

# LOW CARBON INVESTMENT GUIDANCE

North East & Yorkshire Net Zero Hub  
Public Sector Estate Decarbonisation Programme



## OUR PARTNERS

Hull & East Yorkshire LEP,  
North East LEP, South  
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## 1 Purpose

In 2021, the UK Government set out its Net Zero Strategy to end the UK's contribution to climate change by 2050. Public sector buildings account for 9%<sup>1</sup> of building emissions in the UK and removing these emissions is supported by two funding schemes from Government:

### Public Sector Decarbonisation Scheme (PSDS)

- Phase 1 - £1bn [Complete]
- Phase 2 - £75m [Complete]
- Phase 3a - £550m [Complete]
- Phase 3b - £635m [In Delivery]
- Phase 3c - £235m [Expected]

### Low Carbon Skills Fund (LCSF)

- Phase 1-3 supported approximately £60m of Heat Decarbonisation Plan production.

The Government have committed to halve direct emissions from public sector buildings by 2032, from 2017 levels, and aims to further reduce emissions from public sector buildings by 75% by 2037.

This guidance document sets out how a public body can decarbonise their buildings and gives best practice steps to deliver a successful project.

When first thinking about decarbonising buildings, an organisation can utilise the energy hierarchy in *Figure 1* to define a step

by step strategy. This can be described as a 'whole building approach'.

The PSDS provides grants to public sector bodies to install measures that decarbonise heat in their buildings alongside energy efficiency and renewable measures.

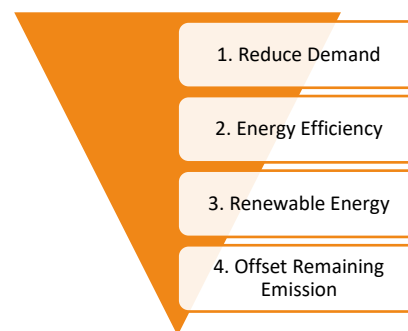


Figure 1: Energy Hierarchy

The LCSF supports the creation of Heat Decarbonisation Plans (HDPs). The purpose of a HDP is to describe how an organisation intends to reduce direct greenhouse gas emissions by replacing fossil fuel heating systems with low carbon alternatives (for example heat pumps, electric heating, or other low-carbon fuel sources) within its estate.

Heat decarbonisation plans should outline the most cost-effective pathways to decarbonising heat through integration of energy efficiency measures that reduce a site's heat demand, taking a 'whole building approach' to decarbonisation.

**The Public Sector has an opportunity to lead the drive to Net Zero buildings in the UK**

<sup>1</sup> <https://www.gov.uk/government/publications/net-zero-strategy>

## 2 Low Carbon Project Steps

Low carbon projects have their own specific challenges, this document aims to highlight these and provide guidance on how to prepare and mitigate risks throughout the implementation of the project. *Figure 2* shows the key steps for delivering a low carbon project with more detailed guidance in the following subsections.



Figure 2: Key Steps for Delivering a Low Carbon Project

## 2.1 Stakeholder Engagement

Before you start preparing for your project, it is important to engage relevant stakeholders. Stakeholders can include:

- Organisation Senior Leadership
- Building Occupiers/Owners
- Organisation Staff
- Business Tenants
- Private Finance Initiative (PFI)
- Buildings Users
- Pupils
- Patients
- Tenants
- Members of the Public
- Local Residents
- Local Council

Distribution Network Operators (DNO)

Early engagement with stakeholders can mitigate issues arising further down the line.

For **senior leadership**, it is important to get buy-in early on so that the organisation can better influence the outcomes throughout the project, including reserving its own capital for investment.

**Building occupiers** or a representative should be consulted to understand constraints specific to the proposed buildings, if known. Are there any quick wins to reduce energy demand before installing measures?

There may be a usage agreement in place such as a PFI contract for a leisure centre or hospital where the impact on the energy bills may need to be negotiated.

**Building users** will need to be considered during the installation period and also for any post installation impacts of the new measures i.e. control systems. Hospital wards or school classrooms may need to be refurbished as part of a project, so this needs to be considered when planning the installation timetable. When planning measures, the effect on the comfort levels within the building need to be considered as well as lighting levels, it may be useful to undertake pre and post occupancy surveys to assess the impacts of the project.

