Infrastructure and Projects Authority

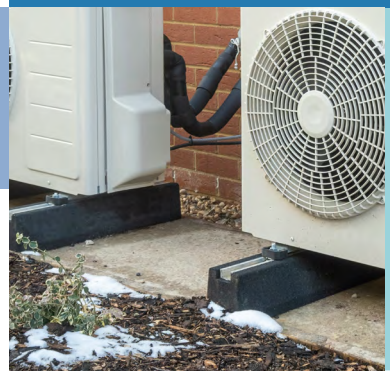
Executive Summary

Decarbonisation of Operational PFI Projects

Handbook of recommended good practice for contracting authorities

Contents

Foreword



This handbook of good practice for decarbonising operational PFI projects sets out how public and private sector project partners should work together to plan and deliver decarbonisation interventions.

A working group has been established by the IPA to bring together public and private sector PFI stakeholders with the aim of developing a standardised approach to decarbonisation.

The output from this working group engagement has been brought together in this handbook of recommendations for the successful planning and delivery of decarbonisation in built environment assets, as well as charting a path for the process of contract variation to support decarbonisation interventions. It has been drawn from technical advice, established government and industry guidance and from the experience of those involved in the ownership, use, management and maintenance of built environment assets delivered through PFI contractual arrangements.

In addition, the working group has agreed and adopted a standardised approach to the collection of data supporting the measurement of greenhouse gas emissions from PFI projects. The use of the agreed data collection template and sharing of collected data with project authorities should minimise the duplication of effort and resource, and should provide a single version of emissions information for each project. This is recognised as the start of a journey in measuring, monitoring and reporting PFI project emissions data. Over time, by working together, public and private sector partners can aim to improve the quality and availability of data that will be essential to planning and tracking the progress of projects toward decarbonisation targets.

The government's commitment to decarbonisation of public sector buildings is a goal that is shared by the private sector partners in PFI projects. A sense of urgency is required from all in response to the climate challenge. A combination of pragmatism and collaboration is necessary to deliver decarbonisation within the context of PFI contractual frameworks developed long before net zero targets were identified and committed in legislation.

There are differences between the assets and services that are being delivered under PFI, as well as differences between the detailed underlying contractual terms that govern these projects. However, the good practice recommendations in this handbook, together with the established technical guidance and toolkits that it signposts, should be universally applicable to operational PFI built environment assets. If adopted by existing PFI projects, it is the aim that this will promote more successful planning and delivery of decarbonisation by projects, and will streamline the contract change process on a journey to net zero that will begin during the remaining years of operational PFI projects and that may continue post contract expiry.

The scale of the decarbonisation challenge in the years ahead will require public and private sector project partners to work together and proactively bring to the table opportunities for decarbonisation. We fully support this partnership approach and agree to apply the good practice recommendations in this handbook to the extent possible as we take on this challenge together.

Abrdn

Amber Infrastructure Group

Albany SPC Services Ltd

Bouygues E&S

CIVIS Infrastructure Fund

Dalmore Capital Limited

Department for Levelling Up, Housing and Communities

Equans

InfraRed Capital Partners

Innisfree

NHS England

Semperian PPP Investment Partners

Serco

Vercity

About this document

This document is part of a handbook of good practice related to the decarbonisation of operational PFI projects. It should be read in the context of the full set of documents, constituting this Executive Summary, Part One - Developing a Decarbonisation Plan, and Part Two - Delivering a Net Zero Change.

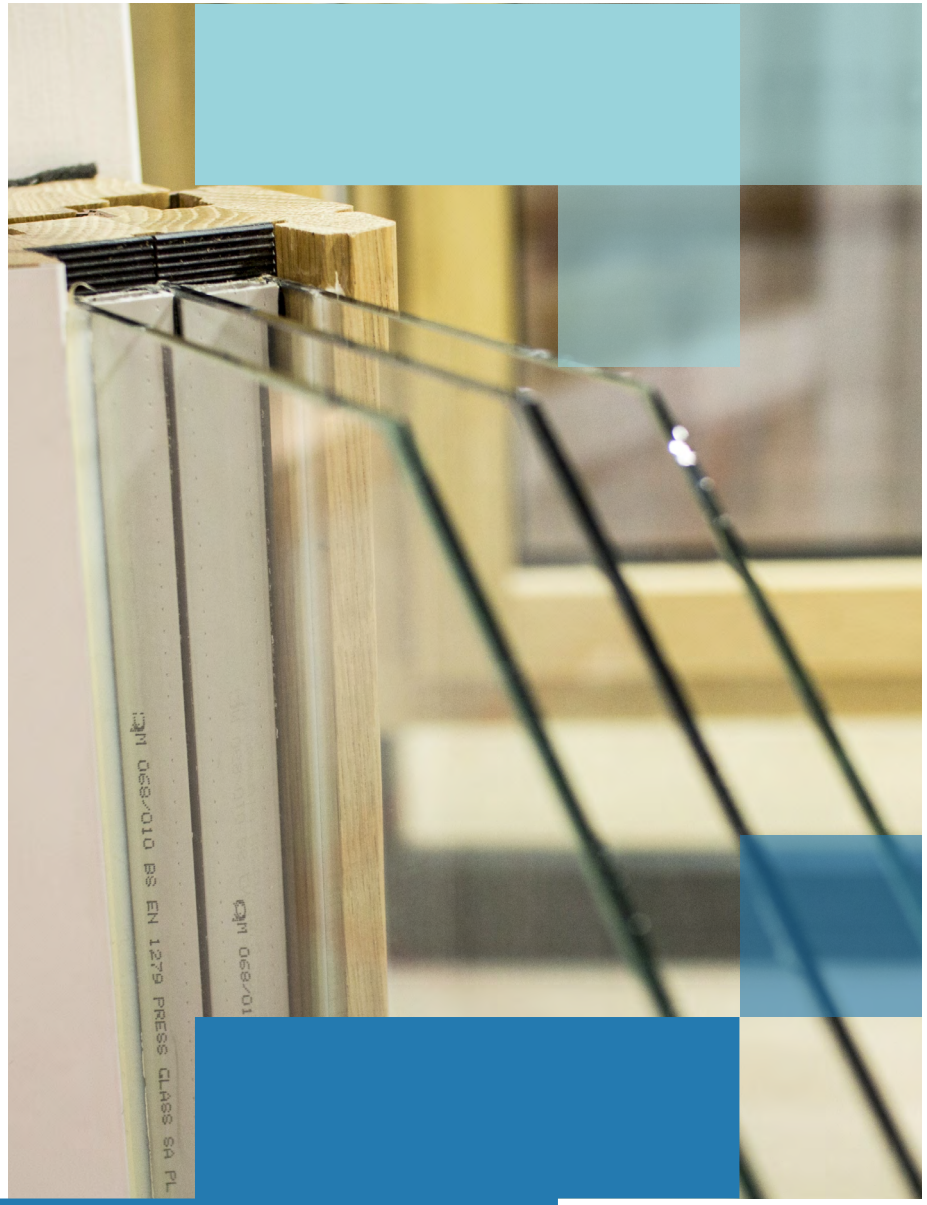
It is acknowledged that there are many challenges to overcome to deliver decarbonisation interventions given the structure of a PFI contract coupled with the complexity of retrofitting within an existing built environment. Accordingly, this handbook advocates a practical and pragmatic approach, centred on transparency and underpinned by good faith obligations on all parties.

