Department for Business, Energy & Industrial Strategy

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Government Property Function

CATAPULT Energy Systems

Building Retrofit Planning
RIBA Plan of Work

Public Sector Decarbonisation Guidance

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Who is this guide for?

This guide is for you if you are involved in the planning and delivery of building decarbonisation retrofit and refurbishment projects.

The guide is also for you if you are responding to competitive tenders for building decarbonisation goods and services, for example, the delivery of a heat decarbonisation plan.

The principles set out in the guide apply to decarbonisation retrofit projects of all scales and sectors in any typical non-domestic public sector building, making it appropriate for use in education settings, healthcare estates, and local authorities.

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What is the purpose of this guide?

As part of a programme funded by the Department for Energy Security and Net Zero (DESNZ), and working with the Government Property Agency (GPA), Energy Systems Catapult (the Catapult) has produced guidance to support the public sector to decarbonise their built estate.

This Public Sector Decarbonisation Guidance (PSDG) covers seven themes and give an overview of all the activities required to successfully develop and deliver a decarbonisation programme. They are designed to be used as a set, but also stand alone as a guide to each theme area. It should be noted that decarbonisation is not a linear process and all themes will be relevant to developing your strategy to a greater or lesser extent.

This guide outlines the actions and processes involved in a building decarbonisation retrofit project, aligning them to the Royal Institute of British Architect's (RIBA) Plan of Work.

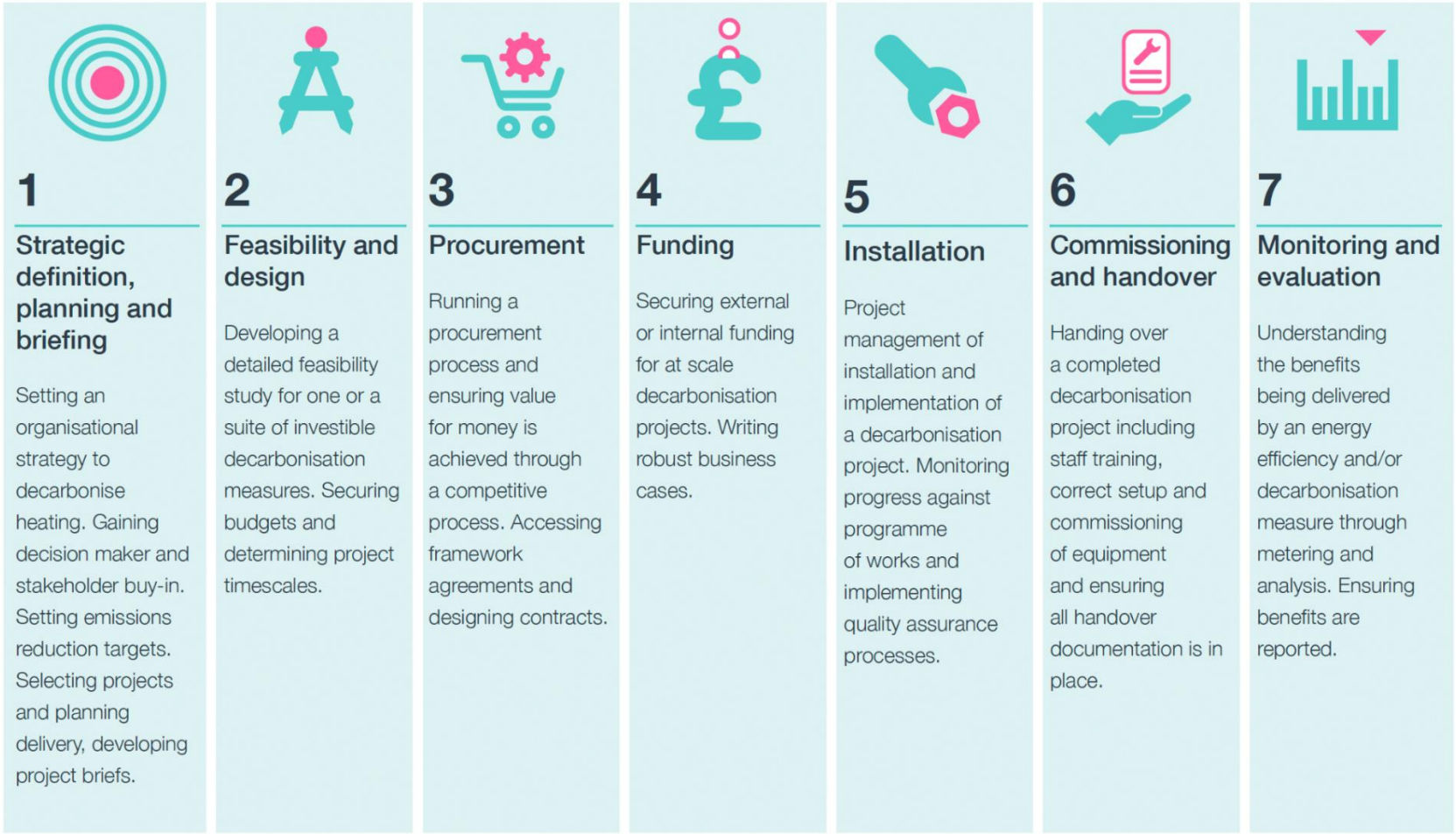
The RIBA Plan of Work is a framework to guide the process of planning, designing, constructing, and managing building projects. It provides a structured approach that helps architects, clients, and other stakeholders understand and manage the various stages of a construction project from inception to completion.

The plan is widely recognised and used across the architecture, engineering, and construction industries. Being able to use this framework to structure your project and the consistent terminology in the context of decarbonisation retrofit will help ensure required project outcomes are clearly defined and achieved.

This guide has been produced by the Catapult and has been peer reviewed by industry experts across the private sector, and RIBA.