In addition, some organisations have resilience requirements, hospital sites with back up heating systems, running on a different fuel type to the main system need to be considered.

**Local residents** may need to be consulted for significant works taking place such as a Ground Source Heat Pump (GSHP) or Heat Networks which require a lot of civils works for buried pipework

The **local council** will need to be considered for works requiring planning permission, which can take several months for approval. In addition, heat networks or other large projects require permissions from the local council such as closing roads.

**Consider engaging stakeholders early in the process to prevent delays further down the line**

## 2.2 Measures

The baseline of your current energy consumption is the basis of how your building portfolio is targeted for energy reduction measures. Therefore, it is important to have robust measurement of current energy consumption.

When procuring a contractor, including a requirement for a Monitoring and Verification (M&V) plan is best practice and the implementation of this plan would take 12 months post procurement to ensure the carbon and energy savings can be verified.

However, at this stage there are several methods to find baseline energy consumption:

- From energy bills
- From Display Energy Certificates (DEC)
- From existing Building Energy Management Systems (BEMS)
- From manual readings of existing meters

It is important when collecting this data to use an average over several years of data and to exclude any abnormal years (such as during Covid lockdown).

To gain a more precise baseline, the yearly energy measurements can be calculated with heating degree days to understand the base heat demand of a building.

Furthermore, there are online tools which can provide cross reference checks on building heat loss by inputting buildings dimensions, fabric insulation values (U values), usage and air changes per hour.



You could also use existing building energy consumption data from a previous carbon reduction plan or sustainability strategy.

To estimate the peak heat loss of a building you can follow these steps:

1. Find U values of the building fabric elements.
2. Multiply the U value of each element by its exposed area.
3. Add the results of each building fabric element together to get the overall building thermal capacity.
4. Find the volume of space to be heated.
5. Estimate the air changes per hour in the building.
6. Multiply the volume by the air changes per hour and multiply by 0.33 (energy required to increase 1m<sup>3</sup> air by 1 degree).
7. Sum results of step 3 and step 6. Divide by 1000.
8. Find the internal set point temperature of the building and minus the outside temperature (between -3 and -6 for peak heat loss).
9. Multiply result of step 7 and step 8 to get peak building heat loss in kW.



After collating baseline energy data from your buildings, you can target the highest consuming and leads to the next section on identifying the right measures to reduce energy.

## 2.3 Business Case

Producing a business case for your project is key to influencing stakeholders across your organisation and potential funding bodies.

A good business case will give several options to achieve the aims of the project and compare their outputs and costs. This includes a 'do nothing' option to show impacts of not doing the project.

A business case could be structured in the following way:

- a. Executive Summary & Recommendation
- b. Background/Situation/Issues
- c. Outcomes and Benefits
- d. Budget and Resources
- e. Scope
- f. Risks
- g. Options Appraisal
- h. Investment Appraisal
- i. Project Information

In the public sector, the government green book sets out best practice for building a business case with 5 cases to put forward:

- 1) Strategic  
Is there a compelling case for change?
- 2) Economic  
Does the option optimise public value?
- 3) Commercial

Is the proposed deal commercially viable?

#### 4) Financial

Is the level of funding required available and affordable?

#### 5) Management

How will the proposal be successful?

This is shown in *Figure 3* below:



Figure 3: 'The Green Book' Five Case Model - Source Government Green Book 2022

## 2.4 Identify

In this section you will identify measures to reduce the carbon emissions of your building's energy consumption. There are many things to consider when identifying measures with the main ones in *Figure 4*.



Figure 4: Themes for Identifying Carbon Reduction Measures

It is best practice to take into account the effect of each measure according to the energy hierarchy. Therefore, look at energy efficiency measures first and then renewables. This way, you won't oversize potential solar arrays or heat pumps due to decreased demand on site.

To reduce energy consumption first, look at the building fabric, electrical

efficiency, heating system and any specific energy sinks such as swimming pools, hot water or lab/hospital equipment. The following questions can be used to think about suitable measures:

**Roofs** – Is there loft space to increase insulation? Is there suitable south facing/flat roof for solar PV with little shading?