The handbook is intended to be used alongside the relevant contractual provisions of each individual project, which provide the framework within which project assets are maintained and services delivered. Success will be much more likely where Authorities have, from the outset, a thorough understanding of their project, and in particular the Project Agreement, including the way in which energy provision and use is addressed and how the change mechanism operates. It is worth noting that there are many different contractual approaches and models in operation, and any net zero change will need to be delivered in the context of the relevant approach in question.

In some cases, decarbonisation of operational PFI projects may require variations or changes to project contracts (referred to in this document as 'net zero changes'). The guidance proposes a unified, systematic approach to the delivery of net zero changes for operational built environment PFI assets, to be used on all projects, irrespective of the genesis of the particular project agreement i.e. which version of SOPC it is based on.

This handbook is designed to assist all interested parties in implementing net zero changes by giving them a roadmap and framework within which they can operate, highlighting key issues and best practice approaches. It is not however a definitive, detailed technical manual for the delivery of retrofit decarbonisation investment. As such, this document signposts preceding government and industry guidance, toolkits and other supporting materials.

This handbook has been produced by the IPA with input from the IPA's Net Zero Working Group, whose members include a number of investors, MSA providers, FM contractors and central government representatives.



Executive Summary

The decarbonisation commitment

Up to 42% of the UK's total carbon footprint comes from the built environment[1]. Decarbonisation of public built environment assets is an essential part of meeting the legal commitment to decarbonisation that has been made in the Climate Change Act and successive Carbon Budgets.

Active programmes across central and local government are driving forward retrofit decarbonisation of public buildings. These include the Government Property Agency's Net Zero Programme; the NHS Estates Net Zero Carbon Delivery Plan; and the Local Partnerships Re:Fit Programme. Broader guidance such as Greening Government Commitments-2021-to-2025[2] has established targets for individual Departments to achieve within prescribed timeframes. Significant capital grant programmes including the Low Carbon Skills Fund and the Public Sector Decarbonisation Scheme have been made available to support decarbonisation investment programmes[3].

All public sector organisations are tasked with planning and acting now to reduce their carbon footprint. Those public buildings delivered in partnership with the private sector, through the Private Finance Initiative (PFI), Private Finance 2 (PF2) and other Public Private Partnership (PPP) contractual arrangements should be included in these decarbonisation plans. The rigidity of the long-term contractual commitments that sit behind these arrangements may make it more complex to make changes to the assets, systems and operations delivered by these contracts. However, there are opportunities to align the interests of public and private sector partners to

1 Government Property Function Net Zero Estate Playbook November 2021 and UK Green Building Council vision for a sustainable built environment https://www.ukgbc.org/climate-change-2/
2 https://www.gov.uk/government/publications/greening-government-commitments-2021-to-2025
3 https://www.salixfinance.co.uk/public-sector-funding-schemes

deliver decarbonisation, enabling contract authorities to tap into private sector project stakeholder motivation to progress project decarbonisation and the potential to access private sector supply chains and expertise in energy efficiency retrofit interventions.

Reducing operational carbon

Extensive and valuable guidance and toolkits are already available to public sector authorities to support the development of decarbonisation strategies for existing built environment assets in their operational phase and as far as possible these are signposted in this handbook rather than seeking to recreate resources that already exist. Particular reference is made in this handbook to frameworks, definitions and other tools including the Government Property Function's Net Zero Estate Playbook[4], the UK Green Building Council's Net Zero Carbon Buildings Framework[5], the Chartered Institution of Building Services Engineers, LETI[6] and the Better Building Partnership[7]. The forthcoming publication of a UK Net Zero Carbon Buildings Standard through collaboration between leading UK property industry organisations is expected to provide a unified definition of a net zero building and provide energy and carbon benchmarks for most building types including schools and hospitals[8]. Sector specific guidance and strategic decarbonisation plans have also been developed, including the NHS Estates Net Zero Carbon Delivery Plan and the NHS Net Zero Building Standards[9], and DfE's energy efficiency guidance[10] and School Output Specification Technical Annex 2J: Sustainability[11].

For operational phase PFI properties and other built environment assets, the focus for decarbonisation investment should be on reducing **operational carbon** (attributable to the energy consumption in the operation, maintenance, repair, refurbishment and use of the asset). This is because decisions affecting the whole life carbon of the asset that relate to design and construction phases have already been taken. Guidance and building standards are available separately that address whole life carbon reduction in the design and construction phases.

