NHS Wales Net Zero Building Standard Alignment

Mapping, application, and considerations for implementing the NHS Net Zero Building Standard

Contents

Using this document

NHS Net Zero Building Standard

This document should be read in conjunction with the NHS Net Zero Building Standard (NZBS) suite of documents as detailed in the following table.

These documents and tools have been developed to help assist the project teams comply with a new process and suite of requirements, and standardise reporting for ease of quality assurance, business case approvals and learning across capital investments.

Document / Tool	Description
NHS Net Zero Building Standard (NZBS)	NHS England Net Zero Building Standard providing technical guidance and requirements for the development of net zero carbon healthcare buildings. Will be an iterative document which will be regularly updated to align with and signpost best practice.
NHS Net Zero Building Standard User Guide	A supporting document to help users interpret and apply the requirements within the NZBS to their project.
Design Management Tool	This Excel tool is provided specifically for the Net Zero Carbon Coordinator to manage the delivery of the net zero carbon requirements and capture qualitative elements of compliance.
Operational Energy and Carbon (OE&C) Compliance Tool	This Excel tool provides the space allocation tab which is populated based on project specific schedule accommodation, proposed building geometry/massing and location to determine requirements for operational energy limits. The output of the space allocation tab is also used in the WLC Compliance Tool to generate the upfront carbon limit. The tool is used to record and demonstrate compliance against operational energy limits and performance targets, and record derogations.
Whole Life Carbon (WLC) Compliance Tool	This Excel tool is provided to generate the upfront carbon limit and demonstrate compliance at outline and full business case stages based on whole life carbon reporting.

Language usage

To be consistent with the NZBS, in this document modal verbs such as “must”, “should” and “may” are used to convey notions of obligation, recommendation or permission. The choice of modal verb will reflect the level of obligation needed to be compliant. The following describes the implications and use of these verbs in this document (readers should note that these meanings may differ from those of industry standards and legal documents):

- “must” is used when indicating mandatory compliance with this document
- “should” is used to indicate a recommendation (not mandatory/obligatory), i.e., among several possibilities or methods, one is recommended as being particularly suitable – without excluding other possibilities or methods
- “may” is used for permission, i.e., to indicate a course of action permissible within the limits of this document

Glossary

Term	Abbreviation	Definition
Building Research Establishment Environmental Assessment Methodology	BREEAM	A method of assessing, rating, and certifying the sustainability of buildings. It focuses on: Energy, Land use and ecology, Water, Health and wellbeing, Pollution, Transport, Materials, Waste and Management.
Embodied Carbon		The total amount of CO2e emitted in the production of a material or product. These include emissions caused by extraction, manufacture/processing, transportation and assembly of every product and element in the asset, (Modules A1-A5,).
Modern Methods of Construction	MMC	Is a methodology to evolve construction from traditional ways of working to those that increase value across the supply chain.
Net zero carbon	NZC	NZC balances the quantity of CO2e emitted by a building during construction and operation, with the amount avoided or sequestered.
Operational carbon		Operational carbon is the CO2e emissions associated with the in-use operation of the building; typically from electricity, gas and oil consumption. Measured in kgCO2e.
Operational Energy Limits		The NZBS includes operational Energy Limits in the energy usage intensities, expressed in kWh/m^2 of gross internal floor area per year that covers all energy use of the building (typically supplied through its fiscal meters), including loads currently unregulated by Building Standards.
Whole life carbon	WLC	The total sum of carbon emissions and related GHG emissions for all assets and removals, both operational and embodied over the lifecycle of an asset including its disposal (Modules: A1-A5 Upfront; B1-B7 In Use; C1-C4 End of Life). Overall WLC asset performance includes separately reporting the potential benefit from future energy recovery, reuse, and recycling (Module D).
Energy Conservation Measures	ECMs	Technologies and solutions that reduce energy consumption and improve energy efficiency on projects such as; fabric upgrades, plant and equipment upgrades, heat pump technologies and renewables.
Health Technical Memoranda	HTM / WHTM	HTMs give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare. WHTM refers to Welsh HTM.
Health Building Notes	HBN / WHBN	HBNs give best practice guidance on the design and planning of new healthcare buildings and on the adaptation or extension of existing facilities. WHBN refers to Welsh HBN.
Net Zero Carbon Coordinator	NZC Coordinator	A role within the design team that oversees and manages the process of compliance with the NZBS. The coordinator interfaces between the client and project team.
Net Zero Carbon Advisor	NZC Advisor	A role within the client organisation during the early project stages to advise on aligning the design brief with NZBS and provide guidance to the Trust/Health Board on setting targets and integrating sustainability criteria into the brief.

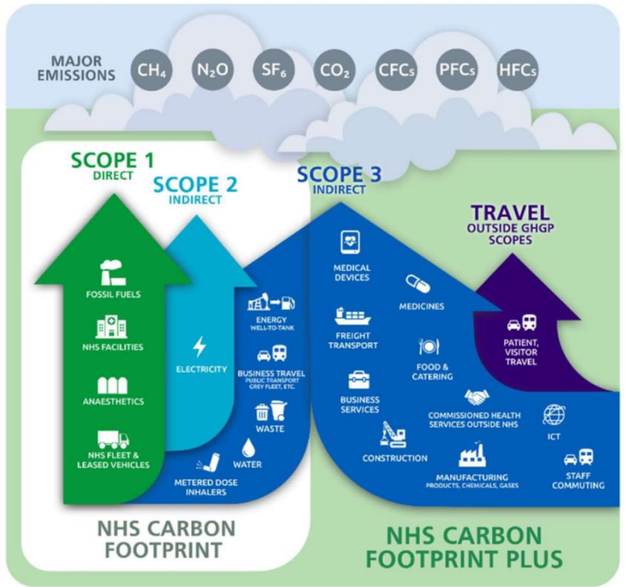
1 Introduction

Background and purpose

1.1 Climate change is a threat to public health, however the healthcare sector also contributes to the problem. In 2019 the Welsh Government declared a climate emergency and subsequently launched the 'Prosperity for all: A Low Carbon Wales' report, which sets out the ambition for public sector to be net zero by 2030 and specifically highlights the need to reduce emission in healthcare. The Welsh Government published the 'NHS Wales Carbon Footprint 2018/19' report (2020) calculating NHS Wales' (NHSW) carbon footprint as approximately 1MtCO2e; this value has been set as the baseline for emission reduction targets moving forwards.

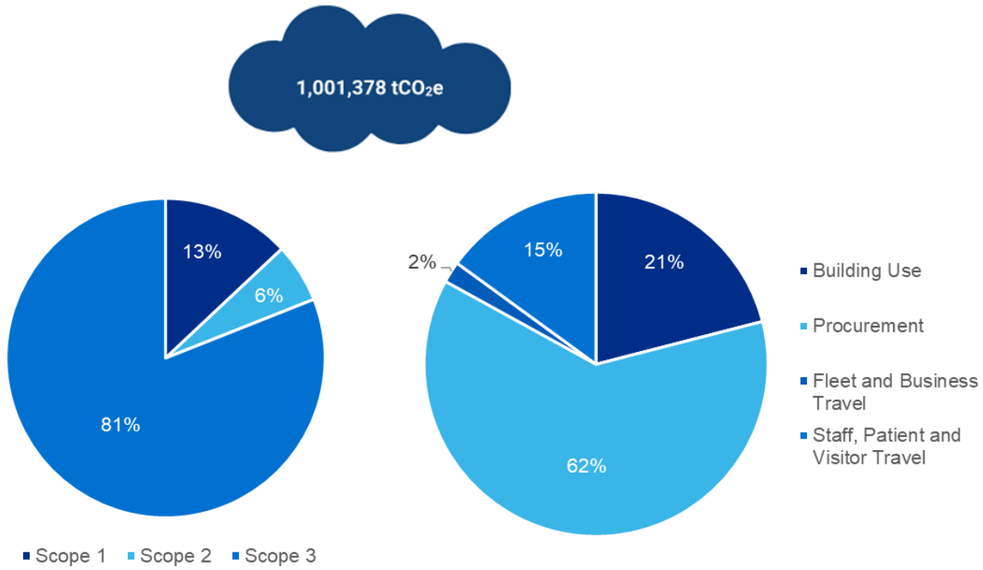
1.2 The Welsh Government published in the 'NHS Wales Decarbonisation Strategic Delivery Plan' (DSDP) (2021) to drive ambitious carbon emissions reductions, reinforcing the commitment of NHSW to achieving net zero carbon emissions by 2030 across all three scopes as defined by the Greenhouse Gas Protocol in line with the Welsh Government's net zero target for the public sector. The DSDP sets out carbon emissions targets for NHSW as a whole, and four categories of use, rather than by scopes; unlike NHS England's 'Delivering a Net Zero National Health Service' (2022).

Figure 1.1: NHS Carbon Footprints and Emissions Scopes



Source: Delivering a Net Zero National Health Service (2022)

Figure 1.2: NHS Wales Carbon Footprint and Categories of Use 2018/19



Source: NHS Wales Decarbonisation Strategic Delivery Plan (2021)

1.3 To meet the Welsh Government's legislative net zero commitments and to prevent irreversible impacts as a result of climate change, leading scientists and industry experts are advising that bold action must happen now. In response to this, NHSW has made a commitment that all new buildings will be designed and accredited to a net zero framework and for all existing buildings to undergo an energy efficient upgrade.

1.4 To meet its targets and commitments, NHSW intends to adopt the 'NHS England Net Zero Building Standard' (NZBS) (2023). The NZBS is the first healthcare net zero building standard and provides technical guidance to support the development of sustainable, resilient and, energy efficient buildings that meet the needs of patients now and in the future.

1.5 The NZBS considers whole life carbon (WLC) emissions; embodied carbon emissions associated with construction and operational carbon emissions associated with the energy consumption of buildings. By considering WLC the aim is to reduce carbon emissions and incrementally improve the NHS estate, progressing towards net zero targets.

