Specification* were selected before the recent rise in concern about climate change, and prior to the COVID-19 pandemic. With a degree

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of normality returning to the workplace, the BCO decided to review and update the Key Criteria to better reflect the net zero carbon (NZC) agenda, the changing patterns of work and improved efficiency of modern technology. The opportunity has also been taken to introduce updates reflecting broader influences, including changing standards and planning requirements, and the continual drive to improve user experience of the workplace.

In June 2022, the BCO published a position paper, *BCO Guide to Specification Key Design Criteria Update 2022: A Position Paper*,[3] proposing changes to many of the Key Criteria. Following an extensive consultation with the membership and key stakeholder groups, the revised criteria have been finalised. This briefing note introduces the revised criteria, provides a comparison with the 2019 guidance and explains the rationale for the changes made.

The BCO does not advocate any particular design solution. As always, guidance should be interpreted by qualified, experienced designers. This is particularly important when applying diversity to building loads – an area where there is often significant overspecification.

NABERS
UNITED KINGDOM

When taking on a building with an existing or targeted operational NABERS performance rating you should seek to understand the basis for the targets and any assumptions that have been made, including:

- How was that performance rating established?
- What occupancy rating has been targeted?
- What level of sub-metering is there?

Links: Further details on the different NABERS UK ratings can be found here including:

- The detailed metering requirements to separate base building and tenancy ratings can be found in the NABERS UK Metering and Consumption Rules document.
- The NABERS UK Energy for Offices document.
- The background to the development of the NABERS UK Scheme can be found here on the BBP web site.
- The scheme documentation and a range of other guidance and briefings can be found here.
- More information on NABERS in Australia can be found here.

Links

GN 4.2: Energy performance standards | Better Buildings Partnership
BBP_How to_GN 4.7 Energy Benchmarking and Target Setting.pdf (betterbuildingspartnership.co.uk)
Operational performance: Building performance modelling and calibration for evaluation of energy in-use (TM63) | CIBSE
NABERS UK - BRE Group
BCO - BCO_Guide_to_Specification_Key_Criteria_Update_February_2023
Net-Zero-Standard.pdf (sciencebasedtargets.org)

What are the factors determining the building's performance?

Having considered how the building is performing against benchmarks and EPC, the specific attributes of the building need to be considered to begin to understand its capability. For example, certain factors such as building age, fabric, and the age of its plant will significantly affect the level of energy efficiency intensity that the building is able to attain, at the same time how the building is being used and operated can also have a significant impact.

The following table will help assess the key factors affecting the building's performance. This will allow for a better understanding of the building's performance level relative to its specification and allow you to start to consider how improvements can be made and where these should be targeted.

WHAT	WHY	HOW	QUESTIONS
Building specification			
Age of building (date of construction).	Older and heritage buildings may be less energy efficient and may perform less well compared to the median benchmark for building EUI performance. An older building may be less well insulated and have lower U values.	Look for a plaque dating the building. Look for the Operations and Maintenance (O&M's)/Building logbook dating the building.	What year was the building originally constructed?
Date and extent of any refurbishment.	Refurbishments may impact the energy performance of the building positively e.g. reduced energy consumption due to plant upgrades.	Look at the O&M's/Building logbook detailing changes. Review historic legal documents for any licences to alter the tenant demise building/M&E. Look particularly at improvements on fabric efficiency, increased wall insulation, improvements to glazing specs and M&E system improvements, if present.	Has the Landlord undertaken any refurbishments? When was the last major refurbishment and how extensive was this i.e. what floor area did it cover? Were additional energy meters added during any refurbishments? Were the refurbishments conducted to a particular standard e.g. BREEAM in Use, SKA Gold?
Date and extent of any fit outs.	Fit outs may have a negative impact, for example in the case of cellular offices being erected without adjustments to the fan coil units and Heating Ventilation and Air Conditioning (HVAC) system in line with the scope of works.	Look at the O&M's/Building logbook detailing changes. Liaison with the Tenant to understand what alterations have taken place.	Did the Owner or Tenant control the fit out? Has the Tenant undertaken any fitouts? If so, what works were undertaken and what was the extent of them?

WHAT	WHY	HOW	QUESTIONS
Construction Typology: What are the building fabric materials, how well insulated are they and how airtight is the building?	Each building material has its own thermal efficiency characteristic which will affect the energy efficiency of the building differently.	Review existing building surveys to understand: • Building fabric materials • Extent and depth of insulation • Building airtightness	What material is the main building made of? For example, is the main elevation material brick? What do building surveys tell us in terms of: • How much insulation there is on site. • How airtight the building is. • Thermal imaging of the building?
Are there any restrictions on the building?	These may limit what works can be undertaken to improve energy performance of the building.	Review the lease and any legal documents relating to the building's use.	Is the building listed? Are there any onerous covenants or lease restrictions?
Glazing: What is the proportion (window to wall ratio)? What type of glazing does the building have?	Glass is less thermally efficient than other materials and may require more heat in colder months. Glass allows solar gain and therefore, without shading may require additional cooling in hotter months.	Calculate the area of glazing using site plans or site inspections. Visually inspect the glass to ascertain the type and characteristics of the glazing.	Is the glazing single, double or triple glazed? If double/triple glazed is the glass sealed? i.e. is there any condensation between panes? Is the glass coated to reduce solar gain (tinted)? Are occupants using the blinds effectively to limit solar gain in warmer months?

Plant on site

Consider the extent of control of the building via a Building Management System (BMS).	A multi-let building without a BMS may be difficult to manage and control.	Liaise with the onsite team, Facilities Management team and Mechanical & Electrical (M&E) contractors to understand how the building is currently controlled.	How much of the building's systems can be controlled via the BMS? Are there any key items of plant missing from the BMS system which could be contributing to building energy consumption (e.g. fit out fan coil units which cannot be scheduled and controlled via the main BMS)? When was the BMS last upgraded? Are on site colleagues competent in the use of the system, do they require training? Are the graphics fit for purpose? Are there controls in place around changes to the BMS e.g. changes to operating hours or heating set points? Do tenants have control/access to the BMS for their demise? What are room air temperature set points, and do they vary by season?

WHAT	WHY	HOW	QUESTIONS
Consider how the building is currently being ventilated.	Buildings allowing for natural ventilation (openable windows) can be more energy efficient. However, where there is mechanical ventilation and openable windows there can be conflicts within the system causing additional energy use.	Speak to FM colleagues and M&E contractors to understand the current ventilation strategy.	What is the ventilation strategy for the building? Are occupiers aware of the strategy for the ventilation? Are there openable windows? How are you going to ensure any openable windows are not conflicting with the mechanical ventilation? If windows are opened does the plant shut down to limit energy wastage? Is there any demand led ventilation and variable speed drives to match energy consumption to occupancy? Does the system appear to be operating as per the commissioning description of operations? Do the mechanical ventilation systems incorporate heat recovery? Is humidification provided and if so, how energy intensive is that control?
Consider HVAC equipment on site: • **Space heating source, system and age** • **Space cooling source, system and age** • **Domestic Hot Water (DHW) heat source, system and age** • **Control systems**	HVAC equipment is one of the largest consumers of energy within a building.	Via conversations with onsite FM and M&E contractor to understand the scope and efficiency of the HVAC equipment. Visual inspection of the HVAC equipment. Reading of O&Ms.	How is the HVAC controlled? Is there any SMART with Demand Led Control features (see Figure 9)? Note: The system should operate 'on demand' rather than 'on regardless' on a time schedule. How is the HVAC maintained? Is the plant specified correctly for the way the building is currently being used and operated? Is plant running at design set points? For example, are condensing boilers being run at lower temperatures to allow condensing and improved efficiencies? How old is the HVAC compared to its expected life span? Are there any records of equipment/fittings which may have been replaced. Examples could include control valves which have been replaced without rebalancing the system. If close to end of life, can it be replaced with more efficient equipment?

WHAT	WHY	HOW	QUESTIONS
Review the fossil fuel systems on site.	Buildings heated by fossil fuels such as gas, may have a greater carbon intensity than buildings heated by lower emissions heating options such as air source heat pumps.	Look at the building logbook and design specifications to ascertain the details of the heating systems used, their age, when they were last upgraded and their efficiencies (flow tests etc). Review the heat demand load for the building. This will enable you to understand whether the system is specified correctly for the current demand and where the systems are in their life cycle and when they will be due for replacement.	Are there Gas boilers? How old are they? How many boilers are there? What is the heating load? What is the efficiency of the boiler based on current testing? Note: Large fossil fuel systems should have an annual record which shows the percentage efficiency (input/output). What is the load/capacity utilisation factor? For example, if you have a 100kW boiler capacity and the load is 40kW peak, based on hourly gas consumption, then there will be the opportunity for rationalisation (see Figure 14 Specification review /equipment density)
Consider the current lighting system.	Lighting can consume a significant amount of energy within a building.	By understanding the current lighting systems on site. By reading existing sub meters to understand energy consumption from lighting. By understanding current lighting output W/m^2/100 lux and lumens per circuit watt. Note: different types of areas require different lux levels. Seek to understand lux at desk level to understand over/ under provision of light at workstations.	Can the controls be further adjusted to achieve energy savings? Can unnecessary fixings be removed? Can the lighting be upgraded to re lamp to LED using the existing fixings as part of ongoing maintenance? Can Passive Infrared Sensor (PIR) lighting be installed? Can daylight dimming controls be installed? Can switches be installed to certain areas e.g. meeting rooms so occupants can turn these off if not needed while they are being occupied e.g. when viewing screens?