4 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1035417/Net_Zero_Estate_Playbook__1_.pdf
5 https://www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-framework/
6 https://www.cibse.org/policy-insight/key-policy-areas/net-zero/cibse-guidance-to-deliver-net-zero-carbon-buildings-and-how-it-relates-to-leti
7 https://www.betterbuildingspartnership.co.uk/
8 https://www.nzcbuildings.co.uk/
9 https://www.england.nhs.uk/publication/nhs-net-zero-building-standard/
10 https://www.gov.uk/government/publications/energy-efficiency-guidance-for-the-school-and-fe-college-estate/energy-efficiency-guidance-for-the-school-and-further-education-college-estate
11 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1119608/GDB_Annex_2J-Sustainability-A-C03.pdf

In this context, it is helpful to refer to definitions provided by the UKGBC and LETI of what net zero operational carbon means:

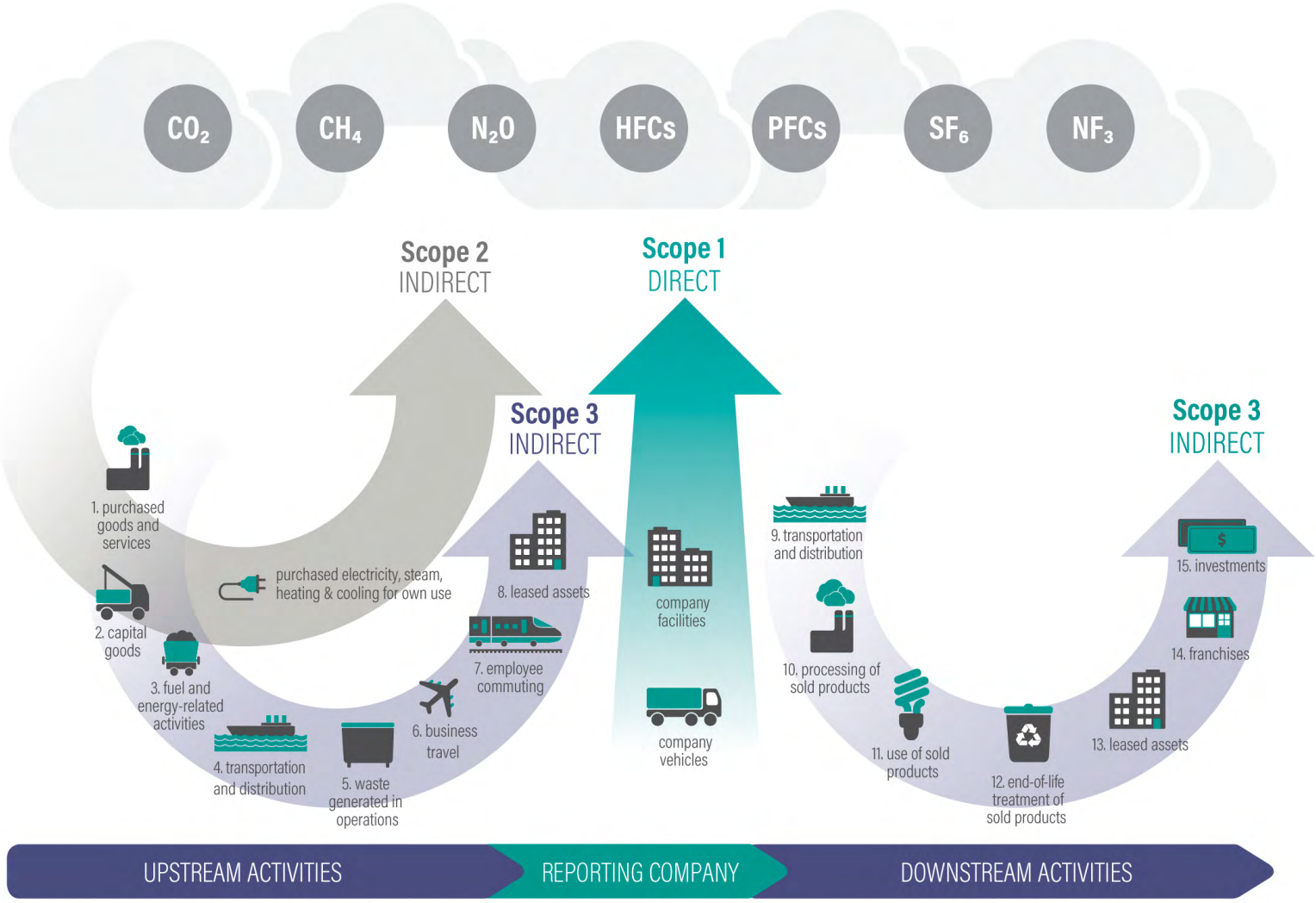
UKGBC – "When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset."

LETI/CIBSE – "A 'Net Zero Carbon - Operational Energy' asset is one where no fossil fuels are used, all energy use has been minimized, meets the local energy use target (e.g. kWh/m^2/yr) and all energy use is generated on- or off- site using renewables that demonstrate additionality. Direct emissions from renewables and any upstream emissions are offset."

Different sources of emissions

Greenhouse gas emissions are often referred to in the three categories of scope 1 direct emissions generated from sources owned and controlled by the reporting entity (e.g. on site fossil fuel heating systems), scope 2 indirect emissions generated from purchased electricity, steam, heating or cooling and scope 3 indirect emissions generated by the full supply chain of products and services delivered to the reporting entity.

As recommended by the UKGBC, it can be helpful to take a staged approach to decarbonisation of a PFI project, beginning with a focus on the scope 1 direct emissions and scope 2 indirect emissions that can be influenced most readily. Given the complexity of reducing scope 3 indirect emissions generated by the full supply chain of products and services delivered to users of the building, it is recommended that projects focus initially on scope 1 and 2 emissions reduction initiatives and aim to progress to consider scope 3 emissions over time.



Source: Greenhouse Gas Protocol Corporate Value Chain Accounting and Reporting Standard, page 5[12]

12 https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf

A recommended approach

This handbook of good practice is structured in two parts. In the first part, five principles are proposed for each PFI project to develop its own decarbonisation plan. The second part of the handbook focuses on how to progress shortlisted decarbonisation interventions that require a contract change, and sets out a staged approach to the contract change process, with recommended activities and checklists at each stage.

Part 1: Developing a decarbonisation plan

Public and private sector partners in a project should work together to develop a decarbonisation plan, identifying the baseline emissions position and a pathway to net zero carbon with a series of preferred interventions that could be implemented in the short, medium and longer term, subject to detailed assessment and approval in appropriate stages. The following five principles are recommended to prepare and implement an effective decarbonisation plan:

Data first

Begin by getting access to information about existing energy consumption and operational carbon emissions. This can be used to establish baselines from which targets can be set and progress tracked

Know your contract

PFI contracts of different vintages and in different sectors do not all treat energy management and risk in the same way. It is important to check your contract and understand where risk and responsibility is allocated and to ensure that existing requirements are being adequately met

Engage stakeholders

Set up the right governance frameworks from the outset. Identify all stakeholders and ensure they are appropriately represented in groups that can approve, deliver and oversee change

Prioritise

Maximise the effectiveness of available budgets by reducing energy demand first, before investing in more efficient mechanical systems and later looking to renewable energy generation options, with offsets a final consideration for the residual carbon position

Make a plan

The project company and the contracting authority should together agree a long term plan for de-carbonisation that identifies baselines and targets, supports the monitoring of progress over time and that is flexible to change

Data first:

The basis of any decarbonisation plan should be reliably sourced data about energy consumption by the project, which can be used to derive a baseline greenhouse gas emissions position, and to calculate metrics such as energy use intensity and carbon intensity reflecting the size of the project assets, and based on levels of utilisation. Baseline data is important to enable the starting position to be identified on a planned pathway to net zero, to enable benchmarking against other similar projects or assets and by reference to sector standards, and to calibrate the scale of the decarbonisation challenge. Most project investors and many contracting authorities have already started to collect energy consumption and emissions data.