Applicability

1.6 The NZBS will be applicable to all NHSW capital schemes aligned with the 'Design for Life' (DfL) framework, soon to become the Building for Wales framework, thresholds:

- Secondary care (acute hospitals) new builds subject to the DfL threshold (£7million)
- Refurbishments above £4million
- Primary care (GP and community services) new builds above £4million

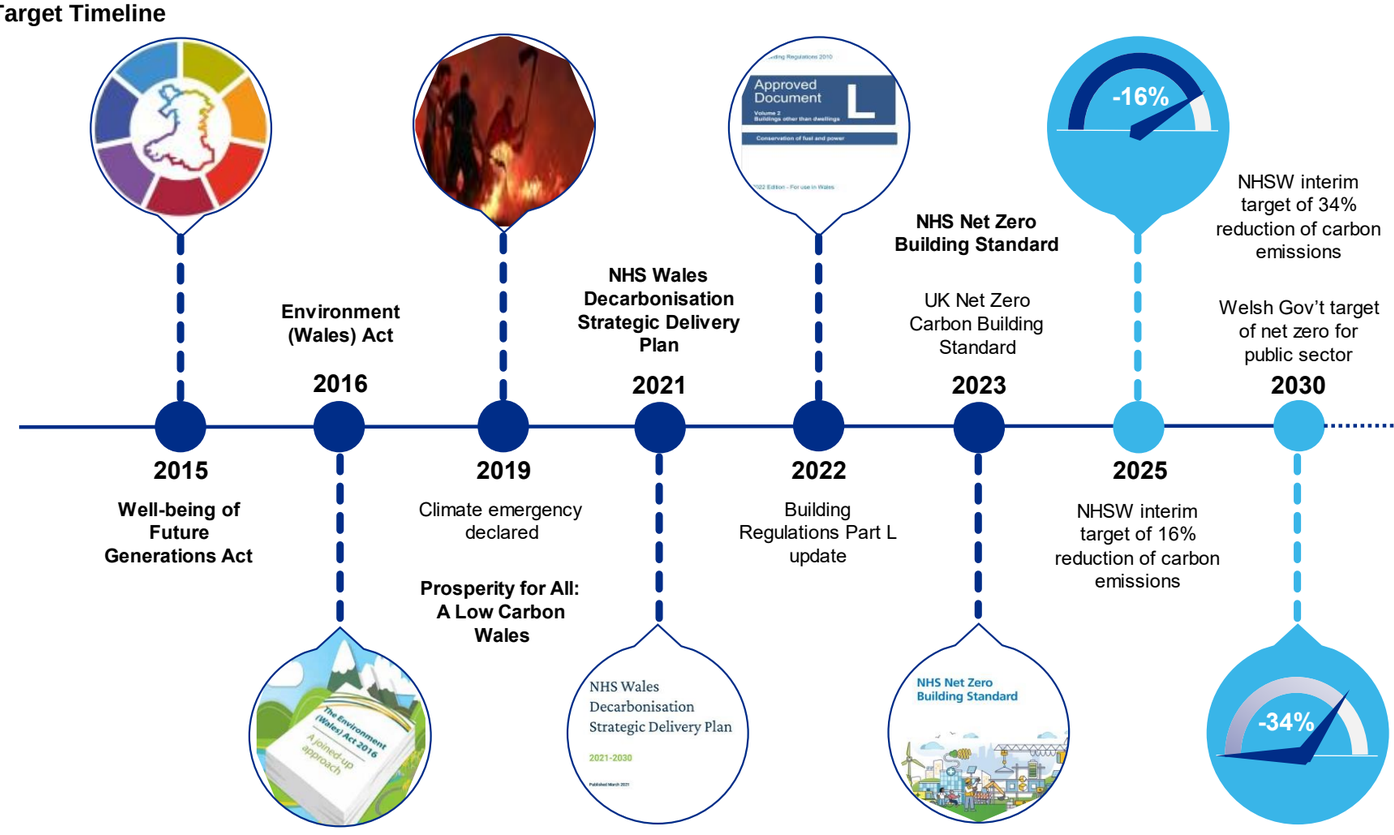
1.7 The purpose of this report is to support the adoption of the NZBS in Wales. The report aims to map and align the principles and processes of the NZBS to enable roll out in Wales. Practical considerations and methods of application are also highlighted.

1.8 The NZBS applies from 1 October 2023 to all applicable schemes that are pre-strategic outline case (SOC).

Policy landscape

1.9 The NZBS aligns with the key policy documents published by the Welsh Government and NHSW and will provide additional guidance in the development of net zero healthcare buildings without contradicting the trajectory of progress already established. The following timeline details the targets and policies in Wales and the broader targets of the UK Government the development of policy and guidance considered in this document.

Figure 1.3: Policy and Target Timeline



*The recent announcements by the UK Government do not affect the policies and targets outlined for NHS Wales, NHS and UK Net Zero in F1.3 above.

1.10 The NZBS aligns with the following legislation, strategies and ministerial ambitions that run throughout Wales' policies.

Table 1.1 Wales Policies

Legislation	Strategy	Ministerial Ambition
• Well-being of Future Generations (Wales) Act 2015 • Environment (Wales) Act 2016 • The Climate Change (Carbon Budgets) (Wales) Regulations 2018	• Prosperity for All – Economic Action Plan (2017) • Prosperity for All – A Low Carbon Wales (2019)	• Net Zero public sector by 2030 • 70% of Wales's electricity consumption to be renewable by 2030

Well-being of Future Generations Act

1.11 The NZBS supports the aims of the 'Well-being of Future Generations Act' (2015) and provides a practical framework to implement actions that support the act's goals. The NZBS's aims to develop sustainable, resilient, and energy efficient buildings that meet the needs of patients now and in the future, aligns closely with the Well-being of Future Generations Act, which seeks to improve the social, economic, environmental and cultural well-being of Wales.

1.12 Business cases for programmes that implement the NZBS are strengthened by this strong alignment to national policy. Key features of the NZBS that map to the goals of the Well-being of Future Generations act are presented below. Themes of the NZBS are reflected under all goals, except for 'A Wales of vibrant culture and thriving Welsh language', due to the culture-agnostic nature of the NZBS.

A prosperous Wales

- The **NZBS** will ensure improved **energy efficiency, generating cost savings** and improving public finances
- The **NZBS** will ensure **improved energy performance** which in turn will **improve patient and staff health and wellbeing**, assisting in comfort and productivity of building users

A resilient Wales

- The **NZBS** sets performance criteria for development, creating framework for development that is resilient to **future demands of health system**
- The **NZBS** recommends the use of **modern methods of construction and digital solutions**, which will create estates that are **resilient to future** requirements
- By applying the NZBS, energy efficiency and local energy generation will reduce dependency on external factors (energy prices)

A healthier Wales

- By complying with the **NZBS**, improved **energy efficiency** will generate **cost savings** and allow for investment in other areas of healthcare
- Net zero actions drives better environmental health, reducing risk of diseases such as heart disease, asthma and cancer
- The NZBS sets a vision for achieving whole life net zero carbon buildings, whilst improving patient care

A more equal Wales

- **Net zero** actions provide the opportunity to **reduce health inequalities** through improved environmental health
- By following the principles of the **NZBS user-centric designs** with be developed, with **accessibility** as a key principle of design

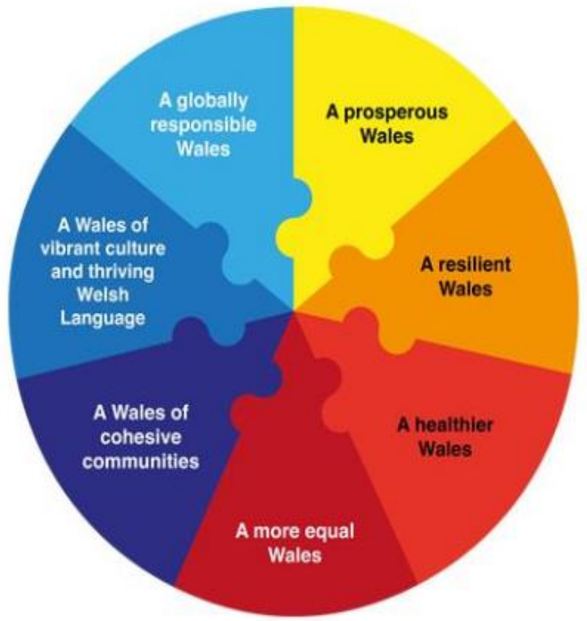
A Wales of cohesive communities

- Adoption of the **NZBS** will ensure **sharing of best practice** within the healthcare industry
- In turn this will enable visible implementation of best practice

A globally responsible Wales

- Adopting the **NZBS** will ensure a visible contribution to **UK's net zero targets**

Figure 1.4: Well-being of Future Generations Act goals



- **Supply chains** are also considered through use of **whole life carbon assessments** and benefits of locally sources labour and materials

NHS Wales Decarbonisation Strategic Delivery Plan

1.13 The NHS Wales Decarbonisation Strategic Delivery Plan (DSDP) highlights building decarbonisation as a key focus area for the plan, with building use being responsible for 21% of carbon emissions as reported in the 2018/19 baseline. Building decarbonisation forms one of six main activity streams to deliver NHSW's net zero goals, and the activities for building decarbonisation and carbon management are itemised into 16 actions in the DSDP. These have been mapped to the NZBS to show points of consensus and difference, and are presented in **Appendix A**.

1.14 The DSDP sets out targets for NHSW as a whole, and the four categories of carbon emissions, rather than by scopes. With building use being the category that is most relevant for comparison with the standard. Our review identified that there were no contradictions between the two documents and therefore role out of the standard would support delivery to achieve the requirements of the DSDP.

- The application of the NZBS to both new build and refurbishment schemes as detailed in **1.6** will support the following initiatives in particular:
  - 4, 6, 7, 8 – the NZBS highlights the need for all sites to have plans for decarbonising existing fossil fuel primary energy systems which should include measures to reduce energy and water consumption as well as energy source changes
  - 9 – monitoring and verification of energy and performance is a key driver of the NZBS and will support driving improved building management systems (BMS)
  - 11 – provides a net zero building standard approach for developing and building low carbon buildings
  - 12 – the Net Zero Carbon Coordinator role developed as part of the NZBS supports due diligence support throughout all project stages and is responsible for process compliance
  - 13 – the NZBS supports enabling modern methods of construction (MMC) to optimise embodied carbon
  - 15 – prioritisation of low carbon heating solutions is in line with the NZBS heat usage hierarchy
- The NZBS complements the DSDP focus areas and goals by defining specific targets for carbon and energy efficiency, providing measurable performance criteria.
- The NZBS requires detailed operational energy (TM54) and WLC calculations increasing measurable data associated with the impact of construction and building use, complementing the principles of the DSDP. The reporting of all results (including elements outside of the upfront carbon and operational energy limits) will enable iterative development of the standard and provide more detailed data for NHSW for future carbon foot printing and target setting.

WHTMs and WHBNs

1.15 The NZBS has been developed in England in compliance with the majority of the requirements set out within NHS England's Health Technical Memoranda (HTMs) and Health Building Notes (HBNs). There are a number of derogations from the HTMs/HBNs challenging previous guidance to drive towards increased energy and carbon savings and reaching net zero carbon targets. Upon review, there aren't any significant differences between the HTMs/HBNs and the WHTMs/WHBNs that will impede the adoption of the NZBS in Wales.