**Walls** – What type of walls, cavity wall, single brick etc.

**Windows** – Are they single/double glazed? Are they airtight/sealed to the walls?

**Heating system** – are the heat emitters suitable for lower temperatures of a heat pump? Are the pipes insulated? Is it sized correctly? How is hot water covered?

**Controls** – how is the lighting, ventilation and heating controlled?

There can be barriers to certain technologies being installed. These can include:

- Planning – does the technology require planning permission?
- Listed – is the site a listed building with restriction on the building fabric?
- Usage – is the site highly ventilated e.g. depot where radiant heating may be more suitable?
- Location – is the site close to a large energy source such as area of ground or water suitable for a ground/water source heat pump?



- Connection – is the site close to an existing heat network?
- Cooling – are there any large cooling loads that can make heating more efficient?

## 2.5 Funding

Once you have identified sites and measures in your portfolio, this can inform a funding route depending on the scheme criteria and availability of internal funding.

Sources of funding:

### Public Sector Decarbonisation Scheme (PSDS)

#### Benefits:

- Government grant funding aimed at low carbon heating measures.
- Energy efficiency and renewable measures can be included.
- Unlimited in size of application.

#### Considerations:

- Minimum 12% client contribution.
- Next round will only be open for projects that complete within a single financial year.
- Electrical saving measures do not count towards carbon criteria.

### Public Works Loan Body (PWLB)

#### Benefits:

- Not limited to certain measures.
- No up-front cost for organisation.
- Not limited to complete by a specific deadline.

#### Considerations:

- Adds to the organisation's debt.
- Pay interest on the costs.

### Internal Funding

#### Benefits:

- No time limit on completion.
- Can be used more flexibly for measures with good paybacks (LED Lighting, Solar, Controls etc.)
- No criteria to meet.

#### Considerations:

- Unsecure budgets for future financial years.

**Some measures can be funded from current maintenance budgets, for instance, replacing existing fluorescent lighting with LEDs as the fittings fail**

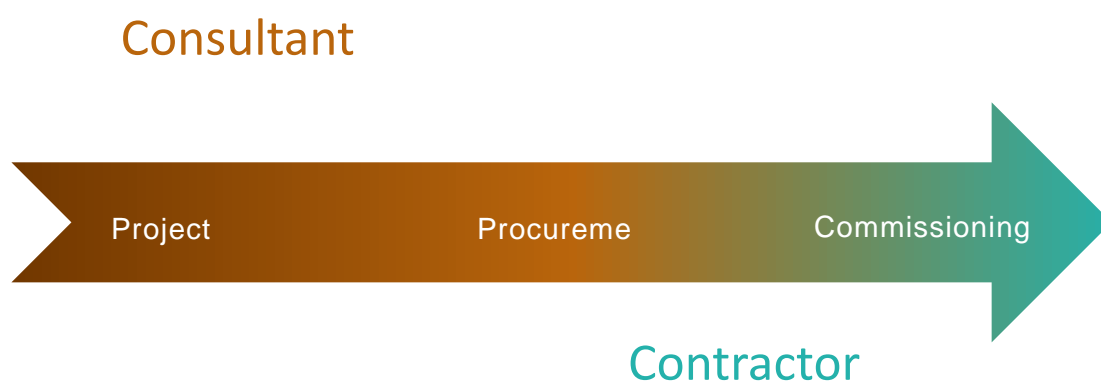


Figure 5: Consultant and Contractor Involvement

## 2.6 Procure

There are two main stages where your organisation may need to procure services: consultancy services at the beginning of the process to help project manage and after funding is secure from a contractor(s) to implement the project.

A consultant can provide services that cover across a project from the engagement stage through to procurement. After a contractor has been procured, the main contractor will lead through to the end of the project.

Public sector organisations can use different procurement frameworks to streamline the process.

Depending on the funding criteria and internal requirements, the invitation to tender (ITT) will contain different scoring criteria. This could include provision on energy savings guarantees, level of carbon savings or energy cost savings.