The quality and granularity of energy consumption data available to projects and authorities will vary, dependent amongst other things upon installed metering systems and the extent to which energy reporting is required within the project contract terms. There is a strong alignment of interests between public and private sector partners in their desire to have access to quality energy consumption and emissions data to satisfy public and private sector reporting objectives, with an expectation that reporting obligations are likely to increase going forward. Irrespective of the specific reporting obligations within contracts, public and private sector partners alike are encouraged to engage positively and make data available to each other as transparently as possible to support shared decarbonisation goals and minimise duplication of effort.

To the extent practical and affordable, the installation of sub metering systems within properties is recommended if not already in place. Greater granularity of energy consumption data from sub metering systems can assist the identification of excess energy consumption in particular zones or by specific items of inefficient plant and equipment, aid the targeting of energy efficiency measures and support ongoing monitoring of impacts from interventions.

Know your contract:

Responsibility for energy use and the allocation of energy consumption and tariff risks is treated differently under different contracts. Some decarbonisation measures may have only minor contract implications, whilst others may require the review and amendment of contracted service, maintenance and lifecycle requirements, the consideration of potential applications for relief or waivers, notification and approval obligations from key project stakeholders including lenders, and may require potentially complex or lengthy contract change processes to be followed. It is important that a contract authority reviews its existing contract carefully, including to confirm that specified energy reporting, efficiency objectives and risk allocation is being met, and to assess the contractual implications of identified decarbonisation measures. Depending on the availability of in-house resource, specialist external support may be required to review contracts and to negotiate and document required changes. Reference can be made to IPA Change Management guidance and training to support in this regard.

It is recommended that any potential changes to contracts should be considered carefully and discussed with a sponsoring department where relevant, to ensure that any accounting and budget implications can be assessed, in particular where the change may alter the proportion of public funding for the project (which includes capital contributions and publicly funded grants) or the allocation of risks between public and private sector partners.

Engage stakeholders:

To be delivered successfully, the development of decarbonisation plans and the delivery of identified interventions will require the collaboration of public and private sector partners, as well as in some cases the approval or support of wider stakeholders. Benefits can be gained by accessing the expertise of project partners, in particular the management services and facilities management providers with technical knowledge of the project assets and equipment and experience of delivering decarbonisation measures elsewhere. Efficiencies may also be achieved by aligning a project decarbonisation plan with wider maintenance and capital programmes of the project authority or investors or facilities management providers.

It is recommended that decarbonisation be made a standing item on existing project liaison groups or operating committees to actively assess and promote decarbonisation in the management and use of the project assets. In addition, the establishment of a stakeholder group is recommended to manage wider responsibilities, interests and approval requirements as part of the delivery of decarbonisation plans. Best practice guidance is available from various sources on setting up effective stakeholder groups to support the development and delivery of decarbonisation plans, including the Net Zero Estate Playbook and private sector industry bodies such as the Better Building Partnership. Project stakeholders can also offer insight of practices that have worked well in other projects in their portfolios.

Prioritise:

The most effective range of decarbonisation options for a particular project and its built environment assets should be tailored to the specifics of a given site or asset and will be dependent upon a range of factors including the size, nature and age of the asset, the age and efficiency of existing plant and equipment, the cycle of planned repair and replacement of installed equipment, site and property specific design limitations, the remaining PPP contract duration and the availability of budgets. Parties should be open to review existing contractual requirements if appropriate to reflect new decarbonisation objectives. As set out in Part 1 of this handbook, it is recommended that the first areas of focus for decarbonisation should be the reduction of scope 1 emissions, from onsite fossil fuel use, and scope 2 emissions, from purchased energy consumed directly on site, as these two categories of emissions can be most readily influenced. The reduction of scope 3 emissions from the full supply chain of products and services used by a project will be more complex to achieve, particularly in the context of contracting authorities of PFI projects where the authority will have little or no control over procurement decisions made by project delivery partners. Plans can be added to over time to build in the consideration of scope 3 indirect emissions reductions once progress has been made with reducing scope 1 and 2 emissions.

When considering alternative potential decarbonisation measures, the Net Zero Estate playbook and UKGBC recommended approach is to consider first energy conservation measures, to reduce the energy demand from existing assets and equipment. This includes energy campaigns to promote behavioural change in the use of the building and existing lighting, heating and cooling systems, and through building fabric improvements such as building and pipe insulation, glazing solutions and solar shading. These measures can often be the lowest cost and quickest to implement, and are also likely to have least complex implications for the PFI contract provisions. The next area of focus should be investing in more energy efficient plant and equipment to get the most out of energy inputs. This might include the installation of LED lighting and lighting controls, upgrading air handling units and heating and cooling systems and controls. Where existing project lifecycle plans contemplate the like for like replacement of plant and equipment at end of life, authorities should ask for lower carbon options to be considered. Finally, the use of renewable energy sources should be maximised, by switching purchased energy to renewable tariffs where available, and assessing the feasibility of onsite renewable energy generation such as the installation of solar photovoltaic panels or wind turbines.

Make a plan:

Having a short-, medium- and long-term plan with an opening baseline, decarbonisation target milestones and with a set of expected carbon reduction contributions from a series of interventions, will enable a pathway to net zero to be charted and progressed over time. It will also make it easier to plan implementation of preferred options to align with the project company's planned maintenance and lifecycle intervention points and to assess and amend delivery plans to reflect changes over time, for example if operational performance or budgets change or new technologies become available.