1.16 The notable approaches that differ from traditional HTM/WHTM compliance when implementing the NZBS are listed below:

- **Hot Water Storage temperature** - The NZBS suggests a target hot water storage temperature of 55^{o}C where possible, making allowance for the system to be able to increase the temperature periodically to eliminate the risk of legionella as a means to reduce energy consumption associated with domestic hot water storage. HTM 04-01, WHTM 04-01, and HSE guidance all request a minimum storage temperature of 60^{o}C; NHS Wales will not deviate from the HTM guidance. The domestic hot water (DHW) energy use is included within the energy limit for 'low tech type' spaces only; where the operational energy model does not meet the energy limit for the low-tech spaces due to the DHW storage temperature and this is fully evidenced, this will be an acceptable derogation.
- **Temperature set points** - The set points within the clinical space types in the NZBS differ to the typical 18-28^{o}C and 18-25^{o}C set points in the HTMs; reflecting typical operational temperatures in the range of 21-25^{o}C to better predict operational energy consumption.
- **Resilience review** - The NZBS suggests a resilience review is required as the current HTMs assume fossil fuel heating with dual fuel backup and electrical system with generator backup. With a move to electrical heating and cooling as well as future weather conditions it is becoming increasingly challenging to meet backup of the full site with generators.

2 Alignment

2.1 The purpose of this section is to provide detail on how the standard is applied specifically to NHSW business case stages due to the difference compared to the NHSE process and outline the required evidence at each business case stage to enable the project to progress to the next stage.

Business case stage alignment

2.2 Business case stages are where compliance is checked formally by parties outside of the Project Team – the requirements and evidence for compliance with NZBS and BREEAM and the required submission for reporting are provided in Table below. The requirements closely align with the business case stages in the NHSW decarbonisation process, and this table is supplemented by the 'NZBS Compliance Matrix' (2023).

2.3 The early business case stages of NHS E/I and NHSW processes have a slight difference; there is the additional Business Justification Case (BJC) process in NHSW that runs across RIBA stages 1-4 that is used for projects typically below £4million.

2.4 The business cases are aligned with the 'NHS Wales Infrastructure Investment Guidance' (2018).

Table 2.1: Correlation between business case stages, NHSW proposed decarbonisation process, NZBS and BREEAM

Business Case Stage		RIBA Stage	NHSW – Proposed Decarbonisation process	NZBS Requirement	BREEAM Requirement	Submission Documents
Strategic Outline Case (SOC)		0	Commitment to achieve Net Zero Carbon and adopt the NZBS approach. Make cost provisions for decarbonisation. **Responsibility of Health Board, TCA and NZC Advisor.**	Derive the project brief including operational energy and upfront carbon limits using schedule of accommodation.	Commitment to relevant BREEAM minimum target rating: Excellent – new builds Very Good – refurbishments	No requirements.
Outline Business Case (OBC)	**Business Justification Case (BJC)**	1-2	Pre assessment decarbonisation outline estimate (Design tool) Attainment of rating precondition for approval of OBC. **SCP to produce evidence, TCA and NZC advisor to review.**	Review evidence submitted by SCP. NZC coordinator to ensure demonstration of compliance.	BREEAM pre assessment and targeting of early-stage credits.	NZBS compliance tools – Design Management Tool, OE&C Tool, WLC Tool. Feasibility study of Decarbonisation Strategy.
Full Business Case (FBC)		3-4	Include populated compliance tools to demonstrate new builds will achieve targets. Refurbishment to populate tools and provide derogations for non-compliance. **SCP to produce evidence, TCA and NZC advisor to review.**	Review evidence submitted by SCP. NZC coordinator to ensure demonstration of compliance.	Design stage BREEAM certification.	Submission of updated NZBS compliance tools.
Construction		5	Develop as-built information and update tools to log any changes during construction to ensure compliance is still achieved. **SCP to produce evidence, TCA and NZC advisor to review.**	As-Built revision of DSM. Undertake Quality assurance inspections.	Design activities, evidence collection and assurance across BREEAM Credits to be done throughout RIBA 2 – 7.	Submission of Design register and carbon savings evidence.
Handover		6	Six months after project handover undertake post construction review to demonstrate attained targets. **SCP to produce evidence, TCA and NZC advisor to review.**	Evidence of carbon savings must be presented and collate evidence that installed technologies comply with project's Energy strategy.	Post Construction BREEAM Certification.	Submission of updated NZBS compliance tools. Carbon assumptions from design stage to be replaced with actual data.
Use		7	**SCP** to undertake post occupancy evaluation and create lessons learnt summary. **End user** to follow monitoring and verification (M&V) plan and report findings.	Follow M&V plan for 3 years. Contractor and project team to prepare lessons learnt summary	Post occupancy evaluation.	Summary of missing information and results of each stage to be reported back to NHS.

Roles and responsibilities

2.5 The NZBS has a defined set of responsibilities assigned to roles to deliver the requirements. A high level summary of roles and responsibilities for the Health Board/Trust, supply chain partners (SCPs), BREEAM assessors and the net zero carbon (NZC) coordinator are is presented in Table , as part of the main activities across the project lifecycle. This summary is supported by additional information for activities, processes and responsibilities for the delivery team.

2.6 At SOC stage the Health Board/Trust team will require input from both the NZC advisor (client side) and the Trust Cost advisor (TCA) for the development of the business case. These roles will continue throughout the project to validate outputs from the SCP. The NZC advisor links to the role of an 'independent client-side sustainability representative' as referenced in initiative 12 of the DSDP.

Net zero carbon coordinator

2.7 The net zero carbon (NZC) coordinator is a role whose purpose is to manage the design process regarding net zero carbon performance, and to create an interface between the client/trust and the project team. It is likely that this role will sit within the design team and will support the supply chain to navigate the processes outlined in the NHS net zero standard. Where appropriate, the coordinator challenges the design teams to help them work towards compliance with the NZBS.

2.8 The Net Zero Carbon Coordinator is an identified and trained member of the Design Team who is responsible for compliance against the Standard's process and technical requirements. There are no additional fees for funding this role as it is seen as an integral element of the Design Team that should be considered at the same level as other members.

2.9 This role differs from the **NZC advisor** who would sit within the Health Board/Trust team at SOC stage to support with development of a brief that aligns with the NZBS. A summary of responsibilities of the NZC Coordinator include:

- Act as an interface between project teams, to translate technical requirements and outcomes to internal and external stakeholders
- Maintain close engagement with the TCA to ensure cost is a key consideration for all decisions making and appropriate cost data is provided to evidence chosen net zero solutions are value for money
- Advocate for NZC performance within the Design Team
- Finalise requirements around Carbon and Energy Limits
- Facilitate stakeholder engagement
- Complete and maintain the Net Zero Carbon Design Management Tool. This will involve capturing key design decisions that impact operational energy and carbon, and embodied carbon performance
- Assist in capturing and sharing lessons learnt across with the Trust/HB, other Professional Bodies and Supply Chain to enable continuous improvement services
- Ensure Energy and Carbon Limits and PTs are set and communicated to the Design Team, and that the Design Team are on track against the limits through design stages

A detailed description of the responsibilities of the NZC Coordinator is in Appendix B, as well as the responsibilities for the Net Zero Carbon Advisor at SOC stage.

2.10 Whilst the NZC coordinator does not need to be a technical specialist, they must have sufficient knowledge of the components of operational energy, whole life carbon performance and design processes so that they can effectively communicate between project teams and wider stakeholders. This is not necessarily a new role for the SCP to fulfil, an existing member of the design team with suitable knowledge of carbon can undertake this role and evidence best practice design already required under the DSDP. Full responsibilities are specified in the NZBS, section 6.26 – 6.31.

Table 2.2: Roles and Responsibilities Matrix

Business Case Stage		RIBA Stage	Health Board / Trust			Supply Chain Partners (SCP)[1]		
			Health Board	NZC Advisor	Trust Cost Advisor (TCA)	Supply Chain Partner	NZC Coordinator	BREEAM Assessor
Strategic Outline Case (SOC)		0	Develop the project brief. Commitment to relevant BREEAM rating.	Support project brief development and target setting.		-	-	-
Outline Business Case (OBC)	**Business Justification Case (BJC)**	1-2	Appoint SCP. SCP team to include NZC coordinator. Review of RIBA 2 deliverables.	Potential to continue the role within the Trust/Health Board to provide ongoing assurance through the project lifecycle.	Review costs provided by SCP including costs associated with net zero design.	Engage with and understand low carbon design philosophy. Passive design analyses, TM54 modelling, energy and carbon strategy development and input for OE&C and WLC tools. Develop M&V plan and adaptability strategy. Provide costs for TCA review.	Review schedule of accommodation for the project and undertake space allocation exercise to inform limits for operational energy and upfront carbon. Complete relevant tabs for Design Management, OE&C and WLC tools. Support with development of net zero cost evidence.	Undertake BREEAM preassessment. Identify mandatory credits and confirm target rating. Collaborate with the SCP to develop evidence required for early-stage credits. Review of RIBA 2 deliverables.
Full Business Case (FBC)		3-4	Review of RIBA 3 and 4 deliverables including design, BREEAM and completion of NZBS compliance tools and relevant supporting documents.		Review costs provided by SCP including costs associated with net zero design.	Develop design and update TM54 modelling. Provide updated inputs for OE&C and WLC tools. Finalise M&V plan. Provide costs for TCA review.	Update limits for the project to reflect any design changes. Complete relevant tabs for Design Management, OE&C and WLC tools. Support with development of net zero cost evidence.	Support development of design stage evidence and review for completion of design stage assessment. Submission for in design certification.
Construction		5	Review any updates associated with changes during construction to ensure ongoing compliance.		Support during construction to review any changes and ensure value for money is still maintained.	Prepare As-Built revision of model. Undertake quality assurance inspections.	Monitoring through construction and collation of evidence for reporting.	Monitoring through construction and collation of evidence for reporting.
Handover		6	Attend any training sessions and ensure familiarisation with M&V strategy and building usage.			Evidence of carbon savings must be presented and collate evidence that installed technologies comply with project's Energy strategy	Complete relevant tabs for Design Management, OE&C and WLC tools	Submission for construction certification.
Use		7	Ongoing monitoring and verification of the building in use and reporting.			Contractor and project team to prepare lessons learnt summary.	Involvement within use data reporting and lessons learnt.	Involvement with lessons learnt.

