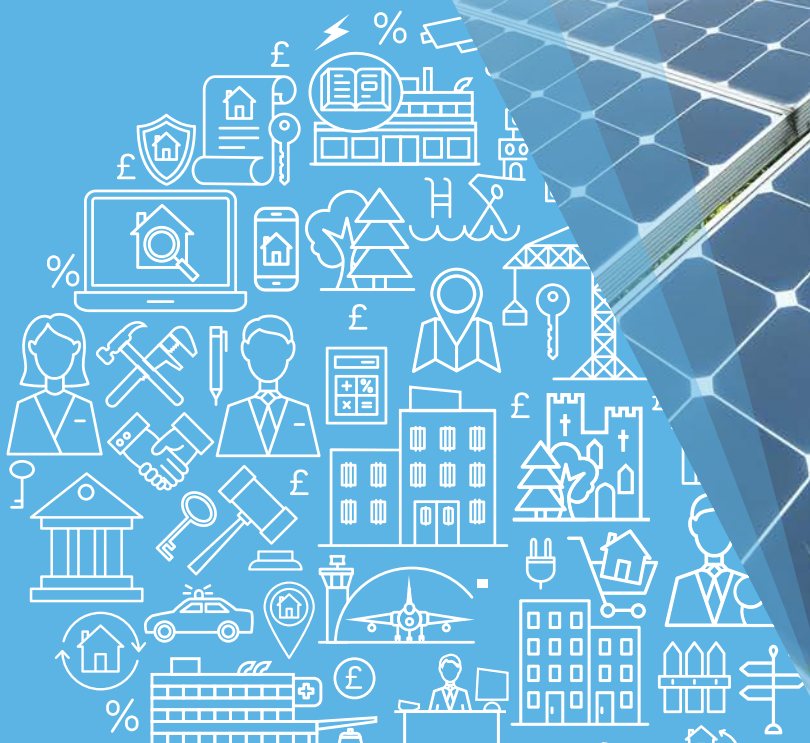
Government
Property
Function

Net Zero Estate Playbook

A guide to decarbonising government property



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Foreword by Lord Theodore Agnew Minister of State for HM Treasury and Cabinet Office

Decarbonising the public estate will play a pivotal role in our fight against climate change. With more than 300,000 individual properties, at a combined value of £515bn, the UK public sector manages, by some distance, the largest property portfolio in the country.

Operating at this scale means that every decision we make and every improvement we implement has an impact. We must go beyond decarbonising our own estate, by leading from the front, setting an example, and bringing industry with us.

There is a very clear direction set out for Government property. We are steadily working towards creating a greener public estate. Since 2010, we have reduced carbon emissions by 50%, but there remains much more work to do. We have made significant progress on encouraging collaboration and co-location between parts of the public sector. We are working to improve maintenance, insulation, and efficiency across the public estate. We are prioritising retrofitting existing buildings where we can, and adopting modern and sustainable methods of construction where we need new buildings.

This Net Zero Estate Playbook is about helping us go further, and faster. It is a guide to support every Government organisation. It takes best practice from around the UK, aligning with government policy and bringing the best advice into one place to inform and improve sustainability strategies and simplify the path to Net Zero.

It provides, for the first time, a methodical step-by-step guide to help government property professionals decarbonise their estate.

This document has been informed, developed, and improved by expert support from our partners. I would particularly like to thank colleagues at the Department for Business, Energy & Industrial Strategy (BEIS) and the Energy Systems Catapult for their insight and advice.

It builds on work already underway across Government. This report will support and complement the Greening Government Commitments, the 25-Year Environmental Plan, and the hard work of estates and property teams across Government who are working tirelessly to make the public estate greener.

I am delighted to support the Net Zero Estate Playbook.

Introduction - Net Zero Estate

- The UK's commitment to Net Zero and what this means for UK Government property.
- What is the purpose of the Net Zero Estate Playbook?
- Who is the Net Zero Estate Playbook for?
- The role of the Office of Government Property in the Net Zero transition.
- The role of key policy holding departments in the Net Zero transition.

The UK's commitment to Net Zero and what this means for UK Government property

In 2008, the UK passed the Climate Change Act, committing the Government to cut national greenhouse gas (GHG) emissions by at least 80% from 1990 levels by 2050, and agree progressive 'carbon budgets' to drive progress toward this target. In 2019, this was amended to require the UK to bring all GHG emissions to Net Zero (NZ) by 2050. This commitment is widely known as NZ, or Net Zero Carbon (NZC), 2050. In the interim, the 5th Carbon Budget (covering 2028 to 2032) requires emissions to be reduced by 57% by 2030 compared to 1990, and the 6th Carbon Budget requires emissions to be reduced by 78% by 2035 compared to 1990.

In December 2020, the UK communicated its new Nationally Determined Contribution (NDC) under the Paris Agreement, which commits the UK to reducing its emissions by at least 68% by 2030 compared to 1990 levels. This underlines the UK's commitment to reducing GHG emissions and to providing global leadership on climate change.

For the UK, the commitments defined above and the UK Government's Ten Point Plan for a green industrial revolution outline how the UK will transition onto the NZ path. As the built environment contributes up to 42% of the UK's total carbon footprint, the efficient management and decarbonisation of property portfolios is a focal point in the UK's transition to NZ. As it is estimated that 80% of the UK's buildings in 2050 are already standing today, we need to ensure that current stock is appropriately addressed, as well as new construction projects.

For the public sector the UK Government sets the ambition in the Clean Growth Strategy, that a 50% reduction in direct public sector emissions would be delivered by 2032 against a 2017 baseline. In order to deliver on this ambition, all public sector organisations should be planning and acting now to reduce their emissions, in particular direct emissions. As highlighted in the Net Zero Strategy: Build Back Greener, decarbonising buildings will support clean, local growth in every region of the UK, while investing in equality of living standards and job creation. It will also encourage investment in innovation to refine processes and technologies to deliver value-for-money and value for the UK economy.

What is the purpose of the NZ Estate Playbook?

The NZ Estate (NZE) Playbook provides guidance to support UK Government departments and public sector bodies to transition their estate towards NZ. It provides Government property professionals with guidance on how to approach the design, implementation, and monitoring of a NZ strategy and delivery programme. The goal is to provide direction on how to adopt a systematic approach to the delivery strategy, and drive consistency in the design, implementation and monitoring of NZ transition across the UK Government estate.

This document is not intended to provide exhaustive guidance for the design and implementation of a NZ strategy for Government property. Further details can be found using the references to external guidance provided throughout, with active hyperlinks where publicly accessible, as well as a linked index in the appendix of this document.

Who is the NZE Playbook for?

The NZE Playbook can be used by anyone responsible for the management of Government property. Therefore, the general term 'organisation' is adopted throughout the NZE Playbook to refer to the user of this guidance. Some essential requirements that organisations should adopt in order to achieve their NZ commitments are highlighted throughout and summarised at the beginning of each section of this document.

This Playbook is a high-level guide to help property professionals understand their current emissions and energy use across their portfolios and the steps to take in designing and implementing solutions and monitoring emissions in the transition towards NZ.

The role of the Office of Government Property in the NZ transition

As a major land and property owner, UK Government must transition its estate to NZ. The Office of Government Property (OGP) sets standards, provides guidance and tools, drives best practice to facilitate this transition and improve capability across Government. As part of this work OGP has developed the NZE Playbook as an initial step to provide guidance and consistency in how to address NZ across the wider Government property portfolio. As aspects of wider Government NZ policy are still under development, further guidance and commitments that emerge will be reflected in future versions of the NZE Playbook.

The NZE Playbook serves as guidance to support the Government Functional Standard for Property (GovS 004). OGP recommends that any NZ strategy should be developed as part of a wider Strategic Asset Management Plan (SAMP), ensuring investment is planned wisely on assets where the organisation holds a long-term interest.

The role of key government policy organisations in the NZ transition

All Government organisations have a key role to play in the delivery of the NZ commitments, including the transition of government property towards NZ. The organisations below have particular roles in driving this agenda forward, which all organisations using the NZE Playbook should be aware of.

Department for Business, Energy and Industrial Strategy (BEIS): BEIS owns the overall policy for UK-wide activity to deliver NZ, including public sector decarbonisation.

Department for Environment, Food and Rural Affairs (DEFRA): Sets out how the Government will tackle the effects of climate change in the 25 Year Environment Plan. It also manages and publishes the Greening Government Commitments (GGC) which set out how UK Government departments and their agencies will contribute towards the Environment Plan by reducing their environmental impacts.

Office of Government Property (OGP): Provides leadership and coordination to help departments in meeting GGC targets and achieving NZ across the Government estate. This is also supported by the Infrastructure & Projects Authority (IPA) whose remit is to improve the way in which projects and programmes are delivered across Government, including property and construction projects.

Government Property Agency (GPA): Has introduced a coordinated approach for the management and decarbonisation of the Central Government office estate. The GPA NZ Offices Programme seeks to make carbon and energy reducing interventions to buildings in the Central Government office portfolio (not just the GPA onboarded estate). Central Government departments should liaise with GPA to establish their NZ strategy for this aspect of their portfolio.

Labelling legend

Developing area

These sections highlight policy environments and topics which are currently under development.

Case study

These sections cover case studies and examples to provide insight behind guidance notes.

Essential requirements

Placed at the beginning of each chapter, the essential requirements listed in these labels provide users with a quick snapshot of the essential items expected from each respective section in order to fulfil minimum expectations of each estate's NZ strategy.

Tools, guidance and more information

Provided at the end of each section, this provides labelling and links all references and resources for the user which are relevant to the content covered.

Net Zero for UK Government Property

In order to understand how to decarbonise UK Government Property, it is important to understand how to define and measure emissions, so that action can be taken on a clear and consistent basis. This section provides an approach for Government Property Professionals to adopt, and also sets out how it fits within the wider framework of UK Government NZ policy.

Within the definition there is also guidance on:

- Assessing emissions within the property life cycle phases.
- Setting activity boundaries to establish how to measure emissions.
- Understanding different types of emissions and how to prioritise them.

The section is split into four parts:

1. Overarching definitions for the UK and Government Property.
2. Life cycle phasing.
3. Setting activity boundaries.
4. NZ scope of emissions.

The NZE Playbook defines NZ for Government Property Professionals, and identifies three potential types of emissions across the property life cycle stages, in line with the Greenhouse Gas Protocol.

NZ definition for UK Government Property

Essential requirements

All UK Government organisations and estates within the scope of this guidance should develop decarbonisation plans for their portfolio, contributing towards NZ for operational emissions and construction. In preparing these plans, organisations will need to clearly differentiate between different asset types, activity required, and scope of emissions to be addressed, ensuring the strategy enables them to meet agreed emissions targets. These plans should be developed as part of a holistic Strategic Asset Management Plan (SAMP) for the organisation, in line with the UK Government Functional Standard for Property.

The UK Government definition of NZ is set out in the Climate Change Act 2008, which specifies that net UK emissions must be 100% lower in 2050 than the 1990 baseline, along with the gasses that are in scope of this requirement: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

The approach to NZ set out in the NZE Playbook has been informed by the UK Green Building Council (UKGBC), and adopts its NZ operational emissions definition (for buildings in operation) and NZ construction emissions (for major renovations but with the ambition for new buildings in the near future) for a number of reasons, as they:

- Enable the modelling of predicted future emissions and reporting delivery as progress is made.
- Are in line with the Greening Government Commitments targets for the wider Government[1].
- Are aligned with the Greenhouse Gas Protocol (GHG Protocol).
- Focus on carbon impacts of property lifecycle stages that can be readily measured and mitigated enable flexibility regarding details such as energy sources.
- Are widely endorsed by industry networks and professional associations.

The following sections provide a breakdown of how this should be applied to estate operations and management, and a portfolio of buildings.

1. The Greening Government Commitments (GGCs) set targets for reducing the Government's GHG emissions and commit the Government to consider sustainability in procurement as well as to reporting publicly on actions on sustainable construction, and any other significant aspects of climate change work.

Definitions

The definitions provided, informed by the UKGBC, should be adopted by any organisation responsible for managing the built environment within the wider Government estate.

Net Zero carbon operational energy – for buildings in operation

When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net-zero carbon building is highly energy-efficient and powered from on-site and/or off-site renewable / green energy sources, with any remaining carbon balance offset.

Note

Offsetting should only be an absolute last resort in the development of a NZ strategy. The purchase of offsets cannot currently be recommended for Government property. For further information on offsetting, see step 3B.4 'Offset Remaining Carbon'.

Net Zero carbon construction – for major renovations and for new buildings

When the amount of carbon emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy.

Note

Whole Life Carbon is not in scope for the NZE Playbook as the concept is currently in its early stages of development. Work in this area is expected to improve with the wider roll-out of Whole Life Carbon Assessments and the wider availability of data and estimates on a whole life basis. More detail is provided below.

Net Zero carbon whole life

When the amount of carbon emissions associated with a building's embodied and operational impacts over the life of the building, including its disposal, are zero or negative.

Note

As NZ Whole Life is still a developing and challenging area, further work will be needed to define the scope and requirements for this approach in a future version of this guidance. At present, organisations should follow the guidance set out in the Construction Playbook regarding the use of Whole Life Carbon assessments to inform decisions at early stages of project definition and option assessments.

Developing area

IPA is currently working on the implementation of the Construction Playbook and the roll-out of Whole Life Carbon assessments across Government departments and ALBs. This roll-out should ensure greater availability of estimates and data for a wide range of building typologies.

Organisational boundaries

In defining the scope for the NZ strategy, property type, activity, and tenure should be considered. DEFRA's guidance on how to measure and report GHGs emissions, which aligns with the GHG Protocol, is particularly useful in cases of shared occupation, if the organisation owns less than 100% of their operations.

Property type

The NZE Playbook covers all of Government property. However, it is acknowledged that this guidance might not be wholly suitable for assets with particularly specialist requirements such as laboratories. Although all Government property is in scope for NZ, bespoke advice, standards and guidance should be used for the decarbonisation of specialised assets.

Property activity

The NZE Playbook provides guidance on the steps required to minimise emissions from the following activities:

- **Maintenance and repair of existing buildings:** A routine work, such as for example the maintenance of windows, necessary to keep the building fabric and systems in good order [2] and facilitate reduced emissions.
- **Retrofitting:** The provision of a component or feature not fitted during manufacture or construction. It is often used in relation to the installation of new systems, such as heating systems, but could also refer to the fabric of a building.

  Historic buildings: The UK is rich in historic buildings that form part of the Government portfolio. A case by case assessment should be conducted, determining whether retrofit is possible whilst maximising the environmental and social performance of the building. For office buildings, the GPA's Design Guide and Historic Buildings Annex should be consulted for guidance. Additionally, Government planning policy can be found in the National Planning Policy Framework (NPPF) and any alterations to a listed building may require Listed Building Consent from the Local Planning Authority.
- **Major refurbishment:** Construction that results in the fundamental remodelling or adaptation of existing elements of the building envelope, structure, and/or renewal of key building services. And where, on completion of the works, such remodelling/renewal will materially impact the performance of the building [3]. The main difference with retrofit is that a major refurbishment implies re-equipping and may include elements of retrofitting.
- **Newbuild construction:** Every new building should aim to meet or exceed NZ expectations. As a minimum, all new-build projects should be able to quantify their NZ impact. The current mandate is to design buildings which can run more efficiently, use less energy throughout their lifetime and with integrated renewables wherever possible. Note that the NZE Playbook does take into account the Future Buildings Standard consultation document, which marks the second stage of a two-part consultation on proposed changes to Building Regulations designed to help deliver NZ ready buildings in the UK. For new buildings, the Construction Playbook should also be consulted in order to understand the art of the possible on all building typologies for the construction stage and to gather the data required to assess targets and timelines.

2. Conservation Principles, 2008.
3. BREEAM, Appendix C.

Note

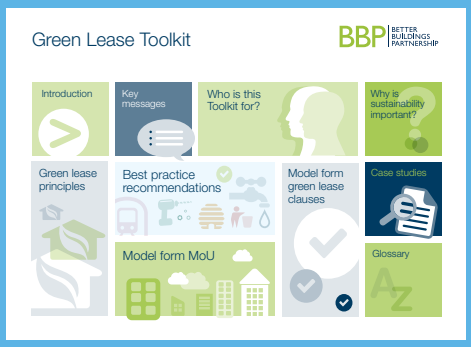
Refurbishment and retro-fitting: Decision makers in the public sector should consider the merits of refurbishment and retro-fitting improvements to existing buildings, rather than commissioning new-build solutions automatically. These measures are included in the HM Treasury Managing Public Money guide, the HM Treasury Green Book and the Government Functional Standard for Property.

Property tenure

This guidance will also provide detail on how to navigate a NZ estate strategy where assets are used for multiple purposes (such as offices and labs) as well as buildings that are publicly owned but partly leased to other organisations.

Users of Government property are increasingly recognising that the Environmental Performance of the buildings they manage and occupy is an integral element of their responsible operations and risk management. For new and renewed leases, owners and occupiers should seek to include green leases / green clauses in leases with the aim of driving down operational emissions, limiting regulatory risk exposure, reducing operational costs and managing reputation. Where appropriate, National Property Spend Control Guidance should be followed. This ensures that organisations occupying leasehold properties plan investment towards achieving NZ while delivering value for money outcomes.

Case study: PRUPIM – Hollywood House



At Hollywood House in Woking, PRUPIM worked in partnership with Skanska as both occupier and contractor to deliver a sustainable refurbishment. The green enhancements enabled PRUPIM to retain Skanska as an occupier, providing a building that lives up to the company's green aspirations. As a result, Skanska was one of the first occupiers to sign PRUPIM's standard lease incorporating "green" clauses and a Green Memorandum of Understanding. Under the terms of the Green Lease, an environmental management plan has been put in place, which sets out targets for the building that both PRUPIM and occupiers are working towards.

Source: Better Buildings Partnership Toolkit

NZ scope of emissions

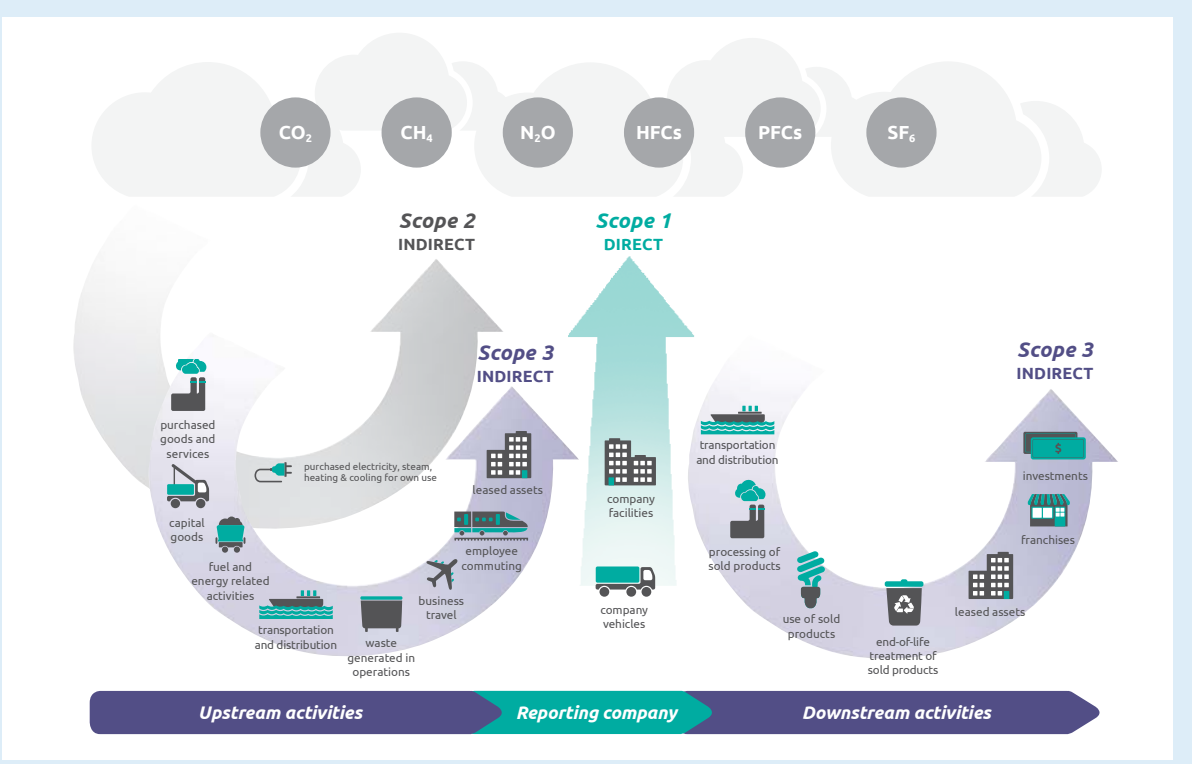
With clarity on the life cycle phase and the boundary of emissions the final definition is to establish the scope of emissions. Emissions from different sources are grouped and captured in several ways. For clarity, the terminology used includes:

- Scopes 1, 2 and 3.
- Direct and indirect emissions.