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Public Sector Decarbonisation Guidance (PSDG) Themes



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How this guide is structured

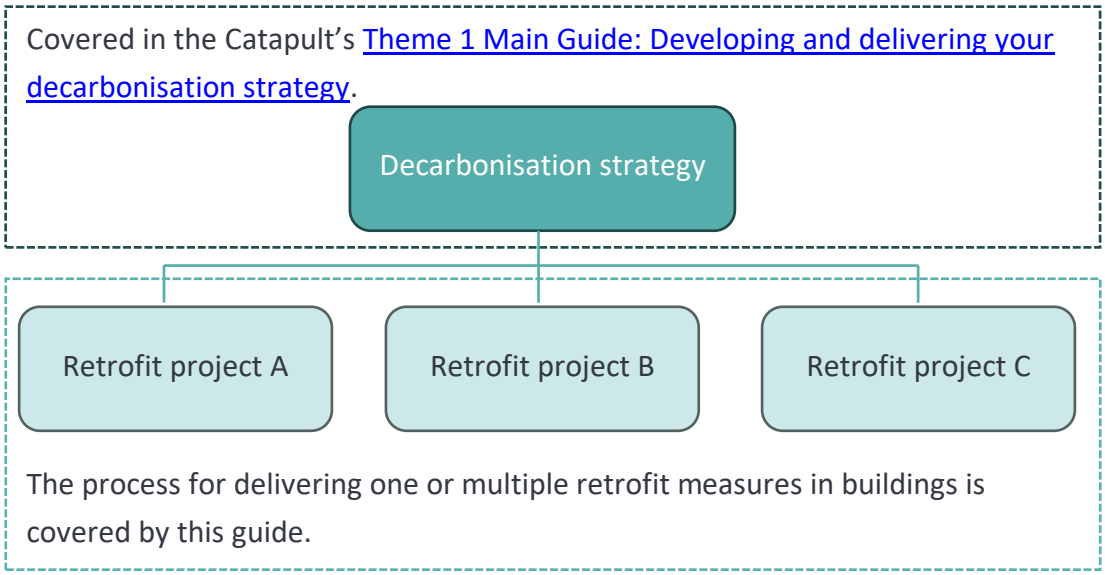
This guide begins by introducing the RIBA Plan of Work and outlining the advantages of aligning project delivery with its stages. It then examines how other industry-recognised delivery planning frameworks correspond to the RIBA Plan of Work, enabling you to map actions across different delivery models. Lastly, the guide provides an overlay that adapts the RIBA Plan of Work specifically for decarbonisation retrofit projects, offering a practical tool for planning and executing your projects.

What is covered by this guide

This guide makes an important distinction between having a decarbonisation strategy that covers your organisation and delivering individual retrofit projects.

Your decarbonisation strategy sets out how your organisation will reduce energy demand and eliminate fossil fuel use across your entire estate. Developing and delivering a decarbonisation strategy is outside the scope of this guide but is covered in the Theme 1 Main Guide: Developing and delivering your decarbonisation strategy.

The interaction between a decarbonisation strategy and the process for delivering retrofit projects covered in this guide are shown in the diagram below.



This guide covers different industry standard frameworks for planning the delivery of building retrofit projects.

The stages outlined in each of the delivery frameworks are different to the seven themes that form the structure of the PSDG. The PSDG themes cover content that is much broader than delivering a single or multiple decarbonisation project.

Delivering a retrofit project

Building decarbonisation retrofit is a comprehensive approach to transforming existing buildings into more sustainable, energy efficient, and low-carbon environments through a combination of:

- Improving building energy performance through the installation of energy efficiency technologies.
- Removing fossil fuel use by installing heating and hot water technologies that use low-carbon fuels.
- Using zero carbon energy by installing renewable generation capacity.

The goal of building decarbonisation retrofit is to achieve significant reductions in greenhouse gas emissions, often aiming for net zero carbon emissions.

Building retrofit as a process

It is important to recognise that building retrofit is seldom a linear process.

Many projects will require an iterative approach at each stage, regardless of the approach or framework used. For example, design may require several iterations, moving between stages to make changes, before a final approach is agreed.

Even after a project has been completed and the technology is in place, you may find that the handover stage reveals additional tasks to ensure the technology operates effectively.

While the Plan of Work and other frameworks outlined in this guide help standardise the delivery of a project, approach their use with adaptability and flexibility in mind.

What is the Plan of Work?

The RIBA Plan of Work[1] is an industry recognised framework for guiding all disciplines on construction projects. It guides the processes of briefing, designing, delivering, maintaining, operating and using a building.

The RIBA Plan of Work serves as a structured roadmap for project management and collaboration, helping to ensure that construction projects are delivered on time,

[1] Plan of Work

within budget, and to the desired quality standards. It provides a common framework for communication, decision-making, and accountability among project stakeholders throughout the project lifecycle.

The RIBA Plan of Work may be applied to any construction project. When thinking about the decarbonisation of existing buildings there will be other things that you need to think about to make sure you maximise the opportunities for reducing carbon emissions. This guide focusses on the elements associated with successfully delivering a retrofit project to decarbonise a building.

The RIBA Plan of Work provides a structured outline of project delivery, broken down into eight stages with each stage representing a distinct phase of a project lifecycle.

Stage	Outcome
0 Strategic definition	The best means of achieving a client requirement is confirmed.
1 Preparation and Briefing	Project Brief approved by the client and confirmed that it can be accommodated on the site.
2 Concept Design	Architectural Concept approved by the client and aligned to the Project Brief.
3 Spatial Coordination	Architectural and engineering information Spatially Coordinated.
4 Technical Design	All design information required to manufacture and construct the project completed.
5 Manufacturing and Construction	Manufacturing, construction and commissioning completed.
6 Handover	Building handed over, Aftercare initiated, and Building Contract concluded.
7 Use	Building used, operated and maintained efficiently.

Consider reviewing the RIBA Sustainable Outcomes Guide and the RIBA Plan for Use Guide, as these resources will aid in successfully delivering your outcomes and complement the RIBA Plan of Work.

For the full suite of RIBA guidance, please visit RIBA's resource website.

What are the benefits of aligning to Plan of Work

Aligning your building decarbonisation retrofit project to the Plan of Work provides a structure and framework that helps to organise and manage the project from

inception to completion. Breaking down the project into stages, ensures that all requirements are systematically completed, leading to better overall project outcomes.