[1] Costing to be provided by SCP at each stage to confirm the cost associated with net zero/decarbonisation measures.

Evidence requirement

2.11 The NZBS is clear that to achieve net zero carbon it must be considered at project outset and remain a key item throughout the project lifecycle, driving design decisions based on whole life carbon benefits to maximise carbon reduction and cost effectiveness of achieving design targets. The compliance tools developed as part of the NZBS should be used at each RIBA stage to ensure project information is captured and the project is on track to meet the limits or capturing derogations as applicable.

Table 2.3: Use of the NZBS and Reporting Requirements.

Aspect of the Standard	RIBA 0-1	RIBA 2	OBC	RIBA 3	RIBA 4	FBC	RIBA 5	RIBA 6	RIBA 7
Use of the NZBS	✓	✓	✓	✓	✓	✓	✓	✓	✓
Design Management Tool		✓		✓	✓		✓	✓	✓
Use Compliance Tools to capture modelling results and monitor progress against limits		✓		✓	✓		✓	✓	✓
Submit Reporting Tabs of Compliance Tools			✓			✓			
Submit additional costing information			✓			✓			
Business Case Checklists			✓			✓			

BREEAM Alignment

2.12 The NZBS supports the NHSW stance that all new builds should target a minimum BREEAM rating of 'Excellent' and all refurbishments, a minimum of 'Very Good'. There are mandatory credits required to achieve these ratings however the NZBS also highlights credits that align with the principles of the NZBS and the development of net zero healthcare buildings. If a new build project targets all BREEAM credits as referred to in the NZBS up to 18 credits can be achieved, however some may only be partially achieved and further coordination with the BREEAM assessor is required.

Figure 2.1 BREEAM Credits and Alignment with NZBS

BREEAM Credits and NZBS Alignment

BREEAM Credit	MAN 03 – Construction	MAN 04 – Commissioning	MAN 05 – Aftercare	HEA 01 – Visual Comfort
Description	**Responsible construction practices**	**Commissioning and handover**	**Aftercare and post occupancy evaluation**	**Encourage best practice in visual performance and comfort**
Compliance	The construction and handover requirement outlined in the NZBS align with the requirements of this credit.	The commissioning activities required in the NZBS align with the requirements of this credit.	NZBS requires seasonal commissioning and 3 years of post occupancy evaluations to be undertaken which supports compliance with this credit.	NZBS recommends daylight analysis to maximise natural daylight and optimise controls. It is recommended this is done at early design stages to maximise impact on design.

HEA 02 – Indoor Air Quality	HEA 04 – Thermal Comfort	ENE 01 – Reduction of Energy	ENE 02 – Energy Monitoring	ENE 04
Encourage best practice in visual performance and comfort	**Ensure building can provide thermal comfort**	**Compliance model and operational energy model**	**Standard requires enhanced sub-metering. 90% of all energy uses required per BREEAM**	**Passive design, LZC, free cooling**
NZBS recommends daylight analysis to maximise natural daylight and optimise controls. It is recommended this is done at early design stages to maximise impact on design	NZBS has a requirement to undertake thermal modelling for current and future weather files. Early stage passive design options will have significant impacts on thermal comfort and system design	NZBS requires dynamic simulation modelling for operational energy in accordance with CIBSE TM54 to provide a more accurate estimation of energy use above compliance modelling. This is required at each RIBA stage (refer to Compliance Matrix)	NZBS requires enhanced metering and monitoring strategy which aligns with this credit.	NZBS requests passive design analysis which aligns with this credit

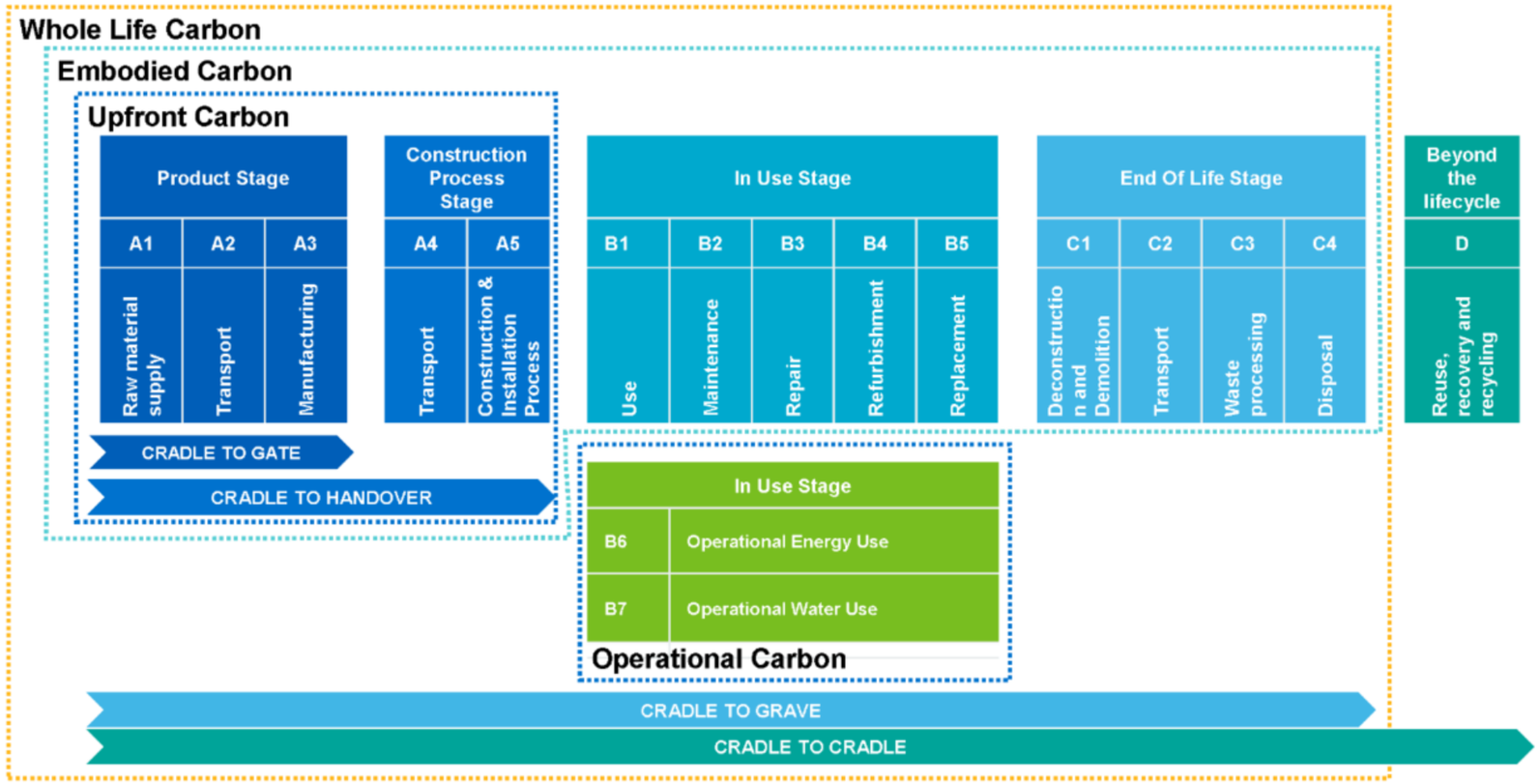
ENE 05 – 08	MAT 01 – Environmental Impact	MAT 02 – Environmental Impact	MAT 03 – Environmental Impact	WST 01 and 02 – Construction waste management and Recycled Aggregates
Specialist energy and unregulated energy	**Life cycle assessment (LCA)**	**Life cycle assessment (LCA)**	**Life cycle assessment (LCA)**	**Waste Reduction**
These credits are directly impacted by the TM54 analysis required in the NZBS, i.e. analysing the equipment being procured and ensuring end users are selecting efficient products.	Carbon optioneering must be undertaken in accordance with section 4.71 of the NZBS which would support compliance with this credit.	Use of EPDs for production of WLC assessment is required in the standard and therefore will support compliance with this credit.	The principles of the standard support sustainable procurement to reduce embodied carbon aligning with this credit.	Although not directly related with the requirements of these credits the nature or reducing embodied carbon means reduced waste is considered throughout design and construction.

3 Application

3.1 The purpose of this section is to advise how the NZBS will be applied to projects in Wales for new builds, and to also advise on the principles in the standard that can be applied to retrofit and refurbishment projects.

3.2 The NZBS considers whole life carbon (WLC) providing limits for both embodied carbon and operational carbon via energy performance limits. This move to considering WLC is intended to drive better carbon lifecycle design decisions.

Figure 3.1: Scope of Whole Life Carbon (WLC) based on BS EN 15978



3.3 The NZBS requires reporting for all stages highlighted within the 'Whole Life Carbon' box, covering all elements of a building's lifecycle. The use of the compliance tools provides limits associated only with 'Upfront Carbon' and 'Operational Carbon'. The operational energy limits generated by the OE&C tool and the predicted annual energy consumption from the TM54 modelling are reported with associated energy source carbon factors within the WLC tool to report B6 and B7 stage emissions. The WLC tool generates an upfront carbon limit for tier 1 elements for A1-A5 stage emissions and is also used for reporting all stage emissions for all elements of the project.

3.4 To minimise the WLC of any project it will be vital to follow the design hierachies for both operational energy and embodied carbon to optimise design and consider all design decisions holistically to avoid negative impacts; for example the NZBS advises not installing triple glazing because of the limited improvement to operational performance when compared with the embodied impact of increased materials.