These terminologies are aligned with each other but offer different interpretation.

- Scopes 1, 2, and 3 (shown in the diagram below) are most commonly known in corporate reporting and defined by the GHG Protocol, repeated in their many standards.

Figure 1: Overview of GHG Protocol scopes and emissions across the value chain
(Source: GHG Protocol)



Scope 1: Direct GHG emissions

Direct GHG emissions occur from sources that are owned or controlled by the organisation, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.: and, emissions from chemical production in owned or controlled process equipment.

Scope 2: Electricity indirect GHG emissions

Accounts for GHG emissions from the generation of purchased electricity consumed by the organisation. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the organisation. Scope 2 emissions physically occur at the facility where electricity is generated.

Scope 3: Other indirect GHG emissions

An optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the organisation, but occur from sources not owned or controlled by the organisation.

Often Scope 1 and Direct emissions are seen as aligned, as are Scope 2 and Indirect emissions. The Scope 1 direct emissions for operational activity are a priority for delivery of NZ. As such heat decarbonisation should be a priority for all public sector organisations, although it is important to reduce all emissions. Action to decarbonise should be taken forward together as a package or bundle of measures which will support the overall goal of decarbonising the public estate, and supporting delivery of NZ.

Note

Decarbonisation should be also considered in relation to energy efficiency and reduction in energy use as described later in the NZE Playbook in Step 3b.3 Reduce Operational Energy Use.

Operational energy carbon emissions

For all buildings in operation, this guidance includes the following emissions:

Figure 2: Operational energy carbon emissions diagram

	Scope 1 emissions	Scope 2 emissions	Scope 3 emissions
Definition	Direct on-site emissions from owned or controlled sources relating directly to operational energy consumption of the building.	Indirect emissions produced from the generation of purchased energy because of the use of grid-supplied electricity, heat, steam, and/or cooling consumed by the entity.	All indirect emissions (not included in Scope 2) that occur in the value chain of the entity's operational performance.
Example	Emissions from combustion in on-site or controlled boilers and power facilities, such as backup generators or incinerators on large sites. It also includes refrigeration.	Use of purchased electricity, steam, heating or cooling.	Transport emissions related to the operational use of the building e.g. emissions from civil servants commuting to work or domestic business flights as it is part of the GGCs.

For the drafting of this guidance the focus has been on energy and refrigerants, and other emissions related building activity has been excluded. It is also recognised that usage associated with transport such as petrol and diesel vehicles is not captured, though electric vehicle (EV) charge points should be taken into consideration, with installations adding additional electrical demand.

Construction energy carbon emissions

For major renovations and new buildings, this guidance addresses the following emissions [4]:

Figure 3: Construction energy carbon emissions diagram

	Scope 1 emissions	Scope 2 emissions	Scope 3 emissions
Definition	Direct on building site emissions (non-traded) from sources within the boundaries of the building controlled or owned by the entity.	Indirect on-building site (traded) emissions because of the activities at a community power plant for providing the energy consumed on the construction site.	Indirect operational and embodied emissions (not included in Scope 2) associated with the building construction and maintenance.
Example	Emissions from combustion in owned / onsite or controlled boilers and power facilities (backup generators or incinerators) as part of construction works.	Energy used to heat and power construction works for new-builds.	Upstream, downstream emissions related to the before-use phase of the buildings, e.g. raw material extraction for metals or after-use activities (thermal recycling and waste disposal).

Note

Organisations need to focus on reducing their scope 1 emissions as a priority. However, at the same time, they should also consider ways to reduce their scope 2 and 3 emissions.

However, note that the UK electricity grid (scope 2) is undergoing substantial decarbonisation due to the increase in renewable generation. These carbon reductions are not attributable to the organisation specifically. Installing renewable generation on buildings will help offset the amount of grid electricity that is imported, however there is a diminishing carbon benefit over time due to the decarbonisation trajectory. This highlights the importance of targeting scope 1 emissions in order to meet decarbonisation targets.

Whole life carbon emissions

Organisations should consider how they can reduce other indirect emissions that are encompassed in a property's lifecycle. However, whole life carbon is outside the scope of this Playbook due to current limitations in the reporting of carbon from the maintenance, repair, refurbishment and end-of-life stages of a building's lifecycle. This is a developing area that will be captured in more detail in future revisions of the NZE Playbook. As explained in the Government Functional Standard for Property (GovS 004), organisations should adopt a whole life asset management approach to determine the whole-life costs of government property assets. This should include consideration and measurement (where feasible) of whole-life carbon impacts, particularly in the design and planning stage for new builds or major renovations. For instance, the Construction Playbook (IPA) encourages the use of whole life carbon assessments in project definition and option assessment. The GPA NZ and Sustainability Design Guide, exclusively for office estate, also encourages the estimation of a building's carbon impact over the life of the asset to inform construction.

4. Scopes are formed from the calculation methodology from the GHG Protocol Corporate Accounting and Reporting Standard.

Figure 4: Further resources for Net Zero definition for UK Government Property

References and resources	Use / relevance
Government Functional Standard – Govs004 for Property	Guidance around setting expectations for the management of corporate functions across Government.
Greenhouse Gas Protocol's Corporate Value Chain Accounting and Reporting Standard and Greenhouse Gas Protocol Corporate Accounting and Reporting Standard	A universal viable baseline in scope that can be applied to any type of entity, across all sectors and in any context. Additionally, this guidance aims to assist Government entities with the application and interpretation of the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard.
GPA Net Zero and Sustainability Design Guide	Design guide for use for office buildings with Government portfolio.
The Construction Playbook	Guidance on use of whole life carbon assessments to inform decisions at early stages of project definition and option assessments.
DEFRA Guidance on how to measure and report GHGs emissions	Provides detail on how to determine the parts of the organisation used to define the accounting and reporting of GHG emissions.
Historic Buildings Annex	Guidance on determining retrofit options for Government Historic Buildings portfolio.
National Planning Policy Framework (NPPF)	Location of Government planning policy for guidance.
Listed Building Consent	Requirement for alterations of listed buildings, to be obtained from Local Planning Authority if applicable.
Future Buildings Standard consultation document	Second stage of a two-part consultation on proposed changes to Building Regulations designed to help deliver NZ ready buildings.
HM Treasury Managing Public Money (MPM) guide	Includes considerations of the merits of refurbishment and retro-fitting improvements to existing buildings, rather than commissioning new-build solutions.
HM Treasury Green Book	Includes considerations of the merits of refurbishment and retro-fitting improvements to existing buildings, rather than commissioning new-build solutions.

Roadmap to Net Zero

A common framework across Government should be shared and encouraged in order to streamline and measure progress. It also allows cross-Governmental benefits to be adopted through the sharing of knowledge and insights through the common approach.

Estate decarbonisation plans are a component of the overall organisational NZ strategy and should not be developed in isolation. To drive consistency, the NZE Playbook sets a high-level NZ Estate Strategy, detailing the common steps to develop (Steps 1-4) and implement (Steps 5-6) a successful NZ strategy as illustrated below. These steps can be applied independently and may not always be applied in succession. The strategy should include governance, roles and responsibilities, information (cost estimates and energy data) management and baselining, technical solutions and procurement. However, whilst the NZE Playbook focuses on the technical content and aspects around delivery, it includes less information on aspects such as skills, capability and capacity building for delivery, which will need to be considered at each step.

Decarbonisation is not a quick fix and is likely to be delivered over a sustained period of time, so this Playbook focuses on the management and structuring of the overall programme, as well as the beginning of the delivery through the commissioning of projects. The majority of properties in the estate or portfolio are likely to be existing and therefore the Playbook focuses on the upgrading, retrofitting or refurbishing of existing stock. New buildings are treated differently and to avoid confusion a separate Appendix: How to approach new buildings pulls out their treatment with references throughout.

Figure 5: The Net Zero Roadmap

	Actions	Essential requirements
Step 1: **Establish governance**	• Develop NZ governance structure. • Assign roles and accountabilities. • Agree processes and procedures.	• Initial reporting structure. • Assurance needs met. • Assigned RACI. • Autonomy and authority limits regarding decisions. • Service commissions arrangements in place.
Step 2: **Baseline and scope**	• Understand the estate. • Establish the baseline. • Sort and set the NZ scope properties.	• Maintenance of a property and site register across an estate. • Initial baseline energy model. • Defined NZ Scope.
Step 3a: **Refine and explore**	• Set a NZ target. • Refine the NZ target. • Long-list the NZ options. • Integrate with Strategic Asset Maintenance Plan. • Model and assess.	• Confirmation of NZ target alignment with UK Government NZ commitments. • Technical consultation against long-list of options. • Agreement and selection of assessment method. • Updated energy model against long-list options.
Step 3b: **Develop the plan**	• Plan the steps to reduce construction impacts. • Assess how to reduce operational energy through decarbonisation and renewable energy.	• Incorporation of modern construction methods. • Potential decarbonisation plan integration with asset management strategies. • Detailed modelling of energy, emissions and cost impacts.
Step 3c: **Refine and sign-off**	• Use assessment methods for assurance. • Understand project feasibility and install sub-meters. • Approval and sign-off.	• Ensure projects and equipment meet Government Buying Standards. • Feasibility studies where interventions are 'non-standard'. • Approval and sign-off by SRO.
Step 4: **Approve and fund**	• Build a Green Book business case with a qualified practitioner. • Sign-off and approve the business case. • Apply for NZ funding.	• Compliance with Green Book guidance with qualified oversight. • Detailed modelling with 'do nothing' approach modelled against. • Reporting and compliance plan for fund applications.
Step 5: **Go to market**	• Refine the requirements. • Select the procurement vehicle to use. • Conduct procurement. • Evaluate and award contract.	• Compliance with Green Book appraisal and evaluation guidance. • Initiation and running of procurement exercise. • Evaluation and award. • Signing of contracts and plan governance.
Step 6: **Deliver and track**	• Deploy delivery governance. • Monitor and track NZ costs and benefits through and after delivery.	• Deployment of delivery governance team. • Contract manager assigned with good knowledge of active contracts. • Active tracking of associated costs, energy and GHG emissions.

Step 1: Establish governance

To develop and successfully deliver a scaled Organisational Estate NZ strategy, a cohesive, capable and effective decision-making governance structure is necessary to drive and embed the required transformation in an effective manner. The governance structure is likely to require review as the NZ strategy progresses and gains maturity, therefore all the planning review points should be scheduled. Considering that every organisation is different and will interpret this differently; however, this section provides guidance and suggestions on the high-level requirements for a NZ governance framework across five dimensions which should be considered throughout the duration of the programme:

Figure 6: Step 1 inputs and outputs

Inputs	Outputs
• Principles of NZ Strategy. • Wider corporate and organisation governance. • Project governance policy (including any instruction and spending gateways). • Available resources to allocate against organisation's NZ estate strategy.	• Flexible NZ Governance Framework and how it will integrate into the organisation. • High level RACI of programme over time. • Initial documented processes, responsibilities and reporting requirements. • Identified initial NZ management team with appraisal of resource requirements. • Sign off requirements / responsibilities for NZ.

Essential requirements

A NZ governance framework that will embed, integrate and complement the organisation's existing property governance structure whilst establishing and defining the following required governance components:

- Reporting structure.
- Assurance needs.
- Accountabilities and responsibilities.
- Degree of autonomy.
- Authority limits.
- Decision-making roles and rules.
- Arrangements for commissioning additional services.

Although the NZ governance structure will likely evolve over time, the above components should be considered and reviewed before progressing further and developing a NZ strategy; they must also be developed prior to compiling the business case. For more information regarding the end-to-end project governance setup, organisations should consult the UK Government functional standards GovS 002: Project delivery and GovS 004: Property.

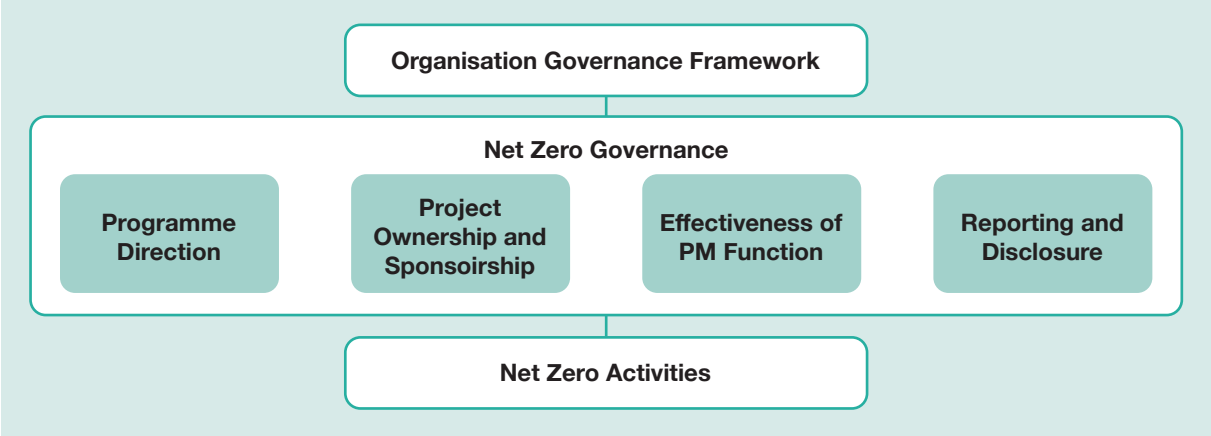
1.1 Governance structure

This guidance focuses on the governance structure at an organisational level. When a project is initiated separate project governance should be put into place, interlinked to the wider programme. The governance structure must reflect how the components of a NZ strategy are interrelated and interact with the existing organisational governance activities which are already in place.

The governance structure must define who is involved detailing a clear set of actions for each, that provide confidence to senior leaders and stakeholders that work is controlled. It must provide for monitoring that the work is on track to deliver against an agreed timeline, if the tasks set out are being undertaken and if not what the barriers are, with appropriate escalation routes, and how the work is aligned with the organisation's overall policy or strategy.

The governance structure is likely to identify and include specific committees, teams, and external parties who have responsibility for delivery. Independent review of progress could be used as a mechanism to check progress. Although this structure will depend on the organisation in question, it must allow for core NZ governance activities, as reflected below:

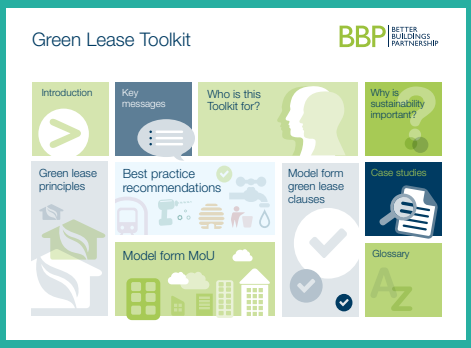
Figure 7: Core Net Zero governance activities diagram



Each activity in the NZ Governance framework should be embedded within existing organisational governance and not be seen as a discrete framework that operates independently. The aim of the NZ governance structure is to provide the key reporting lines between the teams responsible for carrying out NZ activity in order to bring the necessary assurance required by the existing organisational governance framework. However, it is likely that stakeholders from across the whole organisation will need to contribute to the delivery of a NZ strategy and therefore, having a governance structure that connects these stakeholders helps engagement.

Case study:
British land 10 Exchange Square

At 10 Exchange Square, British Land brought together all parties involved in the property's construction to work collaboratively on sustainability initiatives. Between 2000 and 2012, this collaborative approach saved 1,530 tonnes of CO2, diverted over 220 tonnes of waste from landfill, and saved £235,000 on occupiers' energy and water bills during that timeframe.



A well-established Green Building Management Group provides a forum for all parties to agree energy saving initiatives and monitor progress, notably through data provided from the new metering system and optimisation process. All members are asked to sign a MoU and meet at least twice a year.

Source: Better Buildings Partnership Toolkit

1.2 Roles and accountabilities

The roles and responsibilities for a NZ strategy should be defined with individuals assigned clear accountability for activities, outputs, and outcomes. Each organisation should implement roles to suit the scale and needs of its NZ strategy and governance structure. These roles might be throughout the whole organisation, particularly the estates team and not limited to a sustainability or NZ team. This would support decarbonisation through implementation activities such as reactive maintenance works and life cycle replacement programmes.

Characteristics of the roles should consider:

- **Seniority of those showing leadership** – including grade and level, influence to ensure that decarbonisation is supported across the department, ability to enact and support escalation of issues through their leverage and influence with peers, and secure funding.
- **Tiering** – providing an appropriate span for control (e.g. between sites and portfolios).
- **Resourcing** – team support reflecting the amount of workload required as it evolves through the different steps This may need to consider internal and external resources as needed and dependent on skills.
- **Skills** – appropriate skills and expertise available to roles for the fulfilment of duties dependent on the task in hand and the stage of the programme.
- **Contracting** – external resources utilised as needed. Note – best practice is to embed NZ responsibilities into existing roles where suitable as many different functions will have crucial parts to play.
- **Integration** – implement NZ roles and principles within existing organisation resourcing.
- **Accountability** – supply-side unbiased and neutral advice to support decision making, evaluation of benefits, ensuring that responsibility for the appropriate delivery requirements is understood and that the individual is tasked and able to ensure that they deliver.

Resourcing and capacity constraints are a common issue across organisations; any agreed resourcing framework should be able to scale as needed. Specifically, for large and complex

projects, the IPA may also seek assurance that suitable delivery capacity and capability is in place. This is to make sure that the project is delivered efficiently and effectively.

Typically, the following roles would sit throughout the organisation and the NZ governance structure. Work may be needed to define the responsibilities for each of these roles.

Figure 8: Common roles and responsibilities

Function	Common key roles		
Senior leadership	SRO.	NZ Board	Finance Director.
Financial / commercial	Commercial Lead and Contract Management.	Finance Lead.	Market Risk Professional.
Technical	Design & Engineering (incl. Modelling techno / economic).	Technical Assurance.	Sustainability, Energy, Estates or Project Engineer.
Delivery	Programme Lead.	Programme Manager and / or Project Manager.	Delivery Team or Partner (it is likely there will multiple delivery routes).

The above roles are illustrative – for example, estates teams and facilities management (FM) teams have a key role in delivering and operating NZ projects. Sustainability is a technical skill required at different levels across all roles in the Property Profession, with training options available through the Government School of Property. Further details of the Sustainability Technical skill and property roles and responsibilities can be found in the Government Property Career Framework. More examples and potential role outlines can be found in the annex of Functional Standard GovS 002: Project delivery.

Those taking a leadership role (SROs) will be expected to own and sign off the NZ strategy business cases (see Step 4: Approve and fund for details on business case development) and are ultimately accountable for the delivery of the NZ strategy – including the benefits and outcomes. They need to be confident that the roles and responsibilities assigned throughout the governance structure provide the correct assurance to Senior Leadership and Boards, whilst holding the ability to clearly relay and action direction from leadership.

As with any standard resourcing of any normal project or programme through to implementation, the following should be accounted for through a Responsibility Assignment matrix (RACI) as identified by the Government Functional Standard for Property (GovS 004):

- Construction and technical standards.
- Workplace design requirements.
- Diversity, inclusion and accessibility principles.
- Health and safety requirements.
- Security requirements.
- Sustainability requirements.
- Information, data, metrics and targets.

1.3 Process and procedures

An effective set of governance processes should be put in place to enable decision making to be set out. Where existing decision-making processes will be used these should be referenced. The processes should reflect the type of decision that may be made and the

appropriate process for that. This will be different at an organisational estate or portfolio level to a project, for example at an organisational estate or portfolio level decisions may focus on how the whole organisation works towards NZ.

On that basis the design or incorporation into existing governance processes should consider the desired impact against NZ objectives but also seek to support amongst other factors:

- Cross-Government and organisational policy.
- Business (public service) needs.
- Technical, financial and other requirements.
- Active property strategies and related plans.
- Potential for acquisition or disposal of property, whether leased or freehold, or adaptation for optimised use.
- Scope for letting or subletting surplus property.
- Tenure and security of tenure.
- Contracts relating to facilities management and any other property services.

Where existing processes are used they should be checked to ensure that they are fit for purpose to serve the needs of NZ. The processes should define appropriate approvals gateways to manage the flow of information which will ensure the NZ strategy delivery is focussed and meets priorities, considering:

- Contracting authorities have consistent, transparent, proportional, and streamlined processes for decision making.
- Reasoning behind approval gateways (e.g. test approach to project/programme, providing challenge and ensuring outcomes are abided to).
- The greater the complexity, cost, risk – the more robust/rigorous process needed.

Another important factor to consider is the milestones in the delivery of the NZ strategy. Care should be taken in making sure that enough time is allowed for planning and procurement so that the delivery timeline aligns with Government expectations, interim targets and existing trajectories. Escalation processes should be designed to enable blocks within a process or procedure to be unblocked with the appropriate investigation. Escalation should be set out, allowing for an individual who is senior enough to unblock when an issue has been identified. They must be able to reach across the organisation and investigate and resolve issues with others at a similar level.