It provides common language and terminology amongst project stakeholders, enabling you to better communicate your project requirements to contractors, who in turn can more effectively price and deliver your project. It also encourages collaboration among the project team which helps avoid misunderstandings or lack of awareness about roles and responsibilities.

The Plan of Work is scalable to projects of all sizes and is applicable across different sectors. This means it can be applied to small retrofit projects in a primary school, through to a multi-million pound retrofit of an NHS Trust.

Regular review gateways at the end of each stage helps ensure quality and control by checking that the project is meeting its objectives and adhering to standards. This in turn helps manage project budgets effectively, by planning expenditures in a structured way, and ensuring timely delivery of the project by setting deliverables and milestones at each stage.

If you are a contractor reading this guide, the Plan of Work can also help you improve client satisfaction by providing your client with a clear understanding of what to expect at each of the project stages. It encourages the client to get involved in the project at set points throughout the project, ensuring that their needs and expectations are met.

Finally, the Plan of Work supports a long-term strategic vision that is needed to effectively decarbonise the public sector estate. It helps frame projects with wider goals and objectives, enabling more effective integration of Net Zero ambitions into retrofit of the built estate.

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How does the RIBA Plan of Work link to other recognised frameworks?

The RIBA Plan of Work is not the only framework available to help a building retrofit project.

This guide will also overlay three other standard frameworks often used to manage projects in the non-domestic environment:

- Building Services Research & Information Association (BSRIA): Design Framework for Building Services.
- Publicly Available Specification (PAS) 2038: Retrofit of Non-Domestic Buildings.
- HM Treasury Green Book: - business case guidance for projects

BSRIA: Design Framework for Building Services

The BSRIA Design Framework for Building Services[2] aims to ensure that building services (such as heating, ventilation, air conditioning, lighting, and plumbing) are designed and installed to meet the performance requirements of the building while also addressing sustainability, energy efficiency, and user comfort.

The BSRIA design framework outlines seven proformas and closely aligns to the RIBA Plan of Work. The stages are:

Proforma	Outcome
1 Preparation and brief	Covers the building services aspects of development of the initial project brief, including advice on feasibility studies, and the development of project objectives including functional performance of the project as a whole, sustainability and budget.
2 Concept	Concept designs are produced in line with the initial project brief. The level of detail is limited but does allow for some key decisions regarding choice of site, building orientation and overall form to be made. Some less

[2] Design Framework 4th Edition is available at cost from the BSRIA website.

Proforma	Outcome
	important concepts may not be agreed at this stage in which case they will be carried forward to the next project stage.
3 Developed design	This is a collaborative design stage where any remaining concepts from Proforma 2 are decided in the absence of alternative project strategy, this stage also covers the development of the design to the stage where a planning application can be submitted, with emphasis on external matters rather than internal coordination. By the end of this proforma, the design team has arrived at a design where each discipline has its allocated volumes.
4 Technical design	Building services design is advanced through detailed calculations or modelling to arrive at an engineering design and layout for each service from which coordination and installation are feasible. Where there is no building services contractor selected, the design will use generic or typical components that may be substituted during equipment procurement, or specified components where no such “equal or equivalent” substitution is permitted. Building services design is finalised, including details from specialists, and where changes occur the coordination design is checked.
5 Construction	Activities that take place that occur after the building services contractor has been appointed. This stage covers the onsite installation of services and their commissioning, to take the project to a state where handover can occur.
6 Handover and close out	Handover of the completed works to the client. Activities that follow handover include the rectification of any defects identified during the liability period and, if specified, initial aftercare and other soft landing activities

Proforma	Outcome
	during the first year of occupation.
7 In use	This proforma covers any additional soft landings or other post-occupancy activities in the second and third years after occupation.

PAS 2038: Retrofit of Non-Domestic Buildings

PAS 2038 is a specification that provides a standard framework for the retrofitting of non-domestic buildings for improved energy efficiency.

It is part of a suite of standards developed by the British Standards Institution (BSI) to promote best practices in retrofitting existing buildings to reduce all greenhouse gas emissions associated with energy use in buildings to the lowest possible level.

It does so by promoting and defining robust "whole-building" retrofit processes.

The main stages of the retrofit process in PAS 2038 are as follows:

- Project inception, appointment and briefing of project team.
- Assessment of building retrofit.
- Evaluation of improvement options.
- Agreement of intended outcomes.
- Preparation and improvement plan.
- Design and specification retrofit workshop.
- Statutory approvals.
- Retrofit work on site.
- Testing, commissioning, handover, building logbook, and fine-tuning.
- Evaluation.

For smaller buildings of less than 500m^2, the requirements set out in PAS 2035 for domestic building might be more appropriate.[3]

[3] To help ground the scale of a 500m2 building, a typical 3-bedroom domestic property is 80-100m^2.

HM Treasury Green Book: business case guidance for projects

The HM Treasury business case guidance for projects presents step-by-step advice on developing business cases for each stage of project development.

It sets out best practice and aligns with other government approaches in procurement and the delivery of programmes and projects. Experience has demonstrated that when this guidance is embedded in public sector organisations, more effective and efficient spending decisions and implementation plans are produced.

The business case development process is split into three stages:

- **Stage 1** – Scoping the scheme and preparing the Strategic Outline Case (SOC).
- **Stage 2** – Planning the scheme and preparing the Outline Business Case (OBC).
- **Stage 3** – Procuring the solution and preparing the Full Business Case (FBC).

The business case development process is iterative meaning that earlier stages of the development are revisited to verify its continued applicability. The process is also flexible because the quantity and quality of the supporting analysis can be tailored to the scale and complexity of the project that is being developed. Finding out about how your organisation delivers business cases is a helpful step that could save you a lot of time. We cover this in more detail in our Theme 4 Funding main guidance.

The **Strategic Outline Case (SOC)** is the first stage in developing the project business case. This includes:

- Agreeing the strategic context.
- Determining the spending objectives, existing arrangements and business needs.
- Determining the potential scope for the project.
- Determining project benefits, risks, constraints and dependencies.