Figure 3.2: Operational Energy Hierarchy

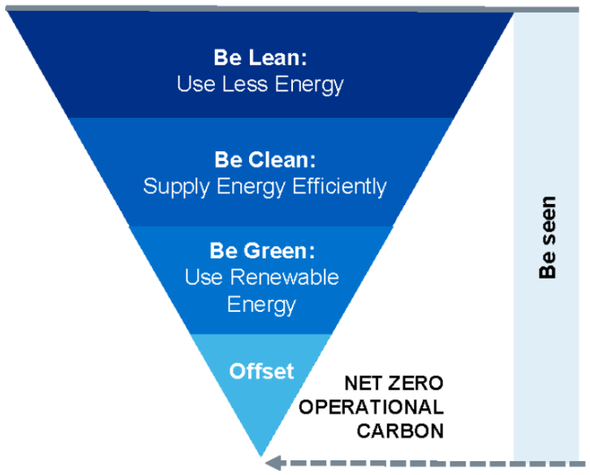
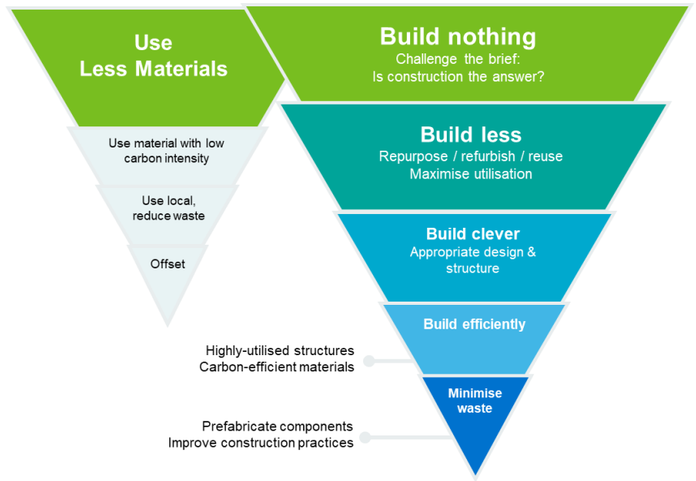


Figure 3.3: Embodied Carbon Hierarchy



New Builds

3.5 NHSW committed to adopting a net zero standard and accreditation approach for new builds by 2024 in the DSDP roadmap timeline for implementation. It is proposed that NHSW adopt the NHS England NZBS. The NZBS takes a phased approach to expected compliance from projects depending on project status and the same procedure is proposed for NHSW projects, applying from 1 October 2023.

Table 3.1 NZBS Application

Projects pre strategic outline case (SOC)	Projects beyond or undergoing strategic outline case approval (SOC) (e.g. undergoing outline business case (OBC))	Projects within construction
Must comply with the newest version of the NZBS in its entirety, including operational energy and upfront carbon limits.	Derogations are permitted for missing new operational energy and upfront carbon limits in detailed design stage and construction.	No application of the newest version of the NZBS required at this stage. However, organisations should be aware that the building will still have to achieve net zero operational carbon by 2030.
	Key reporting expectations from the construction and verification phases (RIBA Stage 5 onwards) of the newest version of the NZBS should be met.	In-use energy monitoring and verification expectations should be taken as best practice by the Trust.

3.6 For NHSW to meet its carbon reduction targets energy demand must be reduced and although the NZBS does not require buildings to be net zero carbon in operation (NZCiO) upon handover it is vital that they have a plan to become net zero by 2030. Where new builds are being constructed on existing sites these sites must have decarbonisation plans to remove fossil fuels from legacy estate.

Retrofit and Refurbishment

3.7 Reusing existing buildings is an integral part of the embodied carbon hierarchy of net zero design, enabling a significant reduction in embodied carbon by nature of reuse. However, it will mean the operational energy limit will be very challenging to meet, and in most instances, technically unfeasible due to the energy limit in the standard being based on best practice new build design. However, when retrofitting a WLC assessment must be undertaken to demonstrate a WLC benefit to the proposed works compared to new builds. We would therefore propose that refurbishment schemes focus on applying the principles of the standard, utilising the hierarchy of operational carbon outlined below- but not focusing on an energy limit.

3.8 The NZBS will apply to all business cases, above the business case threshold, that require NHSW approval as per **0**. For major facilities refurbishment more bespoke operational energy limits and expectations may be required based on existing specification.

3.9 Energy targets defined by the standard will be very challenging to achieve for refurbishment projects and therefore the SCP will need to fully detail all derogations associated with non-conpliance, and these

should be logged using the complience tools. For refurbishment projects the SCP still needs to fill out all compliance tools in line with the requirements of the standard. A typical approach to understanding retrofitting and refurbishment options across an estate might include:

- Establishing the baseline position with respect to current energy, carbon, and costs.
- Carry out building energy audits and assessment of data.
- Identification of the potential Energy Conservation Measures (ECMs) possible within the audited building(s)
- Identification of the priority projects, with an indicative ‘spend to save’ associated with the investments.

Where projects need to be prioritised over one another, a Business Case might be developed to support in the identification of how the priority feasibility projects may be developed, funded, and delivered.

4 Additional requirements

4.1 The purpose of this section is to outline additional information being requested within this guidance note to support the delivery of net zero carbon in Wales, while ensuring the principles in the standard can be applied to retrofit and refurbishment schemes by providing best practice examples for decarbonising existing buildings. It also provides requirements for cost reporting to ensure value for money of proposals is evidenced.

Best practice for retrofit and refurbishment

4.2 Retrofit and refurbishment schemes will require decarbonisation measures to be applied to ensure compliance with the principles of the NZBS and the DSDP. To inform these it is recommended that energy audits are undertaken to assess the extent of decarbonisation measures that can be applied on a project.

4.3 Site energy audits will yield a variety of ECM opportunities which would typically have qualitative assessments or rationalisation. An example qualitative ECM identification and rationalisation table has been included below, and a blank table has been provided in **Appendix C**.

Table 4.1: Example Qualitative ECM Identification and Rationalisation

ECM Category	ECM Item	Opportunity? (High / Medium / Low / None)	Rationale
BE SEEN – Energy Metering	Utility Meters	None	Low availability for meter enhancement unless consideration given to additional electrical capacity requirement.
	Sub-Meters	High	Sub-meter of individual building energy use to enhance energy management capabilities.
BE LEAN – Energy Demand Reduction	Glazing replacement / upgrade	High	Existing windows and surrounds are looking tired with some notable deterioration of window seals etc.
	Wall insulation	Med	On the basis that age of construction is 70s and mid 80s there could be a good opportunity to improve the wall insulation levels. Improving the thermal performance of building envelope will also help facilitate a move to heat pump-based heating.
	Roof insulation	Med	Opportunity to improve building envelope thermal performance.
	Air permeability improvement / draught proofing	Med	Opportunity to improve building envelope thermal performance.
	External lighting replacements	Low	Only small number of external lights have been changed already to LED type. Their installation is not site widespread.
	Lighting replacements	Med	Ongoing replacement and upgrade programme by estates team. Suspect the admin sites are down as the lowest priority as the penetration of LED is not as high as in the clinical buildings surveyed. We have included as a measure as there is a greater level of non-LED lamps still in use, when compared to other sites.
	Lighting controls	Low	No cost-effective automated lighting control opportunities for daylight linking and PIR however good manual light switching. When replacing fluorescent lamps with LED it may be worth considering lamps with integral microwave PIR sensors (subject to consideration of interfering with medical equipment)
	Heating controls	Low	More holistic approach to space heating temperatures could realise savings if areas heating controls are enhanced control from area to area rather than local emitter control.
	Heating infrastructure (including pumps)	Low	Possibly required in the HQ building if VRV system option is taken forward. Some areas of pipe lagging to be replaced

BE CLEAN – Supply Energy Efficiently	Heat pumps	High	Currently the most viable means of displacing fossil fuel consumption for space heating and DHW. Building plant space is limited but it may be possible to utilise the roof above the existing plantroom to site A-W ASHP or VRV Outdoor Units - subject to structural suitability.
	District heat networks	Low	No suitable local district heat network schemes.
	Hydrogen	Low	Currently not a viable solution for the project.
BE GREEN – Renewable Energy	Solar PV	High	Relatively cost-effective measure to help offset increased electrical consumption related to fossil fuel displacement. Subject to structural engineer's assessment of roof.
	Wind	Low	Local wind opportunities could be explored further but anticipate insufficient saving offered in view of other technologies based on limited site boundary to work within.
	Other	None	Other renewable opportunities could be explored further but anticipate insufficient saving offered in view of other established renewable technologies and carbon saving achieved.

4.4 Further to the above, priority ECM planning may provide commentary on the measures chosen to be taken forward and whether any have been ruled out due to infeasibility. The table below outlines a summary example of how this optioneering might be carried out.

Table 4.4.2: Example Priority ECM Projects, Post Qualitative Assessment

ECM Category	ECM	Priority Measure to Progress (Y/N)	Rationale / Commentary
Be Lean	Wall insulation	Y	Where possible and cost effective, this measure will enhance the likelihood of issue free heat pump integration with existing heating systems and reduce overall space heating demand.
Be Lean	Roof insulation	Y	Roofs on site are thought to be original and as such the thermal insulation levels are likely to have room for improvement.
Be Lean	Draught proofing	Y	Low cost means of reducing heat loss from the buildings via infiltration.
Be Lean	Upgrade double glazing	Y	Straightforward means of improving building fabric and reducing air infiltration losses.
Be Seen	Sub-meters	Y	This measure provides an opportunity to enhance energy management by helping to identify superfluous energy use.
Be Lean	Lighting replacements	Y	Included as a measure due to lower penetration of LED lighting than other sites surveyed.
Be Green	Solar PV	Y	This technology will support reduction in grid electricity demand and support renewable 'offset'
Be Clean	Heat pumps	Y	To replace fossil fuel heat generating plant. Where possible, this should be carried out in conjunction with building fabric improvements that allow for lower heating circuit temperatures (which maximise Heat Pump efficiency and performance)
Be Lean	Lighting controls	N	Potential to further improve energy efficiency by introducing presence / absence detection on light switching. In areas of high use this will only provide limited benefit. More useful in more sporadically occupied spaces.

Cost reporting

4.5 A cost reporting pro-forma would be beneficial to enable SCPs to fill out the required costing information that will be requested over and above the standard and ensure consistency of information provided across all schemes. While the NZBS does not currently ask for costing information, NHSW will request the following:

For new builds

- Cost to achieve NZC on the project compared to a baseline (*Part L compliance*).

For retrofit and refurbishment

- Costs to decarbonise the building.
- Potential inclusion of a £/tCO_2e limit, aligned to Salix.
- Payback period.

4.6 An example cost reporting summary table of priority ECMs has been included below, and a blank table has been provided in Appendix C. NHSW will require the cost forms at every stage of business case submission of the project. It is expected that projects track changes of costs as move they through the project stages.

Heat Decarbonisation Plans (HDPs)

4.7 HDPs are an essential part of planning a route for existing NHS estates to decarbonise. 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. The HDP can be used to set a plan in place for future schemes and ensure best practice decarbonisation embedded into all trust projects going forward. 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 plans need to be approached in a way that supports the type of estate an organisation operates. Estate and property portfolios can range from one building to multiple buildings, to campus style activities, or a combination of the above.

4.8 The below outlines typical things to consider when creating an outline scope to produce or tender for a HDP, further detail is provided in Appendix E. This is an indicative scope to provide a high-level overview of key consideration to include within your procurement documents for a HDP and will need to be modified to suit Trust/system specific requirements. The purpose of a HDP is to develop and describe a plan to replace fossil fuel reliant systems with low carbon alternatives.