1.4 Other considerations

Over time, the governance structure will evolve as the NZ strategy matures, from initial concept, to design, delivery and post project monitoring. The processes and procedures alongside the governance, roles and responsibilities must evolve. A timeline and programme ought to be drafted and refined as the NZ strategy evolves which realistically reflects how long it is going to take for each step to be completed. This will support the evolution of the programme and monitoring of governance updates.

1.5 Common pitfalls

Figure 9: There are five common causes of project failure which relate to project governance, as described below:

Common cause	Relevance
1. Lack of clear link between the project and the organisation's key strategic priorities, including agreed measures of success.	For an NZ strategy, embedding the strategy within the organisation's operation is essential.
2. Lack of clear senior management and ministerial NZ ownership and leadership.	Often a NZ strategy falls over as the sponsor is not senior enough or isn't accountable.
3. Lack of effective engagement with stakeholders.	Ensuring that everyone within the organisation is aware of their responsibility will encourage embedding and adoption.
4. Lack of understanding of and contact with the supply industry at senior levels.	Communicating the delivery strategy to supply chain sooner rather than later will help them understand what is needed and support the programme delivery.
5. Inadequate resources and skills to deliver the overall programme.	Ensuring that the resource and skills are consistently reviewed as the programme evolves will ensure that it is delivered.

The Council for Science and Technology (CST) Achieving Net Zero Carbon emissions through a systems approach report outlines other parallel causes that a good governance structure should overcome, such as:

- Lack of capacity and capability in key roles.
- Lack of consideration of devolution of powers to raise money for decarbonisation measures.
- Non-accounting of social, cultural and behavioural factors that can act as both barriers to and levers for change.
- Failure to reveal synergies and interdependencies between different decarbonisation strategies and different policy priorities.
- Failure to monitor effects and adapt responses over time.

Tools, guidance and more information

References and resources	Use / relevance
The Construction Playbook	Provides guidance on use of whole life carbon assessments to inform decisions at early stages of project definition and option assessments.
Functional Standard GovS 002: Project Delivery	Guidance on setting up end-to-end project governance.
Functional Standard GovS 004: Property	Guidance on definitions for construction and operational emissions.
Government Property Career Framework	A career framework to support the development of property professionals across Government.
Green Book Guidance	HM Treasury guidance on how to appraise and evaluate policies, projects and programmes.
CST Report	Outlines other parallel causes that a good governance structure should overcome.

Step 2: Baseline and scope

Step 2 focuses on understanding the organisation's NZ boundaries, confirming the estate, its energy consumption and the associated emissions. This stage is an essential piece of preparatory work which enables the NZ strategy to be checked and monitored throughout. It must incorporate existing estate and any known or proposed new estate with a method for capturing and updating in the future. Following this stage offers a way to establish the baseline for the estate, the energy consumption, and the emissions. It also explains about how to set and manage the delivery of targets. Step 2 is split across four sections:

Figure 10: Step 2 inputs and outputs

Inputs	Outputs
• Listing of all property sites across organisation's portfolio. • Respective energy data for sites (incl. but not limited to EPC/DEC). • Additional emissions data available for sites.	• Agreed baseline year for the Estate. • Defined list of sites/assets within NZ Scope. • Property Portfolio Energy Usage Baseline. • Energy Model for sites/assets in scope.

Essential requirements

- Maintenance of properties and sites register across an estate.
- Development of an initial baseline energy model.
- Defined listing of sites within NZ scope, with suitable explanations otherwise.

2.1 Agree the baseline year

Setting a baseline year for energy consumption and emissions gives a set point against which any change can be measured. For emissions reduction of an operational estate this must reflect the energy and associated emissions used within. Typically, a baseline year will cover a reporting period of 12 months, often either the calendar or fiscal year. It is sensible and logical to align baseline years to those mandated by the government and set by those expecting report on progress, for example aligning them to the GGC requirements for central Government, or Carbon Budget requirements. It is also sensible to pick a year where there is relatively good data, both on the organisational estate and portfolio, and its energy consumption. DEFRA's guidance on how to measure and report GHGs emissions gives more detail on how to measure and set a baseline year.

2.2 Understand the estate

The full extent of the organisation's building asset and property must be understood before the full energy consumption is gathered and associated emissions determined. Capturing this information also helps get clarity on targeted interventions. Therefore, the exercise is two-fold:

- To understand the estate in its entirety.
- To gather the necessary information.

Organisations should have consistent and clear records to reflect their entire estate. If this information is not already available, organisations should have a strategy to collect it. For the Government Estate, a central record of mainly its administrative property assets exists in a system called ePIMS. Data is published from ePIMS in the public domain where site details and further information is available to view. ePIMS is currently being replaced by InSite (formerly called the digital national asset register) and will be expanded to include all assets. There is a mandate requiring government departments to maintain strategic data fields about all of their estate in InSite from when it is launched in early to mid 2022. The strategic data fields required for InSite are listed and defined in a data standard which will be published as a companion document on gov.uk when InSite is launched [5].

A review of the use of the assets should be undertaken to understand if they are no longer operational or active, have been (or are soon to be) marked for disposal, or are an upcoming acquisition or build within the estate. The following information is also useful to gather:

Data should be collected and stored in line with the Government Functional Standard for Property GovS 004, section 6.3 (which includes a list of the records which should be included). This information, together with data for new buildings, should be capable of being brought together in one central point and used to analyse the estate. This is important so that an accurate view of the organisation's present and projected energy usage and emissions across the estate can be developed. Some decarbonisation technologies alone have a lifespan of 30 years; buildings are often forecast to have a lifetime of at least double this.

2.3 Establish the baseline

The recording of all the estate information in the previous section will enable the size and scope of the estate to be confirmed. This then allows the energy and emissions baseline to be measured and established respectively. For the purposes of this exercise it is the "operational, in use" baseline that is being established for both existing and new buildings.

5. To request a copy of the data standard prior to publication, email ogp-sap@cabinetoffice.gov.uk

Figure 11: Steps that must be followed to establish the energy and emissions baseline

Existing buildings	New buildings
Confirm scope and the energy sources that need to be captured.	
E1 – Collect the energy and refrigerant data using the energy hierarchy to capture the best quality data aligned to each part of the estate.	N1 – Capture what the predicted operation energy consumption and emissions are based on design estimates.
E2 – Convert the energy and refrigerant data into emissions using established methods.	

Once the scope is established and the available data is collected (E1), then both E2 and N1 should be combined to give a full picture of operational emissions. The following sections provide more guidance on those steps.

2.3.1 Existing and new buildings: Confirm scope

The introduction explains the sources of emissions and the way in which scopes are interpreted. Against the estate (both new and old) the likely / expected energy sources should be explored and recorded against scopes. This can be done by considering the location and the type of operational asset. Additional sources can be added if discovered during the next steps. As well as consumption sources, any onsite existing energy generation ought to be considered and captured (e.g. roof mounted PV panels). In this instance the amount of electricity generated and consumed on site should also be identified.

2.3.2 Existing buildings: Collecting energy data

Energy data should already be collected. An exercise of reconciling against the full building asset and estate list is required. For the purposes of setting a baseline, only annual energy data is required. However, it is recommended that three years' worth of data is used, as this enables any anomalies to be identified. A check should be done to ensure that the three years' recordings (one either side of the baseline if possible) are similar, and where varied an explanation sought. Variations could indicate partial use or part occupation throughout the year.

Energy data should be collected in consistent units, typically kWh, which may require some conversion for certain energy sources such as oil, LPG, or natural gas which can be recorded in volume. A useful conversion table is provided in Government conversion factors for company reporting of greenhouse gas emissions.

Energy data can vary in type and quality dependent on what is available. In all instances the best available data should be used. In order of preference:

- Energy data through a half hourly meter – this could be through a fiscal meter or sub-meter. This includes smart meters, which transmit readings directly to the supplier, and can provide accurate energy consumption data which is often recorded half hourly.
- Energy data through a manual meter regularly read and recorded – this again could be a fiscal meter or sub-meter.
- Energy data through an apportionment of the building area for use, where the building is part occupied by the organisation.
- Applying similar energy performance of similar buildings where no data is available.
- Applying benchmarks from industry benchmarks such as Building Energy Efficiency Survey (BEES).
- Using ratings from assessments such as an Energy Performance Certificate (EPC) or Display Energy Certificates (DEC).

These routes will enable energy use to be appraised and allocated to both the energy source, and the scope. Where energy is generated on site, a similar exercise should be applied.

Refrigerant refills also need to be understood. Under the Montreal Agreement a number of specific HCFCs are being phased out and replaced with lower global warming potential gases. These gases are monitored through the EPBD Air Conditioning Inspections requirement and more specially CIBSE's TM44 guidance. Air conditioning is required to be inspected annually and volumes of annual refills recorded. These reports and any asset register will provide an estimate of types of refrigerant used across the estate, and the volume of it.

2.3.3 Existing buildings: Converting energy and refrigerant data into emissions

In order to report the GHG emissions associated with an organisation's activities, the energy and refrigerant data collected needs to be converted into carbon emissions. The approach and the method should be agreed and recorded for transparency.

The approach taken should also reflect the standard or guidance that is followed. If applicable, the approach additionally provides guidance on how to treat certain situations which could include:

- How to treat onsite generation (in both new and existing buildings).
- How to re-baseline should the shape of the organisation change significantly, such as if a Machinery of Government change was to occur.

The method for conversion is generally consistent using a series of emissions conversion factors to convert them. In both instances the organisation should adopt the method and factors that are recommended through any external reporting requirements. Some guidance on how to treat renewable generation is provided in the GHG Protocol Scope 2 guidance which shows how to deal with generation and the purchase of low carbon power. Whilst this is useful standard practice for any general reporting, in all instances the reporting framework for the organisation should also be applied. These are likely to give a baseline at a set point in time. This can be done either by setting up a spreadsheet to do the calculation or by using the OGP Net Zero Trajectory Tool (NZTT).

However, for a NZ strategy there is also a need to model out into the future what the emissions are likely to be. Future and current emissions factors in-line with UK Government expectations are published for the Green Book supplementary guidance data tables and may also be considered useful for any future tracking of emissions reduction.

In terms of reporting, the operational energy of a building is likely to need to be disclosed annually for carbon impacts as a total emissions (tCO2e) and using an intensity metric such as by area (kgCO2e/m2) as well as the energy scope and the gross internal area (GIA page 12) .

More guidance can be found in sources such as the methodology section of HM Government Environmental reporting guidelines and in the GHG Reporting Protocol Corporate Standard. Guidelines to conducting energy audits can be found at ESOS and ISO 500001.

Net Zero Trajectory Tool (NZTT)

OGP have developed an excel based calculator which enables a broad estimation of carbon emission reduction and associated costs at a portfolio level based on different types of interventions in the period up to 2050. The tool can be used to assess the effectiveness of different types of interventions in relation to their costs, while taking into consideration the features of individual estates and organisational plans for decarbonisation.

Outputs provided by the tool include:

- Current and future carbon emissions.
- An estimate of the types of technologies that will need to be deployed to achieve NZ.
- Budget estimates of the cost associated with implementing them.

It therefore offers an easy way to develop estimates to inform the early stages of business cases to take forward a NZ strategy and programme. The OGP NZTT and relevant guidance is downloadable from the OGP Property Portal.

For refrigerant emissions, conversions factors are recorded in a number of sources both internationally and within the Government Conversion Factors for company reporting. Against the volume of refill refrigerant, the organisation should capture the emissions associated with the types of refrigerant. The amount of refrigerant emitted each year tends to vary therefore, if possible, capturing and taking an average of the three years data gives a more accurate view of a baseline. If no data is available, within company reporting guidelines there is also a method for approximating the annual amounts.

Note

Typically, the amount of refrigerant emitted (and therefore refilled) is recorded as that which is lost to the atmosphere. However, for longer term planning whilst managing refrigerant emitted is important, the replacement of refrigerant with lower global warming potential is more important. Understanding the baseline of the types of refrigerant and how they have to be replaced or phased out should be kept in mind.

2.3.4 New buildings: Establish the baseline

For any additional new buildings which are going to be operational in the baseline year an estimate of their energy use and emissions should be captured. For any additional new buildings which are going to become operational in the future it is useful to understand how they may increase the operational estate emissions. Similarly, records and forecasts should be adjusted for property disposals and retrofits.

There are already a number of established processes associated with measuring the carbon potential of new buildings both in embodied, construction and operational phases. This section explores those methods.

In advance it is worthwhile considering that new buildings are likely to be built to the standard that is requested within the design specification. Within the UK typically that means that it will meet the minimum Building Regulation requirements, however there are other more aspirational standards that organisations could set as part of their NZ strategy.

These include but are not limited to:

- The LETI Climate Emergency Design Guide, which is specifically targeted towards developers, designers and policy makers. It helps to define 'good' and sets clear and achievable targets. It contains detail on delivery and implementable solutions, with each chapter addressing a key component towards a zero-carbon future[6].
- BREEAM, which is a sustainability assessment method and certification scheme for infrastructure and building projects.
- CIBSE TM 54 methodology, which provides building designers and owners with clear guidance on how to evaluate operational energy use more fully, and accurately, at the design stage. This enables more detailed accounting for operating hours and occupancy based on the intended use of the building.
- ASHRAE Standard 90.1, is a US standard which provides essential requirements for energy-efficient design in all types of buildings except residential.

At a minimum level the Building Regulations require for compliance the calculation of a Building Emissions Rate (BER) to demonstrate that it is lower than the Target Emissions Rate (TER)[7]. This is seen as the baseline for compliance and demonstrates the reductions achieved through energy efficiency measures, clean energy supply[8] and renewable energy systems. However, building regulations only account for regulated emissions, which excludes energy use associated with items like lifts and escalators, small power, catering and more. Similarly, SAP (Standard Assessment Procedure) is applied in a similar way to domestic buildings.

2.3.5 New buildings: Capture predicted energy consumption and emissions

To be compliant with the Building Regulations for new buildings, energy modelling must be carried out at an early stage of the design process. As well as setting the standard for performance for the new building, the adopted approach is also a good way to measure the expected performance. Based on a preferred and agreed approach, energy consumption and carbon emissions should be recorded and combined with the existing estate calculations.

Whilst estimated energy consumption is likely to remain the same, there may be variation in the approach taken to calculate emissions within the models or approaches adopted. This could include the scope of the emissions captured or the emissions conversion factors applied. Often the emissions factors embedded within software can become out of date. Similarly, they may not forecast out to the future. Therefore, when looking at recording the emissions for new buildings it is often better to take the predicted energy consumption and follow the same process undertaken for existing buildings. This avoids any inconsistencies and allows the updating of the overall energy and carbon model for the organisation.

2.4 Sort and set NZ scope properties

This final section looks at using the information that has been gathered on the estate (new and old) with its energy data to:

- Confirm and set an emissions baseline - based on the work completed in 2.3 Establish the Baseline a baseline for the existing and any nearly ready new buildings. This should be against the baseline year that was originally set and provide a baseline from which to measure going forward.
- Consider what the future forecasts of emissions use might look like – see section below.
- Consider and set a target for reduction – Step 3a: Refine and explore.

6. Note this is only applicable for certain types of buildings such as offices and schools.
7. Target Emissions Rate (TER): TER is based on the performance of the notional building. Regulation 17C of the Building Regulations requires that all new buildings must achieve or better this target. Please note requirements of higher aspiration may be applicable at local level.
8. Note: Clean energy is energy that comes from renewable, zero emission sources that do not pollute the atmosphere when used, as well as energy saved by energy efficiency measures. Source: TWI Global.

2.4.1 Future forecasts

When setting a target into the future, an understanding of what the "business as usual" (BAU) activity will look like is needed. Using the estate and energy information with three years' base data, changes to the estate and how it might operate should be considered and projected into the future (to 2050).

Noted in 2.2 Understand the Estate was the collection of useful information of buildings which should be flagged and treated differently. For the purposes of modelling, the changes in their energy consumption should be captured at the point in time where a change is expected. These include:

- Upcoming disposal (i.e. within the next five years) and energy consumption will no longer occur. Additional information regarding site disposals and appropriate maintenance practices can be found in the Government Functional Standard GovS 004: Property.
- Recently extensively decarbonised – as something that should have a rapid drop in energy consumption.
- Contractually unable to modify or adapt such as an EPC or PFI contract – as they will be difficult to amend until the end of the contractual period.
- Structurally unfit for modification or adaptation – and likely to be replaced with a new building rather than be retrofitted or refurbished. Changing the energy consumption at the point where the replacement could happen.

In addition, other impacts on future energy consumption should be considered including changes in activity at a building in use, numbers of occupants, operational hours. These should be captured against energy use going forward. Using agreed emissions factors for the organisation project what the carbon emissions will look like to 2050.

Tools, guidance and more information

References and resources	Use / relevance
DEFRA Guidance on how to measure and report GHGs emissions	Provides detail on how to measure and set a baseline year for reporting.
RICS Code of measuring practice	Provides information regarding the measurement of area within buildings.
Green Book supplementary guidance	Contains future and current emissions factors in-line with UK Government expectations.
Building Energy Efficiency Survey (BEES)	Source of industry benchmarks for energy consumption.
GHG Reporting Protocol Corporate Standard	Provides a universal viable baseline in scope that can be applied to any type of entity, across all sectors and in any context.
Government Functional Standard GovS 004: Property	Guidance on definitions for construction and operational emissions.
Government conversion factors for company reporting of greenhouse gas emissions	Standard conversion tables for converting energy.
UK's National Calculation Methodology	Procedure for demonstrating compliance with the Building Regulations for buildings other than dwellings, by calculating the annual energy use for a proposed building and comparing it with the energy use of a comparable 'notional' building.
PAS 2038:2021 - Retrofitting non-domestic buildings for improved energy efficiency	Draft standard on BSI for the retrofitting of non-domestic buildings for improved energy efficiency.
BPP Better Metering Toolkit	Information on the development of metering strategies.
CIBSE TM44	Guidance for air conditioning inspections in the UK.
ESOS	Guidance that gives an overview of ESOS and how to conduct energy audits.
ISO 50001	Standard that provides a practical way to improve energy use, through the development of an energy management system.
LETI Climate Emergency Design Guide	Helps to define 'good' and sets clear and achievable targets, including zero-carbon.
CIBSE TM54	Provides building designers and owners with clear guidance on how to evaluate operational energy use more fully, and accurately, at the design stage.
ASHRAE Standard 90.1	Used globally as a benchmark to set MEPS (minimum energy performance standards) and energy codes.
Future Buildings Standard consultation document	Second stage of a two-part consultation on proposed changes to Building Regulations designed to help deliver NZ ready buildings.

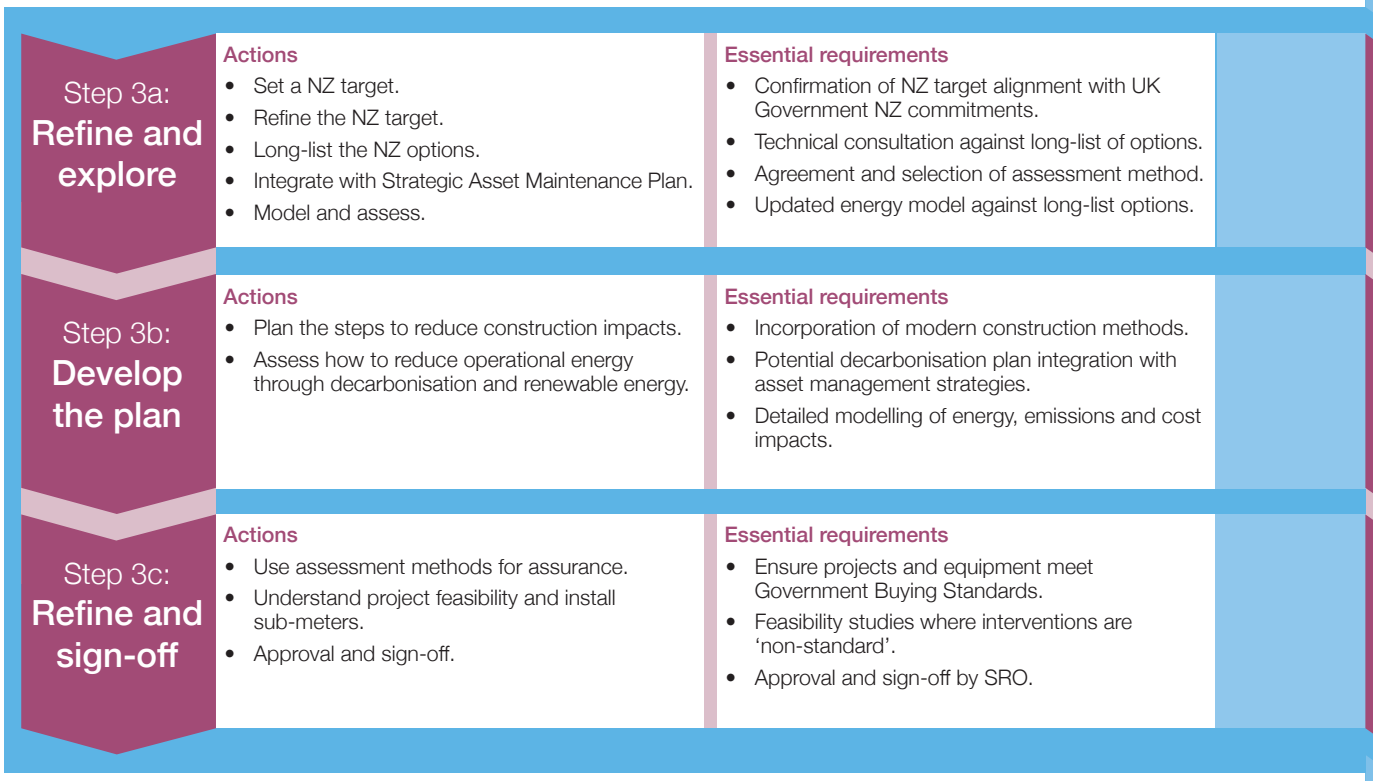
Step 3: Develop and sign-off the estate decarbonisation plan

Once the size of the organisational estate has been established, energy consumption data collected, the baseline identified, and future emissions forecast developed, an emissions target can be defined.