The **Outline Business Case (OBC)** is the next step in the project development process with the purpose of:

- Identify the investment option which optimises Value for Money (VfM).
- Prepare the scheme for procurement.
- Put in place the necessary funding and management arrangements for the successful delivery of the scheme.

The **Full Business Case (FBC)** is the final case before the final project design is agreed by senior management. The purpose of the FBC is to:

- Identify the approach which offers optimum Value for Money (VfM).
- Set out the commercial and contractual arrangements for the negotiated deal.
- Confirm the deal is still affordable.
- Put in place the detailed management arrangements for the successful delivery, monitoring and evaluation of the project or programme.

Much of the work involved in producing the FBC focuses upon revisiting and updating the conclusions of the OBC and documenting the outcomes of the procurement.

This reflects the fact that projects are seldom linear and require movement between stages to achieve the best project outcomes.

Mapping the frameworks

It is not a perfect science to map each of the different frameworks. While each of the frameworks overlap in many regards, they also diverge and processes bleed across stages, owing to how each of the frameworks have been developed. The below table attempts to map each of the frameworks to help you understand the types of activities you might be doing when, as you progress through your retrofit project.

Table 1: Comparing industry frameworks

		Stage							
Framework	**RIBA Plan of Work**	**0. Strategic Definition** Prepare Client Requirements Develop Business Case for feasible options including review of Project Risks and Project Budget Ratify option that best delivers Client Requirements Review Feedback from previous projects Undertake Site Appraisals	**1. Preparation and Briefing** Prepare Project Brief including Project Outcomes and Sustainability Outcomes, Quality Aspirations and Spatial Requirements Undertake Feasibility Studies Agree Project Budget Source Site Information including Site Surveys Prepare Project Programme Prepare Project Execution Plan	**2. Concept Design** Prepare Architectural Concept incorporating Strategic Engineering requirements and aligned to Cost Plan, Project Strategies and Outline Specification Agree Project Brief Derogations Undertake Design Reviews with client and Project Stakeholders Prepare stage Design Programme	**3. Spatial Coordination** Undertake Design Studies, Engineering Analysis and Cost Exercises to test Architectural Concept resulting in Spatially Coordinated design aligned to updated Cost Plan, Project Strategies and Outline Specification Initiate Change Control Procedures Prepare stage Design Programme	**4. Technical Design** Develop architectural and engineering technical design Prepare and coordinate design team Building Systems information Prepare and integrate specialist subcontractor Building Systems information Prepare stage Design Programme	**5. Manufacturing and Construction** Finalise Site Logistics Manufacture Building Systems and construct building Monitor progress against Construction Programme Inspect Construction Quality Resolve Site Queries as required Undertake Commissioning of building Prepare Building Manual	**6. Handover** Hand over building in line with Plan for Use Strategy Undertake review of Project Performance Undertake seasonal Commissioning Rectify defects Complete initial Aftercare tasks including light touch Post Occupancy Evaluation	**7. Use** Implement Facilities Management and Asset Management Undertake Post Occupancy Evaluation of building performance in use Verify Project Outcomes including Sustainability Outcomes
	BSRIA Framework for Building Services		**Proforma 1 – Preparation and brief** Covers the building services aspects of development of the initial project brief, including advice on feasibility studies, and the development of project objectives including functional performance of the project as a whole, sustainability and budget.	**Proforma 2 – Concept** Concept designs are produced in line with the initial project brief. The level of detail is limited but does allow for some key decisions regarding choice of site, building orientation and overall form to be made. Some less important concepts may not be agreed at this stage in which case they will be carried forward to the next project stage.	**Proforma 3 – Developed design** This is a collaborative design stage where any remaining concepts from Proforma 2 are decided in the absence of alternative project strategy, this stage also covers the development of the design to the stage where a planning application can be submitted, with emphasis on external matters rather than internal coordination. By the end of this proforma, the design team has arrived at a design where each discipline has its allocated volumes.	**Proforma 4 – Technical design** Building services design is advanced through detailed calculations or modelling to arrive at an engineering design and layout for each service from which coordination and installation are feasible. Where there is no building services contractor selected, the design will use generic or typical components that may be substituted during equipment procurement, or specified components where no such “equal or equivalent” substitution is permitted. Building services design is finalised, including details from specialists, and where changes occur the coordination design is	**Proforma 5 – Construction** Activities that take place that occur after the building services contractor has been appointed. This stage covers the onsite installation of services and their commissioning, to take the project to a state where handover can occur.	**Proforma 6- Handover and close out** Handover of the completed works to the client. Activities that follow handover include the rectification of any defects identified during the liability period and, if specified, initial aftercare and other soft landing[4] activities during the first year of occupation.	**Proforma 7 – In use** This proforma covers any additional soft landings or other post-occupancy activities in the second and third years after occupation.

[4] A Soft Landings approach ensures that buildings not only meet their design specifications but also function effectively and efficiently in real-world use, ultimately leading to more sustainable and user-friendly buildings.