4.9 A HDP seeks to provide a roadmap to achieve net zero carbon operation focusing on the scope 1 and 2 emissions associated with operational energy, while considering the embodied carbon of the interventions. They should include any specific requirement such as the plan is required to be used for future PSDS funding and should therefore be delivered in accordance with the Salix best practice HDP guidance and/or any relevant NHSW guidance on HDPs.

4.10 The following sections should be included in a HDP:

- Executive Summary – summarise the plan to decarbonise heating on site including the buildings included within the plan, costed interventions, expected carbon emission reductions and indicative programme
- Introduction – context for the development of the HDP including details of the site and the current carbon emissions
- Buildings – overview of the built estate and site infrastructure including the existing heating and cooling systems installed, primary energy sources, consumption and energy uses
- Low carbon transition – context for reduction of carbon and the site methodology to reduce energy consumption. This section should include a qualitative review of options for heat decarbonisation and energy efficiency opportunities, including relevant ECMs
- Electricity loading – a review of the existing electrical capacity and infrastructure on site and constraint analysis for increasing installed capacity to meet the requirements for electrification of heat
- Monitoring and validation (M&V) reporting plan – a review of the existing monitoring and metering strategy on site and proposed improvements to ensure better energy monitoring and reporting on the impacts of proposed measures to reduce energy and carbon emissions
- Resources – governance for decarbonisation projects including potential KPIs, a review of procurement options, funding mechanisms and recommended next steps
- Future plans for the site – consideration of changing requirements for clinical delivery and estate development that will impact energy consumption and site operations

- Key considerations and challenges – high level review of constraints involved with decarbonisation of heat on the site.
- Additional information to be included in the plan includes; project phasing strategy, survey/audit results and cost estimations and assumptions.

Table 4.4.3: Example Priority ECM Cost Summary Table

ECM	ECM Category	Quantity of ECM	Capital Cost (£)	Annual Saving (kWh)	Annual Saving (£)	Annual Maintenance Cost Variance (£)	Annual Carbon Saving (t.CO_2)	Average Simple Payback (Years)	Lifetime Carbon Saving (LT. tCO_2)	£ / LT. tCO_2
Upgrade Wall Insulation	'Be Lean'	m^2 of façade area	£290k	74,000	£3,700	Cost neutral	14	111	400	£710
Upgrade Roof Insulation	'Be Lean'	m^2 of roof served	£295	200,000	£10k	Cost neutral	37	32	1100	£270
Draught Proofing	'Be Lean'	m^2 of doors and windows draughtproofed	£13k	52,000	£2,700	Cost neutral	10	5	280	£47
Upgrade Double Glazing	'Be Lean'	m^2 of window and doors replaced	£500k	160,000	£8k	Cost neutral	29	80	817	£650
Sub-meters	'Be Seen'	No. of sub meters proposed	£11k	24,000	£4k	Minimal	n/a	2.6	n/a	n/a
Lighting Replacements (LED)	'Be Lean	m^2 of floor area served or no. of LED light fittings replaced	£120k	46,000	£8k	Reduction	12	20	100	£1,186
Hot Water Plant Replacement	'Be Clean'	kW rating of system or size of storage in Litres	£180k	0	-£43k	Minimal	28	No Payback	263	£682
Heating Plant Replacement (including heat pumps)	'Be Clean'	kW rating of heat pump	£2m	600,000	-£12k	Increase circa £500/a per installation	83	No Payback	1,908	£1,100
Solar PV	'Be Green'	m^2 of panels or kWp of array	£290k	100,000	£17k	Minimal	26	17	215	£1,300
Total	**-**	**-**				**-**				

The savings set out in Table 4 are informed by the carbon savings associated with each measure. The quantity column provides an indicative unit used to calculate capital costs for the ECMs to then derive their carbon savings.

Appendix A – DSDP Alignment

Table A.1: NHSW DSDP and NZBS Alignment

NHS Wales Decarbonisation Strategic Delivery Plan (2021-2030)		NHS Net Zero Building Standard Alignment
Activity Streams	**Initiative**	
Carbon Management	1. Implement best practice carbon management with dedicated roles in place to undertake Delivery Plan initiatives.	Best practice enabled by dedicated Net Zero Carbon Coordinator role, with oversight of design and construction of projects. Wider roles and responsibilities are recommended within the standard.
	2. Proactively communicate the Climate Emergency to staff and the public with the aim of stimulating low carbon behaviours and growing engagement in the decarbonisation agenda.	Aligns with the principles of the standard i.e. requirement to refine building performance practices to ensure targets continue to be met in use (behavioural and technical). Aim for incorporation of standard into Treasury business case approval process will involve interaction with wider leadership and corporate teams.
	3. Drive the engagement required for decarbonisation across each organisation's leadership team – Finance, Procurement, Estates, and Capital Project teams will engage to develop a focused and active approach to project implementation.	
Buildings Existing	4. Progress a transformational energy and water efficiency retrofit and refurbishment programme across the estate – every building with a long-term future will have undergone a multi-technology energy-efficient upgrade by 2030.	Major refurbishments to align with NZBS. Specific to retrofit, which is not covered by the standard. However the same principles of decarbonisation and decision making can be applied i.e. application of the energy hierarchy.
	5. Fully replace all existing lighting with LED lighting by 2025.	Relevant to existing buildings and best practice decarbonisation. NZBS has greater specification of requirements. New builds will have LEDs as standard, and these must meet defined efficiency levels. Best practice controls methodologies also need to be employed incorporating daylight dimming, presence and absence detection as required based on space usage. Additionally, specialist lighting controls systems should be incorporated to optimise light levels and reduce energy consumption.
	6. Complete expert heat studies by the end of 2023 for all acute hospitals to set the plan to transition away from fossil fuel heat sources.	Relevant to existing estates where the principles of energy hierarchy for operational carbon are applicable. Application of NZBS guidance will ensure best practice is applied to completing heat studies.
	7. Progress low carbon heat generation for all non-acute sites larger than 1000m^2 by 2030.	Aligns with the NZBS requirement to eliminate fossil fuel use. This includes ensuring new buildings are not connected to existing site-wide fossil fuel networks.
	8. We will not plan to install any further natural gas CHP plant – renewable CHP will be championed instead. For existing CHP plant, we will prioritise decommissioning over investment in major refurbishment of failed CHP from 2025, with the ambition for all CHP to be decommissioned by 2030.	Aligns with the NZBS requirement to eliminate fossil fuels. This includes ensuring new buildings are not connected to existing site wide fossil fuel led networks.
	9. Take an active approach to efficient control of energy in our buildings. All buildings will have up-to-date, standardised, and effective building management systems (BMS). Dedicated resource to optimise the use of energy by BMS control will be put in place by 2023.	Energy efficiency measures mandatory within the NZBS for new buildings, with smart BMS systems encouraged.
	10. Determine the overall viable potential for onsite renewable energy generation at each NHS Wales organisation by 2023. Install half of this potential by 2026, and the remainder by 2030.	NHS standard identifies the requirement to maximise generation from renewables. No reference to retrofit in the standard but best practice decarbonisation methodologies align with the action plan.

NHS Wales Decarbonisation Strategic Delivery Plan (2021-2030)		NHS Net Zero Building Standard Alignment
Activity Streams	**Initiative**	
New Builds and Major Refurbishments	11. Develop and build low carbon buildings to net zero standard – engage and collaborate with NHS partners across the UK on the emerging net zero building standard for hospitals and adopt a net zero building accreditation approach which will be defined by 2022.	Direct reference to the NZBS, stating requirement for alignment.
	12. All project teams to have an independent client-side representative to provide due diligence support for the optimal low carbon design across all development stages – and be responsible for ensuring the Net Zero Framework process is followed.	Aligns with the Net Zero Carbon Coordinator role developed as part of the NHS NZBS. Advocate for whole life carbon throughout the design and construction process.
	13. Integrate Modern Methods of Construction (MMC) into the design and construction of new buildings – this will consider modular design, offsite fabrication, and just-in-time delivery to minimise construction-related carbon emissions.	This aligns with the NZBS hierarchy of embodied carbon i.e. build efficiently – embrace new construction technologies and eliminating waste.
	14. Install electric vehicle charging points in new developments beyond minimum requirements, and future-proof new car parks by installing infrastructure to enable straightforward installation of future charging points.	There is some reference to EVs in the standard, however, this is not a main focus area and would form a separate workstream.
	15. Prioritise low carbon heating solutions as a key design principle. No fossil fuel combustion systems are to be installed as the primary heat source for new developments.	Aligns to heat hierarchy outlined in NZBS.
	16. Incorporate the principles of sustainable transportation into the design of new sites (in addition to electric vehicle infrastructure) in line with the Welsh Government's Active Travel Action Plan for Wales.	Transport is out of scope for the NZBS, and therefore does not cover this action.

Appendix B – Roles

Table B.1: Net Zero Carbon Advisor Responsibilities

Stage	**Strategic Outline Case** (*The health board or trust may choose to continue this appointment throughout the project to provide technical and business case development support at subsequent stages*)
Responsibility	• Present to client team on NZC principles within the NZBS • Support optioneering of developments to minimise new-build requirements • Advise client team on the approach to NZC and discuss target setting and KPIs for future developments • Providing technical support to business case authors in demonstrating NZC has been considered in developing the design • Develop NZC brief for project, in line with the NZBS – ensure NZC is embedded into project brief • Support appointment of design team, including assessment of NZC capability
Deliverables	• Prepare and submit the NZC assessment; setting embodied carbon and operational targets (if appropriate SOA available at this stage), in line with the NZBS SOC requirements • Provide input into business case

