

The Standard

Net Zero Public Sector Buildings Standard

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TRUST



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Foreword

The Net Zero Public Sector Buildings Standard is a voluntary standard, owned by the Scottish Government and applicable to public sector new build and major refurbishment projects.



1. Introduction

The Scottish Government is committed to all buildings achieving net zero emissions by 2045. A step change in attitudes to energy use in the built environment is required to achieve this.

Public bodies have demonstrated significant reductions in emissions from their built estates by working collaboratively to reshape them to better suit the needs of the people and service delivery they support. This includes refurbishing or repurposing existing buildings, co-location with partner organisations and other options that improve the efficiency of existing assets, as well as the construction of new ones.

The Net Zero Public Sector Buildings (NZPSB) standard (“the Standard”) is informed by exemplary in-use energy and carbon performance from across the UK and Europe. It supports the development, delivery and operational stages of new build and major refurbishment projects to:

- Take a collaborative, evidence-based approach to identifying priorities that will improve people’s lives, communities and the places they live and work in, contributing to inclusive net zero economy outcomes
- Minimise construction embodied carbon through best practice in options appraisal, life cycle assessment and the measurement, targeting & reporting of impacts
- Cut operational energy use compared to current regulatory requirements by:
 - o Enhancing the client brief to set world class energy performance as a core objective
 - o Rigorously checking and commissioning performance at the design & delivery stages
 - o Ongoing commitment to achieving operational energy targets
- Support growth and flexibility of zero emissions energy supplies by:
 - o Increasing onsite low and zero emissions generation beyond current practices
 - o Establishing zero direct emissions from heating & cooling as the norm
 - o Adopting opportunities arising from Local Heat and Energy Efficiency Strategies
 - o Optimising self-supply from renewables with energy storage & demand response
 - o Fitting electric vehicle smart charging points
- Enable an improved experience for building users through a focus on improving comfort conditions, air quality and availability of natural lighting
- Collect and share data in open, interoperable and transparent formats

The Standard supports a challenging, credible path to net zero materials and energy supplies for all non-domestic buildings. By 2045, projects that adopt the Standard will achieve zero embodied emissions during construction and subsequently the whole life of projects, including operational energy. There are many ambitious public bodies that intend to achieve these outcomes sooner and the Standard provides guidance for them to do so and encourages others to follow their lead.

2. Scope

The Standard guides organisations participating in publicly funded new build and major refurbishment projects to develop and improve buildings to achieve a step change improvement in Net Zero (NZ) Operational Energy (OE), and to take action on embodied carbon; Whole Life (WL) emissions and both indoor and other environmental aspects:

1. Inclusive NZ Economy Outcomes
2. NZ-Construction: Project Specific
3. NZ-Operational Energy (NZ-OE):
 - o Operational Energy Target (OET)
 - o Zero Direct Greenhouse Gas Emissions from Heating, Cooling and Hot Water (ZEH)
 - o Carbon Strategy
4. NZ-Other Whole Life (NZ-OWL): Project specific
5. Indoor Environmental Quality (IEQ):
 - o Indoor Air Quality
 - o Avoidance of Overheating
 - o Natural Lighting
 - o Other Project Specific Targets
6. Environmental Aspects: Project Specific

The voluntary Standard is owned by the Scottish Government, which leads on the setting of its high-level objectives and targets in consultation with sector partners and stakeholders. This includes assessment of infrastructure investment decisions on the basis of their contribution to Inclusive Net Zero Economy Outcomes, further details of which are set out in the Glossary.

A central principle of the Standard is Verified and Transparent Performance Reporting. It is critical that buildings' performance against targets is well reported upon and assessed and that the evidence and findings are made publicly available. This high quality of reporting and evidence gathering is intended to enable the Scottish Government periodically to update the definition of 'exemplar practice' in core objectives as performance improves. It allows the Scottish Government to agree objectives and targets that differentiate between building categories and sectors, encouraging those that can progress fastest to do so, and ensuring that Scotland's climate change mitigation priorities and strategic aims are met by all projects that adopt the Standard.

3. The Standard

3.1. Overview

The Standard's core objectives and governance arrangements will be integrated into existing arrangements for public sector new build and major refurbishment projects in Scotland. The Standard elevates energy, emissions and environmental objectives to core project objectives, as tangible as budget and programme. Checks are made at key stages and non-compliance rectified to ensure projects are able to proceed to subsequent stages without compromising the project's ability to meet all its core objectives.