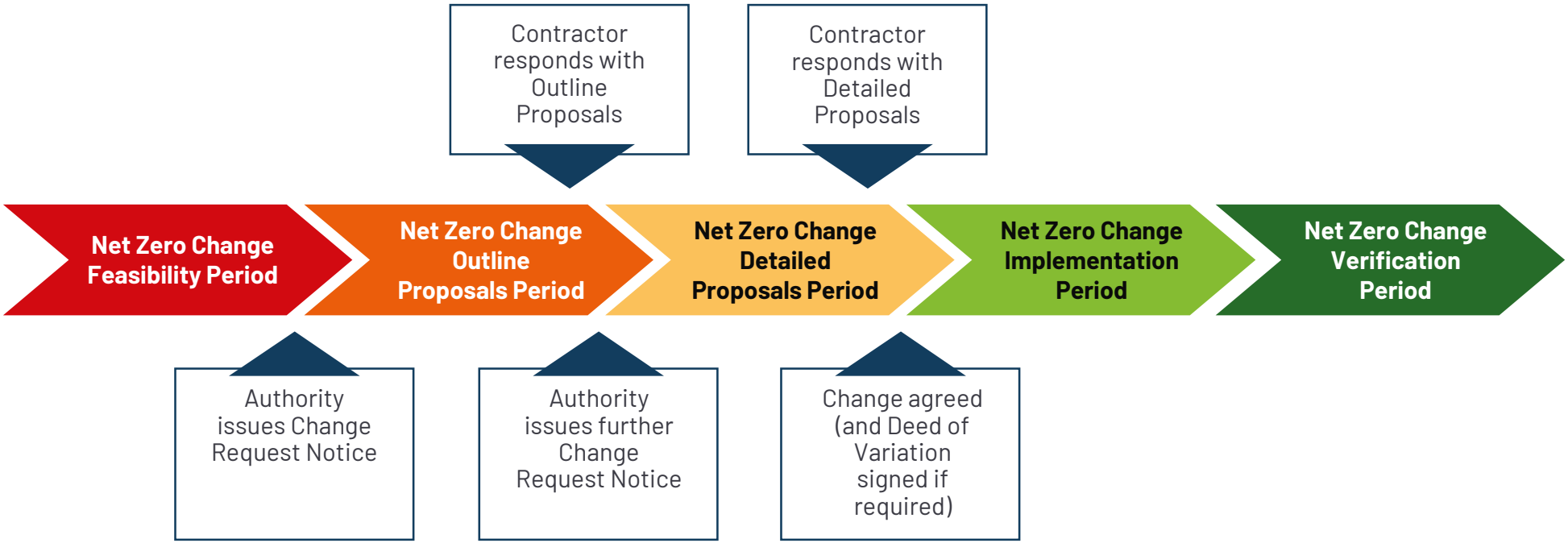
The project company and facilities management providers will play an important role in the development of decarbonisation plans. Periodic Energy Reviews may already be provided by the project as a part of contractual requirements, that will support the identification of excess energy consumption and energy efficiency opportunities. It is recommended that contract authorities walk the project site with their delivery partners to discuss and identify the largest uses of energy and potential options to be explored. External technical advice is also likely to be needed as selected proposals are considered in greater detail at successive stages of the selection, approval and delivery of interventions. Where possible it is recommended that external technical reports be commissioned jointly by project company and the Authority, to enable a common understanding of the issues and to reduce costs.

Early stage Decarbonisation Reports to identify potential options should be broad ranging, and consider short, medium and longer term options in each of the identified categories of energy conservation, increased energy efficiency and renewable energy. More detailed Feasibility Studies will be needed for short-listed options to include surveys and site based technical analysis, delivery responsibilities and a high-level assessment of contract implications and to provide sufficient detail for business case appraisals to be prepared. Comprehensive delivery plans will be needed for each intervention that is subsequently taken forward, to include consideration of appropriate milestones and approval points for all parties including project lenders, and to take account of future measurement and verification requirements and the need for feedback as part of continual monitoring and refinement of the project decarbonisation plan.

Extensive existing guidance, toolkits and other resources are available to support each of the 5 areas of activity referred to above. These have been signposted as far as possible in Part One of the Handbook.

Part 2: Delivering a net zero change

Building on the Part 1 focus on the development of a decarbonisation plan and shortlisting of preferred interventions, Part 2 of this handbook sets out activities recommended to be undertaken in the delivery of options identified in the decarbonisation plan that may require contract change, referred to in this handbook as a net zero change.



Part 2 of the handbook provides recommended checklists, considerations and actions for the above 5 stages of the change process, from the point of assessing and shortlisting of options; to issuing a change notice; and progressing to the delivery and monitoring of selected interventions, as summarised in the tables overleaf.

Net Zero Change Feasibility Period | Net Zero Change Stage 1 | Net Zero Change Stage 2 | Net Zero Change Implementation Period | Net Zero Change Verification Period

Consider	Activities	Governance and decision making
• What is your net zero strategy? • What are the preferred/possible net zero interventions • How much is the change likely to cost? • Is the change mechanism suitable for delivering the net zero change? • Will it be a low, medium or high value change and what are the implications of this? • What affordability constraints exist (capital and revenue)? • Are there any existing funding streams available (e.g. grant) and can the eligibility criteria be met? • How will VFM be demonstrated? • When is the best time to implement the change? • Who will own and maintain any newly installed kit? • Who are the relevant stakeholders? • Timing of and approach to design, using RIBA stages	• Carry out a Site Visit • Engage with all stakeholders, in particular asset users/occupiers, to secure early buy in and set up the working group • Assess resources and consider governance and decision making • Assemble dedicated project team to include legal, technical and financial support • Agree approach to project management of the net zero change • Create actions tracker • Carry our initial due diligence on lender consent requirements • Review and assess suitability of the change mechanism and consider likely contracting structure • Check if contract already places energy saving obligations on the Contractor, including performance risk/reward • Review the contract more generally to understand likely impact of the net zero change • Consider key risks including technology and long-term performance and likely risk share arrangements	• Establish net zero working group • Consider use of an MOU to secure all-party, in principle, buy-in to the proposed net zero change • Agree and document high level commercial terms • Agree high level programme for implementing change • Understand lender approval process • Agree quote or fixed price for lender due diligence costs • Start collecting documentation including as built drawings, energy consumption data, asset register and condition surveys **Authority issues Stage 1 Change Request Notice**