WHAT	WHY	HOW	QUESTIONS
Understand the current onsite renewable generated energy (and scale) (kWh/m²/yr. & kWh/yr.)	On site renewable energy will reduce consumption of imported grid energy, thereby improving energy use intensity, energy security and potentially saving cost and carbon emissions. On-site renewables have the potential to generate income via Feed in Tariff or Export Guarantees.	Visual inspection to find out what is onsite. Review of O&M to ascertain capacity. Understand meters available to measure generation.	What type of renewable energy is on site e.g. Solar PV or Solar Thermal? What is the approximate capacity of the technology? How much is being generated and how does that compare to expectation? How much does it contribute to onsite demand? Is any energy exported? Is the renewable energy feeding the landlord energy? Is the equipment maintained and cleaned? Are they registered for Feed in Tariffs or Smart Export Guarantees? Is there space for additional renewable energy e.g. space for PV on the roof?

How is the building currently being used by occupiers?

Seek to understand the amount of equivalent free area in the building (% void space).	How densely the building is being occupied will have an impact on energy consumption for the area.	By understanding what the peak and average demand for use of the building is and how this compares overtime/different days of the week.	Speak to the onsite FM team to understand: What is the peak number of people for each individual demise? What is the average per day? How does this compare against benchmark? If the building occupancy is significantly below design occupancy numbers, could ventilation systems be ramped back? Do you have separate control of void space to reduce energy consumption in areas not being used?

WHAT	WHY	HOW	QUESTIONS
Consider the operating hours of the building.	The longer the operating hours, the more time the plant will run, the more energy will be used. Are there set operating hours for the building or is the building being used and operated 24/7?	Speak to occupiers to understand their current requirements for building operating hours and check this against any lease obligations. Look at the timings that the plant is programmed to run and understand if there are any opportunities to optimise. Refer to NABERS guidance to provide a consistent approach, noting that occupancy hours may vary by tenant.	What are the operating hours of the building? How does this compare to actual occupancy and current plant run times? Are there any lease restrictions/ requirements on the tenants or the building operator for the running of plant on the building and how do they compare to actual occupancy? Can the building's operational hours be reduced to match the actual occupancy profile? Is there scope for early evening shutdown to take advantage of any temperature over run? What is the pre-heating period before occupants arrive in the building – are there opportunities to reduce this pre-heating period?
Consider the total out of hours energy consumption.	The energy consumption out of hours can be significant and presents a great opportunity to target energy savings.	By reviewing half-hourly energy data and investigating opportunities to reduce base load consumption.	What is causing energy usage when the building is unoccupied? Is energy use coming from tenant loads, or landlord loads? Are there any spikes in energy usage out of hours? Is the back of house AHU running 24/7 or turned off overnight? What is the pre-heating period (the time plant comes on before occupants arrive) does this time need reviewing and adjusting.
Consider how the building is currently being used by occupiers?	The type of occupant can have a significant impact on the energy use of the building. For example, trading floors will be more energy intensive than standard offices. Professional services firms may have enhanced requirements for onsite catering and IT systems.	Speak to building occupiers to understand their current requirements and cross reference this information against the requirements agreed as part of the Lease.	How is the building currently being used by occupiers? As above, is there scope to engage with the tenants to adjust plant operating hours/ zones based on their working/ usage patterns?

So, what will this tell you?

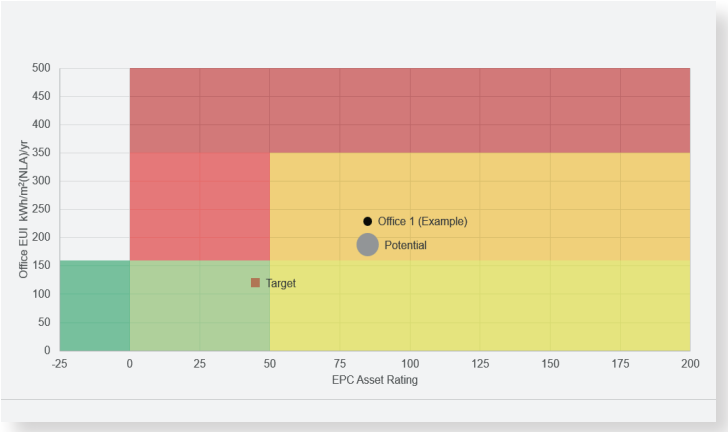
This will provide you with a clear understanding of what is driving the performance of the building and where the building needs to improve. It will enable you to determine: Is the building performing in line with its expectation? If it is not, why is it not and what needs to be done to achieve this? It will also highlight risk areas where your hands may be tied e.g. a listed building or tenant who needs the building to run 24/7.

FIGURE 7: BUILDING ASSESSMENT

To accompany this framework the BBP Managing for Performance Working Group have developed an excel tool to help you understand how your building is performing and guide you to identify the areas where the building needs to improve.

The results of the assessment should indicate priority areas for energy management, engagement and investment in the asset.

This tool is currently being piloted by a number of BBP Members. To register your interest in trialing the tool, please contact Jonathan Hulbert



Phase 2: Improving the management and operation of the building for energy performance

Identifying the "performance gap" in Phase 1 will provide a clearer understanding of the building. The next phase involves identifying key areas where the management and operation of the building can be improved and what needs to be done to implement actions to improve energy efficiency. It will be important that you are aware of any energy reduction or net zero targets that the owner may have set in relation to the building and how progress is monitored and reported.

This phase will focus on quick and easy-to-implement interventions that will optimise the operation of existing building systems as well as identifying areas for capital investment that will have the biggest impact[2].

Phase 2 sections include:

- → Monitoring and Targeting
- → Communications and engagement
- → Control and operation of systems including:
  - → Building Management Systems (BMS)
  - → Heating Ventilation and Air Conditioning (HVAC)
  - → Domestic hot water systems
  - → Lighting

What data is available for the building?

A critical first step in any energy management programme is the accurate measurement and monitoring of how much energy a building is using.

WHAT	WHY	HOW	QUESTIONS
Automatic Meter Reading System: Monitoring and Targeting			
Compare the energy consumption (for both electricity and gas) of the building to: • **Hours of operation of the building** • **Weekend profile** • **Occupancy rate of the building.**	By comparing the energy use to hours of operation and occupancy times, it is possible to identify potential energy wastage. It may be the case, for example, that there is significant energy demand during unoccupied or out-of-service hours. Note: Although the profile will show when the energy is being used (base load and peak load) it will not help the user identify the energy profile of individual energy consuming assets e.g. lighting.	By cross referencing the half hourly energy profile with set hours of operation for the building and current occupancy of the building, you will be able to identify opportunities to optimise timeclocks /schedules as well as investigate spikes in energy usage out of hours.	Does the consumption profile match the hours of operation? Are there elements of the energy consumption profile of the building that look odd (e.g. spikes in energy demand) and require further investigation? For more information see BBP Responsible Property Management Toolkit GN 4.5: Energy consumption profile | Better Buildings Partnership.

2. Note where FM delivery is outsourced, this section should also be read in conjunction with the Phase 3 section "Incorporate energy efficiency withing the Procurement of FM requirements to support a MfP approach".

WHAT	WHY	HOW	QUESTIONS
Regularly monitor the energy consumption profile of the building.	By regularly checking consumption you can quickly establish whether energy usage is increasing and potentially address the cause of this. Equally by reviewing the data you can quantify savings being achieved and gain further momentum. It is important to establish the frequency for the energy consumption review.	By comparing energy consumption data to a previous period. It is recommended that this is done at least monthly but in periods where changes to operation or changes to assets are taking place, a more frequent review of the data (e.g. daily) is recommended.	How does the energy performance of the building compare to the previous period? Have there been any faults with the data suggesting data logging issues?
Human resources			
Review the skills and resources available at the building to support effective energy management.	It is important that colleagues understand their role in relation to energy management and have clarity around expectations of them to manage energy performance. Note: Some colleagues may not see energy efficiency as part of their role and may see it as "someone else's" responsibility. It is important that everyone considers how they can improve energy performance on site as part of their role.	Ensure an ongoing programme of energy management training for key staff is in place and ensure that where relevant energy efficiency is detailed within colleagues' work objectives. See also phase 3 Incorporate energy efficiency withing the Procurement of FM requirements to support a MfP approach	How are colleagues integrating energy management into their everyday BAU activities? Does everyone understand their responsibilities when it comes to the energy performance of the property? Is there shared ownership between stakeholders?
Ensure that there are human resources allocated as part of their job description to effectively manage energy performance on site.	To manage energy effectively you need to ensure there is human resources with day-to-day responsibility for managing the energy performance of the building. Note: Even if this is a small building Energy Management could be part of someone's wider responsibilities.	Via clear roles and responsibilities. Note: When personnel change it is really important that there is clear ownership of data and detailed handovers.	Where applicable is energy management detailed in job descriptions?
Ensure that those with responsibility for managing energy are being proactive and carrying out non-technical energy 'floor walks'.	To enable opportunities for energy optimisation and energy savings to be identified. Non-technical 'floor walks' of the site and plant rooms will enable people to identify 'quick win' opportunities for energy optimisation and energy savings. The floor walk should follow a defined structure with a check list focused on good energy management behaviours. This could include, for example, looking at whether lights are turned off in unoccupied areas.	Ensure daily site / floor walks are being undertaken by the relevant person responsible.	Are colleagues being proactive with energy efficiency measures? Is there evidence for this being gathered? E.g. through daily floor walks. Are there examples of recommendations being identified and implemented? How is this information logged and tracked over time?