After that, a more detailed estate wide decarbonisation plan can be developed and refined over time. This should take into consideration climate change implications, such as rising temperatures and increased precipitation, which will have an impact on building design.

Developing the estate decarbonisation plan can be split between three stages: Refine and Explore; Develop the Plan; and Refine and Sign-off.

Figure 12: Develop the estate decarbonisation plan



Step 3a: Refine and explore

With a baseline established, an emissions forecast developed, and a scope set from Step 2: Baseline and scope, the organisation should now:

- Set an initial target, with initial budget estimates and a delivery date.
- Define it as the NZ strategy evolves. This includes delving into how the target could be met and updating any models previously developed.
- Explore the longlist of potential decarbonisation options.

Step 3a provides a high-level process to do this, outlining some of the options which could be considered throughout the development of an estate decarbonisation plan across the following stages:

Figure 13: Step 3a inputs and outputs

Inputs	Outputs
• Agreed baseline year for the Estate. • Defined list of sites/assets within NZ scope. • Energy Model for sites/assets in scope. • Asset management and maintenance plans and strategies.	• Defined NZ target to achieve in strategy. • Longlist of potential decarbonisation solutions and options. • High-level value analysis within scope. • Energy model for sites with long list options.

Essential requirements

- Confirm NZ target alignment with UK Government NZ commitments.
- Ensure adequate technical expertise is consulted to identify and assess decarbonisation options.
- Confer with FM teams across scoped sites to determine integration feasibility of a developed longlist.
- Updated energy model reflecting initial value of longlist options.
- Agree and select on assessment method for NZ strategy.

3a.1 Setting an overarching target

At a high level and with an understanding of the baseline and the future shape of the estate energy and emissions, a target for reduction should be set. When setting a target the following should be considered:

- Aligning it to national or public sector targets, as described in sections I and II of the NZE Playbook.
- Overall and interim budgets which detail stages of delivery.

Often to set a target the rough cost of delivery and the set timeline or date for delivery should be known or estimated. This can be facilitated by the NZTT which as well as forecasting emissions, it can provide rough cost estimates. Also, organisations must develop and maintain departmental NZ trajectories as required by the Property Function Plan and SAMPs.

Other ways to estimate include:

- Using costs from pilot projects that have been carried out.
- Using industry cost estimates such as SPONS.

Delivery timelines must be considered reflecting on the normal timelines within the organisation for decision making processes, business case preparation, and delivery onsite.

3a.2 Refine the target

With an overarching target in place, it would be useful to consider the implications for different elements of the estate and to have sub-targets for:

- Existing buildings operational energy and emissions.
- New buildings embodied carbon and predicted operational energy and emissions (see Appendix: How to approach new buildings for more details on how to approach new buildings).
- Scope 1 and 2 emissions targets or sources, for example the elimination of high-intensity fossil fuels.
- Generation or consumption of renewable energy and the method in which that is achieved.
- Asset replacement or maintenance programmes.
- Capital programmes.

These are useful as they can be aligned either with a specific target which must be met as part of a national reporting requirement (relevant to the organisation) or aligned with a departmental activity such as replacement programmes which will drive results. Where possible to estimate the baseline and emissions forecasts, this will help to identify key areas for decarbonisation for example the sources of emissions and different scopes. However, it may not be possible to understand or finalise all of these targets at this point. It is important to ensure that within the energy model and other activities that the data recording and reporting framework is in place. These can then be reviewed and refined as the NZ strategy is implemented.

3a.3 NZ decarbonisation options

Although individual buildings may have specific needs and nuances, there are likely to be some common interventions and technologies required across the estate. The objective would therefore be to explore what options are applicable to the estate being operated.

Prior to the development of an evaluated shortlist of decarbonisation options for each site, an initial longlist of potential solutions should be researched to fully understand their potential, including to understand which scope of emissions different solutions address. This should not exclude any particular activity and include the known technology groups from energy reduction technologies (e.g. LED lighting, BMS, and fabric improvements) to low-carbon energy technologies (e.g. heat pumps) and renewable generation (e.g. photovoltaic panelling), as well as any other innovative measures. If the NZTT has been used, it will provide some indication of the technology groups where emissions can be saved and the budget estimates.

Many decarbonisation solutions and technologies need to be considered within a system of interventions and metering/monitoring systems, this offers the optimum to drive decarbonisation both from a technical and cost perspective. This is referred to as a 'whole systems approach' and should be carefully considered throughout the development of a longlist, see Figure 14.

Note

When considering a whole system the additional loading that may occur from the installation of Electric Vehicles (EVs) should be considered. Whilst EVs do not reduce emissions of the operational estate, they will reduce the overall organisational emissions. They are however likely to place additional burden on the electricity demand. When transitioning heat to electricity this has a similar impact and can present supply constraints. Where these occur, there can be an additional cost in the upgrading of supply. This should be checked as part of any assessment.

Figure 14 Whole system approach

Consider appropriate sequencing dependent on site (items 2 to 5 are often interdependent); consider age of asset and likely replacement timeline.

		What	Why
Item 1	Implement no regrets measures	Energy efficiency including LEDs, better control through BMS, and Building Fabric improvements all to cut demand.	Demand reduction of any energy scope (1 or 2) will support managing network constraints.
Item 2	Remove fossil fuels in heat and assess EVs	Resize heat solution to match amended demand, capture future EV charge point demand.	Shifting away from fossil fuels is where future site decarbonisation will be achieved as the electricity grid decarbonises.
Item 3	Amend heat distribution system	If needed, improve heat network to match circulation temperature changes required for new heat source.	The heat distribution system must have the ability to deliver heat even with a lower heat temperature from heat pumps.
Item 4	Review potential network constraints	Consider impact of additional heat demand through vector transition and increased EV charging demand.	Additional capacity to support EVs and heat pump load may not be available without upgrade.
Item 5	Supplement electricity demand	Consider onsite or local renewable generation, electricity storage, and demand management to manage peak times.	Solution will help reduce network capacity issues, and financially support overall system.

There may already be some knowledge in the organisation of what is applicable or even examples of deployment. A summary of decarbonisation options is given in Appendix: Long List Net Zero options describing in more detail some of common interventions groups. These include:

- Energy Efficiency measures such as LED, BMS and building fabric improvements.
- Low-carbon heat technologies such as heat pumps, biogas and the supply of hydrogen.
- Renewable generation such as PV and Wind.
- Storage and power management technologies, such as heat and power storage options, and demand side management.

There are also many ways to capture all the different types of activities that could be deployed, these include:

- Referencing existing material and case studies that the organisation already has or using information published by others.
- Reaching out to the market for expert advice and support through energy appraisals or reviews.
- Researching technologies in the market.

Whilst exploring potential decarbonisation solutions information to gather for review would include:

- Specific applicability of the technology (e.g. wind turbines generally need space).
- Expected cost range.
- Impact on emissions reduction (often this will be quoted in percentages or as a simple payback period (SPP)).
- Particular scope or emissions reduction achieved (scope 1 and 2).
- Supply chain size (potential to deploy at scale).
- Minimum delivery timeframe for the technology once commissioned.
- Complexity and difficulty of installation including capability and skills required.
- Maintenance requirements including capability and skills required.
- How and what would need to be done to ensure that changes in emissions are monitored through sub-metering.
- Procurement and award criteria, including what sort of procurement routes would be applicable.
- Confirmation that they will meet any procurement standards for the department and they meet the Government Buying Standards as a minimum.

This information provides insight on which solutions may be applicable and even those that may be ‘quick wins’, versus works which may need integrating into a long-run asset replacement and maintenance plan.

A final metric should be considered for estate which may be part occupied or controlled by others whilst the organisation is operating; for example, all or part of a tenanting a property which is managed by others. In these instances, additional information ought to be collected on how the solution would impact on the organisation’s own emissions, versus those that other organisations are accountable for. Although the approach will be defined in Step 3b: Develop the plan, the above metrics will enable the establishment of a prioritisation – which is dependent on the needs of stakeholders. These needs should be captured in advance to ensure the estate decarbonisation plan meets expectations of the organisation’s NZ strategy.

3a.4 Asset and maintenance plan integration

It is likely that to deliver full decarbonisation there will need to be multiple delivery routes through multiple contractors and partners. One route is to embed decarbonisation within the existing asset and maintenance programme. This is seen as an essential way to embed decarbonisation into day-to-day activities. Therefore, irrespective of the asset and maintenance programme delivery method, consideration should be given to how upgrading replacements to lower and no carbon solutions are embedded. This will offer a lower cost and business-as-usual delivery route to upgrades. Where services are outsourced to facilities management (FM) contracts and frameworks this must be applied in accordance with the requirements of the Government Facilities Management Control. FM teams will often be responsible for the maintenance of new decarbonisation technologies and engaging them during intervention selection and installation will also ensure a smooth transition to maintenance and monitoring. It is likely that this will be easier for some technologies than others, as some decarbonisation technologies will require specialist suppliers to source, install, and maintain.

Although at this stage only a longlist of potential decarbonisation options has been developed (in Step 3a.3 NZ decarbonisation options) it is recommended that the potential for certain technologies that are to be delivered under asset management are flagged as it helps to form an overall delivery and procurement strategy for the NZ Strategy and delivery programme.

3a.5 Update the energy model

Where granular enough information should be updated in the energy model to provide estimates for technologies which are new or non-standard. The energy model should start providing not just energy usage and emission projections over a range of sites, but also the energy and emission impacts of decarbonisation technologies and their implementation and running costs over time. Where the NZTT has been used it will have already provided a good understanding of the value behind solutions, which may be more appropriate to apply across sites.

3a.6 Assessment methodology

As part of the decarbonisation plan, assessment methods for construction impacts on sustainability and the resulting efficiency ratings should be considered to verify and validate decarbonisation efforts across both new builds and existing sites. These methods should cover the asset life cycle and as a minimum, impacts from both the construction and operation/maintenance phase. Existing methods include:

- The Government Functional Standard for Property (GovS 004) requires minimum BREEAM (or other equivalent method) rating of ‘Very Good’ for major refurbishment projects, and ‘Excellent’ for all new building projects, as well as the evaluation of a costed option to achieve a higher rating than the minimum.
- The Association for Environment Conscious Building (AECB), Passivhaus and RICS, which offer guidance on approaches that can be taken.
- Other industry or organisational specific methods such as DREAM for defence projects.

In addition to this there are Government Buying Standards for construction and building elements such as heating, lighting, taps, paint and timber etc. Some organisations may wish to undertake or require additional assessments to ensure NZ targets are met, or the nature of some construction projects will be sufficiently unusual to justify it. These will all support the future development of projects and help the measurement throughout design and construction and then operation of the emissions impacts.

Tools, guidance and more information

References and resources	Use / relevance
SPONS	Price guides providing the accurate price data for the UK construction industry.
Government Buying Standards	Official Government Buying Standards (GBS) for construction/refurbishment projects and products: heating, lighting, taps, paint, timber, etc.
Government Facilities Management Control	Guidance to request spend approval when buying or extending facilities management contracts, regardless of their cost.
OGP Net Zero Trajectory Tool (NZTT)	A tool based on the OGP property portal that provides an assessment of cost and routes to NZ for an organisational estate.
AECB	Network of individuals and companies with a common aim of promoting sustainable building.
Passivhaus	Provides leadership in the UK for the adoption of the Passivhaus standard and methodology.
DREAM	Online environmental assessment tool for New Building and Refurbishment projects on the Defence Estate.

Step 3b: Develop the plan

This section explains the steps that can be applied to selection and prioritisation of decarbonisation options, informing the implementation strategy:

Figure 15: Step 3b inputs and outputs

Inputs	Outputs
• Defined NZ target to achieve in strategy. • Longlist of potential decarbonisation solutions and options. • High-level value analysis against scoped sites. • Energy Model for sites in scope and long-list options.	• NZ Estate Decarbonisation Plan with shortlisted options to achieve NZ target. • Detailed cost, emission and energy reduction in model.

Essential requirements

- Incorporation of modern construction methods throughout proposed new works.
- Definition of potential decarbonisation integration with existing asset management strategies.
- Modelling of detailed energy emission and cost impacts.

3b.1 Prioritising an approach

There are a number of different approaches which can be adopted when reducing the list of possible options for delivering NZ on an organisational estate or portfolio of buildings. These should be considered and selected as appropriate for the estate characteristics and activity. Typically, a suite of measures from the long-list will need to be applied to a building (in construction or operation) to enable it to meet NZ. These will often have some interaction or overlap with each other. Therefore, the aim of the exercise is to be able to apply a method which will enable these measures to be selected. This is considered best practice and is reflected in two approaches that are commonly used in NZ strategies. These are LETI's Climate Emergency Design Guide and UKGBC's Net Zero Carbon Buildings Framework. Both have been referenced in this section alongside more tools, guides and information links that can be found at the end of Step 3b.

Figure 16: UKGBC Net Zero carbon buildings framework

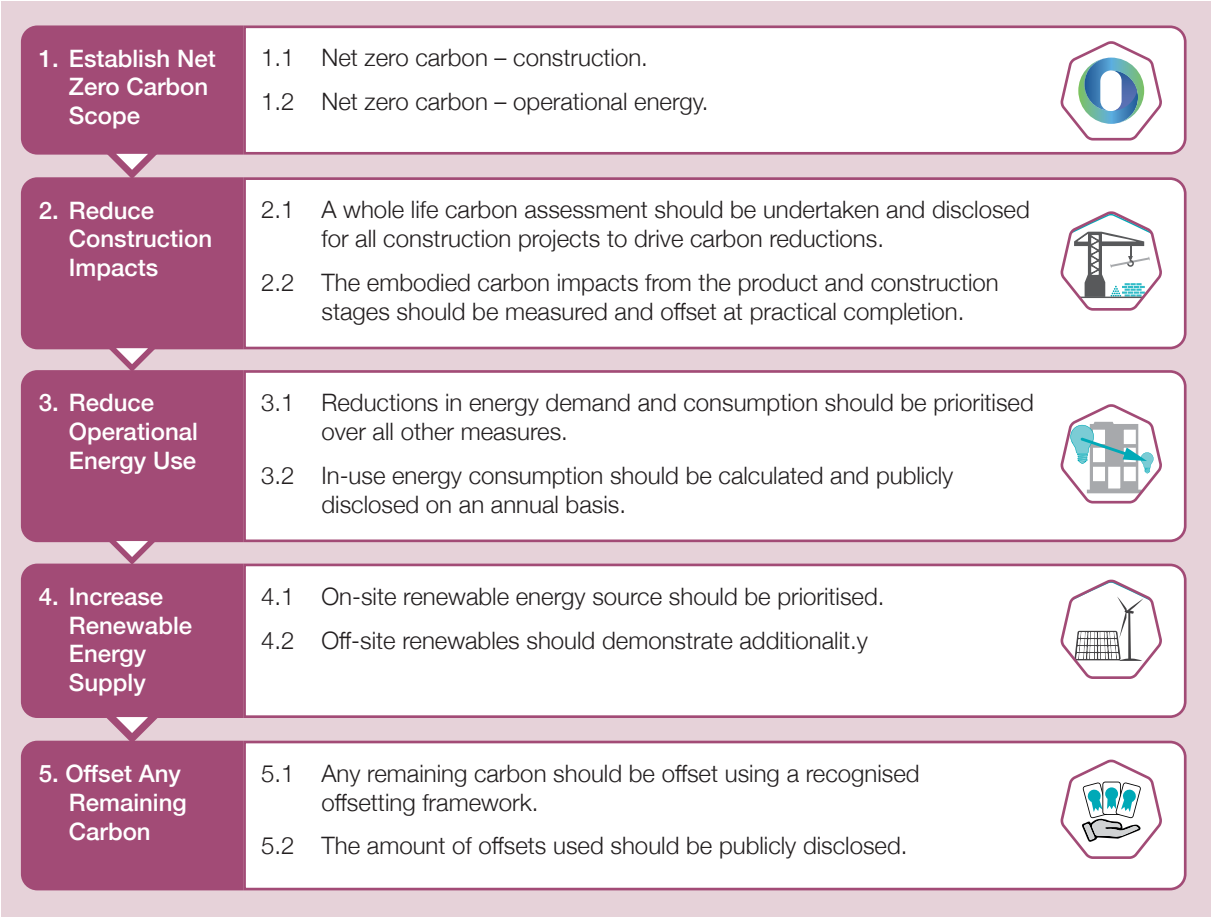


Figure 16 shows a diagram of the UKGBC NZ carbon buildings framework which breaks down the different types of emissions which should be considered. For the purposes of this Step 3b 2-4 are relevant and of interest. Regarding step 5 of the framework (Offset Remaining Carbon) it is important to highlight that the purchase of offsets cannot currently be recommended for Government property.

Additional information regarding the next stages beyond planning, such as feasibility studies, funding, procurement and execution can be found in Step 3c: Refine and sign-off and onwards of this Playbook.

3b.2 Reduce operational energy use (including considering renewable energy)

Within Step 3a: Refine and explore a long list of measures were considered for their suitability across the organisational estate.

This section refines that lists and starts to consider how and what might be applicable in certain parts of the estate. This includes considering what options there are for:

- Installing energy efficiency measures that reduce the energy consumption (both scope 1 and scope 2) such as LED lighting and building fabric improvements.
- Considering the control of operation and use through a BMS or other controls system.
- Installing alternative low carbon heating, air conditioning and ventilation options that move away from fossil fuel usage and eliminate high global warming potential refrigerants.
- The installation of any renewable generation options.

It is important to consider the interactions of the measures and how together they will optimise the solution, particularly in the sequence in which they are installed or implemented. An energy hierarchy (similar to the order of the list above) can be established to use if interventions are identified as being largely independent. The objective is to come out with an understanding of:

- Which measures within those elements are applicable to the estate (including their proportionate contributions).
- What the estimated cost and delivery process would be for each of them.

To do so a review of the original asset and organisational estate is required. This is to understand how the organisational estate could be grouped into 'archetypes' (repeatable similar types of buildings where similar measures would be applicable).

This will allow a testing or sampling of a subset of those groups to establish what the measures are, their cost, and installation options. The results can then be extrapolated back up to understand what the requirements would look like for the whole estate. The results can be checked against the original estimates which were produced as part of the original review (using the NZTT or bespoke energy modelling).

For some sites it may be that options are identified within the same groups that are both equally suitable and provide similar results for example PV and wind providing generation, and a choice of technology may be made based on a wide range of metrics such as installation cost, ease of installation, lifetime, operational maintenance costs, cash flow. For each of the selected options consideration of the equipment specified must be linked back to the embodied carbon listed in Step 3b.3: Reduce construction impacts so that construction and embodied impacts influence decisions.

There are many ways to approach this type of assessment, however the technical assessment of any sample buildings ought to be carried out by construction and energy professionals who will be able to provide proposals of the preferred options. This could be through existing frameworks, FM contractors or by open request to the market. Requirements should be clearly stated, asking for project outputs and all assumptions that have been made in developing their recommendations.

It may be that an Outline Business Case will need to be written to get approval for the assessment to be carried out. Further detail on how to write business cases is provided in Step 4: Approve and fund.