Net Zero Change Feasibility Period | **Net Zero Change Stage 1** | Net Zero Change Stage 2 | Net Zero Change Implementation Period | Net Zero Change Verification Period

Consider	Activities	Governance and decision making
• Is the project company likely to object to the change? • Consider the original OJEU and identify any procurement issues • Authority's affordability envelope • Likely capital cost of the change • Revenue impact of the change (+/-) • Start to develop a project cashflow • Impact of the change on the services • Maintenance implications for existing and new kit • Is the project company likely to require relief from its obligations (and for how long)? • What amendments are needed to the project documents? Are any amendments or recalibration of the payment mechanism required? • Are any consents/approvals required, including from the lender? • The likely programme (for the change and the works themselves) • Impact on risk sharing arrangements • Who will bear design risk • Insurance implications • The technical solution (e.g. mounting solution for PV panels)	• Understand the impact of the change on the existing services • Resolve any constraints that may prevent the technology from being installed • Collect and collate all relevant information • Discuss approach to pricing, including fees, margins, OHP, risk pricing etc. • Agree preferred approach to funding • Resolve any accounting treatment issues • Understand contractual implications of the change • Agree due diligence requirements for all interested parties • Update the programme previously developed • Update the net zero change risk register • Identify any required external expertise	• Authority approval to issue request Stage 1 Change Request Notice • Is lender consent/notification required to allow the Contractor to respond to the Stage 1 Change Request Notice? • Is the Stage 1 Response acceptable, allowing a Stage 2 Change Request Notice to be issued? If not, is there opportunity for the Stage 1 Proposal to be revised? • Consider Construction Design and Management allocation of responsibilities • Confirm price for lender due diligence costs if not possible at earlier Feasibility Stage **Authority accepts Stage 1 Proposal and issues Stage 2 Change Request Notice**

Net Zero Change Feasibility Period | Net Zero Change Stage 1 | **Net Zero Change Stage 2** | Net Zero Change Implementation Period | Net Zero Change Verification Period

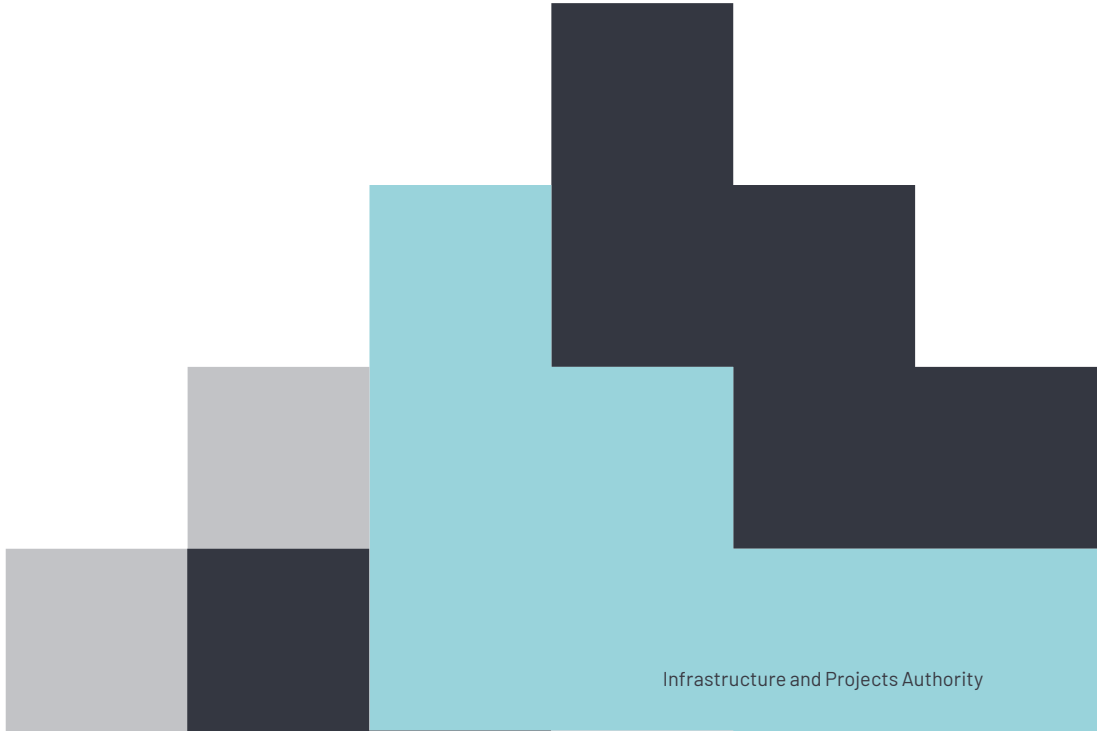
Consider	Activities	Governance and decision making
• Does the Authority have all the information it needs to conclude the net zero change? • Is the pricing clear and in accordance with the contract? Paying particular attention to: — Internal and external costs — Overhead and profit (margin) — Risk pricing — Lender due diligence costs • Have the principles of 'no better no worse' and 'no double counting' been adhered to? • Are the asset users/occupiers happy with the proposed change and how it will be delivered? • Is the timetable acceptable and deliverable? • Who will maintain the installation and how does the maintenance strategy work with handback requirements • Do all involved parties (including users and FM) understand proposals, operational plans and energy performance expectations? • How will progress and issues arising be communicated to stakeholders? • What happens if the change is delivered late? Are contingency plans in place?	• Finalise all surveys, report and studies, including the Detailed Feasibility Study • Secure all third-party consents required for the change • Conclude detailed design • Tender works/works packages • Instruct consultant team (QS, PM, technical etc.), if not already appointed • Develop detailed costings, to be updated as further pricing information becomes available • Agree payment terms (change to UC, capital contribution or a mix) • Agree commercial terms, building on previously agreed heads of terms, including the payment mechanism and prepare deed of variation/ updated project documents • Update the programme • Update risk register • Notify insurer of planned works	• Terms of Stage 2 Proposal to be agreed by all parties • All approvals secured including Authority, project company, FM co and lender where required • Revised project documents (and/or Deed of Variation) agreed **Deed of variation (or similar) signed and works commence on site**

Net Zero Change Feasibility Period | Net Zero Change Stage 1 | Net Zero Change Stage 2 | **Net Zero Change Implementation Period** | Net Zero Change Verification Period