WHAT	WHY	HOW	QUESTIONS
Communications and engagement			
Engage with those who manage and operate the building.	Engagement with those who manage and operate the building is crucial to success, as they should understand the building, the systems on site and how best to optimise energy performance.	An energy efficiency awareness campaign should be implemented to raise awareness of the importance of energy efficiency.	How are the suggestions as to how to improve performance recorded? How are colleagues recognised and rewarded for implementing energy savings on site?
Engage with those who occupy the building.	Engagement between those who manage and operate the building and those who use the building is crucial to success.	The Property Manager should engage with tenants to understand their objectives and priorities for the space.	What are the occupiers' priorities? Given the circumstances around ongoing energy costs, it is likely that they will be paying attention to the cost of operations and be looking for opportunities to reduce these costs where possible.
Energy awareness campaign.	An energy awareness campaign should be implemented to raise awareness of building performance amongst building users and to get "buy in". The campaign can be used to provide guidance to occupants about how their actions such as opening and closing blinds and switching-off lights can improve energy efficiency.	Raising awareness of the "every day" steps that can be taken to improve the energy efficiency in the building. By sharing examples of what occupants can do to reduce energy on site. By sharing data and examples of what everyone is doing to reduce energy.	Is energy performance data being shared with tenants in a format which they can readily understand? What are the 5 things tenants could do differently on site to reduce their energy performance? For more information: See the BBP's Green Building Management Toolkit.
Establishing a champions network.	Establishing a working group within the building to drive optimisation can be a key enabler for driving engagement, gathering feedback on how initiatives to date have been received, as well as where improvements can be made.	Convene an Occupier Energy Champions group to focus on energy efficiency as well as quickly and efficiently disseminating core messages around energy efficiency to building users.	Who are the key stakeholders that should be asked to join the network? Is it possible to have a representative from each tenant within the building? How often should meetings be convened? For more information: See the BBP's Green Building Management Toolkit.
Agree temperature parameters for the building with the champions network	Without agreement around the temperature set points, the management of change requests from building occupants in relation to thermal comfort will be difficult to control. Perceived temperature comfort levels are often subjective.	Indoor temperature ranges should be agreed with tenants e.g. Summer 23°C (+/-2 degrees) winter 22°C (+/-2 degrees).	Are building occupants aware of the agreed temperature range? Are those responsible for the control of the building working within these parameters? How are complaints and temperature change requests monitored, controlled and managed?

WHAT	WHY	HOW	QUESTIONS
Share performance and gain momentum.	Produce quarterly energy reports to share with tenants in order to report on progress on energy reduction over time.	Energy performance data should be regularly shared with building occupiers so they can see that the activities on site are having an effect and get "buy in."	What are the behaviors behind the data driving change in energy consumption? Can the data be normalised to account for seasonal variation (heating/ cooling days) to enable like-for-like comparison throughout the year?
Compile a newsletter.	A regular newsletter is another useful tool for engagement with tenants and can be an effective way of gaining "buy-in." Look to produce a newsletter at regular intervals throughout the year to communicate any energy saving initiatives with the occupiers. These can include national events like Earth Hour.	By producing a regular Occupier Newsletter, including informing building users of the energy improvement initiatives being undertaken on the estate.	Is it possible to get testimonials, or input from certain tenants into the newsletter? Are there any case studies that can be shared, or examples of successful energy saving projects tenants have undertaken in the building? For more information: See the BBP's Green Building Management Toolkit.
Green leasing / MoU.	Green Leases are an essential tool for establishing shared understanding and commitments between the building owner and occupiers. You should engage with Asset Managers to drive the inclusion of green clauses as standard when leases are negotiated. Green clauses, particularly around data sharing, will be crucial to understanding the whole building performance.	Review any existing clauses detailing responsibilities to improve energy performance. Share this information with interested parties, so everyone is aware of contractual obligations to improve energy efficiency.	What are the current clauses (if any)? Are details of the clause requirements being recorded in a central location? (This will prevent PMs from going through each of the leases individually.) For more information see the BBP's Green Lease Toolkit.

Links

GN 4.5: Energy consumption profile | Better Buildings Partnership

BBP Green Building Management Toolkit.pdf (betterbuildingspartnership.co.uk)

Green Lease Toolkit | Better Buildings Partnership

Home | CUBE Competition – A UK wide, yearly competition delivering energy savings in commercial buildings.

BMS Strategy: How is the BMS being operated?

A building management system (BMS) is a computer-based, central control system to manage the operation of building services – heating, cooling, ventilation, hot water and lighting. If well managed a BMS will optimise energy consumption and improve occupier comfort.

A correctly set up and well managed BMS can result in significant energy savings. It provides a 'real-time' understanding of how the building is operating and can help to flag issues such as high energy use and abnormal out-of-hours consumption.

WHAT	WHY	HOW	QUESTIONS
Ensure relevant personnel have a good working understanding of the BMS.	A BMS is crucial to managing demand for energy. It allows those responsible for energy in a building to control energy consumption and supports optimum comfort for users of the building. It allows remote management of heating, ventilation and air conditioning (HVAC) so that you do not have to spend time visiting each building, floor or room to shut down, switch on or adjust temperature levels or equipment.	By understanding what plant and equipment is controlled by the BMS. The BMS should have suitable functionality to control services in a smart and effective way, with adequate accessibility to make alterations to time clocks and limited control alterations to set points. Trending should be available with data provided from sensors linked to centralised plant.	Do colleagues know how to use the BMS? What are the controls around making changes to the BMS? What is within the BMS's control for centralised systems? How are adjustments currently made to the system? How are alarms interpreted and responded to? Is there Demand Led Control? (See Figure 9)
Ensure that the BMS has control of key equipment and the plant controlled via the BMS is being operated and managed effectively.	This will enable the control and adjustment of settings to reduce energy wastage including: • Control of Heating • Control of Cooling • Control of Domestic Hot Water • Heating run time (hours of operation) • Cooling run time (hours of operation) • Heating temperature set points °C • Cooling temperature set points °C	Ensure the verification of run times align with the building core hours. Ensure that the temperature set points are optimised for energy efficiency.	What are the controls in place to manage any changes to the BMS settings? How are changes to heating set points managed? How are out-of-hour requests managed? What are the controls in place to manage any changes? Are you ensuring the heating and cooling setpoints do not overlap? Note: Preventing simultaneous heating cooling by expanding the dead band value is important to energy savings. For more information see Figure 10: Dead Bands. Is there demand-led override?

WHAT	WHY	HOW	QUESTIONS
Investigate opportunities to reduce plant and equipment run times via the BMS.	Reducing plant and equipment operating hours – even by 15 minutes at the beginning and end of the day - can deliver considerable energy savings over time. Note: Design internal environmental conditions may not be achieved at the time of normal occupancy if timeclock settings are reduced. Consider lease requirements and engage with occupiers in advance of making any changes.	Adjust BMS time clocks if feasible. Occupier engagement will be critical.	What are the current time clock settings Monday – Friday and at Weekends? When were the timeclocks last adjusted? Do they reflect the current season? Are there opportunities to further optimise?
Review with competent staff the description of operations (DesOp) for the BMS, the BMS logbook including alarms raised, the BMS controls strategy and defined set points.	To understand the method of control for the building and any potential opportunities for optimisation. To review the BMS Logbook to understand the alarms that are being raised in the system and how these are being dealt with by the M&E service provider/In house team.	Via a document produced by the specialist responsible for the BMS that provides a layman description of operations and recommendations for betterment. Regular review of the logbook by the PM/FM team with any changes documented within the logbook/CAFM system.	What are the recommendations for betterment and return on investment for each review? Can the logbook move from physical logbook to CAFM logbook?
Review Helpdesk calls e.g. relating to temperature and lighting related issues.	This may indicate where the plant is not being operated optimally (e.g. temperature related complaints, examples of the heating and cooling running simultaneously).	Review the data and look for inconsistencies / patterns for more thorough investigation.	Do any of the calls to the Helpdesk suggest that energy performance is not optimised? E.g. building too hot in winter, too cold in summer months.
Set parameters for how changes to the BMS will be controlled.	This will avoid uncontrolled changes being made that may negatively affect energy efficiency.	By seeking recommendations from the service provider to avoid set point extremes, over running timeclocks, and widening dead bands.	How are changes to heating set points managed? How are out-of-hour requests managed? If a one-off change is requested e.g. to change the operating timings on the BMS for an out-of-hours event, is a job also raised to close out the job and re set to original timings? Consider creating a recharge for each additional out-of-hours energy usage requested by an Occupier, so the additional running of the plant is charged back to the occupier requesting the change? This may encourage them to limit the number of changes requested.

WHAT	WHY	HOW	QUESTIONS
Validate with Security and Maintenance teams that plant run times do not exceed their intended control parameters.	Out of hours security will have a good understanding of what is happening in the building when no one is on site.	Regular reporting of actual building occupancy times. Reporting from security on any lighting or plant that is running unnecessarily out of operational hours.	Are the security guards noting any energy "wastage" e.g. lights on out of hours? Are users of the building who are working out of core hours asked to work in specific zones to limit energy wastage? Are the out of hours cleaners aware of their role in switching off lights in unoccupied areas when they have cleaned an area?
Consider BMS analytics systems.	This will support the identification of efficiencies in the system and defective plant and equipment.	By working with a BMS supplier and implementing a building analytics system for the BMS and other connected systems.	What are the system analytics?
Visits from the BMS Maintainer should be managed by the onsite team.	This is to ensure the BMS optimisation focusses on energy efficiency as well as other key priorities for BMS effectiveness such as thermal efficiency. .	Ensure a discussion is had between the relevant Controls Engineer and the M&E Contractor to ensure the BMS is optimised for energy efficiency. This discussion should take place both before and after the site visit to ensure the Maintainer is focussing correctly when onsite and to understand what changes have been made during the visit to optimise so that savings can be quantified.	What are the priorities for the upcoming visit? What has been identified as part of the visit? What are the next steps to optimise the system?
Owner engagement.	Have the owners been advised of energy reductions achieved via the BMS.	Via data and case studies.	Have any case studies been produced? What were the challenges in optimising the BMS and how were they overcome?