						checked.			
	PAS 2038	**Inception** Establishing project objectives, scope, and appointing the Retrofit Coordinator aligns with the strategic definition of the project.	**Assessments** Conducting preliminary assessments, gathering building data, and developing a Retrofit Plan match the activities in preparing the project brief and initial feasibility studies.	**Design** Developing detailed designs, conducting energy assessments, and refining the project budget align with creating and refining the concept design.	**Specification** Further detailed design development, coordination with other disciplines, and integration with existing systems align with spatial coordination activities.	**Pre-construction** Finalising technical designs, obtaining approvals, and preparing construction schedules align with the detailed design and technical preparations before construction.	**Retrofit work on site** Implementing retrofit measures, monitoring progress, and ensuring quality during construction directly correspond to the manufacturing and construction stage.	**Test, commission, and handover** Testing, commissioning, and verifying performance fit within the handover phase, ensuring the building operates as intended before final handover. Final inspections, documentation, training, and formal handover to the client align with the completion and handover activities in the RIBA stage.	**Evaluation** Conducting post-occupancy evaluations, monitoring energy performance, and documenting lessons learned align with the use stage, focusing on building performance and user feedback.
	HM Treasury Green Book	**Stage 1 - Strategic Outline Case** This is the scoping phase for the project, which results in the production of the Strategic Outline Case (SOC). The purpose of this stage is to reaffirm the strategic context for the project, because this may have changed if some time has elapsed since the strategic assessment was undertaken; to make the case for change and to determine 'the preferred way forward'. Identifying the preferred way forward is achieved in two stages: first, by appraising a wide range of possible options ('the long-list'") against the spending objectives and critical success factors for the project; and second, by calculating the indicative Net present social values of a reduced number of possible options ('the short-list') on the basis of a preliminary analysis of their costs and benefits, including optimism bias for uncertainty.							
			Stage 2 - Outline Business Case This is the planning phase for the project, which results in the production of the Outline Business Case (OBC). The purpose of this stage is to revisit the options identified in the SOC, to identify the option which optimises public value ('the preferred option') following more detailed appraisal; and to set out the possible Deal while confirming affordability and putting in place the management arrangements for the successful delivery of the project.					
					Full Business Case This is the procurement phase for the project, which results in the Full Business Case (FBC), following negotiations with potential service providers prior to the formal signing of the contract(s). The purpose of the FBC is to record the findings of the procurement phase and to identify the option that offers the 'most economically advantageous tender' (MEAT) and best public value. In addition, the FBC records the contractual arrangements, confirms affordability and puts in place the agreed management arrangements for the delivery, monitoring and post-evaluation of the project.			

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Retrofit overlay to RIBA Plan of Work

This section follows the stages set out in the RIBA Plan of Work and overlays the expected outcomes and tasks to be undertaken at each stage for a retrofit project.

A retrofit project can be one or multiple measures[5] taking place in one or more buildings across a site. You may have one or multiple projects taking place at one site at any one time.

The first stage is setting the scope and boundary of your project(s).

0. Strategic Definition

The outcome of this stage is to:

- Establish the scope of your retrofit project and define your aims and objectives.
- Develop a project brief that outlines the scope, expected outcomes, and key performance indicators.
- Identify and engage with key stakeholders including those responsible for building operations, maintenance, signing off the project, and external funding bodies.

You will need to be clear about the scope or boundary of what you are proposing with this project. It could be a single measure in one or more buildings (for example replacing existing lighting with LEDs in several buildings) or it could be a package of measures in one or more buildings (for example replacing a fossil fuel boiler with a heat pump in one building, and installing better heating controls and some insulation at the same time.

With this scope in place, you will begin setting the aims and objectives of your project which will include setting out the overall emission reduction targets. This stage should give you a time-plan and have targets that are realistic and measurable.

Think about:

Identifying clear gateway steps where stakeholders can express their expectations before diving into detailed design.

This ensures alignment and avoids misunderstandings later in the project.

Consider downloading the Catapult's stakeholder engagement guide to find out more.

Activities such as desk top assessments and building audits will help inform the details, and expected outcomes, of the project. This information should enable you to develop key

[5] In the context of this guide, energy efficiency, low-carbon heating, and renewable technologies.

performance indicators to help monitor the progress of the project against key milestones or gateways.

If your organisation has the right skills or experience in your estates, facilities, sustainability, or energy management teams you may be able to carry out some or all of the planning required in-house.

A good outcome at this stage would be that you have:

- Gathered information about the building energy consumption and associated carbon emissions and set measurable objectives and targets.
- Started to identify the activities needed to refine and prioritise actions to achieve greenhouse gas emission reduction targets.
- Conducted initial building audits and feasibility studies to determine project viability.
- Linked in with other relevant strategies such as capital maintenance programmes.

Finally, this stage will outline how internal and external stakeholders will be managed, including key responsibilities for the project, external funders, and need for additional capacity and capabilities.

Think about:

Incorporating funding requirements from grant schemes such as the Public Sector Decarbonisation Scheme into the objectives of your project at this early stage. Find out what funding is available by downloading our funding sources table.

This will help align outcomes with the requirements of the scheme as your project(s) develop.

The following table provides links to useful resources for this stage:

Resource	What does it provide you with?
Theme 1 guide: Developing your strategy	This guide supports you to develop your decarbonisation strategy and programme with the aim of reducing energy demand and eliminating fossil fuels across your estate.
Decarbonisation strategy documentation checklist	This checklist sets out the content you may wish to consider including when developing a high-quality decarbonisation strategy.

1 Preparation and Briefing

The outcome of this stage is to:

- Refine your project brief to include specific decarbonisation targets, greenhouse gas emissions modelling, and identify the retrofit measures.
- Perform detailed assessment of buildings on your site including further building audits if required, feasibility studies, with the specific aim of identifying decarbonisation options.
- Conduct a risk assessment of the potential risks related to technical feasibility, financial constraints, and compliance with regulatory requirements.
- Develop initial budget estimates and project timelines.

This stage includes gaining a comprehensive understanding of energy use across the building(s) impacted by the project so that the high-level objectives set in the first stage can be refined before the next stage. This will involve conducting building audits of one or more buildings across the site to further develop information gathered by a desktop analysis

Think about:

Defining data requirements in explicit terms at the project outset.

Collect condition information thoroughly. Assess the existing state of buildings, utilisation patterns, and any changing conditions. This knowledge informs decision-making and project planning.

Look at the requirements of the application form for grant funding schemes to ensure all data required to make an application is collected now, avoiding repeat visits to site.

The building audits will at this stage focus on gathering information about the existing building fabric, heating systems, and other building services such as ventilation, cooling, and lighting. The building audit should also provide you with some high-level recommendations about the opportunities available which could help to decarbonise your buildings or sites and identify the further feasibility or specialist studies needed at this stage to evaluate the options in more detail.

This will help to set a consumption baseline for buildings across the estate, providing a figure that can be used over time to identify the progress made against your targets. The building audits may also begin to identify no regrets[6] solutions for reducing energy

[6] Solutions that either have little to no cost or very quick paybacks due to the small cost vs. returns of completing the project. This could be as simple as adjusting existing heating controls to ensure heating is provided as efficiently as possible.

consumption and/or carbon emissions.

Think about:

Aligning your project with local area-based plans and zoning strategies. Consider how heat decarbonisation fits into broader regional energy goals.