Consider	Activities	Governance and decision making
• Has a full review of risk assessment method statements, health and safety plans and safeguarding plans taken place? • How will progress and issues arising be communicated to stakeholders? • What happens if the change is delivered late? Are contingency plans in place? • Will the change require asset users/occupiers to be trained on how to use/operate the assets? • Is disruption to asset users/occupiers being minimised? • Is the net zero change part of a wider energy awareness campaign? • Have all collateral warranties, product guarantees etc. been provided to the Authority? • Have the as built drawings been updated? • Has a revised operating manual been produced? • Have handback condition implications been reviewed and any appropriate amendments considered?	• Confirm insurer approval prior to works commencement • Monitor delivery against agreed programme/ agreed milestones • Monitor compliance with any conditions imposed where grant funding is being used • Monitor service performance during implementation, including any agreed relief from obligations • Regular meetings of the working group with agreed structure, chair and agenda • Regular updates and reporting • Agree control strategy for new equipment if relevant • Training, where relevant, for building/asset users and FM staff • Has operating manual been updated • Finalise data recording and sharing arrangements	• Make sure all stakeholder roles and responsibilities are understood. A RACI matrix helps identify who is to be Responsible, Accountable, Consulted and Informed • Works will need to be certified/signed off in accordance with procedure agreed as part of the change **Assets operational following completion of net zero change works**

Net Zero Change Feasibility Period → Net Zero Change Stage 1 → Net Zero Change Stage 2 → Net Zero Change Implementation Period → **Net Zero Change Verification Period**

Consider	Activities	Governance and decision making
• Are any new data collection and/or reporting requirements being met? • Have any energy targets been reset? Is an initial monitoring period required?	• Commence monitoring under agreed measurement and verification plan	**Measurement, monitoring and verification**



Appendix: Case Studies

Case Study - **Controls Dead-band Adjustments**

Authority: University College London Hospitals NHS Foundation Trust (UCLH)

Project: Health Management UCLH Ltd (Dalmore Capital, Semperian and Grovenor)

FM provider: Mitie

'Dead band' widening (first gatewayed via a monitored trial of control 'dead-band' changes)

In a large Acute Hospital, the FM Provider raised an opportunity to save energy (cooling in particular) by allowing a widening of the control systems 'dead band' (the gap between the environmental control system starting to act to provide localised additional heating or cooling). Proof of this was provided when in wintertime the building experienced a loss of chillers due to a planned 'Black start'. This resulted in wards and rooms 'over heating', even when outside air was only 11oC i.e., there was nearly a year-round cooling need in busy areas as heat from equipment, people, lights etc. meant environment cooling was needed not just on hot summer days.

The change was proposed as the 'dead band' in a range of areas had been set at such a narrow tolerance to ensure that there was plenty of heating or cooling applied before there was any likelihood of hitting contractual usage room temperature parameters (maximum or minimum). This had caused considerable 'cycling' between the hot and cold controls inputs and the potential for the heating and chilling processes to be fighting against each other due to thermal inertia related swings.

The allowance of a slightly larger 'dead band' was agreed as a trial; environmental controls starting to call for more heating or cooling inputs, to then ensure a room 'set point' (the target control temperature for a space, e.g. set at 22oC +/-1.5oC). This then allowed less chilled water inputs and its resultant reduction in electrical demand and a far lower likelihood that chilled and heating inputs were rapidly short cycling between each other.

This proposed change was subject to a controlled 'gateway' approach with a multi -discipline team to ensure that:

a) More critical clinical areas such as ITU, SCBU etc were not changed and clinical teams in affected areas were given notice that this was to change so issues could be reported and escalated and '% dissatisfied' rates for calls regarding 'too hot' or 'too cold' in spaces being very closely monitored.

b) The rooms also remained within their contract usage parameters, notwithstanding there was a greater likelihood of some limited failures with the wider 'dead band' being applied (but with the benefits outweighing that risk).

The outcome was no discernible change in 'too hot' or 'too cold' calls to the helpdesk and a worth-while carbon saving, as well as increasing the life of field mechanical controls that had to 'actuate' far less with the slightly wider dead band (i.e. a better drift was allowed before valves started to open to then add heating or cooling inputs etc).

Changes like this need careful and multi-party collaboration and stakeholder approvals. However, they can provide significant savings in terms of energy and carbon reductions in the right circumstances if all parties work together.

Case Study - **Chiller replacement and removal of redundant steam humidifiers**

Authority: Norfolk and Norwich University Hospitals NHS Foundation Trust

Project: Octagon Healthcare Ltd (Semperian/Innisfree)

MSA provider: Semperian

FM provider: Serco

Chiller Replacement Programme (no variation required by authority – managed under lifecycle)

A modern acute hospital uses a large quantity of chilled water for process-related cooling (MRIs etc) and environmental cooling for mechanical ventilation systems to allow 'comfort cooling' for the building's occupants. These chiller units are fairly large and have multiple banks of refrigerant compressors that are electrically driven. The units then 'dump' the waste heat generated by the refrigeration cycle into the atmosphere via 'blast' air coolers (large fans that sit on top of fairly large heat exchangers that are typically roof mounted - some can be part of the chillers and some standalone nearby).

As is the case for most building services technology, chiller design and energy efficiency has moved on considerably in the past 15 -20 years. The project was pleased to be able to replace under lifecycle old, outdated chillers with more efficient modern alternatives. The replacements selected by the multi-disciplined design and project team for the multi-year programme are of a similar size as the units being replaced but provide an increase in overall cooling capacity (useful given the propensity for warmer or more extreme heat events) and the manufacturers claim they are up to 30% more energy efficient than older technologies they are replacing (primarily but not solely as a result of very low friction technologies used in their compressor cores).

Removal of Steam Humidifiers (managed via a 'spend to save' variation)

In close-control air conditioning systems, steam humidifiers are occasionally used to re-introduce moisture back into the air handling units' tempered air. This is because cooling warmer outside air in summer de-humidifies the air and in winter as outside colder air holds less moisture than warm air the heating process causes its relative humidity to reduce.

The ability to control supply air to set the percentage of relative humidity was formerly very important when the healthcare setting still used explosive anaesthetic gases, which in very low humidity conditions can help promote static electricity to form. Modern anaesthetic gases now in use are a low risk in this regard. Whilst humidification control of mechanically ventilated supply air still represents the highest level of environmental control and thermal comfort, it is also very energy intensive and as a result most modern comfort cooled buildings do not have wet/steam humidifiers. Also, controls have vastly improved over time, so there is generally a better control of heating and cooling within air plant and within room spaces to reduce the likelihood of extreme swings of humidity.