FIGURE 8: GETTING THE MOST FROM YOUR BMS SPECIALIST

BMS optimisation is often critical to energy reduction strategies and can be relatively low cost and high benefit. Getting help from a BMS specialist can be key to maximising this opportunity. It is important to make sure that the BMS specialist you use is suitably qualified & experienced in the following:

- Understanding HVAC plant and control
- Energy conservation, carbon and net zero with regards to building controls
- Competent in BMS architecture with software, hardware, and infrastructure design
- Capable in designing software and describing it in plain text format
- Able to read and understand electrical, mechanical and BMS software drawings
- Knowledgeable in system integration including open protocols such as BACnet, MQTT & LoRaWAN

It is important to be aware of how best to get help from your supplier in order to assess the existing BMS's capability, optimise the system & plant run times, calibrate and optimise sensors.

Below are some examples of how to get the most from your supplier:

- Prepare a detailed brief that includes information about the property (size, layout, and existing infrastructure) as well as what you are seeking to achieve for the site. This will help them understand the property's unique requirements and develop a tailored solution.
- Communicate and be clear about your goals and expectations for the BMS specialist. Ensure that the specialist understands what you want to achieve, and how you will measure success.
- Be very clear and ensure understanding via a documented scope of work, budget and timeline.
- Collaborate: This is key to achieving energy efficiency improvements in your building. Work closely with the BMS specialist to develop a plan of action and ensure that they are monitoring the results to make any necessary adjustments.
- Provide regular feedback to the BMS specialist on progress towards achieving your energy efficiency goals. This will help identify any issues early on and whether any further changes need to be made.
- Be open to new ideas and technologies: BMS specialists are experts in their field and can offer valuable insights and recommendations for new technologies to improve efficiency and performance.
- Ensure data privacy and security: With the increasing use of digital systems, data privacy and security have become critical concerns. Ensure that the BMS specialist has appropriate measures in place to protect the property's data and infrastructure.

A BMS Specialist should be able to review a building's Building Management System software and strategy from an energy performance perspective and grade it according to the British and European Standard BS-EN 15232 to highlight any improvements and upgrades required. They will also be able to provide an upgrade plan to improve the BMS software so that the system achieves the highest level of efficiency (CLASS A) to support energy optimisation.

A BMS Specialist should also review O&M's and drawings to identify any gaps in information, BMS hardware and infrastructure to identify where it is in its lifecycle according to the manufacturer and CIBSE guidelines, and any potential upgrades and investments required to minimise risk.

Looking to the future

With the development of cloud computing, machine learning, and digital twins the BMS of tomorrow will move towards predictive control and predictive maintenance utilising IoT platforms with building analytics. Property Managers should engage with their BMS specialist to understand all the opportunities in relation to the BMS for a building.

FIGURE 9: DEMAND LED CONTROL

The essence of demand led control is that whether and at what capacity systems operate is determined by the actually demands of the building. When demand led control is optimised you should hear fans turning on and off in the ceiling void, similar to if you use a small fan heater at home and it turns off when the thermostat temperature is reached.

At the moment most buildings operate 'on' regardless of occupancy, and all pumps and large fans are turned on fully during core hours, with temperatures being achieved by the amount of hot or cold water that flows over coils infront of the fans. This can result in a lot of wasted energy.

Implementing demand led control:

When demand led control is implemented, once the system has 'optimum started' to temperature, if no heating, cooling or fresh air is needed in the space the fans in fan coil units or other terminal units will turn off automatically. This is achieved when there are temperature sensors and CO_2 sensors located within the space, at the appropriate height (normally 1.5 m above the floor) to sense environmental conditions of occupants when seated .

The BMS software should be set up as follows:

- Room Sensors: If there is no need for heating, cooling or fresh air the terminal unit fans are turned off until a 'demand' is generated from the room sensor initiating terminal units to turn on. Often in offices the fans can be off for hours, especially when there is low occupancy.
- Temperature dead bands: The temperature band for heating and cooling should be as wide as possible for example 19 to 24°C. (See Figure 10).
- Central Landlord controlled plant: The landlord's BMS needs to be of sufficient capability to 'poll' all the Fan Coil Unit demands, so that it only turns on boiler & chillers systems and air handing units, when the fan coil units have a demand. At all other times, all pumps and fans associated with these systems should be off.
- Mixed mode: If there is an option to perform a 'mixed mode' control, then when the windows are open in the summer all fan coil units, boilers and chillers systems should be disabled until all windows are closed. This can either be based on window contacts or manual control.
- If demand led control is implemented on either space heating/cooling systems or ventilation systems, it should incorporate a pressure reset on pumps and fans. This provides significant savings over a constant pressure system by reducing the pressure set point to suit system demands.

Demand led control is a basic function the BMS can perform if a BMS controls engineer with sufficient abilities is used to specify, install and maintain the BMS to optimise this function. This may result in additional maintenance costs, but these will normally be outweighed by the energy and cost savings.

Links

Optimised Control: Unlocking the secrets of the black box: control strategies for engineers – CIBSE Journal

FIGURE 10: DEAD BANDS

A dead band is a set range within which no action occurs. In relation to building HVAC plant, dead bands are usually a feature of HVAC control and refer to the temperature range within which the thermostat won't send a signal to the system. The dead band serves the purpose of ensuring the system is not constantly switching between heating and cooling where temperatures are raised above or decreased below the setpoint.

The setpoint is the target value for the air temperature of the zone, this could be set to 22°C is Winter, and 24°C in Summer, for example. In a scenario where the dead band is very tight, heating will be activated whenever temperatures drop below the specific set point of the system. If the heating then increases the zone temperature above the set point then cooling will be activated to bring the temperature back down again. This cycle will continue, meaning that plant is running constantly to adjust the temperature to the desired level.

In order to avoid a scenario where fan coil units (FCUs) are constantly alternating between heating and cooling, the dead band value can be expanded (i.e. extending the temperature parameters within which FCUs are activated). Expanding the dead band value can reduce heating and cooling loads significantly, however, a tighter dead band is better for comfort and therefore significant adjustments to the dead band value should not be made without prior engagement with occupiers.

FIGURE 11: BUILDING CONTROLS ROLES AND RESPONSIBILITIES

Initiative	Owner	Description
AHU time control	Maintenance	The AHU should be controlled to the business hours of the property.
AHU time control validation	PM	Out of operational hours, the PM should instruct periodic inspections to ensure that plant does not run.
AHU sensors	Maintenance	Maintenance provider should share trends and confirms parameters as suitable to PM's.
Heating time control	Maintenance	The Boilers and associated pumps should be controlled to the business hours of the property.
Heating set points	PM	Out of operational hours, the PM should instruct periodic inspections to ensure that plant does not run.
Cooling time control	Maintenance	The HVAC should be controlled to the business hours of the property.
Seasonal adjustments to time clocks	Maintenance	The time clocks should be adjusted by one hour when the clocks go forward in spring and backwards in autumn to reflect GMT e.g. for outside security lighting on a time clock.
Bank holiday time clocks	Maintenance	The BMS time clocks should be adjusted in line with bank holiday occupancy, so plant does not run unnecessarily on bank holidays.

HVAC Systems: How is the HVAC system being operated?

Heating, Ventilation and Air-Conditioning (HVAC) systems account for a large amount of the energy consumption in an office building. To further increase building energy efficiency, the ways the HVAC system is utilised should be considered and potential areas for improved operational efficiency identified.

WHAT	WHY	HOW	QUESTIONS
Review the chilled water system and heating system set points.	Heating / cooling set points can often be reduced / increased and deliver significant savings.	Consider increasing/decreasing the operating set points. Review time schedules and consider reducing plant operating hours, especially in areas where there is low occupancy. Note: By reducing the cooling capacity, you risk overheating of space leading to complaints from building occupants. Optimising blinds operation and reviewing other internal gains such as day light control on lighting goes hand in hand with this strategy.	What is the current set point? What is the recommendation? When should this be reviewed again? What is the potential impact on connected loads such as hot water system calorifiers?
Review of Air handling units (AHUs)	Air handling units consume large amounts of energy so you should look at opportunities to save energy from the AHU.	Ensure that the set points align to Summer / Winter temperature bandings. Instruct a regular review of the commissioned flow rates (air, heating/cooling) with a competent contractor and if out of tolerance, consider rebalancing the system. Note: Terminal units need to be aligned to this strategy to ensure there is not the unintended consequence of being required to use additional heating/cooling to condition the fresh air.	Are the set points regularly reviewed? When were the flow rates last reviewed by a competent contractor? Is the AHU controlled from CO_2 sensors in the space and turned off when fresh air is not required?
Undertake a review of the performance of the building's HVAC system to rebalance air flow rates back to what they were originally commissioned to do.	During the lifecycle of a property, settings and balancing of HVAC systems will require re-commissioning to support an even and fair distribution of services. This subsequently allows the evaluation of the plant performance and savings to be identified.	Via a Commissioning Review: Recommissioning should be undertaken on a regular basis to ensure that buildings are operating in line with their original specification. Technical experts should be procured to come on site to take flow rates around the building to assess how the heating and cooling systems are performing, and whether they need to be recommissioned. Tenant engagement is advised.	Do you have the original commissioning documentation? Do you have a specialist with sufficient knowledge? When was the whole building air flow rates last reviewed? Have there been any works that may alter those flow rates e.g. large fit-out works?

WHAT	WHY	HOW	QUESTIONS
Duct work leakage tests.	Air leakage may cause increased energy consumption.	Ensure that ductwork leakage tests are undertaken in line with the PPM regime for the sites. Note this will require specialist technical resource.	When was the last ductwork leakage test performed?
Consider summer time night cooling opportunities: Heat Purge.	Night time cooling is an energy savings opportunity which removes the need for the chillers or VRF systems to work harder in the morning and can further improve the building conditions for occupants.	This can be performed by your BMS contractor implementing a control strategy that dynamically removes hot air from the building when it builds up.	Is there a night time purge function on the building's BMS and how does it work? Can the energy saving be demonstrated?