When setting out the tender, you should include requirements for decarbonisation projects such as:

### Technical requirements

Are there technologies you want to include?

How are service levels going to be covered?

### Strategic requirements

What are the wider goals?

Timeline linked to funding criteria

### Contract points

What is the liability cap?

Is a performance bond required?

### Finance requirements

Is there a mixed finance approach?

Is the business case signed off?

### Monitoring and Verification (M&V) requirements

What is being measured?

Who is responsible for monitoring

### Site requirements

Is the building's information available to bidders?

Finally, ensure there are key performance indicators (KPI's) included in the tender to ensure your requirements are met in the right way and in the timescales set out.

## 2.7 Install

The steps taken prior to this step should provide a good base for successful installation of your low carbon measures. However, there are always risks and surprises that haven't been anticipated.

A significant risk during installation is balancing the requirements of the installer for access/disruption to the buildings and the ongoing operational requirements.

In addition, it can be economically beneficial and can reduce disruption if installation is done alongside existing maintenance program or major refurbishment.

There are also technology specific considerations:

**Ground Source Heat Pump** – doing ground works in the winter can cause delays and extra costs due to poor conditions.

**Heating emitter upgrades** – can cause disruption to school classrooms and hospital wards unless carried out in holiday periods or patients are relocated.

**Heating system upgrades** – backup generators/heating equipment may be required during downtime caused by the removal of the existing system. You should ensure there is sufficient space in plant rooms for new system if the existing one needs to remain in place over install period.

Figure 6 shows the key principles for successful project delivery:



Figure 6: Key principles for project delivery

## 2.8 Commissions and Verify

This section sets out the key steps to complete your low carbon project, ensure the technologies are installed correctly, operating alongside existing systems & controls and carbon savings are measurable.

There may need to be a period after installation of a new heating system where the system needs to be balanced and controls systems monitored alongside existing plant operation. Is the system working as designed?

In addition, engaging with stakeholders post install and commission can help fine tune the comfort levels, for instance, the controls may be too limiting, and areas are cold, or the new fabric has meant that heating systems can operate for less time.

Post commissioning is also when you can re-engage in your Monitoring and Verification (M&V) team whether external or internal. Using International

Performance Measurement and Verification Protocol (IPMVP) standard suppliers will ensure that the measurement of the energy and carbon savings are robust.

Figure 7 shows the outputs from M&V review following an IPMVP process. The energy savings can then be converted into carbon savings using standard government carbon factors.