It is also at this stage where you would begin to assemble the project team and make sure your project governance 'plugs into' any wider governance structures, and identify the roles and responsibilities needed to continue developing and eventually delivering your project(s).

This stage will also begin to identify internal budgets needed to deliver the project and options to apply for external grant funding sources, such as the Public Sector Decarbonisation Scheme.

The following table provides links to useful resources for this stage:

Resource	What does it provide you with?
What could decarbonisation look like for you?	This guide provides insight into what an overall decarbonisation solution could look like – including various examples of technology and how they can work together.
Site survey and building audits guide	This guide provides a description of how to carry out a site survey along with a helpful checklist.
Decarbonisation grants and funding sources table	This document provides information on the main public sector decarbonisation grant and funding schemes, with links to where you can find guidance and apply.
Stakeholder engagement guide	This guide helps you think about your stakeholder engagement and communications plans and how these are critical to the success of your programme.

2 Concept Design

The outcome of this stage is to:

- Develop the concept design for retrofit measures.
- Complete energy modelling to estimate the financial and carbon impact of the measures. Use this modelling to determine the best options for the site specific requirements.
- Present conceptual designs to stakeholders to gain their feedback. It is particularly important to get feedback from those who know the building(s) and how they are used. They will be able to comment on how the proposals will impact from a practical point of view, not just a technical or financial standpoint.
- Begin to plan measurement and verification.[7]

This stage will provide you with an understanding of the technical solutions that are feasible to decarbonise and help you select a preferred solution for your buildings as well as understand any practical limitations to implementing them. An output of this stage is a completed options appraisal of feasible decarbonisation interventions tailored to the site-specific requirements of each of your buildings.

The type of information you should understand at this stage are the high-level capital costs of the project, the potential impact on energy use and how this translates to a cost of fuel and greenhouse gas emissions into the future.[8]

Following the completion of feasibility studies, you should be able to select the most viable options for your site to explore through further investigations. This might mean different things depending on the specific requirements of your site or project. For example, you might be constrained by space in your buildings to support decarbonisation technologies. Whatever it might be, this stage will provide you with an early indication of some of the most likely challenges associated with each option.

Think about:

Separating strategic definitions from tactical details.

Consider long-term investment decisions—such as which buildings to keep for 20 years or rationalise—versus short-term efficiency improvements.

Users will be interested in knowing what the changes means for how they use the buildings

[7] Consider reading the Catapult's Theme 7 Guide on Monitoring and evaluation

[8] Consider downloading and using the Catapult's decarbonisation intervention estimator that allows for quick assessment of key decarbonisation options, including heat, renewables and energy efficiency, which can be applied to your building, site or portfolio.

and improvements that are made to comfort. If your project involves other changes such as the rationalisation and change of how spaces are used in the building, it is at this point that consulting impacted users will be critical to feed-in to the next stage of your project planning.

Consider rolling out sub metering to collect detailed consumption information if it is not already available. Having access to more granular data about how energy is used in your buildings will enable more accurate estimates for sizing equipment (e.g. heat pumps to meet peak heat demands) and measurement of impacts from new technologies.

One thing that is often left too late in the process is measuring and verifying the impact of changes to how energy is used on the site, either through small adjustments to controls, or through the installation of energy efficiency technologies. It is at this point that organisations should think about implementing a monitoring and evaluation plan.[7] This will enable you to gather data and information now that will become necessary at the close of your project to verify whether an impact has been made. It will provide you with a point in time to compare future consumption profiles against.

The following table provides links to useful resources for this stage:

Resource	What does it provide you with?
Theme 2 guide: Feasibility and Design	This guide covers undertaking feasibility and design studies, including information on the different types of studies and how to ensure they support your funding applications and ultimately reduce CO_2 emissions.
Stakeholder engagement and communications guide	This guide helps you think about your stakeholder engagement and communications plans and how these are critical to the success of your programme.
Theme 7 - Measurement and verification guide	This guide covers information on metering, how to collect your energy data and how to make best use of it. Collecting high quality data is helpful for developing your strategy, monitoring energy use and verifying your energy and carbon savings.

3 Spatial Coordination

The outcome of this stage is to:

- Refine the chosen concept into spatial layouts and into detailed plans for building systems and materials.
- Refine energy models to ensure they accurately predict the chosen concept performance.
- Determine ancillary measures, such as insulation and enhanced building controls required to efficiently operate the retrofit measures.
- Update the project budget to reflect detailed design work.

This stage will take the chosen retrofit measures forward and focus on integrating them within the existing building systems (e.g. ensuring that heating distribution is suitable for the low-carbon heating solution). This may require additional specialist audits to ensure that measures are compatible.

Think about:

If your preferred solution is a heat pump, it is crucial that this stage outlines the number of heat pumps and their kW size.

This information directly impacts cost estimation and electrical demand calculations.

Consider engaging experts to perform initial calculations and create a cost schedule.

Energy models developed in previous phases should be refined with the latest information for the chosen measure(s), including specifics about how the new technology will work in-situ. This will also help inform the monitoring and verification of the measure performance post-installation.

If you are installing low carbon heating, the designs at this stage should identify if other improvements are required to ensure the low-carbon heating technology operates as efficiently as possible. This might include additional insulation, renewable energy generation, or building energy management controls.

If the chosen low-carbon measure is a heat pump (or significant renewable generation capacity), this stage should provide you with an indication of electricity capacity requirements for the buildings. It should identify whether capacity upgrades are required and then you can begin exploratory conversations with your district network operator.[9]

This incremental increase in detail and information about your project should enable you to

[9] Consider reading the Catapult's guide on local DNO capacity

refine estimates about project costs and timescales, including the requirements for ancillary measures and capacity upgrades. These can have a significant impact on the total cost and time spent on a project.

This is a critical point in the project whereby all project stakeholders should agree on the design of the project before it proceeds to technical design. The next stage of the project could potentially be costly and therefore it is imperative that all sign offs are in place before proceeding to technical design.