Domestic Hot water provision: How is the Hot water system being operated?

Domestic hot water is energy intensive. The greater the heated water volume and distribution losses the more energy will be required to heat it.

WHAT	WHY	HOW	QUESTIONS
Review time schedules and reduce operating hours.	Availability of hot water should align with the operational requirement for the building.	By periodic review of the BMS time schedules.	Do the times on the BMS align to core occupancy hours? Is there a requirement for hot water outside defined occupancy hours? Have occupiers been consulted around requirements for hot water provision? Have water hygiene requirements been considered with the building's Responsible Person for Water Hygiene to ensure safety compliance?
Temperature set points: check and adjust domestic hot water systems to optimise temperature settings.	To ensure the optimal balance between assuring water hygiene and avoiding unnecessary energy usage and scalding.	Adjust temperature controls.	What is the current water temperature set points e.g. supply and return on circulating systems? Have you consulted the Responsible Person for Water Hygiene for the building ahead of making any changes?

WHAT	WHY	HOW	QUESTIONS
Check for opportunities to reduce the water flow from taps to reduce hot water wastage.	Domestic hot water is energy intensive. The greater the heated water volume the more energy will be required to heat it.	Investigate opportunities to install flow restrictors to existing outlets, for example low-flow fixtures for taps used for hand washing. These will reduce the water flow and thereby reduce the amount of water consumed by users.	What is the current water flow/ volume rate for each outlet? How does this vary across the building? How does this flow rate compare to benchmarks? Are there opportunities to reduce the water flow?
Thermal insulation: Checking that all hot water pipes and tanks are insulated.	To ensure heat losses are minimised as part of hot water storage and distribution.	Ensure that all pipework and duct work is checked for thermal insulation.	Upon visual inspection, can you see evidence of insulation around pipes / equipment? Is it suitable and efficient to minimise heat losses?

Lighting Systems: How is the Lighting system being operated?

Inefficient lighting systems in commercial buildings can consume a lot of unnecessary energy. The careful management and optimisation of the lighting system substantially reduces this demand. Optimising performance can reduce building energy demand as well as being a very visible way of demonstrating your focus on energy efficiency - we all know what it is like to pass a building at night with all its lights still switched on and how bad that looks to stakeholders.

WHAT	WHY	HOW	QUESTIONS
Ensure light switches are labelled with a clear description detailing the associated lighting areas.	To support behaviours around building users and operators taking responsibility to switch off lighting when not in use.	Undertake a review of the spaces that are controlled by various light switches and work with site-based colleagues to produce labels for the various switches accordingly.	Is it possible to install PIR sensors to prevent tenants, or other building users, from having to manually turn the lights on/off?
Maximise daylight and dimming where possible.	This will reduce energy required for lighting.	Natural light can be used to light areas close to windows and atria instead of artificial lighting. This can be assisted by lighting controls which automatically adjust artificial lighting to reflect the amount of natural light entering a space and ensuring that lighting circuits are designed so that whole floors do not remain lit whilst a small area is in use or where there are sufficient levels of natural light.	Is artificial light regularly switched off during the day where natural light is sufficient to perform tasks? Are there areas of the building where solar glare is a problem during the year? Is there daylight control of lighting? Is the blind operation optimised to reduce internal solar gains?

WHAT	WHY	HOW	QUESTIONS
Review existing lighting control strategies.	Having existing automatic lighting controls optimised reduces lighting load when not required.	Check that the lighting controls align with the hours of use for the building. Note: In some older offices the zoning for light control may no longer be optimal after fit out. If the zones are too large, or the central zones are not separate from the zones near window the daylight sensors and PIRs may not work optimally.	Where are the lighting controls located? What are the current lighting timings and how does this compare against hours of use? How many lights are connected to the same control?
Review and adjust lighting intensity (LUX levels).	If the lighting is too bright, then energy is being wasted.	If the lighting system is controllable through the BMS it may be possible to turn down LUX levels at minimal cost. CIBSE design guidelines SLL Code for Lighting (2022) | CIBSE recommend minimum lux levels for different spaces. For instance, an open plan office requires higher lux levels compared to a storeroom. In addition The Carbon Trust's Lighting Guide provides Illuminance (Lux) levels for different types of activity see Table 1, page 7.	Can the LUX level be reduced?
Consider removing light fittings from over lit areas as part of ongoing maintenance.	Lux levels and the number of luminaires may exceed what is necessary for the space.	By reconfiguring the luminaire density where feasible. Note: A review of safety considerations and appropriate engagement with building occupants should be undertaken before this is done.	When was the lighting design last reviewed by a specialist contractor? What are the pros and cons of the existing lighting density, what are the options available to you? When replacing lighting do you need to replace like for like? Could you replace with fewer lamps?
Consider replacing non-LED lamps and luminaires with LEDs as part of ongoing maintenance.	New LED lamps and luminaires are far more energy efficient and have a longer life span, reducing requirements to replace bulbs.	Replace halogen luminaires with LED luminaires. Replace compact fluorescent luminaires with LED luminaires.	What existing lighting do you have? How old are the current luminaires? Is the landlord communal lighting LED? Are occupiers choosing LED?

WHAT	WHY	HOW	QUESTIONS
Install and/or optimise Passive infrared (PIR) motion sensors as part of ongoing maintenance.	PIR sensors detect people moving in the building and can be used to automatically switch lights off following a set period of inactivity and on again once movement is detected.	Energy is saved by the PIR sensor switching on and off the lights automatically. PIR sensors require periodic checking to ensure they are functioning correctly. It is important to quantify how long it takes for the PIR to switch off after movement has been detected.	Are PIR sensors in place? When were they last checked / maintained? What are the timings for any existing PIR sensors? This can normally be adjusted for example: Core hours 20 minutes* Out of hours to 10 minutes*. **Note this is just a guide and will vary business to business.*
Install Photocell sensors as part of ongoing maintenance.	Installing photocell sensors can reduce the amount of artificial light used to light a space when there are adequate levels of natural lighting.	Photocell sensors automatically dim artificial lighting levels when there is enough natural light entering a space.	Does the perimeter lighting have photocell sensors in place? When were the photocell sensors last checked / maintained?
IT Systems			
Consider current requirements for 24/7 Main Equipment Room (MER) and Satellite Equipment Rooms (SER) and any additional cooling plant.	On site IT data rooms require cooling which uses a lot of energy in addition to the IT server requirements.	Investigate the optimum strategy for onsite IT equipment by looking at O&Ms and talking to IT representatives from Occupiers.	What is the extent of onsite data rooms? What temperatures are the rooms currently being cooled to? Are temperatures consistent between MER's? Are there opportunities to reduce cooling in line with Industry Benchmarks for data rooms? Have IT colleagues been consulted and provide consent to any changes?

Links

ASHRAE TC9.9 Data Center Power Equipment Thermal Guidelines and Best Practices

GN 4.6: Undertaking an energy audit | Better Buildings Partnership

BBP_How to_GN 2.1 An asset register.pdf (betterbuildingspartnership.co.uk)

The Carbon Trust's Lighting Guide

The Lighting Industry Association Lighting Control Guide

CIBSE: SLL Code for Lighting (2022)

Phase 3: How to maintain and improve the performance of the building above and beyond?

By going through the optimisation process in Phase 2, the building can be optimised for energy performance. The next phase involves putting in place measures to further improve the building performance, including identifying areas to invest to improve the building efficiency in the longer term in line with building lifecycle plans. This may include retrofitting of existing plant and the installation of new innovative technologies to improve the operational energy efficiency of the building in the future.

Phase 3 sections include:

WHAT	WHY	HOW	QUESTIONS
Energy policy, planning and target setting			
Ensure there is an Energy Policy for the site.	An Energy Policy sets out the high-level energy intent and describes the framework through which energy will be managed.	The policy should demonstrate a commitment to improving energy performance and can provide a foundation on which to develop any wider Energy Management System.	Who are the key stakeholders who should be involved in the development of an Energy Policy? Who should the energy policy be shared with once established?
Engage with the landlord and occupiers in setting targets for the building.	An energy reduction target will formalise the intended objectives for the building, within an agreed specific time frame. A target will focus management attention and enable stakeholders to engage and buy into what the building is aiming to achieve.	An energy reduction target should be established for the site. • Energy Intensity Targets (e.g. per person, per m^2) • Absolute energy reduction targets (kWh savings compared to previous period) • Additionally Net Zero targets and SBTi targets should be considered.	Does the Landlord have a target? Where will the financial budget come from to support the successful implementation of the energy action plans required to achieve the target (e.g. Capex)? How can senior management and key stakeholders be encouraged to endorse the targets?
Co-ordinate the creation of an energy management action plan for the site. Outline how the policy will be implemented and the targets for the building achieved.	Normally with the help of specialist consultants, you will be able to establish a pathway to achieving targets, and the measures that need to be implemented for this.	This should include a detailed action plan with clear roles and responsibilities and resources. The Asset Manager for the property should also be involved in the development of this strategy especially in relation to understanding and authorising any capital investments that may be required to enable the building to achieve the set targets.	How does data monitoring and targeting support the delivery against targets? Where does operation and control enable efficient delivery? What elements are outside of your control, and will need engagement with stakeholders and/or capital investment?