Other factors to consider include:

- **Exploring local energy options**. How energy is supplied is a key decision for newbuilds: the energy landscape is shifting away from fossil fuels and continuous grid decarbonisation means that all-electric options are likely to be the way forward in many cases. This is likely to put additional burden onto the local electricity network which may mean that electrifying the site in question will require grid reinforcement and an additional cost burden. However, this is not always the case, in some areas local area plans and local low-carbon power generation or heat networks may be planned which can provide solutions. See Appendix: Long List Net Zero options and Appendix: Power Purchase Agreements on alternative power solutions. With this in mind it is always important to explore the local context and decarbonisation paths that each local council has set out.
- **Building fabric.** Building fabric assessments tend to be bespoke to the building and not just related to the archetype therefore making initial estimates of the potential for the whole estate against a sample will be less accurate than other elements. There is no obvious solution, however the Climate Emergency Design Guide provides an 'elemental recipe' regarding fabric thermal performance of building elements, air permeability, thermal bridging and g-value of glass. These are best practice and relatively easy for manufacturers to deliver. It is important that even if these specifications are not fully adhered to, the specification for each item is not worse than what is defined for the notional building in Part L2A of the Building Regulations.
- **Renewable energy**. On-site renewable energy should be used where possible, with renewable technologies suitable to the contextual characteristics and use patterns of the building (such as wind power where energy use is continuous with little variation). Dependent upon the type of organisational estate different locations should be considered e.g. ground mounted PV, roof mounted PV or other options such as solar PV carports.
- **Bespoke and innovative technologies**. Whilst it is likely that patterns and themes will be seen throughout the organisational estate archetype groups there will be some tailoring to each building. Novel or different approaches may be found that suit only one building. These should be considered for their impact, and not become the focus when trying to decarbonise a whole portfolio. Gaps in existing technologies are also likely to occur where innovative and new technologies are evolving, this currently includes areas such as heat and battery storage, demand side management and artificial intelligence. These again have a role to play, and should be considered and monitored, however, may not be ready for widespread decarbonisation of a portfolio.

For newbuilds, the range of decarbonisation options and technologies highlighted in Step 3a: Refine and explore should be factored into the design of the property and incorporated into the energy model baseline.

3b.3 Reduce construction impacts (for newbuild or major refurbishments)

Whilst new buildings are likely to be a small proportion of the overall organisations estate it is essential that they are NZ in their design, build and operation. Whilst the way in which a design is developed for a new-build may be different to that of a major refurbishment some of the principles for the way in which the selection of products, and the way in which the construction is managed, are similar. The same can be said for even the smallest of replacement projects.

Within Step 2: Baseline and scope of this guide the way in which to measure and track emissions associated with new builds is detailed. During the design process for both newbuilds and major refurbishment the minimisation of all environmental impacts should be

taken into account. Further guidance on the expectations of roles at each RIBA stage can be found in the LETI Embodied Carbon Primer.

Recommendations include using modern methods of construction (MMC) as they can heavily reduce the embodied carbon present in new buildings. At a conceptual level, MMC outline the following principles:

- Build **Less**: Is the entire build necessary, with any materials reused where possible?
- Build **Light**: What loadings are essential, and can they be reduced any further?
- Build **Wise**: Has materials and systems longevity been reviewed and considered?
- Build **Low Carbon**: Can high embodied carbon materials be minimised or switched?
- Build **for the Future**: Have future uses and end of life plans been considered?
- Build **Collaboratively**: Are all design teams and parties involved in the design?

In line with the Construction Playbook, organisations should adopt a portfolio approach to increase MMC potential through long-term programmes that have repeatable assets.

When it comes to product, selection should be considered on the basis of the 'overall' environmental performance. Measures and standards such as Environmental Product Declarations (EPDs) are a useful way to compare products.

Environmental Product Declaration (EPD)

An EPD is a transparent and objective report which reflects what a product is made from and how it impacts the environment across its entire life cycle. There are currently no requirements to request EPDs throughout procurement exercises, however the sustainability of equipment and fabrics used by suppliers should be considered.

Developing an effective and efficient asset maintenance strategy will reduce resources, costs, long-run inconvenience, but also reduce the amount of GHG emissions due to the minimisation of repair work and replacement parts (further reducing embodied carbon) and allowing assets to reach optimal lifespans before requiring system replacements. The selection of replacement parts should consider the embodied energy associated with the manufacture of the product, the operational life of the product and any disposal requirements, as well as the operational efficiency of the product.

When considering the property as an asset, it is good practice to set out potential plans for the building's end of life, ideally repurposing, especially in cases where the building is no longer fit for its original function but has not necessarily reached its the end of physical lifespan. This process should follow National Property Control guidance which incorporates sustainability and NZ considerations.

If the building is to be demolished, best practices should be followed to ensure materials can be reused where possible - a key tool in assessing this is a pre-demolition audit. The pre-demolition audit will determine whether refurbishment or reuse is feasible. If it is not, meaning that demolition is likely to be decided, the pre-demolition audit will help maximise recovery of material. Information regarding property maintenance and disposal practices can be found in the Government Standard for Property, GovS004, whilst emissions assessment approaches of demolition and disassembly can be found in the RICS Guidance on Whole Life Carbon Assessments.

Case study:
NHS Net Zero carbon hospital

As part of the NHS' 'Delivering a Net Zero Health Service' strategy, a new standard has been developed and will be available to 40 new hospitals under construction, which utilises a whole life carbon framework to reduce emissions over the course of the hospitals' lifespan.

A mixture of innovative low-carbon materials and renewed focus on design for flexibility and care in the future have been at the centre of the standard, which will begin implementation in Spring of 2021.

Source: Delivering a Net Zero Health Service.

3b.4 Offset remaining carbon

When all possible measures for reducing both embodied carbon and operational energy emissions have been exhausted, offsets could be utilised to cover any residual carbon which remains. Although an option, offsetting should only be an absolute last resort in the development of a NZ strategy: the purchase of offsets cannot currently be recommended for Government property. Organisations should continue to explore all available options to reduce emissions, including those arising from new technology and innovations. This guidance will be reviewed and updated over time as policy is developed further. Although the UKGBC provides an outline for the processes which should be adhered to should carbon offsets be the chosen route, the current guidance is to invest in forms of carbon storage.

Carbon storage options should always be selected with a clear target (i.e. the remaining carbon to offset), and whilst other solutions should be evaluated, a common Government property approach is tree planting and management. It is unlikely that the contribution of tree planting will be accounted for in immediate carbon offsetting calculations however, as carbon removal from trees occurs 20-30 years after being planted. Useful information regarding tree planting and management is available from UK Woodland Carbon Code.

3b.5 Decide the preferred option(s)

Approvals processes required to agree the preferred option for a NZ strategy will all depend on a well-developed energy model (which can be checked using the OGP NZTT). The approvals process is likely to be different for the type of approval being sought. If a high-level approval (for an NZ strategy or delivery plan) is sought, then it is likely to cover the whole operational estate. However, it may be for a NZ project which is part of the overall delivery plan and needs to focus on the specific merits of that project. This would apply to the approvals sought and the scenarios and modelling developed to support it.

For a portfolio or organisational estate approval, it is likely to reflect a range of decarbonisation options and scenarios for the organisation's estate, against the different types of activities; this will reflect a whole-portfolio approach rather than site-by-site. Sample surveys can be extrapolated to provide cost, energy, and emissions forecasts across the estate. However, if it is for a specific project or activity a subset of the energy model or specific site data may be required to be modelled and presented.

In either case, an updated timeline for delivery must be used which reflects when it is realistically likely for the organisation to be able to fund and implement the programme. In doing this exercise it is useful to consider a range of options including but not limited to:

- **'Do nothing'** scenario (i.e. carry on in a business-as-usual fashion) as explained in Step 2:Baseline and scope – this is mandatory under Green Book guidance.
- **'Minimum'** decarbonisation strategy with some of the more cost-effective interventions applied.
- **'Preferable'** option which outlines the strategy modelled as most effective.
- **'Maximum'** strategy which reflects as much intervention work as feasibly possible to achieve NZ.

This should inform a wider NZ estate decarbonisation plan and will help with any further business case writing as described in Step 4: Approve and fund. This modelling provides a good update of the original energy model and the overall NZ strategy.

3b.6 Defining NZ strategy, programme and project

It is important to be clear on the differences between a NZ Strategy, Programme and Project, as they will all have a role in the overall delivery of NZ. To support the understanding of this guide these are the definitions that have been applied to the terminology throughout.

- **NZ Strategy** - the overarching strategy that states the strategic thinking that has gone into the delivery of NZ. This is likely to include initial energy and carbon forecasts and modelling, estimates on budgets, and ideas on how to deliver over a time period. It might also have thoughts on overall delivery including internal and external capability for delivery. It is likely to be updated and refined over time as more knowledge is gained.
- **NZ Programme** - this is a programme that begins to detail how NZ will be delivered. It will have more detail on the actual tasks that are to be undertaken, each of which becomes a project. It will think about how the organisation is going to mobilise and be supported for delivery of each aspect across the organisational estate.
- **NZ projects** - these are likely to be taken forward as part of the overall programme enabling specific activities to be undertaken. This could include the delivery of NZ at one site, or the installing of metering or LED lighting.

Tools, guidance and more information

References and resources	Use / relevance
LETI Climate Emergency Design Guide	Helps to define 'good' and sets clear and achievable targets, including zero-carbon.
Net Zero Carbon Buildings Framework	A NZ carbon buildings framework which breaks down the different types of emissions which should be considered.
Functional Standard GovS 004: Property	Guidance on definitions for construction and operational emissions.
UK Woodland Carbon Code	Information regarding tree planting and management.
LETI Embodied Carbon Primer	Guidance on the expectations of roles at each RIBA stage.
RICS Guidance on Whole Life Carbon Assessments	Emissions assessment approaches of demolition and disassembly.
National Property Control guidance	Guidance to request spend approval on leaseholds, property acquisitions and disposals.
OGP Net Zero Trajectory Tool	Provides an assessment of cost and routes to NZ for estates (hosted in the Government Property Portal).

Step 3c: Refine and sign-off

Step 3c further refines the plan, by taking the proposed measures that were agreed in the last step as part of the overarching NZE Decarbonisation Plan / Strategy. These measures should be refined and tested to ensure that they can support the development of procurement strategies and business cases once the necessary approvals processes have been met. This is the final step in establishing the NZ estate decarbonisation plan and the plausible options available before taking the programme through to application funding, in Step 4: Approve and fund.

3c.1 Utilise assessment methods.

3c.2 Understand the project feasibility.

3c.3 Installation of sub-metering.

3c.4 Decarbonisation plan approval and sign-off.

Figure 17: Step 3b inputs and outputs

Inputs	Outputs
• NZ Estate Decarbonisation Plan with shortlisted options to achieve NZ target. • Detailed cost, emission and energy reduction model data.	• Detailed scopes of works. • Verified cost, emissions and energy reduction model data. • Approval to proceed with funding of programme. • Updated NZ Governance Structure.

Essential requirements

- Assess projects and equipment to ensure compliance with Government Buying Standards.
- Undertake feasibility studies where interventions are ‘non-standard’ or uncertain.
- Approval and sign-off of NZ estate decarbonisation plan by Senior Responsible Officer.

3c.1 Utilise assessment methods

Going from an estate portfolio plan to a project delivery phase requires assessment using the energy model and all relevant data to enable prioritisation of the estate or measure to be implemented first. Reviewing the information that has been gathered in Step 3b: Develop the plan, a programme of projects that will be taken forward needs to be developed and then taken forward.

Depending on the cost, sustainability and emissions impact a detailed assessment to determine the preferred options should be carried out. There is no fixed way to determine the best route however the modelling and thinking carried out in 3b.5 Decide the preferred option(s) should form the basis.

Consideration should also be given to the procurement and delivery routes that might be adopted for the options and any capability building that may be required to oversee the delivery of the NZ strategy. For procurement options it may be that some of the measures identified can be incorporated into asset replacement programmes, others into new FM-led replacement programmes, but some may need to be supported by capital projects or be delivered through one overarching delivery partner. Whilst not needing to be fixed at this point the choice of the procurement may have an impact on the price of delivery, the speed at which the selected options can be delivered and how they are then managed going forward. The benefits of each of these options should be explored.

Some sites may be operated under contractual agreements where certain parts of their activities are delivered as a service. Agreements can last for up to 15-20 years and therefore can limit the amount of decarbonisation that can be achieved in the near term. As a result, sites of these types may not be included in the priority groups for implementing decarbonisation. Alternatively, partial decarbonisation must be planned, for example renegotiating contractual obligations to include sustainability commitments. For refrigeration replacement with lower global warming potential it makes sense to combine this with ongoing maintenance and annual servicing. These risks and factors which will impact the potential benefits and options of NZ strategies should be identified at the earliest opportunity to prevent delays and re-planning of the NZ strategy.

Note

Even the simplest NZ intervention programmes typically take 24 months from inception to final delivery and completion, including any time allocated to business case development and procurement strategy writing. Therefore, it is important to minimise the risk of understating delivery timelines and consult relevant providers during plan development to gain further assurance.

3c.2 Understand the project feasibility

Once a NZ estate decarbonisation plan has been drafted with preferred procurement routes, thought must be given to the process and procedures that will need to be followed to enable each project's implementation. Whilst an initial high-level assessment of the emissions reduction potential may have been carried out a more detailed feasibility study for the project is likely to be required. This will firm up the cost estimates and enable a more accurate business case to be written for the implementation of the work.

Depending on the organisation's preferred contracting route and management of operations, cooperation with the FM or other providers should be sought. They may be able to help to further specify the studies and designs needed. For more simple interventions such as LED lighting implementations this may be relatively simple however for more complex

interventions both feasibility studies and detailed design documents may be required. Detailed designs and surveys provide accurate estimates of the true cost of interventions. Estimating the costs of interventions can be a difficult task. The cost estimates should include a range of factors capturing the practicality of installation procedures such as security clearance measures, site escorts and final fittings and specifications.

Consultancies, design houses for specific technologies, and specialist energy services firms may also be used to support in the scoping and determination of decarbonisation solutions. Each one of these different types of providers will offer different benefits so it is worthwhile being aware of them in the decision process. To get the best out of a feasibility study, specific and unbiased technical expertise will be required. If one measure only is being assessed there must be some reference to how it fits with the other measures that are being considered for that building or suite of buildings. For example, if heat pumps are being assessed as well as building fabric the heat pump specialist ought to know what the change in heat demand is going to be. In some instances, existing FM contractors may provide this, or alternatively the energy provider. Please refer to Step 5: Go to market more on how to go about procuring solutions.

The following technical guidance notes will assist in assessing the requirements for different asset classes:

- General use offices: BCO Making the Future Workplace, GPA Government Workplace Design Guide.
- Hospitals and healthcare: Health Technical Memoranda (HMT).
- Laboratories: NERC Guidance on Design of Safe Laboratories.
- Prisons: MoJ Estate Directorate Technical Standards.
- Schools: School Design and Construction Guidance.

3c.3 Installation of sub-metering

In advance of carrying out further work, better data on each site should be gained. Dependent upon the size and complexity of the site, there will be differing levels of energy data available. Within any original baselining exercise for an organisation, estate annual energy data is required to establish size and performance. For better scrutiny of building by building progress it is preferable to capture and use half hourly energy data. This exercise will offer the following benefits:

- A baseline to use as a comparison after anything has been installed - where a proxy has been estimated for a building or part of a building it will also help provide a more accurate understanding of the annual energy consumption and should be fed back into the energy model.
- An opportunity to improve operational performance through the identification of anomalies including excessive consumption.
- Data which will help the design and optimisation of the measures.
- Verification of any savings that are achieved.

To improve the quality of data provided on sites and properties, sub-metering is a common solution in both existing and new builds. The sooner that good metering is installed the

longer the period of data available and the better the quality of the data baseline will be for sites. This is particularly important in:

- Large complex sites: In this instance sub-metering can be installed.
- Smaller buildings where only part is occupied: In this instance sub-metering can be installed.
- Smaller buildings where the class of meter installed means that the readings are manual: In this instance SMART meters can be considered.

Smaller sites which are in scope of the non-domestic smart metering mandate, i.e. gas sites where the annual consumption is no more than 732 MWh per year electricity consumers in profile classes 3 and 4, might also benefit from the installation of smart-meters. The Energy White Paper highlights the Government ambition to achieve market-wide roll-out of smart meters as soon as practicable, enabling homes and non-domestic sites to access digital energy services that put them in charge of their energy use. For schools, an additional benefit includes harnessing energy data from smart meters to support curriculum learning.

Historically the focus for submetering has been on electricity meters however with a need to move away from fossil fuels it is now more important to ensure that submetering covers both electricity and heat use. This can be done through the metering of the fossil fuel used or the heat being distributed across the building(s).

Similar principles apply to the installation of submetering for monitoring water consumption and usage. This is particularly important given the considerable amount of energy used for water treatment and distribution. The efficient use of water for Central Government departments is required as part of the Greening Government Commitments 2021-25 which set targets for water consumption and measurement. Water submetering can provide detailed information on water consumption and facilitate improved water management, occupier billing, and decision making in line with the recommendations of the BBP Better Metering Toolkit. For example, water submetering data can be used for measuring energy use for water treatment processes, such as greywater recycling, and enable the evaluation of water efficiency measures, such as rainwater harvesting.

Installation of submeters across a building or buildings need to be planned and allow for data to be collected in one repository for analysis. It does not necessarily need to stand alone and can be incorporated into a BMS system either new or existing. Similarly, some buildings will already have some submetering which can be augmented.

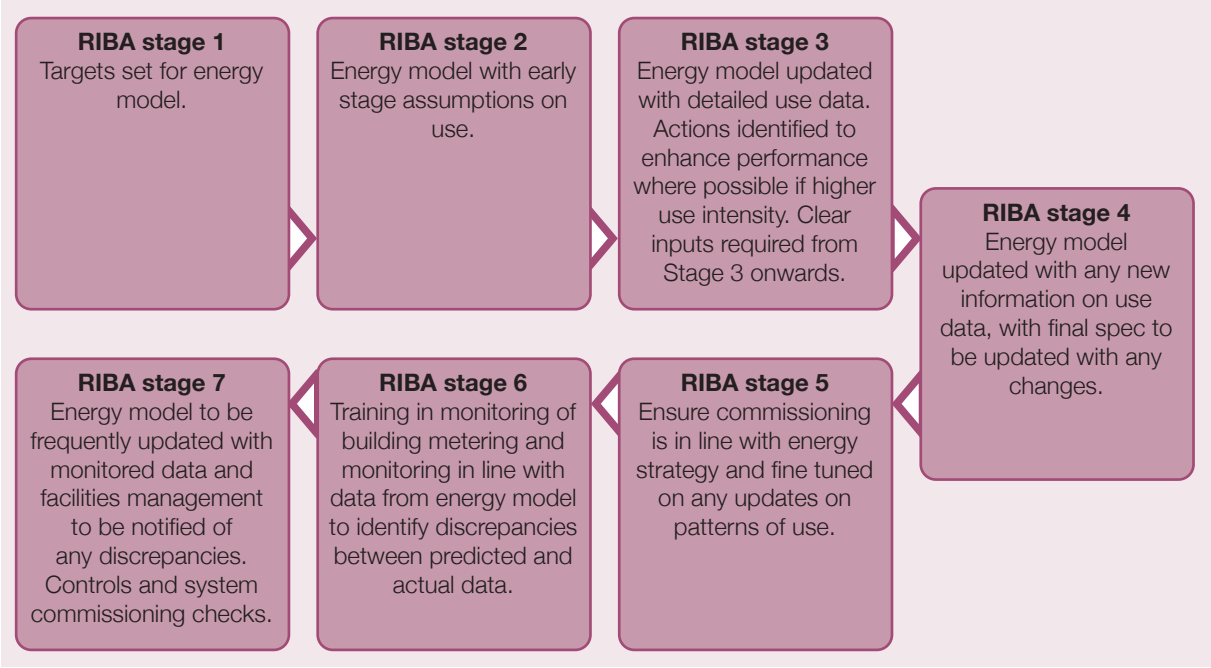
Before beginning the installation of metering, the data management and analysis strategy needs to be developed. Metering data can be captured, processed, and stored through a variety of mediums including accessible web-based platforms. Consideration should also be given to the person(s) who will be responsible for data management and how that will be used to improve general energy use. This could be a third-party provider or be managed by operational staff.

Further information regarding procurement can be found in Step 5: Go to market. In addition to procurement and the parties responsible for maintaining sub-metering data, security and data-sharing concerns should be identified and clarified as early as feasibly possible.

Guidance on metering, monitoring and reporting frameworks can be found in the documents below:

- CIBSE TM39: Building energy metering (currently in revision), which promotes best practice in the design of energy metering and sub-metering in non-domestic buildings.
- CIBSE TM63: Operational performance: Building performance modelling and calibration for evaluation of energy in-use.
- CIBSE TM22: Energy assessment and reporting methodology, which provides a method for assessing the energy performance of an occupied building based on metered energy use and a 'bottom up' assessment of the installed plant and equipment present in the building.
- BBP Better Metering Toolkit: End to end overview of good metering strategies and implementation approaches.