The following table provides links to useful resources for this stage:

Resource	What does it provide you with?
Theme 2 guide: Feasibility and Design	This guide covers undertaking feasibility and design studies, including information on the different types of studies and how to ensure they support your funding applications and ultimately reduce CO_2 emissions.
Understanding six activities that make up Feasibility and Design	This guide expands on the main theme 2 guide, providing more information on six activities you might undertake as part of your work on feasibility and design. The guide covers what the 6 activities are, how to differentiate and choose between them, and how they fit in with the Royal Institute of British Architects' (RIBA) plan of work.
How to treat technologies and what to ask for	This guidance covers the common technologies you might be considering as part of your decarbonisation programme, for example building fabric upgrades, heat pumps or energy storage. This guide provides information on how you might go about assessing their potential on your site.

4 Technical Design

The outcome of this stage is to:

- Produce comprehensive technical design documentation including specifications, detailed drawings, and schedules.
- Finalise energy performance estimates and targets.
- Finalise cost estimates and prepare tender documents that clearly specify the decarbonisation requirements for contractors and suppliers.

This stage involves completion of all designs for the proposed measures. This stage will provide you with the final detailed project technical drawings, schedules, and schematics. It is at this point where the final specifications are made for things like the new heating system including distribution routes, heat emitter sizing, and final sizing of the low-carbon heat source.

This stage will also identify the final finishes, and construction methodologies that will be applied to ensure smooth installation for your specific site requirements. This should include phasing requirements to reduce operational disruption.

The final design documents will inform the project outcomes in a tender specification. This may also include other expectations specific to your project, such as contract working expectations (for example the removal of waste from the site, or particular security clearance requirements). This, in combination with the final technical designs will provide you with all the information needed to obtain firm pricing for your retrofit project through a competitive tender process.

Before moving on to the installation phase of your project, you should also finalise a detailed project risk assessment, accounting for both health and safety as well as project related risks to your decarbonisation targets. This will allow you to actively manage and mitigate risks during the construction phase of the project.

Have you considered:

How data will be shared between stakeholders, especially external contractors. How will data be managed, processed, and stored?

Social value in procurement is about making sure that what you buy creates additional benefits for society. To get it right, you need to start thinking as early as possible about how to apply it to what you are buying.

The Social Value Act 2012 states that all public bodies must consider how what they are proposing to buy might improve economic, social and environmental wellbeing. The

legal requirements of the act are quite limited, and many public organisations choose to go further than just 'considering' social value, and actively apply the principles across their procurement activities.

The following table provides links to useful resources for this stage:

Resource	What does it provide you with?
Theme 3 guide: Procurement	This guide aims to help you navigate your net zero procurement processes with your procurement team. It covers the basics of public sector procurement, why it is important to make the right procurement decisions and helps you to understand the routes available.
Procurement routes and frameworks list	This guidance aims to provide you with examples of public procurement frameworks that are available for you to use as part of your procurement process.
Theme 4 guide: Funding	This guide provides information on how you might generate estimates for your decarbonisation programme and identify available funding sources such as the Low Carbon Skills Fund and the Public Sector Decarbonisation Scheme. Information on how to secure sign off for your projects is also included.

5 Manufacturing and Construction

The outcome of this stage is to:

- Oversee the construction phase, ensuring work is carried out to agreed process and specifications.
- Monitor site progress and manage any design adjustments or variations.
- Coordinate building services and construction team in commissioning the measures.
- Conduct quality assurance checks to ensure retrofit measures are installed as designed.

It is at the stage that the project transitions into the capital delivery phase where construction begins, and the retrofit measures are installed.

You will also be required to monitor quality of finish and ensure that your contractor is delivering the project to the specifications outlined in the agreed contract. This may be an iterative process up until the completion of this stage and you may hire external project management or snagging expertise to support you in managing the project.

In some cases, the technical designers[10] may be kept on in a construction support capacity to ensure that any design changes made on-site will not affect the performance of the designed system or contradict approvals in place or create an unforeseen cause or effect.

You should use and maintain the risk register developed throughout your project to monitor any risks, log any issues and act where needed. You should also work with your contractors and project team to identify any emerging risks or issues that arise that could impact project delivery and ensure the Health & Safety File, Fire Safety Information and Building Manual are updated.

The following table provides links to useful resources for this stage:

Resource	What does it provide you with?
Theme 5 guide: Installation	This guide covers the areas you need to think about when project managing the installation of retrofit measures on site. It covers the skills you might need, roles and responsibilities and managing risks.

[10] Typically the contractor who completed the technical design

6 Handover

The outcome of this stage is to:

- Ensure completion of all building work and commissioning of the measures for optimal performance.
- Provide training for staff responsible for maintaining and operating the new equipment.
- Prepare operation and maintenance manuals for new measures.
- Ensure that you have post-occupancy support from your contractors where required.

This stage sees the handover of the new building services. Both commissioning and handover timeframes are often squeezed at the end of the project but it's important to note that to enable a successful project the handover process shouldn't be considered one event and may take several weeks to complete as final checks on operation are made.

You should have received all documentation and certification from your contractor setting out that the installation is complete at the beginning of the stage. This is important evidence not only to provide to stakeholders, but to enable the drawdown of grant funding if you have applied to funding schemes such as the Public Sector Decarbonisation Scheme.

If the new equipment has changed how the building will operate or be maintained, be sure to identify and complete any training needed for staff who will be responsible for smooth operation going forward. At this stage you should ensure that initial and extended aftercare plans are in place such that any issues with the installation can be resolved quickly. Your new equipment may require an ongoing longer term maintenance contract due to the specialist nature of its operation.

Finally, this is a good opportunity to conduct a look back at the project and capture lessons learned. If this project is something that you are likely to roll out to other buildings across your estate, this is a valuable exercise to complete. Ensuring future replicability of your project, approaches and processes you've put in place will speed up future projects, saving on time and cost.

The following table provides links to useful resources for this stage:

Resource	What does it provide you with?
Theme 6 guide: Commissioning and Handover	This guide helps you achieve the best outcomes when commissioning equipment and achieve a high-quality handover, giving you the best chance of maximising the benefits of your decarbonisation project.

Resource	What does it provide you with?
Government Soft Landings Guide	Government Soft Landings (GSL) plays an important role in enabling a smooth transition from construction to operation. It also helps clients to assure the performance of an asset and inform future project performance setting.