WHAT	WHY	HOW	QUESTIONS
Technical review			
Review the asset register and lifecycle plans for the equipment on site.	This will enable a detailed assessment of what is on site, its age/life cycle, the current maintenance strategy for equipment on site. If no lifecycle plan (including Net Zero Pathway) has been completed, you should look to complete this with a competent consultant.	The lifecycle plan should clearly break down costs associated with each recommended improvement project. For funding options (see Figure 13).	What was the date of installation of key energy consuming equipment? When was the equipment last upgraded? Has a lifecycle assessment been conducted? When was it last done? Are the recommendations from the lifecycle reporting in accordance with other long-term asset strategies and aligned to Net Zero Carbon?
Review Planned Preventative Maintenance (PPM) reports and EPC enhancement considerations.	These will detail the age and efficiency of the plant and any recommendations to improve efficiency. .	Use the Government register to review the EPC report for the building and review the recommendations and potential impact (low, medium, high) of implementing these. Locate PPM reports to understand where plant may need replacing or upgrading.	What actions can be brought forward to realise energy cost savings in the short term (before end of life)? Going beyond traditional lifecycle planning, considerations should be made for opportunities to achieve net zero and capex requirements.
Review TM44 Air Conditioning Reports.	TM44: Inspection of air conditioning system Reports are a requirement to meet Energy Performance Buildings Directive (EPBD) compliance. The inspection focuses on refrigerant systems.	These are available here: Find an energy certificate In-line with lifecycle planning and changes to Fluorinated gases (F-gas) requirements you should seek to ensure that low global warming potential (GWP) and ozone depletion potential (ODP) refrigerant gases are used. The monitoring and reporting of release of F-Gas is often the responsibility of the PM.	What are the recommended actions for the site from the TM44 Report? What will the impact on energy efficiency be?

WHAT	WHY	HOW	QUESTIONS
Technical Audit: Commission a building specific assessment to understand the fabric and services of the building in more detail.	This will enable the development of detailed recommendations on what needs to be done to fundamentally improve the building's energy performance, including via Capex.	The audit should deep dive on the current building specification (both fabric and M&E) looking at opportunities for both "quick win" up to "best practice" capital investments. Ideally the scope of works for this should also include virtual modelling to assess the impact of various interventions. Note: Financial Budget will need to be allocated to this activity.	Does the consultant have access to the required data gathered under Phase 1? How detailed is the energy data e.g. is it sub metered to each tenant demise? Is the audit scope of works and requirements brief clearly defined? Are the outputs aligned with client requirements for energy efficiency? See Figure 12 Technical Energy Audit Guidance.
Review the findings of the technical audit report.	This report will provide specific recommendations on the steps required to improve energy performance. The technical audit report will form the basis for prioritising capital works to be undertaken and to enable quotes for works to be requested.	After consideration of the Lease Terms and recoverability position, you should assess and report to the budget holder: 1. Investments that may be funded through Service Charge e.g. Replacement of BMS or controls, installation of submetering. 2. Investments that should be funded through Capex investments. • Low Cost (Short payback) e.g. Window film to reduce solar gain, replacing old lights with energy efficient ones, installing PIR motion lighting control. • Economically viable large energy efficient projects e.g. PPM and asset life cycle replacement e.g. replacing Gas boilers with Heat Pumps. Note: Beware of unintended consequences e.g. a potential increase in embodied carbon by replacing existing equipment with newly sourced and manufactured equipment.	Does the lease allow for recoverability of the investments suggested? (replacement/repair vs improvement). What is the payback period for each investment decision? For more information see Figure 13 Funding options.

FIGURE 12: TECHNICAL ENERGY AUDIT GUIDANCE

Technical Energy Audits are a great opportunity to engage with industry experts to establish a detailed and site-specific roadmap for lowering the energy use intensity (EUI) of a building with professional input. An energy audit is also an important opportunity, that should not be missed, for you to engage and get involved with the auditors to ensure that the outputs of the audit are tailored to your buildings specific situation, build on the information you may hold and opportunities you may have already identified for your building and truly support your energy demand reduction objectives for your building.

The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) has identified 3 levels of energy audits for commercial buildings. You will need to establish which level of Audit is most relevant to your situation.

Below is a very high-level summary of each level:

Level 1
The purpose of a Level 1 audit is to identify the rough potential for energy savings in a building. It includes:

- Benchmarking
- A list of recommended energy efficiency measures

Level 2

This is a more detailed audit than Level 1, where auditors spend more time on site undertaking a detailed building survey and speaking with onsite teams such as FM. The Level 2 report includes all the information from Level 1, plus:

- Site-specific analysis of recommended energy efficiency measures, including expected costs, savings and paybacks (or ROI)
- Summary of the building energy-consuming systems, and opportunities to optimise

Level 3

This audit builds on Level 2, with energy use monitoring over a more significant period. Recommendations are developed into actual supplier quotations.

More information on the differences between each audit level and how to choose the right level for your situation can be found here.

FIGURE 13: FUNDING OPTIONS

Capital Expenditure (CapEx)
Capital expenditures are purchases made to buy new assets or add value to existing ones, with the aim of improving a building's performance in the future. This could be refurbishing an existing building, including any structural upgrades to the building fabric and replacement of existing equipment.

Operating Expenses (OpEx)
OpEx includes expenses that are incurred through running the daily operations of a building. These are short term and regular, and include items like:

- Utilities
- Property tax
- Wages

Operating expenses are sometimes tax-deductible.

WHAT	WHY	HOW	QUESTIONS
Metering enhancement strategy			
Metering of equipment and areas.	An effective Automatic Meter Reading (AMR) system can allow the monitoring and targeting of energy reductions in real time.	Measuring consumption and its trends will help identify energy saving opportunities. By using data from advanced sub-meters, it is also possible to review how system components, such as lighting and HVAC systems, for example, compare to industry standards e.g. CIBSE Guide F. Due consideration should be made for metering deployment that meets the requirements under NABERS. A metering system and strategy should be developed and aligned to the property. Where necessary a consultant specialising in metering should be engaged.	What is the extent of main and submetering on site? Where are the gaps in measurement? Is the data clear on what areas/ equipment is being measured?
BMS enhancement strategy			
Ensure centralised control of all plant and equipment.	The BMS coverage should be assessed by a specialist and any equipment not under centralised control should be identified.	The BMS should have a modernised control strategy to make use of: • Variable temperature control • Variable volume control • Weather dependent adjustment controls • Demand-led control • Reduce simultaneous Heating and Cooling scenarios • Dynamic occupancy time-clock controls	What are the potential options for updating BMS strategies using inhouse capabilities vs outsourced subscription-based performance services which offer remote monitoring?
HVAC plant enhancement			
Consider a variable demand led system to modulate the set point of the primary HVAC plant (boilers, chillers & AHUs) based on the demand of the building.	A demand-based system will use less energy as the energy is tailored to the demands of the building rather than the potential heating and cooling requirements of the building (For more information see Figure 9).	Review the HVAC control strategy and ascertain whether a demand led strategy can be implemented. Note: Investment will be required to develop control strategies and a BMS specialist will be required to implement changes to the description of operations (DesOp).	Can you practically move to demand led control and what is the cost & the return on investment? How will this be funded?

WHAT	WHY	HOW	QUESTIONS
Pumping: Review the pumping control strategy for the building.	There are good energy savings potential in reviewing flow rates to understand if you are pumping more water around the building than you need to.	Options to change from a constant volume system to a variable volume strategy should be considered with appropriate technical colleagues as this will allow better control of flow rates. Note: Such a change will normally require fundamental modifications to the system to enable the change. However, pumping can be a significant energy load with the change in pumping strategy providing the opportunity for potentially significant energy savings.	What is the current pumping control strategy e.g. constant volume or variable volume? What are the run times that water is pumped around the building? What are the requirements for the building for water pumping e.g. can the operating times be reduced?
Specification review			
Check that the HVAC systems are specified correctly for the way that the building is currently being used and operated.	It is important to ascertain whether the building is specified correctly for how it is being used. Overspecification is an industry wide problem at the point of design to minimise risk.	Undertaking an assessment of the equipment on site against the requirements for the building will help form an understanding of the building specifications and any changes that may be required. You should work with your technical colleagues to understand whether the plant is currently specified correctly for the way that the building is currently being used.	Are the boilers being utilised to full capacity? Are there opportunities to make the systems more modular to meet the heat loads of the building? Can the boilers be modulated down to part load operation? Can the sequencing of the lead boiler be changed to improve life span? See Figure 14.
Domestic hot water			
Consider the benefits and savings opportunities of moving from centralised boilers to point of use.	This will minimise pumping and distribution losses around the building.	By moving from a centralised system and calorifier to point of use systems.	How much hot water is the building using? Can this be split by area? Where and how is hot water being used in the building? Is there an opportunity to move to decentralised systems or point of use systems to generate hot water in the area where it is needed?

WHAT	WHY	HOW	QUESTIONS
Lighting			
Consider recommissioning existing lighting system controls to ensure they are fully optimised.	To ensure that the existing lighting and control system is fully functional and satisfies owner/occupier requirements as well as being optimised for energy efficiency.	By working with a lighting controls specialist to determine how the lighting control system is currently operating and what the opportunities are to improve performance.	How much control is there over the lighting and are all the systems integrated? Are the sensors working as they should? Are there any lighting related complaints from occupiers?
Develop a new lighting control strategy.	A lighting control strategy will enable energy optimisation through agreed operating times, lux levels and control parameters.	A qualified lighting consultant should be engaged to undertake this assessment.	What are the opportunities to reduce energy consumption from lighting? Are any proposed changes to lighting levels still meeting health and safety requirements to ensure occupant safety?

FIGURE 14: SPECIFICATION REVIEW / ENERGY DENSITY

HVAC systems that are oversized are potentially susceptible to higher maintenance costs, increased failure rate and lower life expectancy. In addition, there is a high risk for the associated equipment to operate less efficiently when compared to similar applications where the plant is correctly sized. Whilst the above is the general rule, there are exceptions where oversized systems can operate efficiently if designed and controlled suitably.