Figure 18: Example metering and monitoring flow diagram



3c.4 Estate decarbonisation plan approval and sign off

The approach to decarbonising the estate, with the projects that are going to be taken forward first, a timeline programme for delivery, costs and budget estimates, and the submetering strategy should all be included in the NZ strategy. Previous steps may need revision and remodelling may be required as part of the approvals process, and this should be encouraged to ensure the most effective solution which provides value for money has been identified for the organisation. Prior to applying for funding, the Senior Responsible Office (SRO) who oversees the NZ programme should approve and sign-off the NZ estate decarbonisation plan. Often this may need to be agreed as part of the annual funding cycle to secure funding for subsequent years.

Tools, guidance and more information

Tool	Use / relevance
Government Buying Standards	Official Government Buying Standards (GBS) for construction/refurbishment projects and products: heating, lighting, taps, paint, timber, etc.
Non-domestic smart metering mandate	Aim to deliver a smarter, more flexible energy system that supports innovation in new smart products and services.
Energy White Paper	Provides strategy on Governments' ambition to achieve market-wide roll-out of smart meters as soon as practicable.
CIBSE TM39	Building energy metering: Best practice in the design of energy metering and sub-metering in non-domestic buildings.
CIBSE TM63	Operational performance: Building performance modelling and calibration for evaluation of energy in-use.
CIBSE TM22	Energy assessment and reporting methodology, which provides a method for assessing the energy performance of an occupied building based on metered energy use and a 'bottom up' assessment of the installed plant and equipment present in the building.
BBP Better Metering Toolkit	Information on the development of metering strategies.

Step 4: Approve and fund

This section is about taking forward a business case for approval and to get funding for either part of the overall NZ programme or part of a project. It is likely that a business case will need to be written at least once in the decarbonisation process, if not multiple times to agree funding and approach for each stage of delivery. Each organisation is also likely to do things differently. This step also covers the overall requirements and needs of developing a business case, including information on some common funding sources:

4.1 Building a Green Book business case.

4.2 Funding applications.

Figure 19: Step 4 inputs and outputs

Inputs	Outputs
• Verified cost, emissions and energy reduction model data. • Final detailed designs of decarbonisation work. • Updated NZ Governance Structure.	• Green Book compliant business case. • Approved funding to initiate spending. • Additional reporting requirements, including delivery programme.

Essential requirements

- Compliance with the Green Book appraisal and evaluation guidance.
- Detailed estate energy model fulfilling minimum scenario modelling requirements.
- Business case must include the 'do nothing' cost of carbon emissions.
- Business case must consider the use of MMC as an option for projects involving construction works.
- Reporting compliance plan for approved and successful funding applications.

4.1 Building a Green Book business case

In order to gain funding for the NZE decarbonisation plan, a fully developed Green Book compliant business case should ideally be written by someone with the Better Business Cases Practitioner qualification and must be approved by the SRO. Business cases are a requirement for all NZ strategies, regardless of the intended funding sources. For more information regarding Green Book business cases and their development, please see Appendix: Business case development.

4.2 Funding applications

It is likely that the funding route for a programme or project will have been considered before drafting a business case and seeking approval.

Funding can come from many routes and depending on the organisation there are likely to be different funding options. These may include:

- **Funding through annual budgets** – though this will need to be planned for and secured in advance.
- **Grant funding** through programmes such as the Public Sector Decarbonisation Scheme (PSDS).
- **Private sector financing** for the programme potentially linked to the commercial option chosen.

Although research will be required to determine which funding schemes would be appropriate and available for an organisation's NZ strategy, each will demand different calculations and inputs to determine a programme's feasibility and funding credibility. It is likely that dependent upon the route selected there will be a variation in delivery metrics such as CAPEX, OPEX, ongoing operational maintenance, and delivery timelines. Despite this, funding applications should be completed in-line with and reflective of their respective business cases.

Some funding applications such as PSDS may utilise a calculated metric for assessment purposes; relevant guidance for each funding scheme should be available and referred to for more information.

Note

The above funding options are available at the time of writing; over time funding schemes both public and private will evolve and change to reflect the changing circumstances of NZ programmes and wider policy commitments. Research analysis to confirm what is possible, and what the market offers should be conducted to identify the most appropriate funding sources. Factors to consider include post-delivery requirements and any future funding implications.

Agreement and approval of funding sources must be sought prior to application by the respective person(s) per the NZ governance framework.

Case study: Dryden School funding

Dryden School is a secondary special school in Gateshead. They cut their energy bill using a 100% interest free loan of almost £80,000, funded by the Government's Salix scheme. By installing LED lighting, pipework insulation and improving the Building Energy Management System and hydrotherapy pool ventilation system they cut their bill by £17,000 a year – saving over £342 per pupil, and meaning their loan pays back in just over four years.

Source: The Clean Growth Strategy.

Tools, guidance and more information

References and resources	Use / relevance
Green Book Guidance	HM Treasury guidance on how to appraise and evaluate policies, projects and programmes.
Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal	Supplementary guidance to the Green Book providing Government analysts with rules for valuing energy usage and greenhouse gas emissions.
Salix Public Sector Decarbonisation Information and Guidance Notes	Grant scheme that encourages green investment, supporting the Government's NZ and clean growth goals.
Public Sector Loans Board – Lending Facility	Provides loans to local authorities, and other specified bodies, from the National Loans Fund, operating within a policy framework set by HM Treasury. This borrowing is mainly for capital projects.

Step 5: Go to market

Step 5 covers the process to initiate the works by an external party to help deliver all or part of the plan. The procurement approach will vary dependent upon a number of factors, such as:

- The specific requirements being sought from the market (feasibility, design or implementation, at programme or specific project level).
- The procurement vehicle best suited to the organisation (given existing arrangements and type of estate).
- The contracting arrangements required to successfully deliver NZ ambitions.

There are four parts to securing a contractor for implementation, this section covers those sub-steps as follows:

Figure 20: Step 5 inputs and outputs

Inputs	Outputs
• Green Book compliant business case. • Updated NZ Governance Approach. • Detailed scopes of work. • Approved funding pot.	• Approved suppliers' contracts. • Resources to support works as requested. • Supplies and materials to conduct works. • Updated pricing model. • Updated and detailed delivery plan.

5.1 Refining the requirements

Often there is a need to produce several business cases during the implementation journey.

Essential requirements

- Compliance with the Green Book appraisal and evaluation guidance.
- Initiation and running of the procurement exercise..
- Evaluation and award of the contract(s).
- Signing of contracts and establish governance.

These are sometimes termed Outline Business Case (OBC) and Full Business Case (FBC). The OBC provides justification for the funding of the initial feasibility, design, cost estimation and development of documentation. This is then used to complete the FBC which raises agreement to take the project forward to full implementation. This will vary depending on the organisation, but as part of writing any business case the procurement strategy will need to have been proposed. This section is about taking the proposals made in the business case and refining them ready for issuing to the market.

Whilst commercial strategies can vary significantly in granularity and scope, they should be well established throughout Step 4 Approve and Fund, and the NZ strategy, and supported by appropriate evidence. This will provide a clear foundation from which to refine and finalise the NZ procurement strategy. Common factors to be considered when refining a procurement strategy are:

5.1.1 Roles and responsibilities

The roles required by the procurement strategy and responsibilities of each party (including the organisation and external support) should not only be clearly defined, but also tested and mapped to relevant RACI matrices with appropriate risks, dependencies and accountabilities per the Governance setup. Specifically:

- It is encouraged that NZ technologies are overseen and owned by separate parties to those installing the solutions as this typically provides greater flexibility and value for money for the overall programme.
- Responsibility should be clearly identified against those accountable for ensuring equipment is operated and understood per design; this is especially important for new technologies to the market.
- Existing contracts or suppliers such as FM providers should be involved in procurement if they are expected to either manage the delivery of the contract or oversee future operation. It may be the most appropriate route to market to leverage on existing providers for aspects of the NZ strategy process.
- Engaging NZ technical expertise (either within or outside of the organisation) at the design stage to ensure solutions suggested can be supported by the existing supply chain and proven operational and technical evidence.

5.1.2 Data validation

Depending on the quality and integrity of data, additional data collection may be required prior to initiating the procurement. This could include detailed scoping of submetering such as a delivery precursor, or technical assurance to validate the impact of NZ interventions once installed. This should be integrated with the wider data management and smart metering strategy and will allow the market to design, size, and price more accurately during procurement.

5.1.3 Change control

Any changes introduced by the contractor or the organisation should be clearly tracked for the impact that they will have ON outcomes and costs. A change control process must be developed and clearly laid out within any specification documentation and followed by all parties.

5.1.4 Risk management

Risks take many forms but an additional risk that must be managed appropriately is that

the carbon emissions reductions expected to be delivered are not achieved. This must be added to the risk register and appropriate mitigation/management put in place.

5.1.5 Value drivers and outcomes

The desired outcomes of procurement exercises must be clearly defined and communicated. This should include a technical definition of the expected outcomes. Thought must be given to how the outcomes are going to be achieved so that expectations are clearly explained. It may be that as support is sought for early stages of feasibility and design the outcomes for later stages become clearer. These should be tracked and managed to ensure that the original intention is not lost. The emissions in both the construction and operational phase must be captured. Other criteria include the credentials of suppliers and the sustainability of their operations, making it clear what the expectations are on third parties, such as the sourcing of materials (e.g. EPD) and labour. The Government Buying Standards should be referenced in doing this.

5.1.6 Market maturity

Depending on the NZ technology or strategy involved, pre-procurement consultation may be required to gauge the ability of the market to provide an adequate response to the procurement process. Although significant progress is being achieved through initiatives, such as the Construction Leadership Council's Net Zero Carbon Industry Initiative, this is particularly relevant for NZ strategies as the decarbonisation marked evolves. The market should also be leveraged to help shape requirements and solutions at the design stage, as they are typically the parties with the greatest technical expertise.

5.2 Selecting the procurement vehicle

The integration of a NZ strategy into an organisation's existing delivery routes is likely to offer optimum value for money by blending with asset management. Therefore, the preferred route for conducting and carrying out works is through pre-existing site and asset maintenance arrangements, and using existing contracts (such as FM contracts) where possible. However, that isn't always possible, in some instances other routes to market could be effective. These include procurement frameworks with dynamic purchasing systems and other contracting methods. The rationale for the selection of the appropriate route is given below.

5.2.1 Current contracting arrangements

Simple no regret works: Some works can be considered routine, not particularly complex, or challenging to manage or deliver, and will give a good return on investment. This might include LED lighting, building fabric improvements, pipe insulation and other energy efficiency works. It is likely that this can be carried out as a small works project on a site by site basis or a wider programme of implementation. This could be delivered with relative ease by someone who is able to run maintenance programmes. If an FM contractor is in place this could be through them.

More complex no regret works: Some works such as installing or upgrading a BMS may be more complex and require greater consideration at the design phase. Therefore, this may require a capital works team to oversee the work. In both instances some sort of feasibility and design work is likely to be needed before moving to implementation.

Complex heat plant or renewable works: where plant and pipework installations are going to need to be renewed or replaced further scrutiny and expertise is required. This is likely to need to pass through any capital works routes, and potentially use existing frameworks or delivery routes. Similarly, for renewables projects it will make sense to seek out specialist

advice and support for design and installation.

Design and installation phases will be required and must be overseen appropriately. It may be that additional support to oversee the process is also required. Existing frameworks may be accessible to the organisation or the wider public sector and should be researched. Some of the possible frameworks are listed below.

5.2.2 Procurement frameworks and dynamic purchasing systems

Under circumstances which require more technical expertise, a procurement framework or Dynamic Purchasing System (DPS) currently in use may be a suitable vehicle for the procurement strategy. Common frameworks and systems which may be suitable for a NZ procurement are:

- Heat Networks and Electricity Generation Assets (HELGA) – is a Dynamic Purchasing System Framework (DPS) which provides access to a range of services from simple energy auditing to complex installation projects. It is operated by the Crown Commercial Services (CCS) and once registered for use gives access to a broad range of contractors who can be contacted for a tendering exercise.
- Project Management and Full Design Team Services – Framework which provides broad, strategic advice on property projects across a range of disciplines and functions.
- Supply of Energy and Ancillary Services - Supplying fuels to the public sector and associated bodies and agencies, including billing, administration, customer service and ancillary services.
- Construction Works and Associated Services – Framework that enables organisations in the public sector and arm's-length bodies to access all types of building and civil engineering works.

There are more available on the Crown Commercial Service website. Although standard frameworks are also suitable, the use of a DPS is preferable as they allow suppliers to join at any time, making new decarbonisation technologies and costing models accessible and more accurate.

5.2.3 Other contracting methods

Depending on the organisation and contracting preferences from procurement and commercial teams, other options may be available depending on the requirements, such as running a procurement through the UK's Find a Tender Service (FTS). To understand more about these options, procurement/commercial teams should be contacted. Additional guidance, reference guides and tools can be found towards the end of this section.

5.3 Conducting the procurement

Throughout the procurement exercise, it is encouraged that an outcome-based approach is adopted by all parties. Practically speaking, this removes a focus on scope, and encourages value placement across whole life value and performance. However, it is still important to be clear on the scope and the expected tasks that will be undertaken. If a specific task is required it should be described and clarity must be given how a change should be tracked or monitored, with rationale provided. All procurement options should be assessed to ensure the best possible response from the market.

Whilst the advertisement of a Request For Proposal (RFP) may be restricted or limited by the framework or purchasing system selected, it is important that all suppliers within the remit of

such procurement exercise are aware and able to respond within a reasonable timeframe.

Centre, University of East Anglia

Dubbed by the press as the UK's greenest building, the Enterprise Centre been designed and delivered to achieve the Passivhaus standard and a BREEAM outstanding rating. The concept comprises a new building and landscape that is an exemplar of low embodied energy and carbon construction technologies, using natural and bio-renewable materials sourced through local supply chains. The Enterprise Centre is a recognised centre of excellence at a European level, providing world-class facilities through its sustainable design and use of materials.

Source: UKGBC.

5.4 Evaluation and award

Upon conclusion of the procurement exercise, tenders must be evaluated according to a set of criteria which align with the RFP's requirements and expected outcome. These are likely to vary depending on what type of contract is being let but the criteria may include:

- Payment terms.
- Delivery timeline.
- Overall fee and rate card against emission reduction.
- Guarantees and warrantees for equipment.
- Credentials, experience, testimonials and resource profile in delivering projects and achieving the results.
- Understanding of the technical requirements including confirmation of the emissions reductions that will be achieved.
- Benefits delivered.
- Mobilisation.
- Risk and incentivisation approach.
- Specialist supply chain setup and knowledge.
- Payment-linked KPIs.
- Innovation approach.

Another method to appraise the benefits offered is to use known standards or other routes for product selection to reflect on the uptake of the most efficient plant and machinery, and energy related products. One such way is through the use of the Energy Technology List (ETL). The ETL is updated monthly by BEIS and is incorporated into the Government Buying Standards. It should be noted that this only applies to certain technology areas.

Note

An important aspect of evaluation for NZ achievement is the supplier's understanding of requirements; despite pressure to seek the cheaper approaches, it is crucial that the specifications used throughout feasibility studies and detailed design stages are matched by the supplier. Where appropriate, value engineering exercises should be carried out to ensure that the right results are achieved.

Cabinet Office recently published the Procurement Policy Note 06/21 (PPN 06/21) which requires suppliers bidding for major Government contracts to commit to achieving NZ by 2050 and publish a Carbon Reduction Plan for their organisation. Suppliers who fail to meet this requirement risk being excluded from the commercial process. Commercial teams should review PPN 06/21 to ensure they are building the requirement into their sourcing strategy and applying the measure as required. PPN 06/21 applies to all Central Government Departments, their Executive Agencies and Non-Departmental Public Bodies (in scope organisations) and will come into effect for new procurements launched from 30th September 2021.

Tools, guidance and more information

References and resources	Use / relevance
The Construction Playbook	Guidance on use of whole life carbon assessments to inform decisions at early stages of project definition and option assessments.
Sustainable Procurement: Government Buying Standards	Official Government Buying Standards (GBS) for construction/refurbishment projects and products: heating, lighting, taps, paint, timber, etc.
Government Functional Standard GovS 002: Project Delivery	Guidance regarding the structure and resourcing of delivery governance.
Government Functional Standard GovS 004: Property	Guidance around setting expectations for the management of corporate functions across Government.
Government Functional Standard GovS 008: Commercial	Information regarding the management of contracts and suppliers.
Crown Commercial Services agreements listing	List of possible contracting frameworks that can be used.
UK Find a Tender Service landing page	Find a Tender service to search and apply for high value contracts (usually above £118,000) in the UK's public and utilities sectors.
Procurement Policy Note 06/21	Requirement for suppliers bidding for major Government contracts to commit to achieving NZ by 2050 and publish a Carbon Reduction Plan for their organisation.
Net Zero Carbon Industry Initiative	Advice on the regulatory, policy and technical framework required to deliver a zero carbon, zero waste built environment (both buildings and infrastructure) and to identify the commercial, jobs and export opportunities that such a clean growth, zero waste economy requires.
Energy Technology List (ETL)	Government list of energy efficient plant and machinery. In order for a product to be listed, it must meet the ETL's robust energy saving criteria - typically set at the top 25% of products in the market.

Step 6: Deliver and track

With the award and finalisation of contracts, the last step in delivering the NZ strategy is delivering and tracking the progress of works, and monitoring the impact on the organisation's NZ trajectory and the Government's Estate transition towards NZ. This step will largely be defined and agreed when the NZ governance structure has been established at the beginning of the programme, and then for each project. Before initiating a project, it will need to be reviewed to ensure that it is still fit for purpose. Stakeholders may have changed and plans for ongoing measurement and monitoring processes are likely to have evolved:

6.1 Delivery governance.

6.2 Monitoring and data management process.

Figure 21: Step 6 inputs and outputs

Inputs	Outputs
• Approved suppliers' contracts. • Resources to support works as requested. • Supplies and materials to conduct works. • Energy monitoring strategy. • Updated pricing model.	• Emissions and energy data. • Updated pricing model. • Contract completion and handover of assets . • New asset maintenance plans.

Essential requirements

- Deployment of delivery governance team.
- Contract manager assigned with good knowledge of active contracts.
- Active tracking and monitoring of all associated costs, energy consumption data and GHG emissions.

6.1 Delivery governance

Although guidance is given on a NZ governance structure in Step 1 Establish Governance, it is possible that before contract commencement, refinement is required to meet the needs of the specific project or programme. For more guidance regarding the structure and resourcing of delivery governance, see the Government Functional Standard GovS 002: Project Delivery and the NAO Good practice contract management framework.

Although there is no one standard delivery governance structure, there are common values amongst typical successful models which should be considered:

- Communication and transparency.
- Agility and flexible working.
- Robust change management.
- Risk minimisation through early warning.

Upon award and signing of the contract, the delivery governance structure should be mobilised and deployed to ensure NZ intervention works and sites are in line with contractual obligations agreed by suppliers and third parties. This will include the appropriate agreed KPIs/SLAs to ensure an outcome-based approach is sufficiently delivered across the programme, its timeline and schedule, as well as maintaining reporting and communication channels to escalate risks and issues.

Note

The contract manager responsible for managing delivery teams should fully understand the contract and the boundaries which it outlines. For estate NZ strategies, this is particularly important regarding the use of modern construction methods and low-carbon practices per contract agreement. Where the utilisation of such practices has not been outlined (i.e. in an existing contract) their use is strongly encouraged.

More information regarding the management of contracts and suppliers can be found in the Government Functional Standard GovS 008: Commercial.

6.2 Monitoring and data management process

A robust costs, energy and emissions tracking process which is integrated with current operational and FM reporting processes should be deployed, as set out through the preceding steps regarding governance. This process should also ensure that all data captured across the NZ strategy has relevant metadata tags allowing it to be assigned against relevant sources, typically mirroring that of the governance framework. Following the sub-metering strategy discussed in Step 3c.3 Installation of Sub-metering, it should be the responsibility of a person(s) to research and determine the most appropriate data management strategy for the NZ plans.

6.2.1 Data requirements

For any project delivery and subsequent monitoring, the minimum expectations for tracking and recording fall across the following three dimensions: financial, energy, and GHG emissions. This is to ensure adequate data is being captured for reporting purposes and future performance improvement beyond the finalisation of site construction and intervention implementations. However, at a project level, additional information may enable metrics to be developed, which assist in the monitoring of performance. These include size

and area or use of a space by occupant, or activity. Information collected in Step 2 Baseline and Scope and considered in Step 3b Develop the Plan and Step 3c Refine and Explore will support this structure.

6.2.2 Financial

All costs since inception of the estate decarbonisation plan should be tracked and recorded, including both capital costs and resource costs. Although their labelling may alter or change depending on the funding applications populated and their classification criteria, common cost allocations are:

- Design and engineering costs.
- Main equipment capital costs.
- Installation and commissioning costs.
- Contingency costs.
- Other programme costs.

Aside from the costs of programme delivery, the cost of energy consumed across sites should also be tracked during and after implementation. This will allow elements in the business case to be verified. Where renewable power generation exceeds the demand on-site, the financial benefits and revenue received should also be tracked.