7 Use

The outcome of this stage is to:

- Implement measurement and verification strategies, collecting data to measure performance.
- Evaluate measured performance against pre-installation estimated performance.
- Carry out regular maintenance and optimisation to sustain performance over time.
- Collect feedback from building users to ensure comfort and help identify future projects.

Once your building has operated for a few months, it is a good time to conduct performance standards tests to check that the building services have been commissioned properly and that the building is running as efficiently as possible. This will also help you determine whether the building retrofit project is performing to the design standards. Ideally, this should be conducted whilst still in an aftercare period with the contractor such that any snags can be picked up.

Using your monitoring and verification plan, you can start to monitor the consumption of your building post-completion and compare to your baseline consumption. This might involve collecting and analysing metered data and compare back to modelled estimates carried out before the installation of the retrofit measures.

This will serve two key purposes: to identify any further efficiency improvements and verify whether the intended savings or benefits are being made. It is important that you follow the monitoring and verification plan that you set at the outset of the project because this will define the measurement boundaries, and measurement methodology.

Collecting user feedback will provide you with helpful insight into how the building performs from a user's perspective. For example, a change in heating method might result in differences in comfort levels, or upgraded lighting might be unfamiliar for users.

Finally, carrying out regular maintenance and optimisation of the building will ensure the project continues to deliver expected impacts on energy consumption, and progress

towards decarbonisation targets.

The following table provides links to useful resources for this stage:

Resource	What does it provide you with?
Theme 7 guide: Monitoring and Evaluation	This guide covers information on metering, how to collect your energy data and how to make best use of it. Collecting high quality data is helpful for developing your strategy, monitoring energy use and verifying your energy and carbon savings.

Overlay for decarbonisation retrofit projects

RIBA Plan of Work	0 Strategic definition	1 Preparation and briefing	2 Concept design	3 Spatial coordination	4 Technical design	5 Manufacturing and construction	6 Handover	7 Use
End of stage outcomes	Write the project brief detailing the aims and objectives.	Gain a comprehensive understanding of how energy is used across your site, and the options to reduce your emissions.	Understand the technical solutions that are feasible to decarbonise your buildings.	Identify the preferred retrofit solution(s) to move to design.	Complete detailed design for the proposed solution(s) and develop procurement specification.	Procure equipment, complete the installation works and, manage the construction process including risks	Handover the new building services and begin to use the building.	Continual monitoring operation of the new equipment and verify savings
Operational tasks	Establish the scope of your retrofit project and define aims and objectives. Conduct initial building audits and desktop studies. Develop a project brief including scope, expected outcomes, and key performance indicators. Identify and engage with key stakeholders.	Refine your project brief. Perform detailed assessment of buildings on your site including building audits, and feasibility studies. Conduct a detailed risk assessment. Develop initial budget estimates and project timelines.	Develop the initial/concept designs for retrofit measures. Complete energy modelling. Use this modelling to determine the best options. Present conceptual designs to stakeholders. Plan measurement and verification strategy.	Refine the chosen concept into spatial layouts and into detailed plans. Refine energy models. Determine ancillary measures required to efficiently operate the retrofit measures. Update the project budget to reflect detailed design work. Sign off.	Produce comprehensive technical design documentation. Finalise energy performance estimates and targets. Finalise cost estimates and prepare tender documents.	Oversee the construction phase. Monitor site progress and manage any design adjustments or variations. Coordinate building services and construction team. Conduct quality assurance checks.	Ensure completion of all building work and commissioning. Provide any training. Prepare operation and maintenance manuals. Ensure that you have post-occupancy support from contractors.	Implement measurement and verification strategies. Evaluate measured performance. Carry out regular maintenance and optimisation. Collect feedback from building users.
Data	Annual consumption data from utility bills or metered data.	Annual consumption data from utility bills or metered data. Data collected during audit.	Annual consumption data from utility bills or metered data. Data collected during audit and feasibility studies. Conditions information. Roll out submetering.	Annual consumption data from utility bills or metered data. Data collected during audit. Conditions information.	Half-hourly meter data of heat. Data collected during audit. Detailed information about replacement product. Roll-out submetering. Data sharing agreement with external stakeholders.	Install sub metering on new equipment.	Install software to download and interrogate data. Plan to process and store data. Understand interactions with controls regime.	Half-hourly meter data. Start downloading, monitoring, and reporting energy performance.
People	Identify and gain stakeholder buy-in. Identify sustainability roles and responsibilities.	Review resource and capability. Assemble project team. Identify governance structures.	Engage with stakeholders for feedback on retrofit proposals. Fill skill gaps.	Engage with stakeholders for feedback on retrofit proposals. Enact or ‘plug into’ governance structures. Sign off.	Enact governance structures. Working cross multi-disciplinary teams (e.g. procurement). Build working requirements into procurement material.	Select suppliers? project manager and supporting team. Regular project governance stewardship.	Ongoing responsible officer (e.g. facilities manager). Identify training requirements and changes to job descriptions.	Identify analysis and reporting personnel. Feed into governance and accountability structure through the organisation.
Funding	Identify potential internal and external funding options that your organisation and buildings might be eligible for. Understand application timescales and evidence requirements.	High-level budget costs using benchmark information. Identify and approve internal budgets. Determine if you need funding for consultants to support your project.	High-level budget costs using benchmark information. Finalise funding strategy and timescales, including if you need consultant support. Apply for external funding.[11]	Budget costs based on initial quotations or similar projects. Apply for funding. Agree internal budgets.	Firm project quotations through competitive tender. Adjust existing funding application or apply for funding. Finalise internal budgets. Apply for external funding.[12]	Manage project costs closely. Follow agreed processes. Use the contract to proactively manage project costs.	Receive completion evidence required for funding schemes. Draw down grant funding. Pay final invoices.	Use performance information to secure budget for future projects.

[11] It is possible to apply for the Public Sector Decarbonisation Scheme at RIBA Stage 2.
[12] It is possible to apply for the Public Sector Decarbonisation Scheme at RIBA Stage 4.

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