Having an awareness of these risks and undertaking the correct due diligence early in the process will enable appropriate measures to be applied. The following steps will help you establish the status of the plant and requirements:

- Undertake a building heating, cooling and ventilation study to establish the actual building loads
- Review the existing plant capacity versus the actual loads
- Review the tenants' lease agreements in regard to capacity allocation
- Establish the magnitude of the over/under sizing and explore remedial actions (controls optimisation and strategy, plant replacement, design set points, tenant liaison etc.)

It is advisable that prior to wholesale plant replacement, the existing plant's embodied carbon is considered. Plant replacement maybe a requirement, but it should only be applied as the last resort, in instances where the existing (oversized) plant is within its life expectancy.

FIGURE 15: VERIFYING PERFORMANCE OF AN ENERGY EFFICIENCY PROJECT:

The International Performance Measurement and Verification Protocol (IPMVP) provides a framework that is used to:

1) verify a project has the potential to perform and save energy, and

2) quantify site-level energy and cost impacts from a targeted project.

Both of these components are essential to the measurement and verification (M&V) of energy performance savings once implemented. IPMVP is based on the premise that Energy savings in a facility cannot be directly measured because savings represent the absence of consumption or demand. Instead, savings are based on measurements of each fuel type or energy source impacted within a given measurement boundary before and after implementing a project, making suitable adjustments for changes in conditions.

WHAT	WHY	HOW	QUESTIONS
Incorporate energy efficiency within the procurement of FM requirements to support a MfP approach. If outsourced, the FM contract is of critical importance to the optimisation of a building's operations			
Management procurement: Performance contracting.	3rd party contractors will be focused on delivering against their contractual requirements. If energy efficiency is not included in the specification, it is unlikely to be prioritised. By correctly specifying requirements within the contract, all parties will have clarity on what the most important drivers for contract success are.	Consider whether the existing maintenance contracts are incentivising and prioritising energy efficiency. Provide guidance on setting out how energy efficiency and performance outcomes can be integrated into the procurement of M&E services to ensure the building and plant are being maintained and operated effectively. Examples include: • Absolute energy reduction • No cost energy efficiency improvements delivered as part of BAU. • Identification of energy savings opportunities requiring capital investment.	Where are the contracts held? What are the details of the contractual arrangements relating to energy efficiency? Is there a clear specification of works and contractual KPI's around energy efficiency? What is the competence of the staff working on the contract? Do they have the necessary skills to deliver performance in relation to the energy performance of the building? Are there policies and procedures to support the delivery of contractual requirements? Do incumbent suppliers have a track record of identifying energy efficiency in the building? If performance is proactively monitored there is a reduced risk of failure as issues are addressed proactively. See SFG 20 Section 4.4 Is the supplier adopting a Condition Based approach to Maintenance to reduce the risk of plant failure/energy wastage? For more information see SFG20 section 4.4? If looking to appoint a new supplier, questions should be asked about the supplier's track record in identifying and delivering energy savings, with the supplier asked to provide examples by way of case studies.

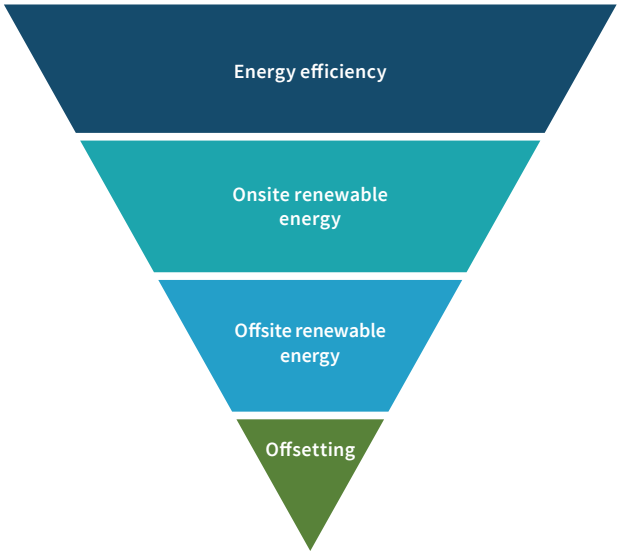
WHAT	WHY	HOW	QUESTIONS
FM supplier to establish an energy optimisation plan	The FM suppliers act as stewards for the mechanical and electrical operations of the site. Gaining buy-in from third parties to improve the energy performance of buildings under their management is a pivotal mechanism by which further energy savings can be delivered.	The service provider should provide an energy optimisation plan. They should do this to a recognised industry standard e.g. ISO 50001. The service provider should develop processes to address energy reduction, optimise plant and deliver property specific improvements. This could include: • Annual objectives • An optimisation action plan • Quarterly milestone report This will encourage the service provider to focus beyond maintenance standards to a more proactive focus on energy efficiency.	Is there an existing energy optimisation plan? Is it being monitored? Can the contractor / service provider evidence their savings? If the contractor can't evidence their energy savings what are the reasons for this? For example, do they not have access to metering data?
Targets for FM provider.	A target will focus the attention of the supply chain team to improve energy efficiency as well as the responsible management of the building.	Set targets for the FM provider to reduce building energy consumption using their knowledge and control of the building. Examples include: • Absolute Energy reductions e.g. achieving a 5% absolute energy saving a year. • Identification of measures that can be achieved under minor works. • Identification of measures requiring capex.	Is there an annual absolute energy reduction target for the contract? Is the FM provider collecting and reviewing energy data and monitoring consumption trends? Are they comparing this consumption to HVAC operations, lighting controls, BMS controls and any other associated automatic control systems? Are all personnel working in FM operations for the site aware of the targets? Does each person working on the contract understand their role in achieving these targets?

WHAT	WHY	HOW	QUESTIONS
KPIs for the M&E and BMS Contractors	This will enable the performance of the contractor and key priorities to be measured. Effective operation and maintenance of the BMS system is key to energy optimisation.	KPIs for both M&E and BMS Contractors should be established, including: • Key deliverables on how they will recommission the system to ensure that it aligns to the use of the building. • Whole system performance as opposed to individual component performance. • Frequency of assessment of original occupant times and set points vs what is currently in play. • Frequency that calibration tests are undertaken on sensors to calculate that the information being used to regulate energy usage is accurate.	Are contract ambitions aligned around energy efficiency as well as occupant comfort? Are the service providers incentivised to invest time into supporting energy efficiency measures?
Meeting and reporting	An agreed frequency for meeting and reporting will ensure a proactive approach to partnership working.	Establish agreed frequencies for meeting with and reporting from individual subcontractor companies. For example, a management review meeting could take place every 90 days followed by an additional annual review.	What are the headline successes for the performance of the contract in relation to energy efficiency?
Alignment of incentives within contracts.	By aligning incentives across contracts, this will cascade responsibilities across the whole workforce and contract supply chain.	Identify M&E contracts that can be aligned to improve performance around energy efficiency and reduce total cost of operation where investing time and money in energy efficiency leads to a lower cost of operation of the asset.	Are contracts aligned so that opportunities for energy efficiency are flagged and actioned by appropriate parties?

FIGURE 16: UNDERSTANDING WHAT IS A NET ZERO CARBON BUILDING?

Within the BBP's Net Zero Carbon Pathway Framework, "net zero carbon" is achieved when the carbon emissions emitted as a result of all activities associated with the development, ownership and servicing of a building are zero or negative.

In delivering their net zero strategies, signatories to the BBP Climate Commitment and those using the framework must follow the principles of the energy hierarchy. This means that they must demonstrate they have made every effort to improve the energy efficiency of their buildings and limit the emission of their portfolios, before employing other measures such as offsetting to cover any residual emissions.



(Source: BBP Net Zero Carbon Pathway Framework)

Links

BBP_How to_GN 4.8 Template Action Plan.pdf (betterbuildingspartnership.co.uk)
BBP Climate Commitment | Better Buildings Partnership
https://ukgbc.org/wp-content/uploads/2020/01/UKGBC-Net-Zero-Carbon-Energy-Performance-Targets-for-Offices.pdf
bbp-low-carbon-retrofit-toolkit.pdf (betterbuildingspartnership.co.uk)

Links to other BBP resources

Responsible Property Management Toolkit

Operational Management

Energy

Supply Chain Management

REEB performance in use Benchmark

BBP_How to_GN 4.1 An energy policy.pdf (betterbuildingspartnership.co.uk)

BBP_How to_GN 4.2 Energy Performance Standards.pdf (betterbuildingspartnership.co.uk)

GN 4.2: Energy performance standards | Better Buildings Partnership

BBP_How to_GN 4.7 Energy Benchmarking and Target Setting.pdf

bbp-better-metering-toolkit.pdf (betterbuildingspartnership.co.uk)

Transactional Agents Sustainability Toolkit | Better Buildings Partnership

Core Provisions | Managing Agents Partnership

bbp-low-carbon-retrofit-toolkit.pdf (betterbuildingspartnership.co.uk)

Links to other Resources

TM61: Operational performance of buildings (2020)

TM62: Operational performance: Surveying occupant satisfaction

TM63: Operational performance: Building performance modelling and calibration for evaluation of energy in-use

TM64: Operational performance: Indoor air quality — emissions sources and mitigation measures

BRE Bridging the Performance Gap

Quick Wins to Reduce Building Energy Consumption

Guide_to_Design_for_Performance.pdf (bregroup.com)

NABERS_UK_The_Rules_Energy_for_Offices.pdf (bregroup.com)

ISO 50001

HM Government: Net Zero and Sustainability, Design Guide, Net Zero Annex (Section 2 p 19-22)

ASHRAE Performance Measurement Protocols for Commercial Buildings

IPF Costing Energy Efficiency Improvements in Existing Buildings

RICS International Building Operation Standard

RICS Service Charges in Commercial Property, 1st edition (rics.org)

Improve your NABERS rating | Commercial Building Disclosure (cbd.gov.au)

energy_efficiency_guidance.pdf (cbd.gov.au)

BCO - Delivering_Net_Zero_Carbon_in_the_Workplace

BSRIA BG 54/2018 Soft Landings Framework 2018

BSRIA BG 76/2019 Soft Landings and Design for Performance (free download for everyone) https://www.bsria.com/uk/product/vBG24D/soft_landings_and_design_for_performance_bg_762019_a15d25e1/

BSRIA NZBC NZG 1/2022 Net Zero Carbon Buildings (free download for everyone) https://www.bsria.com/uk/product/nyPAbr/net_zero_carbon_buildings_nzg_12022_a15d25e1/

BSRIA BG 54/2018 Soft Landings Framework 2018

Definition of Terms

AMR Meters: Automated Meter Reading (AMR) is a technology which automatically collects data from energy meters and sends it to a centralised database. This data can support analysis, troubleshooting and billing.