A final consideration to implement in a cost monitoring plan is the impact that NZ interventions have had on lifecycle replacement costs. Where historic datasets are rich, the significance of NZ interventions should be prevalent and will further assure the benefits outlined in the business case. This will not exist for new construction projects.

6.2.3 Energy usage and production

All historical and future energy usage records should be maintained regardless of their form (including those from electricity provider statements) to enable the tracking of energy reduction over time. Depending on the metering capacity and time of availability, accurate energy usage records may or may not be available for sites within the scoped estate portfolio of the organisation.

The data management strategy set in Step 3c Refine and Sign-off that considered metering (including for example sub-meters and smart meters) must be continued and all energy data tracked. This may be through an outsourced arrangement provided by external suppliers. Under such circumstances, the data management team should be engaged to develop an understanding of ways to track energy reduction. Renewable energy generation should also be metered and tracked.

6.2.4 GHG emissions

Linked to getting better data on a site tracking scope 1 and 2 emissions change from both new and existing estate within the portfolio should continue. At an organisation level, estate emissions tracking systems are discussed in Step 2 Baseline and Scope. With the use of good metering on a site, granular data can be used to track where emissions savings are being achieved, and fed into the overall energy and emissions calculations. Within a building (new or old) it is important to capture the two parts of any reductions: any change in scope usage (for example the change in use from natural gas to electricity for a particular service or system) and the generation of any renewable energy. The system for calculating emissions from Step 2 Baseline and Scope and Step 3a Refine and Explore

should continue to be applied in the same way to ensure that comparable data is being generated. Emissions should be tracked over the course of at least a year after the project implementation has been completed. This is because they can adjust drastically over the course of a year due for example to seasonal differences.

Tools, guidance and more information

References and resources	Use / relevance
Energy Technology List (ETL)	The Energy Technology List (ETL) is a Government list of energy efficient plant and machinery. In order for a product to be listed, it must meet the ETL's robust energy saving criteria - typically set at the top 25% of products in the market.
Government Functional Standard GovS 002: Project Delivery	Guidance regarding the structure and resourcing of delivery governance.
Government Functional Standard GovS 004: Property	Guidance around setting expectations for the management of corporate functions across Government.
Government Functional Standard GovS 008: Commercial	Information regarding the management of contracts and suppliers.
The Construction Playbook	Guidance on use of whole life carbon assessments to inform decisions at early stages of project definition and option assessments.
Contract Management Professional Standards	Sets out the capabilities expected of Government professionals who are involved in the management of contracts.
NAO Good practice contact management framework	Guidance regarding the structure and resourcing of delivery governance.
Greening Government Commitments	The Greening Government Commitments set out the actions UK Government departments and their agencies will take to reduce their impacts on the environment.

Appendix

- Terminology glossary.
- Reference guide.
- How to approach new buildings.
- Long List Net Zero options.
- Energy supplier agreements.
- Energy options appraisals.
- Business case development.
- Data management.

Terminology glossary

BMS: Building Management System. Computer-based control system integrated into building which controls and monitors mechanical and electrical equipment such as lighting, HVAC systems, power systems, fire systems, and security systems.

Circular economy: An approach to design and manufacturing which targets the minimisation of waste and raw material demand through material reuse, repair, refurbishment, remanufacturing, and recycling. In construction, a circular approach can include reuse of the existing asset in its redevelopment, designing a new building for its eventual disassembly and the recoverability of its materials, and designing out waste from the construction process.

CO2e: Carbon dioxide equivalent. Each greenhouse gas has its own global warming potential (GWP). The unit CO2e allows the impact of all six contributing greenhouse gases (GHG) (e.g. methane, HFCs) to be conveyed in terms of the carbon dioxide emissions with an equivalent impact.

DEC: Display Energy Certificate. Reflects the energy performance of a public building, using a scale which ranges from A (most efficient) to G (least efficient).

Embodied carbon (or A1 to A5): Refers to embodied carbon in the construction materials and process (as for Whole Life Carbon). A1-A3 refers to the Product Stage, the sourcing of materials, transport to manufacturing plant and fabrication processes. A4-A5 refers to the Construction Stage, the transport from plant to site and on-site construction and installation including waste disposal. For further information, see the Royal Institute of Chartered Surveyors (RICS) guidance Whole life carbon assessment for the built environment, 1st ed, Nov 2017.

EPC: Energy Performance Certificate. Provides an energy efficiency rating and an environmental impact rating, estimating energy use, carbon dioxide emissions, lighting, heating, and hot water per year. A score is provided ranging from A (lowest emissions) to D (highest emissions). These are theoretical ratings and not performance based, like DECs.

EPD: Environmental Product Declaration. EPD is a transparent, objective report that communicates what a product is made of and how it impacts the environment across its entire life cycle.

FRI leases: A Fully Repairing and Insuring (FRI) lease is a lease where the tenant bears responsibility for the maintenance and repair of the property.

NABERS UK (or Design for Performance): An energy rating scheme for offices. With the NABERS UK scheme, developers will be able to use the Design for Performance process to target a NABERS Energy Rating at the design stage of a new office development or refurbishment and verify performance when the building is occupied. NABERS UK is designed to address the existing performance gap between the design and in-use energy performance of offices in the UK.

Net zero carbon (NZC) or net zero (NZ): For buildings, NZC refers to: In construction, when the amount of greenhouse gas emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy. In operation, when the amount of emissions associated with the building's operational energy on an annual basis is zero or negative. A

NZC building is highly energy efficient and powered from on-site and/ or off-site renewable energy sources, with any remaining carbon balance offset.

Offsets: Refers to emission reductions / removals credits, a transferable instrument certified by Governments or independent certification bodies to represent an emission reduction of one metric tonne of CO2 or CO2e. Any carbon offset credits bought must be 'retired' in a registry for the purchaser to claim the related reductions / removals towards their own GHG accounting.

Operational emissions: The total GHG emissions generated in running a building. This includes emissions from electricity and gas used to heat, cool and light the building, both in common areas and customer spaces.

PIR: Passive Infrared Sensor. An electronic sensor which detects movement from infrared light radiating from objects within field of view. Typically used in automatic lighting systems to reduce energy consumption.

PPA: Power Purchase Agreements are contractual agreement between a generator and a customer for the supply of energy.

REGO electricity: Renewable Energy Guarantee of Origin (REGO) certificates are a tracking instrument which demonstrate that power supplied to an end consumer comes from a renewable source. Renewable energy includes the use of on- or off-site solar, wind, or geothermal power sources.

RFP: Request for Proposal. A formal request for general information from potential vendors during a procurement exercise.

Science-Based Target initiative (SBTi): The SBTi is a partnership between CDP, the United Nations Global Compact (UNGC), World Resources Institute (WRI) and the Worldwide Fund for Nature (WWF). SBTi facilitates a third-party validation process which assesses whether corporate climate targets are in line with the emissions reductions required by climate science.

UKGBC: The UK Green Building Council is a charitable organisation which campaigns for a sustainable built environment.

Whole life carbon: The total embodied and operational emissions that occur over the lifetime of a building. In the RICS guidance, this is structured into stages A1-A5 (Product and Construction Process stages), B1-B7 (Use stage), and C1-C4 (End of Life stage), as per Embodied Carbon.

Reference guide

AECB: Network of individuals and companies with a common aim of promoting sustainable building.

ASHRAE Standard 90.1: Used globally as a benchmark to set MEPS (minimum energy performance standards) and energy codes.

BBP Better Metering Toolkit: Information on the development of metering strategies.

Building Energy Efficiency Survey (BEES): Source of industry benchmarks for energy consumption.

CIBSE TM 54: Provides building designers and owners with clear guidance on how to evaluate operational energy use more fully, and accurately, at the design stage.

CIBSE TM22: Energy assessment and reporting methodology, which provides a method for assessing the energy performance of an occupied building based on metered energy use and a 'bottom up' assessment of the installed plant and equipment present in the building.

CIBSE TM39: Building energy metering guidance which promotes best practice in the design of energy metering and sub-metering in non-domestic buildings.

CIBSE TM44 guidance: Guidance for air conditioning inspections in the UK.

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

Climate Emergency Design Guide: Provides an 'elemental recipe' regarding fabric thermal performance of building elements, air permeability, thermal bridging and g-value of glass.

Contract Management Professional Standards: Sets out the capabilities expected of Government professionals who are involved in the management of contracts.

Crown Commercial Services agreements listing: List of possible contracting frameworks that can be used.

CST Report: Outlines other parallel causes that a good governance structure should overcome.

DEFRA Guidance on how to measure and report GHGs emissions: Provides detail on how to measure and set a baseline year for reporting.

DREAM: Online environmental assessment tool for New Building and Refurbishment projects on the Defence Estate.

Energy Technology List (ETL): The Energy Technology List (ETL) is a Government list of energy efficient plant and machinery. In order for a product to be listed, it must meet the ETL's robust energy saving criteria - typically set at the top 25% of products in the market.

Energy White Paper: Provides strategy on Government's ambition to achieve market-wide roll-out of smart meters as soon as practicable.

ESOS guidance: Guidance that gives an overview of ESOS and how to conduct energy audits.

Future Buildings Standard consultation document: Second stage of a two-part consultation on proposed changes to Building Regulations designed to help deliver NZC ready buildings.

GLA Whole Life-Cycle Carbon Assessments guidance Pre-consultation draft: A pre-consultation draft of whole life cycle assessment guidance.

Government Buying Standards: Official Government Buying Standards (GBS) for construction/refurbishment projects and products such as heating, lighting, taps, paint, timber.

Government conversion factors for company reporting of greenhouse gas emissions: Standard conversion tables for converting energy.

Government Facilities Management Control: Guidance to request spend approval when buying or extending facilities management contracts, regardless of their cost.

Government Functional Standard GovS 002: Project Delivery: Guidance regarding the structure and resourcing of delivery governance.

Government Functional Standard GovS 004: Property: Guidance regarding the development and management of Government property.

Government Functional Standard GovS 008: Commercial: Information regarding the management of contracts and suppliers.

Government Property Career Framework: A career framework to support the development of property professionals across Government.

GPA Net Zero and Sustainability Design Guide: Design guide for use for office buildings the Government portfolio.

Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal: Supplementary guidance to the Green Book providing Government analysts with rules for valuing energy usage and greenhouse gas emissions.

Greenhouse Gas Protocol's Corporate Value Chain Accounting and Reporting Standard and Greenhouse Gas Protocol Corporate Accounting and Reporting Standard: Provides a universal viable baseline in scope that can be applied to any type of entity, across all sectors and in any context. Additionally, this guidance aims to assist Government entities with the application and interpretation of the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard.

Greening Government Commitments: The Greening Government Commitments set out the actions UK Government departments and their agencies will take to reduce their impacts on the environment.

Historic Buildings Annex: Guidance on determining retrofit options for Government portfolio.

HM Treasury Green Book: Provides considerations of the merits of refurbishment and retro-fitting improvements to existing buildings, rather than commissioning new-build solutions.

ISO 50001: Standard that provides a practical way to improve energy use, through the development of an energy management system.

LETI Climate Emergency Design Guide: Helps to define 'good' and sets clear and achievable targets, including zero-carbon.

LETI Embodied Carbon Primer: Guidance on the expectations of roles at each RIBA stage.

Listed Building Consent: Requirement for alterations of listed buildings, to be obtained from Local Planning Authority if applicable.

NAO Good practice contact management framework: Guidance regarding the structure and resourcing of delivery governance.

National Planning Policy Framework (NPPF): Sets out Government's planning policies and how these are expected to be applied.

National Property Control guidance: Guidance to request spend approval on leaseholds, property acquisitions and disposals.

Net Zero Carbon Buildings Framework: A NZ carbon buildings framework which breaks down the different types of emissions which should be considered.

Net Zero Carbon Industry Initiative: Advice on the regulatory, policy and technical framework required to deliver a zero carbon, zero waste built environment (both buildings and infrastructure) and to identify the commercial, jobs and export opportunities that such a clean growth, zero carbon, zero waste economy requires.

Non-domestic smart metering mandate: Guidance aiming to deliver a smarter, more flexible energy system that supports innovation in new smart products/services.

OGP Net Zero Trajectory Tool: A tool based on the OGP property portal that provides an assessment of cost and routes to NZ for an organisational estate.

PAS 2038:2021 - Retrofitting non-domestic buildings for improved energy efficiency: Draft standard on BSI for the retrofitting of non-domestic buildings for improved energy efficiency specification.

Passivhaus: Provides leadership in the UK for the adoption of the Passivhaus standard and methodology.

Procurement Policy Note 06/21: Requirement for suppliers bidding for major Government contracts to commit to NZ by 2050 and publish a Carbon Reduction Plan for their organisation.

Public Sector Loans Board – Lending Facility: Provides loans to local authorities, and other specified bodies, from the National Loans Fund, operating within a policy framework set by HM Treasury. This borrowing is mainly for capital projects.

RIBA 2030 Climate Challenge: Provides industry consulted recommendations on action required to meet NZ.

RICS Code of measuring practice: Provides information regarding the measurement of area within buildings.

RICS Guidance on Whole Life Carbon Assessments: Emissions assessment approaches of demolition and disassembly.

Salix Public Sector Decarbonisation Information and Guidance Notes: Grant scheme that encourages green investment, supporting the Government's net-zero and clean growth goals.

SPONS; Price guides providing accurate price data for the UK construction industry.

Sustainable Procurement: Government Buying Standards: Official Government Buying Standards (GBS) for construction/refurbishment projects and products such as heating, lighting, taps, paint, timber.

The Construction Playbook: Provides guidance on the use of whole life carbon assessments to inform decisions at early stages of project definition and option assessments.

UK Find a Tender Service landing page: Service to search and apply for high value contracts (usually above £118,000) in the UK's public and utilities sectors.

UK Woodland Carbon Code: Information regarding tree planting and management.

UK's National Calculation Methodology: Procedure for demonstrating compliance with the Building Regulations for buildings other than dwellings, by calculating the annual energy use for a proposed building and comparing it with the energy use of a comparable 'notional' building.

UKGBC Renewable Energy Procurement & Carbon Offsetting guidance: Guidance from UKGBC for use when everything that is possible has been completed.

How to approach new buildings

In addition to the legally binding NZ target and aim to reduce direct emissions by 50% by 2032, against a 2017 baseline, public buildings which are, or will be, under construction should meet both of the following targets where feasibly possible:

A. Embodied carbon (as this is an emerging area, organisations should seek to establish targets for embodied carbon where possible).

B. Operational Energy.

A. Embodied carbon targets

In the case of new buildings, after it has been established that a new building is necessary and the need cannot be met by adapting existing stock, embodied carbon targets should be set in line with current guidance. Best practice targets can be found and assessed for suitability in the following:

- LETI Climate Emergency Design Guide (includes benchmarks for embodied carbon for both offices and schools).
- LETI Embodied Carbon Primer.
- RIBA 2030 Climate Challenge.
- GLA Whole Life-Cycle Carbon Assessments guidance Pre-consultation draft.

The table below presents a summary of the targets as set out in the above documents, along with a timeline for reductions which can be considered. Although there may be upcoming guidance regarding embodied carbon targets, the below should be used currently.

Figure 22: Embodied carbon targets

	Embodied Carbon Targets (kgCO2e/m2)				
	Baseline	2020 target	2030 target	NZ target	Life cycle stages
LETI	1000	600 30% reused / 50% reusable materials.	350 50% reused / 80% reusable materials.	0 100% reused / 100% reusable materials.	A1-A5
RIBA 2030	1000	600	300	-	A-C
GLA (offices)	900-1000	550-600	-	-	A1-A5
	400-500	250-300	-	-	B-C

It is important to note that the targets above do not cover the full extent of life stages. These are set out in the RICS professional statement, Whole life carbon assessment for the built environment, which is the most current methodology to be followed for conducting whole life cycle assessments.

Note

Embodied and Whole Life carbon are areas currently under review across the Government, with the IPA coordinating an initiative to support the implementation of whole life carbon assessments early in projects, in line with Construction Playbook recommendations.

B. Operational energy targets

There is evolving work in establishing estimated operational energy targets for newbuilds. Currently, best practice in the construction sector is adherence to the LETI Climate Emergency Design Guide. For operational energy, targets are outlined at 55 kWh/m2 per year for office buildings, and 65 kWh/m2 per year for schools. Space heating demand alone should be limited to 15 kWh/m2 per year across both building types.

The development of best practice targets and standards for more property types is currently ongoing. Not dissimilar to the LETI Climate Emergency Design Guide, the RIBA 2030 Climate Challenge sets the target for operational energy to under 55 kWh/m2 per year for 2030 with intermediate steps for 2020 (under 170 kWh/m2 per year) and 2025 (under kWh/m2 per year).

Long List Net Zero options

Energy efficiency measures

LED lighting

Light Emitting Diodes (LEDs) offer a low energy solution to lighting. They reduce energy and emissions by up to 80% and are therefore seen as no regret option to reduce electrical consumption. LED upgrades also typically include the installation of passive infrared (PIR) sensors to maximise energy reduction. Because LEDs are cost effective, they are often considered an easily justified investment as part of the overall estate decarbonisation plan.

LEDs are a known technology and can therefore be undertaken relatively easily under existing delivery options such as through FM contractors.

For healthcare facilities such as hospitals and surgeries, the LG02: Lighting for healthcare premises guidance should be adhered to regarding best practice design.

Building fabric

Building fabric improvements can be thought of in two ways, as the reduction of infiltration through draught and open apertures or through the improvement of the building fabric. The first should be carried out as a matter of course, with thermal cameras providing a quick indication of where draught exist. Secondly, Building fabric improvements such as additional insulation of roofing systems, cavity wall insulation, replacement glazing and doors, external and internal wall insulation and floor insulation, is more bespoke and will need to be assessed depending on the nature of the site under review. It often therefore requires a specific survey to consider what the options are. However it should be noted:

- Loft insulation is easy to add and generally cost effective. Even if loft insulation exists it is prone to slumping over time and becomes less effective. Therefore adding more insulation on top is likely to offer benefits.
- Cavity wall insulation is dependent upon the size and current fill of the cavity. By understanding the age of the building and the width and construction of the wall an assessment can be made of if there is potential to fill. A test drill will confirm size and current fill. Similar to loft insulation it can also be prone to slumping overtime and therefore, replacement or additional fill can also be seen as beneficial.
- External and internal wall insulation is generally applied to older buildings where the walls are solid. To improve the thermal efficiency of the wall however can present problems with the sofit, waterproofing, decoration, and drainage outside, as well as the electrics, doors, and skirting boards internally. As a result, it tends to be more expensive.
- Glazing should be double glazed and meet the most recent building regulations as a minimum. However, it can be expensive and as a result does not always offer a good business case unless part of a refurbishment. If possible, this should be incorporated into the whole life management of the estate.

Improving building fabric efficiency in newer buildings is also an option that should be explored and assessed thoroughly as improvements tend to require less intervention but benefit from good energy reduction.

Often fabric improvements are a requirement and support the benefits for other low-carbon heating technologies such as heat pumps. This is one of the reasons why building fabric solutions are well suited to being assessed and chosen within a whole systems approach.

Building Management Systems (BMS)

BMS systems are controls that manage and operate building systems automatically. They can be for a building or a portfolio of buildings and can be accessed remotely. They are configurable with set points and often consider internal and external temperatures, occupancy and air quality. They are able to flag when equipment is in need of a service or has failed, supporting the management of an organisation's estate. They can also provide energy meter use.

Traditionally they operate mechanical and electrical equipment such as lighting, HVAC systems, power systems, fire systems, and security systems. However, in the future it is expected that they will evolve to support EV charging consumption, renewable energy generation and energy demand management. Some products on the market are already starting to broaden their scope to do this.

They offer significant energy and operational savings as well as improving the working conditions in buildings. Often, they are quoted of saving 10% of the energy consumed, although if a site is being operated poorly the savings can be higher.

Heating, Ventilation and Air Conditioning (HVAC) improvements

HVAC systems often provide heat and cooling throughout the year. Heating, cooling, and ventilation systems are not always combined; there are multitude of different combinations but, dependent upon the type of estate the organisation operates, there are likely to be patterns in the systems.

Often systems with ventilation and cooling contain refrigerant and therefore, the focus of the emissions reduction must take into account refrigerant management as well as energy.

For schools and properties in an educational environment, the Building Bulletin 101: Ventilation, thermal comfort and indoor air quality in schools should be adhered to in order to ensure optimum performance is maintained across the estate. Additionally, CIBSE Guide B: Heating, Ventilating, Air Conditioning and Refrigeration provides insight for a range of assets, including laboratories. Depending on the specifications and use of the laboratory, additional ventilation criteria may need to be applied – further information can be found in the NERC Guidance on Design of Safe Laboratories.

Due to the Covid-19 pandemic, ventilation guidance has been updated and may continue to develop over time. The latest standards and regulatory requirements during the pandemic can be found on the dedicated Health and Safety Executive (HSE) guidance pages regarding the topic.