Table B.2: Net Zero Carbon Coordinator Responsibilities

Stage	Outline Business Case	Full Business Case	Construction
Responsibility	• Deliver stage specific NZC workshops. • Support with development of NZC proposals. • Advise on project targets for delivery against the NZBS at OBC. • Advise on project requirements from design team to complete the OBC stage requirements. • Support development of adaptability and flexibility report – with design input by others. • Challenge and support the design team in its development of ideas for NZC. • Review design team deliverables in relation to NZC; i.e. embodied carbon calculations, TM54 modelling etc. • Participate in any Value Engineering discussions and review proposals from a WLC perspective. • Complete technical reviews of design proposals with respect to NZC; these may be architectural, MEP or structural designs. • Provide technical support to business case authors in demonstrating NZC targets have been considered in developing the design.	• Deliver stage specific NZC workshops. • Support with development of NZC proposals. • Advise on project targets for delivery against the NZBS at FBC based on targets set at OBC. • Advise on project requirements from design team to complete the FBC stage requirements. • Challenge and support the design team in its development of ideas for NZC. • Review design team submittals in relation to NZC; i.e. embodied carbon calculations, TM54 modelling etc. • Participate in any Value Engineering discussions and review proposals from a WLC perspective. • Complete technical reviews of design proposals with respect to NZC; these may be architectural, MEP or structural designs. • Providing technical support to business case authors in demonstrating NZC targets have been considered in developing the design.	• Deliver stage specific NZC workshops. • Reconfirm benefits profile for the project to support monitoring the achievement of NZC opportunities and objectives across the project. • Develop and agree with the Contractor(s), targets with reference to NZC, including collation of carbon calculations and energy modelling etc. • Review and comment on the Contractor(s) NZC strategy and methodology and the proposals for measurement and reporting. • Input into discussions on NZC with the Project Team and Contractor(s) where relevant and appropriate. • Review of NZC design stage outputs and input into the refinement of the Works Information. • Provide advice and support in relation to the review of the Contractor(s) proposals. • Support the delivery of the client's NZC targets through construction and into operation.
Deliverables	• In collaboration with the design team prepare and submit elements requested by the NZBS compliance register. These include the Design Management Tool, the Whole Life Carbon Compliance Tool and Operational Energy Compliance tool. The calculations/data will be provided by architectural and engineering teams. • Ensure relevant costing information is provided by the Quantity Surveyor as part of the business case submission to identify NZC costs associated with proposals. • Provide input to end of RIBA Stage / Business Case reports, to be collated by the Architect, summarising the consultant's work in the relevant RIBA Stage.	• In collaboration with the design team prepare and submit elements requested by the NZBS compliance register. These include the Design Management Tool, Whole Life Carbon Compliance Tool and Operational Energy Compliance tool. The calculations will be provided by architectural and engineering teams. • Ensure relevant costing information is provided by the Quantity Surveyor as part of the business case submission to identify NZC costs associated with proposals. • Provide input to end of RIBA Stage / Business Case reports, to be collated by the Architect, summarising the consultant's work in the relevant RIBA Stage.	• In collaboration with the Design and Contractor team prepare final NZC assessment, in line with the NZBS compliance register. These include the Design Management Tool, Whole Life Carbon Compliance Tool and Operational Energy Compliance tool. Note calculations provided by architectural and engineering teams. • Ensure relevant costing information is provided by the Contractor to identify actual NZC costs associated with delivered solutions. • If required, undertake a post-occupancy review (subject to additional scope of services).

Appendix C – Templates

Table C.1: Qualitative ECM Identification and Rationalisation

ECM Category	ECM Item	Opportunity? (High / Medium / Low / None)	Rationale
BE SEEN – Energy Metering	Utility Meters		
	Sub-Meters		
BE LEAN – Energy Demand Reduction	Glazing replacement / upgrade		
	Wall insulation		
	Roof insulation		.
	Air Permeability Improvement / Draught Proofing		
	External lighting Replacements		
	Lighting Replacements		
	Lighting Controls		
	Heating Controls		
	Heating Infrastructure		
BE CLEAN – Supply Energy Efficiently	Heat Pumps		
	District Heat Networks		
	Hydrogen		
BE GREEN –Renewable Energy	Solar PV		
	Wind		
	Other		

Table C.2: Priority ECM Cost Summary Table

ECM	ECM Category	Quantity of ECM	Capital Cost (£)	Annual Saving (kWh)	Annual Saving (£)	Annual Maintenance Cost Variance (£)	Annual Carbon Saving ($t.CO_2$)	Average Simple Payback (Years)	Lifetime Carbon Saving ($LT.\ tCO_2$)	£ / $LT.\ tCO_2$
Upgrade Wall Insulation	'Be Lean'									
Upgrade Roof Insulation	'Be Lean'									
Draught Proofing	'Be Lean'									
Upgrade Double Glazing	'Be Lean'									
Sub-meters	'Be Seen'									
Lighting Replacements (LED)	'Be Lean									
Hot Water Plant Replacement	'Be Clean'									
Solar PV	'Be Green'									
Heat Pumps	'Be Clean									
Total	**-**	**-**				**-**				

Appendix D – Approvals Processes

The below figures outline the decisions trees related to best practice against the NZBS.

Figure D.1: Project and Compliance Development using the NZBS prior to Business Case Submission

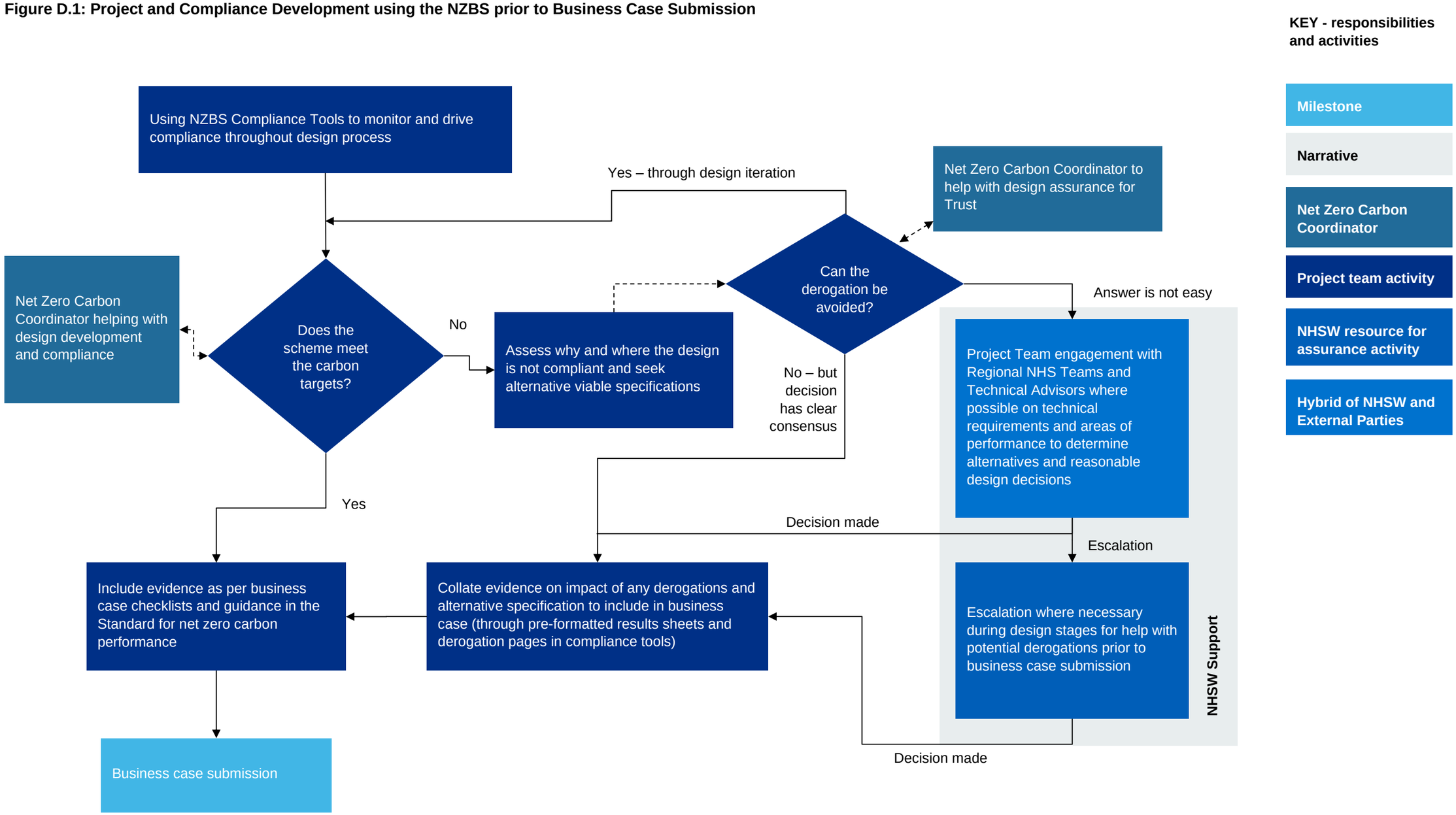
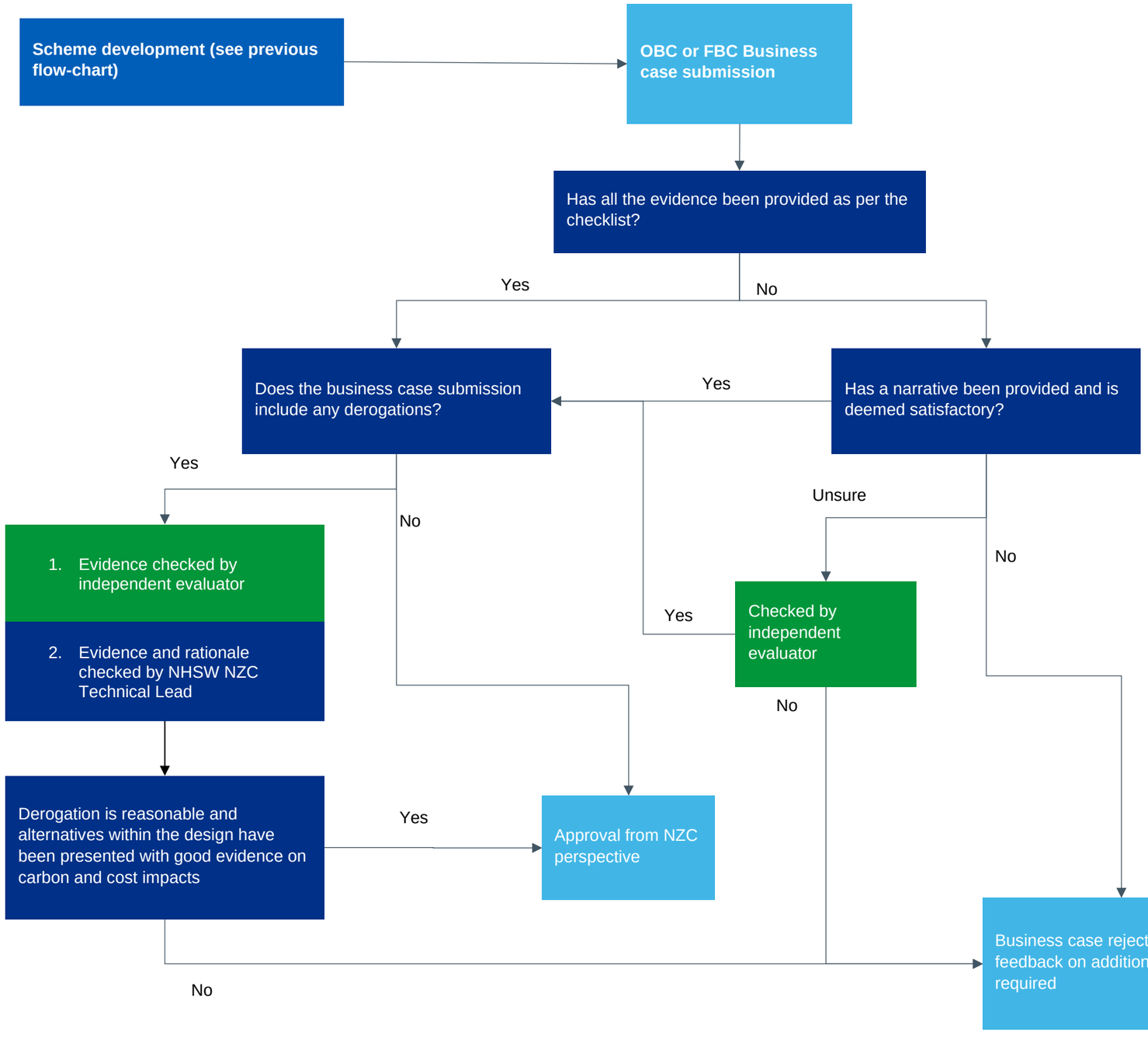