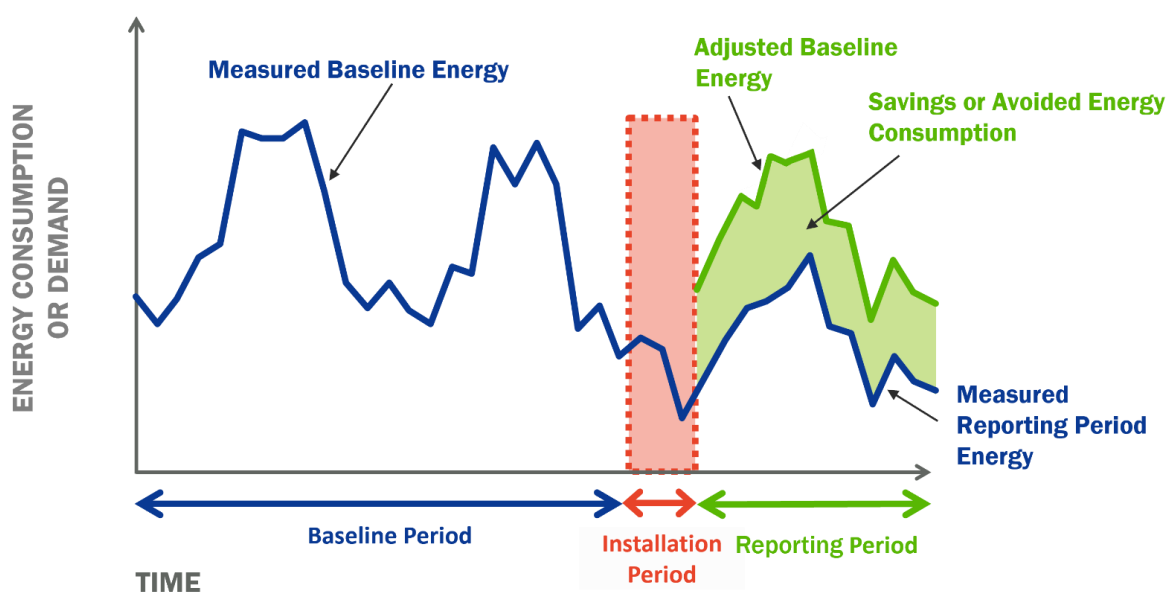


Figure 7: IPMVP Process – Source: Efficiency Valuation Organisation

### 3 Success Stories and Good Practise Examples

There have been several success cases reported by recipients of grants from the previous phases of PSDS. This section of the document highlights some examples from Phase 2 where we identified that the participants showed good practises based on the key steps in this document.

#### 3.1 Royal Latin School in Buckinghamshire

*Best practise – stakeholder engagement, measure, identify, verify*

The Royal Latin School in Buckinghamshire in the Southeast region was granted £282,000 to decarbonise their building. They are replacing their old heating system with air source heat pumps. The 600-year-old building was also upgraded with efficient lighting, double glazing, and energy efficient radiators. This project was a follow up after the successful funding from phase 1 allowed them to install several carbon reducing technologies and begin their decarbonisation journey.



The school identified that upgrading their heating system would bring the largest benefits and has measured the financial benefits and carbon reductions of this upgrade. It was important that they had good

measuring systems and have been monitoring the benefits of these implementations since the previous phase.

The school leadership also identified that bringing all stakeholders on board of a decarbonisation programme would help maximise the benefits of these implementations. They have achieved this by establishing a programme that raises awareness in students and faculty to make efficient use of energy in the building, and cycle to work among other initiatives.

#### 3.2 Nottingham University Hospital NHS Trust

*Best practise on measure, identify, funding, install*

The Nottingham University Hospital was granted £24.7m to decarbonise their hospital buildings. The main measure will be to replace old fossil fuel heaters with air source heat pumps and a more efficient heating system. Additionally, they have identified that they can build a new energy centre to provide heating and electricity for the hospital in place of an old laundry room facilitating the installation process and reducing risks to users.

The trust is combining the funding granted from PSDS with government funding from the Health Infrastructure Plan (HIP) to maximise the benefits of the investment and achieve their targets.





The Nottingham University Hospital estate management has clearly measured the financial benefits of this investments as well as the carbon reduction it brings. Additionally, they go one extra step by reporting spill over benefits such as reduction of noise pollution or the risk of air pollution due to ageing infrastructure.

### 3.3 City of Leeds

*Best practise in identify, funding, procure, install*

The city of Leeds received a fund of £25.3m to implement decarbonisation measures across the city. This project will help them achieve their net zero and clean growth targets. They have identified the most suitable technologies to provide decarbonisation measures to over 80 of their buildings.

Their main project, completed with the use of their funding, consists of the implementation of a waste-powered heat and hot water business, the Recycling and Energy Recovery Facility (RERF) in Cross Green. This centre provides energy to the city through a district distribution network.



The city of Leeds obtained funding from a variety of sources including European initiatives. Additionally, they contribute with the private sector as providers for their distribution network, using their expertise to support with the installation making sure that it is set in place and operates successfully.

### 3.4 London Borough of Hounslow

*Best practise in measure, identification, commission and verify*

As part of their strategy to achieve net zero target by 2030 London Borough of Hounslow received a fund of £7.6m from the PSDS to continue their plan to reduce their boroughwide emissions. They are using the fund to implement measures across 33 schools. The decision to use the fund to address schools comes from the finding that these account for 70% of their overall carbon emissions.

They have installed efficient air source heat pumps in all schools and renewable energy sources from solar PV in 27 of them.

Additionally, they will be getting the students involved in a Green-school programme where they will address issues such as waste management and



more importantly learn and understand the importance of monitoring the school's water and energy usage.