Low-Carbon heating measures

Many public sector sites have centralised heating distribution systems or district heat networks. These are often in poor condition. They also often operate at traditional low, medium and high temperature flow temperatures and 11°C flow and return differentials.

The condition and operating temperatures are key to choosing the heat generation system because heat pumps typically operate at lower operating temperatures and wider flow and return differentials (>20°C).

Therefore, in assessing the best route for heat decarbonisation, an assessment of the heat network and its ability to operate at lower temperatures must be done. Based on that knowledge a suitable heat solution can be chosen, or the cost for upgrading the heat distribution network can be incorporated into the proposals.

Heat pumps

Heat Pumps offer a low carbon solution to heating by removing the combustion of fossil fuels in favour of electricity. Heat pumps can be of various types: air source, ground source or water source. Each type has specific characteristics that need to be assessed for applicability to the site or specific building requirements. Heat pumps operate at lower flow temperatures than traditional systems. Therefore, to operate as efficiently as possible, heat pumps require some adaptations to the site. These might include building fabric improvements to minimise heat demand and the potential resizing of the heat distribution network to ensure that heat is distributed appropriately.

The cost of installing heat pumps is higher than traditional heating technology. Adaptation works to pipework and heat emitters can be a costly exercise, particularly where access and security concerns may be a factor, such as prisons or other high-security facilities.

Biofuels

A biomass or biofuel heating system may be able to provide heat at the existing flow and temperature differential without changes to the existing heating system. However the supply of good quality ethical and sustainable sufficient biomass or biofuel must be ascertained in the local area. Therefore, consideration to the source of fuel must be conducted at the same time as evaluating the suitability of the plant. The current price per unit of biomass and biofuel would need to be established and confirmed (including potential future price variation) to minimise the risks to the organisation entering into a supply contract should the plant be installed. BEIS has stated that it intends to publish a new biomass strategy in 2022, potentially setting out a policy background that may influence near-term investment decisions.

If the site is within an urban area increased transport of fuel and road use should be considered, as well as compliance with any air quality requirements of the local area. Additional site requirements regarding the provision and smooth operation of the biomass supply need to be considered, such as access to suitable fuel store and ongoing maintenance.

Hydrogen

Analysis and pilot programmes are currently in flight to understand how the existing gas network could be updated to replace the currently used methane with hydrogen, a gas which does not produce carbon when burned. Whilst it is expected that this option will become available for some areas across the UK, uncertainty exists in terms of the timescales for this to become available and for which locations this might apply. In addition, it is not yet known what specific activity will be required to transition, or associated cost and impact of doing so.

Note that significant on-site upgrades would be likely in the event that hydrogen was available in the area, as existing boiler plant is unlikely to be capable of burning hydrogen directly.

An alternative to gas network hydrogen supply is to use excess renewable electricity generation on site to generate hydrogen on site. This can be done via electrolysis; however, at present it is expensive and not an efficient use of renewable electricity.

District heating

District heating is a distribution system of insulated pipes that takes heat from a central source and delivers it to a number of buildings. Campus style properties tend to benefit from district heating as they tend to be high density. This reduces the potential costs as installation of underground insulated pipework is expensive. When a district heating

system is already in place, retrofitting the heat source with a low-carbon alternative can be an effective solution for NZ. Where an assessment of a campus style site determines that a district heat network would be beneficial (due to the high linear heat density), the solution can be designed with a low-carbon heat source from the outset. Note that in a retrofit scenario, substantial adaptations may be required to ensure the system operates as efficiently as possible.

An alternative district heating option to consider is a fifth-generation heat network. These systems typically utilise heat pumps by integrating them into a wider ambient temperature heat network and can result in several advantages such as reduced running costs, elimination of on-site heat-related emissions, and the modular expansion of heating. This allows for future buildings to 'tap in' to the network.

Renewable energy generation

Renewable energy can be generated on-site and/or off-site, depending on the practicality of onsite energy generation and storage. Although off-site generation can deliver small cost savings compared to onsite alternatives, it can offer large volumes of renewable power which may not be achievable through onsite options alone.

Photovoltaic (PV)

PV solutions can be an effective measure to implement where there is a need to reduce the reliance of low-carbon technologies on grid electricity which could become costly during peak times. Ground mounted PV solutions, if an option, are straightforward to cost and evaluate the benefits for, however they require substantial land area without risk of shading. Roof mounted PV, although utilising the same benefits calculations, comes with higher costs to install and often greater uncertainty due to the roofing conditions which are required. Despite this, they remain an effective solution to reduce estate emissions. An emerging option is to install solar carports, which have PV cells mounted on canopies under which cars are able to park. Similar to roof mounted PV, costs for solar carports tend to be high and might result in a small reduction in existing car parking capacity.

Note that whilst resource from solar generation is reasonable in the UK, the generation profile from PV peaks in the summer and falls during the winter. This poses some challenges given that heating demand peaks during the winter. A potential solution would be to integrate PV generation with storage; however, at present inter-seasonal storage of a capacity to support winter peaks in demand is particularly expensive. An alternative is to combine PV solutions with wind generation (see below).

Wind power

Generating renewable electricity from wind turbines is becoming a low cost and effective solution. Whilst there are constraints with location and/or planning, the benefit of wind turbines is that there is year-round generation, and they require less space than solar PV for the equivalent output. In the UK, wind resource tends to be higher during the winter and is also not limited to daylight hours. Therefore, there is likely to be a better match between demand from the electrification of heating and generation of energy.

Whilst wind turbines require a suitable amount of space to operate with optimum conditions, it is possible to install a turbine close to site and connect via a Private Wire. Their ongoing maintenance and support plans must also be factored into any FM contracts. Like PV, they can provide good value for money as a decarbonisation option. Their evaluation can also be undertaken with a fair degree of certainty.

Energy supplier agreements

Purchasing renewable (green) energy

When purchasing energy, customers can buy Low-Carbon Tariffs, or Power Purchase Agreements (PPA). Some PPAs can be on-site and provide energy directly to a customer off the grid; 'behind the meter'.

Selecting a low-carbon tariff

A supplier providing a 'Green Tariff' will have green electricity certificates, REGOs (Renewable Energy Guarantees of Origin), to cover their customer's expected energy demand. However, due to the nature of much of the renewable energy available, it is often not possible for suppliers to fully link real time generation to real time usage. In practice, customers receive the same energy as any other customer via the grid, unless the supply is via private wire or on-site generation, being a mix of renewable and non-renewable generation. Because of the low values of REGOs, these tariffs will likely not materially increase the total amount of renewable energy generation itself.

However, the use of green tariffs and REGOs remain important to signal the intent of an organisation. It is also the case that if enough customers sign up to Green Tariffs, energy suppliers would have to invest in more renewable energy to meet demand. Some Green Tariffs could be considered "better" than others but there are currently no agreed standards to make a distinction.

The other form of Low-Carbon Tariffs is 'Blue Tariffs', which use nuclear energy supply instead. Similar to Green Tariffs, this is only a contractual arrangement and does not impact the energy on the grid or that being received by the customer. Although nuclear energy is not renewable it does not emit Greenhouse gases - however, it does produce other toxic waste.

Central Government cannot currently claim a Green or Blue tariff as zero carbon on their GGC reporting. The wider Public Sector, however, is able to disclosure through the additional optional reporting of net emissions (as defined in the SECR).

Case study: Crown Commercial Services energy solutions

Through their supply agreements, CCS already have over 30% of their organisations using green backed supplies. Enabling organisations to source power and gas through certified sources is fundamental to the agreement. The renewable power supplied is independently verified as renewable through the Carbon Trust as being sourced in line with the WRI GHG Protocol Scope 2 Guidance (2015).

CCS has a dedicated Energy Net Zero team who can guide organisations on green energy supplies and are setting up Power Purchase Agreements for their portfolio of customers.

Power Purchase Agreements (PPA)

A PPA is a contractual agreement between a generator and a customer. These can come in different forms. Private Wire PPAs are where there is a link, usually onsite, between a newly built energy generator and the customer. In this agreement the customer is using a new generation asset to reduce or eliminate its national grid demand. This arrangement is generally considered the 'most green' and is suitable for both Central Government and Wider Public Sector reporting. Private Wire PPAs can also help a customer reduce or avoid non-energy costs such as transmission and distribution costs.

The other main type of PPAs is a Corporate PPA, which are market-based solutions without on-site construction. In a Corporate PPA a customer contracts with a generator for a certain volume of energy on agreed commercial terms for a period. This energy is then "sent" through the national grid, so could be located anywhere in the country.

Virtual PPAs can take a variety of forms but are typically financial instruments that may provide the customer REGOs as part of the agreement. The supply of power is not tied to the customer and will generally be supplied to the grid. Public Sector customers should take appropriate legal advice to determine the suitability of entering such arrangements and to ensure compliance with HM Treasury rules on managing public money.

A customer could either contract with an existing generator or a new one. The latter, 'new-to-earth', assets are considered 'greener" than the former, as a customer is directly helping new renewable generation for the grid, benefitting the UK's overall decarbonisation targets.

PPAs can vary in term, with terms of 10-15 years typical for new build assets, and shorter terms being available for existing assets. PPAs can help manage long-term energy price uncertainty but can also introduce complexities in contracting.

For more information regarding PPAs and how they may benefit an organisation, the UKGBC Renewable Energy Procurement & Carbon Offsetting guidance should be consulted.

Case study: Flintshire County Council

The council has signed on a PPA with Good Energy for the supply of 3.5MW of solar power over a five-year period. The local authority will be the sole power purchaser for the two projects located in Flint Landfill and Crumps Yard – both on land owned by the council.

Together, these sites have been redeveloped to host around 9,000 solar panels. Good Energy currently holds PPAs with more than 1,600 renewable generators across the UK, covering in excess of 100% of its customer's energy consumption across the year.

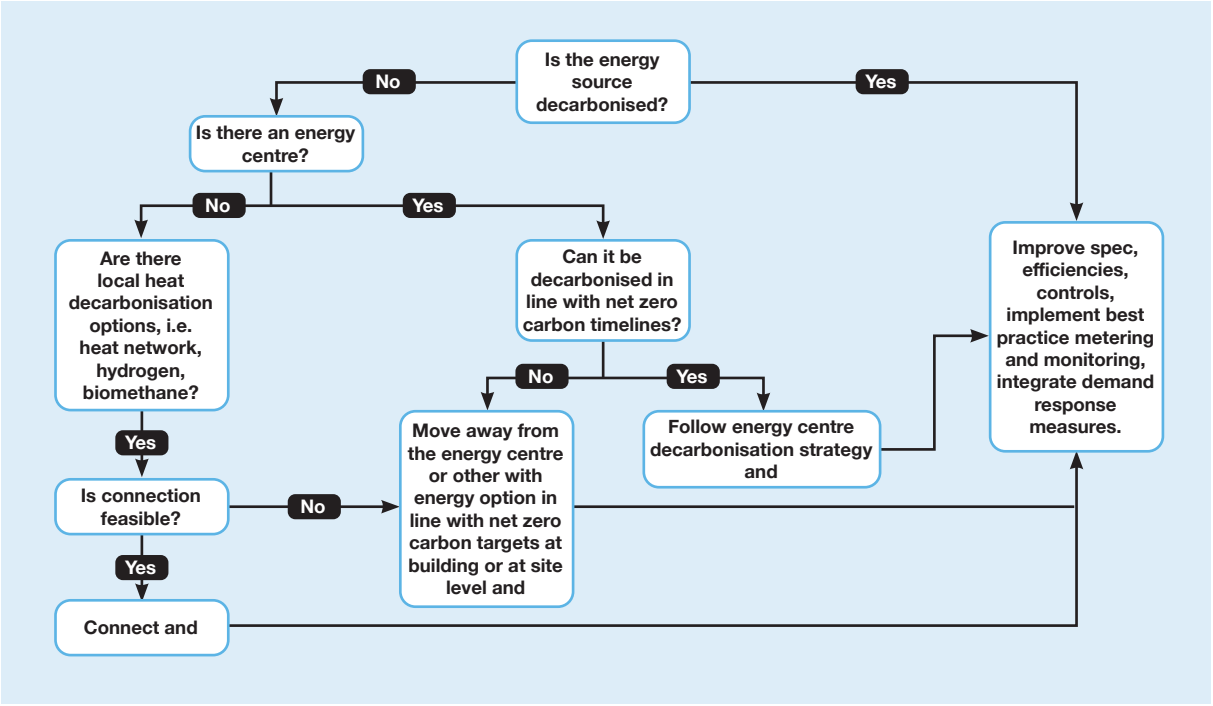
Source: SolarPowerPortal.

Energy options appraisals

Energy options appraisals are undertaken to provide an understanding and insight into the energy requirements of a site and the solution pathways which could be viable in order to aid decarbonisation. They typically include the assessment of site suitability for renewable technology such as solar power and biomass. They also provide a guide of potential running and maintenance costs of options suitable to the site.

The below flowchart provides a high-level view of the steps and considerations to be taken at the beginning of an energy options appraisal.

Figure 23: High-level energy options appraisal flow diagram



Decarbonisation options in terms of energy supply will always be building and location specific to a certain extent. Therefore, it is important that these are carefully evaluated and utilised where possible in order to align with national strategic approaches.

Business case development

Although there may exist processes for appraising and evaluating programmes and projects which are unique to the organisation, all NZ strategies must have a fully developed Green Book compliant business case. In order to gain funding for the NZ estate decarbonisation plan, a fully developed Green Book compliant business case should ideally be written by someone with the Better Business Cases Practitioner qualification and must be approved by the SRO. Business cases are a requirement for all NZ programmes, regardless of the intended funding sources.

In terms of the actual evolution of the business case, the initial Business Case – referred to as a 'Strategic Outline Case' (SOC) – is subsequently updated to become an 'Outline Business Case' (OBC) and eventually a 'Full Business Case' (FBC) through later stages of progression and procurement of the programme. This step covers the build of the SOC and the actions necessary to start developing an application for funding.

Note

Alternative Cases: Depending on the size of the NZ strategy and associated project portfolio, a 'Strategic Outline Program' (SOP) or 'Business Justification Case' (BJC) may alternatively be required. The accountable Green Book practitioner will be able to advise whether either of these options would be necessary.

Green Book compliant Business Cases follow a consistent five case model which outlines and details the appropriate dimensions of the programme in question, covering:

- Strategic case.
- Economic case.
- Commercial case.
- Financial case.
- Management case.

Green Book compliant business cases should utilise a SMART objective setting methodology and endorse a best practice framework (as outlined in HM Treasury Green Book) such as the ROAMEF (Rationale, Objectives, Appraisal, Monitoring, Evaluation, Feedback) policy development cycle where appropriate. Depending on the size and scale of a NZ strategy, external guidance and support may be required in order to develop a suitable business case.

Case study: GPA Net Zero programme

During the summer of 2020, the Government Property Agency (GPA) developed a Green Book compliant business case for 430 offices covering a range of decarbonisation options and interventions. Total financial benefits were calculated at up to £320m over 15 years, whilst the wider social value was estimated at up to £841m over just 10 years.

Strategic case

Provides the case for change for the estate decarbonisation plan and NZ strategy, such as policy requirements and Governmental commitments. This should relay into how the NZ strategy meets wider strategic and operational needs of the organisation, which for many cases will be the provision of a modern working environment and, crucially, much needed investment to sustain operations which complement a pre-existing site and asset maintenance plan.

The needs and goals of not just Governmental personnel but all stakeholders which will be impacted by the NZ strategy should be outlined, including their respective positions and ambitions. This should loop back to the ambitions of the NZ strategy, reflecting how it achieves its purposes beyond emission and energy reduction (such as improving public health, better employee morale and providing jobs across the sites within scope).

The IPA's Project/Programme Outcome Profile tool has been published as supplementary guidance to the Green Book to support teams in the development of stronger business cases by identifying from the outset how they will contribute to Government's priority outcomes. The tool should be used throughout the business case process to maintain a 'golden thread' of strategic alignment from priority outcomes to projects and programmes and into procurement and delivery.

Economic case

Reflects how the programme of works provides an optimal public value for money with regards to the associated costs, benefits, disbenefits and risks considered. This should build upon a foundation of critical success factors for the NZ strategy, as well as a robust approach for managing risks and their associated costs.

Scenarios presented must reflect the economic costs and benefits over a range of scenarios, including a 'do nothing' (business-as-usual) case and typically a realistic 'minimum' offering. These should reflect why the chosen NZ decarbonisation interventions and overall strategy has been selected as a preferred option which will provide the greatest benefit for society and the environment. Specifically, this should also be supported by the modelling process to demonstrate how the selected suite of interventions have been arrived at.

The development of the economic case will, in addition to standard Green Book guidance, require inputs from further supplementary Green Book guidance for energy and GHG emission valuation. For larger or more complex works, it may be that further sources will be required for calculations such as social value. In such circumstances, HM Treasury have endorsed a range of suppliers and tools which can support this.

Commercial case

The commercial case should outline how the programme is both attractive and viable for all parties involved, including how the market will be able to efficiently provide supply-side requirements throughout procurement, as well as how a potential deal may be structured. This includes not simply the arrangements for specified goods and services, but also risk transfers involved between parties (as with outcome-based procurement), charging mechanisms, and programme personnel implications.

Clarity between the respective roles and responsibilities throughout the contracting period will be a key input to the commercial case, along with associated risks and their management strategies. A view on how suppliers will be evaluated and assessed should be well developed and agreed.

Financial case

In contrast to the economic case, the financial case provides a view of the affordability to the organisation which is engaging with the NZ strategy and financially appraising the works as a form of investment. This outlines the realistic capital and revenue costs and savings over the expected lifespan of the capital involved, including the financial requirements and support needed for the programme.

For NZ projects it is expected the forecasted cost of ongoing maintenance and repair would be factored into a wider cost model of the estate covering the estate's ongoing lifecycle replacement costs. This would typically be linked directly with the energy and financial modelling which has been developed over the course of the NZ plan development. Scenarios presented in the financial case should map directly across to the economic case (i.e. a 'do nothing' case, and commonly a 'realistic minimum' case and the preferred option case).

As per the economic case, guidance sought in the development of the financial case should be the Green Book and BEIS' Green Book supplementary guidance, which will allow the organisation to calculate and understand the internal rate of return (IRR) and simple payback period (SPP) – which can be factored into the NZ business case.

Other key modelling differences between the Economic and Financial case include:

Figure 24: Key differences of economic and financial cases

	Economic	Financial
Focus	Value for money.	Affordability.
Coverage	UK.	Organisation.
Standards	HM Treasury Green Book.	Standing Orders and Financial Regulations.
Includes	• Real Prices. • Opportunity Costs. • Attributable Costs. • Quantifiable Benefits and Risks. • Environmental Cost.	• Current Prices. • Transfer Payments. • Inflation. • Cash-releasing Benefits. • Depreciation.

Management case

The management case outlines the mechanisms through which the programme will be deployed and delivered in order to successfully meet the ambitions laid out in the previous four cases. This includes the governance structures and approvals processes developed in Step 1: Establish governance.

Alongside governance, a comprehensive delivery plan and resource allocation approach should be factored in, reflecting how the programme will be scaled over time and effectively managed from the NZ management team available. This includes change, risk, and stakeholder management strategies, as well as a benefits realisation approach which encapsulates the approval and tracking of benefits of the NZ strategy (such as emission reduction and financial savings etc – more information on this topic can be found in Step 6: Deliver and track).

Where the NZ management team or other resourcing teams (such as Design and Engineering) are light or under-resourced for the ambitions of the NZ strategy, a suitable resourcing strategy should be developed including redeployed resources internally or

procured externally. The additional resource requirements would have to be built into the commercial case and the respective procurement strategy for the NZ strategy. Depending on the resource being procured, alternative arrangements and considerations may need inputting into the governance structure to ensure appropriate delegation of authority and removal of conflict of interest are achieved.

Data management

Understanding energy consumption is critical in order to evaluate where a decarbonisation project has succeeded or failed and to learn what could be done better. Having better data across the estate and being able to monitor emissions reduction as it happens is essential.

Future decarbonisation needs to focus on heat in order that direct emissions from the public sector are reduced. There is a need for better data on-site, specifically to understand where and how heat is used. A balance of meters (a mix of electricity and fossil fuel, heat, power use, and water consumption) are required to give a full picture of the consumption on-site.

Historically, good energy management has always centred around understanding energy data. This commences with metering, monitoring, and targeting (MMT). Analysing the data gathered reveals variations in consumption to be investigated. It also permits improvements to be tracked after energy saving interventions. Regular data analysis, as well as engagement with site-based teams, to understand consumption and opportunities for improvements is good practice. However, a site's energy consumption is often determined exclusively from fiscal meters data. This does not provide enough granularity for a large campus-style site to understand variations and plan decarbonisation effectively. Although access to real-time half-hourly data is not always possible, this information is powerful as it links energy consumption with building use.

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