Plans are now underway to remove a number of unused or not clinically needed steam humidifiers (local electrical element boiler type units) that is due to release an estimated £88k pa of savings mainly associated with energy plus some maintenance costs and is to be realised for a decommissioning 'one off' cost of circa £28k (pipework and power has to be removed safely to ensure no 'dead-legs' are left from humidifier water supplies). This spend-to-save scheme also equates to a carbon saving per year that is estimated in the region of 140 tonnes of CO_2.

Case Study - **Energy Management and Reporting**

Authority: Department for Education

Project: GT NEPS Limited (investment manager InfraRed Capital Partners)

MSA provider: Galliford Try

FM provider: Galliford Try

The Priority Schools Building Programme North East Schools project, comprising 6 primary schools and 6 secondary schools, is taking a collaborative approach to the promotion of energy efficiency and decarbonisation, supported by the project investment manager and positive engagement between the project manager, the FM provider, the schools and the contracting authority.

The contract payment mechanism and service specification for the project require energy monitoring and reporting (on both the base load of the building and in relation to unregulated power usage) and a risk share mechanism relating to base load consumption provides an incentive for the project to undertake effective energy management and reporting. The project company collects energy consumption data from each of the schools and shares this on a monthly basis across the batch of schools, fostering a spirit of competition between the schools to compare their energy consumption with other schools in the batch and reduce consumption below target levels.

Decarbonisation has been made a standing item at each month's project liaison meetings between the project company and the schools. Feedback from these meetings confirms that this has increased engagement and discussion on the topic between the project partners.

The project company has so far commissioned decarbonisation reports for two schools in the batch to identify a range of potential options to reduce energy consumption and carbon emissions. The reports assessed current energy consumption of each school, compared with CIBSE benchmarks, and calculated the corresponding CO_2 equivalent emissions. The main energy consuming items of plant were identified and recommendations made for saving energy. Short-term options considered included training for staff in the

more efficient use of energy consuming equipment, LED lighting installation, fitting energy saving devices to fridges and freezers and timers on point of use water heaters and the potential for solar PV installation. Medium- to longer-term options were also considered including future installation of more energy efficient catering equipment as part of planned lifecycle replacement and switching from gas boilers to heat pumps for heating and systems. The Project Company is now advancing the short term actions from the reports at several schools while instructing the FM provider and working closely with DfE, its contracting authority.

Case Study - **Hydrogen lighting tower**

Authority: Royal Free London NHS Foundation Trust

Project: Barnet Hospital

FM provider: Bouygues E&S

Hydrogen-powered tower lights

Barnet Hospital had areas of the site which were difficult to light due to cabling infrastructure issues. Bouygues ES and the Royal Free London worked together to take this as an opportunity to highlight the benefits of using hydrogen-powered tower lights to reduce carbon emissions across the healthcare sector.

Rather than running on small diesel generators, hydrogen-powered lights offer a sustainable temporary lighting solution. This solution helps the authority to achieve their pledge to create a greener NHS by reducing their fuel consumption and improving local air quality. BYES are also committed to supporting the local community and their environment by eliminating the risk of fuel and noise pollution.

After trialling the hydrogen-powered tower lights at Barnet Hospital, it was clear the environmental and social benefits outweigh the slight monthly cost increase to run them, which it is hoped will eventually balance out assuming that hydrogen costs drop and diesel prices rise.

Operationally, the battery life and lighting sufficiency of the hydrogen-powered lights were excellent and rated highly by the site team. The elimination of the risk of fuel spillage facilitates better resource-efficiency by reducing the amount of operational checks and the supplier service engineer only has to replace the hydrogen tank when required.

Client benefits:

- Lighting in hard-to-reach areas
- Reduce CO_2 emissions on site by removing diesel generator
- Reduction of noise pollution - ideal for night work in residential areas and enclosed spaces
- Safe to use in enclosed areas
- Special low-impact lighting similar to lunar light

Case Study - **LED installations**

Authority: GPA (occupying dept Home Office)

Project: Annes Gate Property Plc (investment manager InfraRed Capital Partners)

MSA provider: Vercity

FM provider: Bouygues E&S

The 2 Marsham Street PFI project was onboarded from Home Office to Government Property Agency in August 2021.

The programme was to replace the existing lighting with LED to reduce utility costs and reduce carbon, build contingency into the building for longer term usage post 2031 PFI expiry and reduce heat load as part of thermal comfort modelling.

The programme completed over October and November 2022 and savings are active from 1 December 2022.

The programme provided the following savings:

- annual utility bill saving of £91,365
- reduction in CO_2 per annum of 159.6T
- annual KWH reduction of 673,790
- overall reduction in lighting power/cost of 48%

Case Study - **Air conditioning optimisation**

Authority: Mid and South Essex NHS Foundation Trust

FM provider: Bouygues E&S

A proof of concept pilot study was undertaken to prove the benefit of installing Coolnomix, a unique patented intelligent thermostat, on reducing the energy consumption, costs and carbon emissions of the air conditioning. Emissis and the Bouygues team carried out a 10 day trial on one air conditioning unit in Room 1CP at Broomfield Hospital, part of Mid and South Essex NHS Foundation Trust.

To measure the energy consumed by the air conditioning, an MID smart meter with remote connectivity was connected to the external condenser During the trial in the month of February the metered half hourly and 4 hourly data was downloaded and analysed.

With Coolnomix active, daily energy consumption was reduced by 16%, a reduction of 4.1kWh per day. At an electricity unit cost of 13p per kWh, the installation to one AC unit would save Mid and South Essex NHS Foundation Trust £243.18 per year. In the warmer months of April and throughout the summer months the outside temperature increases, making the AC unit work harder and increasing the savings and avoided CO_2.

The Mobile Solutions team Operations Manager commented: "The Mobile Solutions' experience with the Coolnomix equipment and the support from Emesis has been exceptional. The equipment can be installed within a couple of hours per system and so far we have had great carbon reductions and cost savings for the trials, which has been demonstrated in the reports to date, showing that pay back will only take around two years if the current cost of electricity stays the same."

Daily energy consumption (kWh) and saving with COOLNOMIX