Figure D.2: Derogation Review and Approval within Business Case Process



***Note:** we are considering resource requirements for NZC business case reviewers in our technical assurance team going forward (longer term solution)

Appendix E – Example Heat Decarbonisation Plan Scope

Decarbonisation Strategy

Standard Scope

Task 1 – Inception

Attend an inception workshop to establish the following:

- Review existing information; including:
  - Green Plan
  - Estates strategy (Case for change / Strategic Outline Case)
  - Previous energy strategy works
  - Proposals for site developments
- Scope the plan and agree governance, site contacts etc
- Agree trust / stakeholder drivers
- Determine required data and agree sources

Task 2 – Data Collection and Desktop Study

Data collection and desktop study to ascertain the background information of the site.

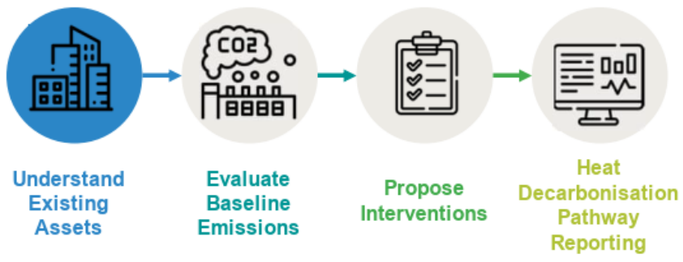
- Outline legislative background
  - Local planning policy (e.g. local net zero targets)
  - NHS Guidance (NHS NZC Standard)
- Building data, including:
  - baseline utilities consumption (half hourly data)
  - expenditure at a site level
  - building areas/volumes (6-facet survey information)
  - occupancy profile
  - ownership of buildings
  - asbestos risk
  - contractual arrangements (e.g. energy service contracts)
  - primary services distribution routes / infrastructure plans
  - current metering strategy / locations / data
  - primary plant and equipment details
- Building systems, including;
  - energy efficiency works already completed in the buildings previously
  - current heating technologies for the buildings and their ages
  - existing energy centre arrangements, including fuel mix
- Future considerations, for example:
  - Capital plans - proposed site works (demolition / refurbishment / extension)
  - Proposed energy system upgrades including DNO infrastructure
  - Proposed 'green' technology proposals (e.g. LED lighting, planned PV installations etc)

Task 3 – Site Walkthrough and Familiarisation

Attend site to verify data collection and enhance understanding of existing condition; type, age and condition of plant and equipment in use and energy efficiency measures already implemented.
It will establish where there may be cost-effective opportunities for further reductions in energy/utility use and associated carbon emissions and costs, through improved energy efficiency and the deployment of renewable or low carbon energy sources

- Physical site inspection - building services, for example;
  - space heating and hot water generation equipment and distribution
  - ventilation and air conditioning,
  - medical equipment
  - lighting
- Physical site inspection – building fabric, for example:
  - existing fabric form
  - estimated U-Values

Heat Decarbonisation Pathway Process



Deliverable

'Existing estate' report (section) capturing findings from data collection, desktop study and site walkthroughs.

Findings will be recorded digitally as spreadsheets, drawings, and/or energy models, as appropriate.

This report will indicate any gaps in the data or information available, the effect that this will have on the rest of this project and any assumptions made. This will be reviewed by the Trust prior to starting Task 4.

Decarbonisation Strategy

Standard Scope

Task 4 - Calculation and confirmation of the Energy and Carbon Emissions Baselines

Develop initial energy model of site

- Establish an energy consumption and CO_2e emissions baseline for the site/ estate
- Establish energy consumption and CO_2e emissions at a building level
- Produce a calculation of up to three years' data, in order to show recent trends in emissions
- Calibrate the baseline model using metered data, information from site surveys, and Building Management System (BMS) (where available).

Task 5 – Determine Routes to Decarbonisation

Determine the routes for decarbonisation applying the energy hierarchy. Qualitative assessments will be undertaken for the decarbonisation of heat, including potential options for connection to proposed off site heat sources, use of heat rejection from current and future cooling plant and the potential this has to deliver heat, use of steam and de-steaming implications. Interventions will take into consideration the impact on site electrical infrastructure.

Energy hierarchy of carbon emissions reductions:

- Lean: reduce energy demand and CO_2e emissions adopting a fabric first approach. Review efficiencies of installed services such as heat recovery and ventilation systems.
- Clean: supply energy efficiently and cleanly by switching away from fossil fuels as the primary energy source.
- Green: maximise renewable energy generation and storage to reduce grid demand and CO_2e emissions

The above will be supplemented by a review of the following:

- Impact of future capital proposals, phasing etc
- Practical implications of works; planning, capital cost, operating costs, technology readiness, land availability etc
- Embodied carbon impact assessment of interventions

Establish the CO_2e emissions target:

- 80% reduction by 2032 in line with NHS guidance
- Local net zero targets

Task 6 – Develop Future Emissions Models

Future carbon emissions for the 'Business As Usual' (BAU) scenario will be developed using the energy baseline. The model will account for any future changes that might affect carbon emissions such as:

- Changes in the grid electricity emissions factor due to changes in the electricity generation mix (using forecasts provided by BEIS)
- Planned new builds / demolitions and energy efficiency projects

The model will also be used to calculate the emissions for two default scenarios which will provide 'bookend' pathways.

The energy and CO_2e impact of each intervention at building level individually and cumulatively are developed using the Net Zero Pathways app modelling to create the 'bookend' pathways and for discussion in the Decarbonisation Pathways Workshop (Task 7).

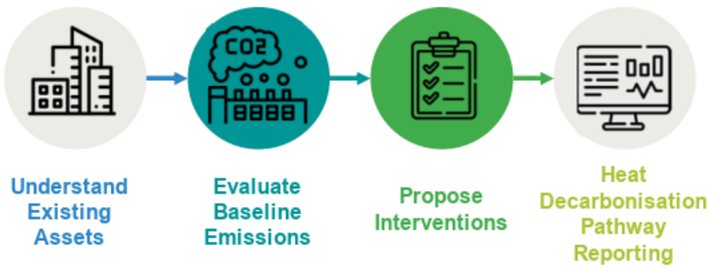
Deliverable

Energy and carbon baseline for the existing estate and 'Business as Usual' (BAU) projections for CO_2 emissions. Estimated energy consumption and CO_2 emissions per building to identify 'hotspots.

Development of a qualitative assessment on potential interventions across the site/ estate using the energy hierarchy, overlaid with Trust specific considerations, e.g. proposed developments.

Emissions pathways for agreed 'bookend' scenarios.

Heat Decarbonisation Pathway Process



Decarbonisation Strategy

Standard Scope

Task 7 – Decarbonisation Pathways Workshop

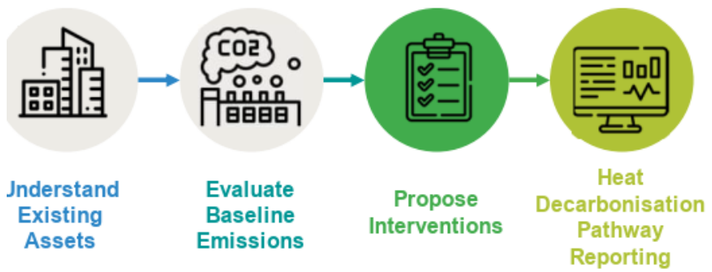
Workshop with the Trust and key stakeholders to discuss interventions at building level, identifying opportunities, impact on the estate, masterplanning and infrastructure concern. The outcome will be an agreed decarbonisation pathway for each site.

Task 8 – Develop Model, Set Targets and Provide Plan

Having determined the interventions for each building, these will then be overlaid onto the model (as described in Task 5 and 6) to show how the decarbonisation targets might or might not be achieved over a range of timescales and costs. This deliverable will effectively be the building level Heat Decarbonisation Plan (HDP).

A summary of the measures will be presented in a prioritised, costed, order of delivery that will be aligned with the Trust's future plans. This will be used to inform future funding applications and project plans on how to progress decarbonisation across the estate.

Heat Decarbonisation Pathway Process



Deliverable

Heat decarbonisation plan (HDP) with decarbonisation pathway for each site. This will include OPEX and CAPEX information and prioritised actions.

Presentation of the decarbonisation pathway to the Trust.

Additional Services

Task 9 – Delivery Methods

When the final list of measures has been created the project team will review what methods of delivery are available, e.g. which procurement frameworks are appropriate and which preferred contractors would be most suitable for delivering the works, so that projects are shovel ready in the event of funding opportunities arising.
Support for Public Sector Decarbonisation Scheme (PSDS) applications can be undertaken to seek funding.

Deliverables

Cost model and procurement advice

PSDS application support

Task 10 – Monitoring Plan

Provide an ongoing Monitoring Plan to support the HDP. The plan will describe the following, to assist in the delivery of decarbonisation projects:

- Data to be collected and recorded
- Responsible parties for data collection
- Frequency of data collection
- Reporting requirements and frequency

Deliverable

Monitoring plan

This document has been produced by Mott MacDonald, for and on behalf for NHS Wales Shared Services Partnership.

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