Asset Register: Provides the site team with details of the core plant and equipment within the asset used for the site to effectively function. This lists all major plant and equipment and is the basis for planning scheduled maintenance activities.

BMS: A building management system (BMS) is a computer based, central control system to manage the operation of a building's services, for example, heating, cooling, ventilation, hot water and lighting. If well managed a BMS should optimise energy consumption and improve occupier comfort.

BMS Logbook: Log of all changes to the BMS system including set point/ temperature and time schedules.

Energy Use Intensity (EUI): expresses a building's energy use as a function of its size or other characteristics such as per person.

Fan Coil Units (FCU): Devices consisting of a fan and a heat/cooling exchanger. These are found in HVAC systems of buildings and are used to deliver heat or cooling to an area.

HH Meters: A half hourly (HH) meter records electricity consumption data every half hour.

HVAC: Heating, Ventilation, and Air Conditioning (HVAC) is the system responsible for cooling and heating a building.

Lux Levels: Lux is a standard unit of measurement of light levels/light intensity.

O&M's: Operating and Maintenance (O&M) manuals contains all the information on the operation, maintenance, and refurbishment of a building. The O&M form an important part of the management handover of a building.

Planned Preventative Maintenance (PPM): This is routine maintenance that is scheduled for buildings ahead of time.

Regulated loads: Fixed building services, heating, cooling, hot water, internal lighting.

Solar PV: Solar photovoltaics (PV) is the generation of electric power using sunlight. The solar cells on PV panels capture light and convert the energy into electricity.

Solar Thermal: A solar thermal system uses solar energy to heat up water in a building using solar thermal panels.

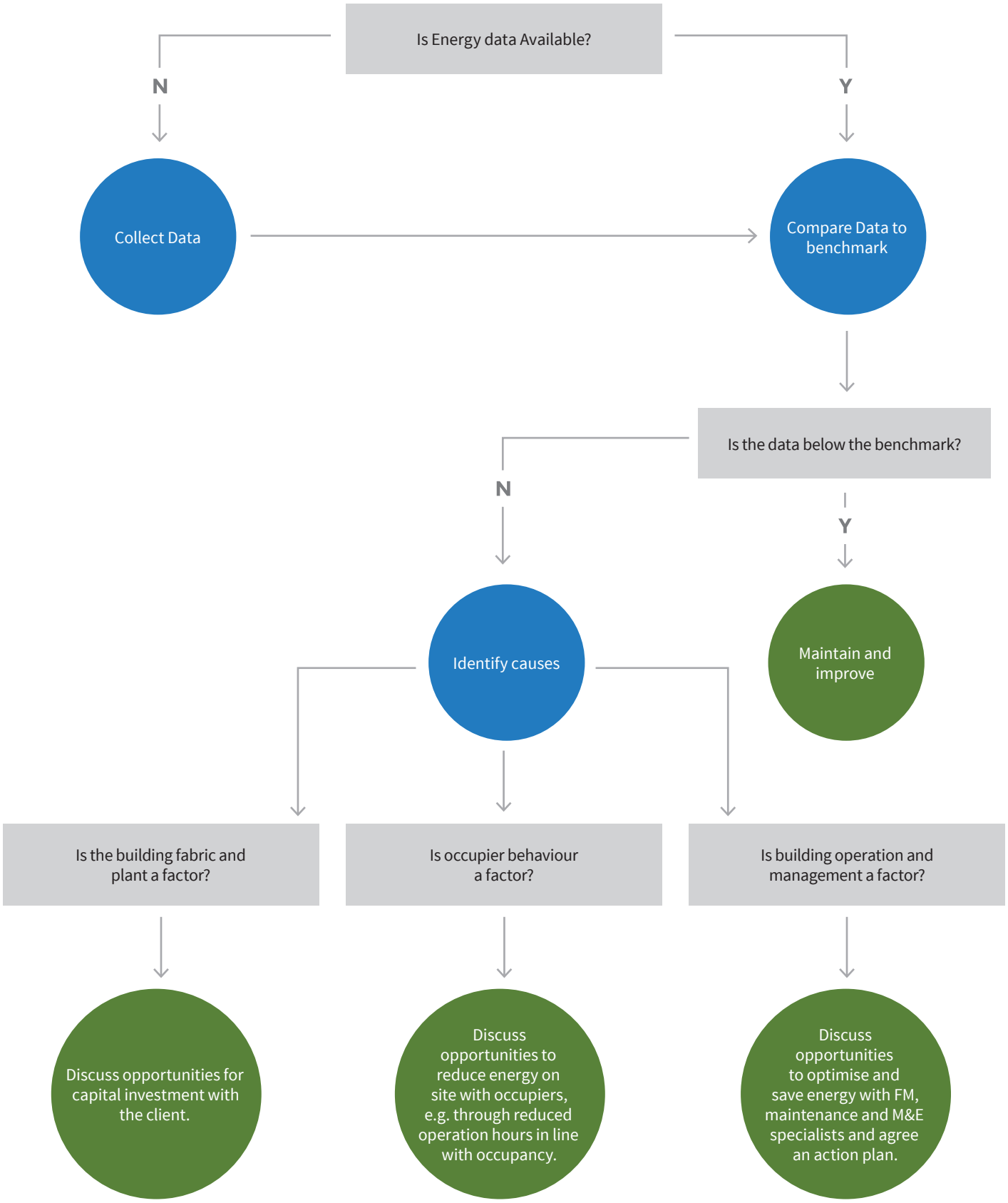
Stranding: When assets suffer from premature devaluation or conversion to liabilities, this is known as asset stranding. This can be caused by environmental factors, such as climate change or environmental legislation.

TM44 Air Conditioning Reports: Statutory Requirement. Undertaken to provide a report to business owners and managers on how energy efficient their air-conditioning is. Having a TM44 inspection every five years is mandatory.

U Values: A U-value is a sum of the thermal resistance of layers in a building, including walls, floor or roof. It includes adjustments for air gaps. U-values generally range from 0.1 (indicating very low heat loss) to 1.0 (very high heat loss).

Unregulated loads: These are different to regulated loads and include plug loads, external lighting, servers and security cameras.

Appendix 1: Decision tree



Appendix 2: Checklist – Managing for performance

Asset Name:

Reviewed by:

Date reviewed:

Task		Commentary, feedback & findings	Suggested Frequency	RAG status
Energy Data & Analysis	Energy data available?		Monthly	
	Quality of data available? Is it based on estimates? Is there sufficient sub-metering to enable EUI calculations for the base building vs. tenanted areas?		Monthly	
	Building performance analysed against previous performance & Benchmarks in line with action plan?		Monthly	
	Performance shared with M&E team?		Quarterly	
Energy Management Action Plan	Action plan developed? Date it was developed			
	Energy audit undertaken and actions added to energy management plan? Date of last audit.		Annual	
	Annual energy reduction target for the building established? (Yes, No, including details of the target)		Annual	
	Plan reviewed and updated? (Yes, No, including details of the target).		Quarterly	
Technical review	Energy profile of building reviewed?		Ongoing	
	BMS Alarms and temperature related helpdesk calls investigated?		Ongoing	
	BMS optimised?		Ongoing	
	Any changes made to BMS?		Ongoing	
	Temperature parameters reviewed?		Ongoing	
	Temperature setpoints optimised?		Ongoing	
	Flow rate and leakage tests conducted?		Ongoing	
	Lighting control optimised?		Ongoing	
	Comms room cooling temperature agreed and standardised/verified across the building and occupier demises?		Quarterly	
	Asset register and lifecycle plans for the equipment on site reviewed?		Quarterly	
Occupier Engagement	Review of building operational hours in line with occupier requirements?		Quarterly	
	Energy champions group convened (PM & occupier)?		Quarterly	
	Energy data shared with occupiers?		Quarterly	
	Occupiers engaged to identify where savings could be made?		Quarterly	

Appendix 3: Team structure for actively managed assets

Who owns the energy performance of the building and how each role contributes:

Asset Manager: Overall responsibility for net zero strategy for asset. Driving environmental and financial performance.

Mechanical and Electrical Engineer: Leading on technical optimisation of M&E plant and equipment. Delivery of technical improvement projects.

Property Manager: Leading on practical implementation of the transition to a net zero building. Liaising with stakeholders on opportunities to reduce energy and other environmental impacts.

BMS Specialist: Leading on the optimisation of the Building Management System and projects to enhance performance and functionality.

Facilities Manager: Leading on day-to-day operations of the building to optimise building performance.

Environment Manager/Sustainability Manager: Monitoring and verifying performance. Benchmarking and Reporting environmental performance.

Contributing companies

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Working Group

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