In addition to robust governance arrangements covering project leadership, budgets and programme, applying the Standard involves the Participant designating an Inclusive Net Zero Champion. The INZ Champion should be appointed to communicate the requirements of the Standard to the Project Design & Facilities Teams and to support the analysis and reporting they will need to carry out to ensure reports are submitted to the Scottish Government at each stage in the process, to demonstrate that core objectives have been met. The competency and independence requirements for the INZ Champion are set by the Scottish Government.

The Standard comprises six stages. The stages take the Participant through the full lifecycle of a project from briefing, development and delivery to the operational stage when the core performance objectives are verified in use:

1. Application Stage
2. Concept Design Stage
3. Detailed Design Stage
4. Delivery Stage
5. Performance Verification Stage
6. Continuous Improvement Stage

The table below shows how the six stages of the Standard align with a selection of current Scottish Government Frameworks.

Frameworks for Project Governance, Briefing, Management and Verification

Scottish Capital Investment Manual (SCIM)	Assurance Review Framework Gateways	RIBA Plan of Works	Government Soft Landings (Adjusted for Energy Focus)	Net Zero Public Sector Buildings Standard
Service Change Planning				
Strategic Assessment	0 Strategic review of a programme	0 Strategic Definition	Draft Energy Management Plan	Application
Initial Agreement	1 Business Justification before IA Approval	1 Preparation & Briefing		
Outline Business Case	2 Delivery Strategy & readiness to proceed to procurement	2 Concept Design		Concept Design
Full Business Case	3 Investment decision review before contracts are placed	3 Spatial Coordination	Energy Management Plan	Detailed Design
		4 Technical Design	Draft handover and aftercare strategy plan	
Construction & Commissioning	4 Readiness of service to use the facility	5 Manufacturing and Construction	Final handover and aftercare strategy plan	Delivery
Project Monitoring & Evaluation		6 Handover		
	5 Operations review & benefits realisation	7 Use	Qualitative health check and seasonal commissioning	Verify Performance
				Continuous Improvement

 NHS Design Assessment Process (NDAP)

3.2. Application Stage

Participants intending to apply the Standard to their project should contact the Scottish Government to determine the current targets applicable to its building categories and sector.

The ambitious OET applicable to the Standard is typically only achievable if it has been considered from its earliest stages, e.g. RIBA Stage 0.

A key output of the Application Stage is an Application Stage report that the Participant should produce, setting out the project's core objectives. It should state the assessments that have been carried out, evidencing the investment's contribution to Inclusive Net Zero Economy Outcomes and, where the project includes new build components, justifying this rather than repurposing existing assets. The approach to renewable energy sources should clearly differentiate between the technologies that will be installed by handover and plans for the remaining period to the target date to achieve Net Zero – Operational Energy.

3.3. Concept Design and Detailed Design Stages

Energy Modelling (or other approved approaches) should be used throughout the design process to assess the impact of design decisions upon the achievement of relevant targets, applying iterative adjustment and remodelling to optimise them and verify success. This is applicable to physical parameters with quantitative target values, e.g. OET, IEQ, peak power loads, renewable energy generation and storage and other environmental parameters.

Concept and Detailed Design Stage Reports are key outputs that should be produced by the Participant, demonstrating that the design is on track to meet the targets. The reports should include outline and detailed Measurement & Verification Plans respectively. The Detailed Design Stage Measurement & Verification Plan should specify the meters, sub-meters and other equipment needed for Transparent and Verified Performance Reporting.

3.4. Delivery Stage

Participants should demonstrate a robust approach to checking construction quality. Commissioning of equipment and controls that impact upon the achievement of core objectives should be thorough. This should include seasonal commissioning and adjustment where applicable and be accompanied by operational verification. All metering, sensors, loggers, equipment, controls and software that the design depends upon to meet the core objectives and for them to be verified should be demonstrated to have been installed, programmed and producing the required outputs in appropriate format. Bespoke and effective training and documentation should be delivered to the relevant operation teams and Participants' staff.

The Delivery Stage Report should demonstrate systems' capability of operating in accordance with the Energy Modelling to achieve the core objectives and targets. The Report should include a NZPSB Reporting Plan, setting out how the targets' requirements will be reported upon during the Verify Performance and Continuous Improvement stages. This should include finalising the Measurement & Verification Plan for third party verification of performance versus targets.

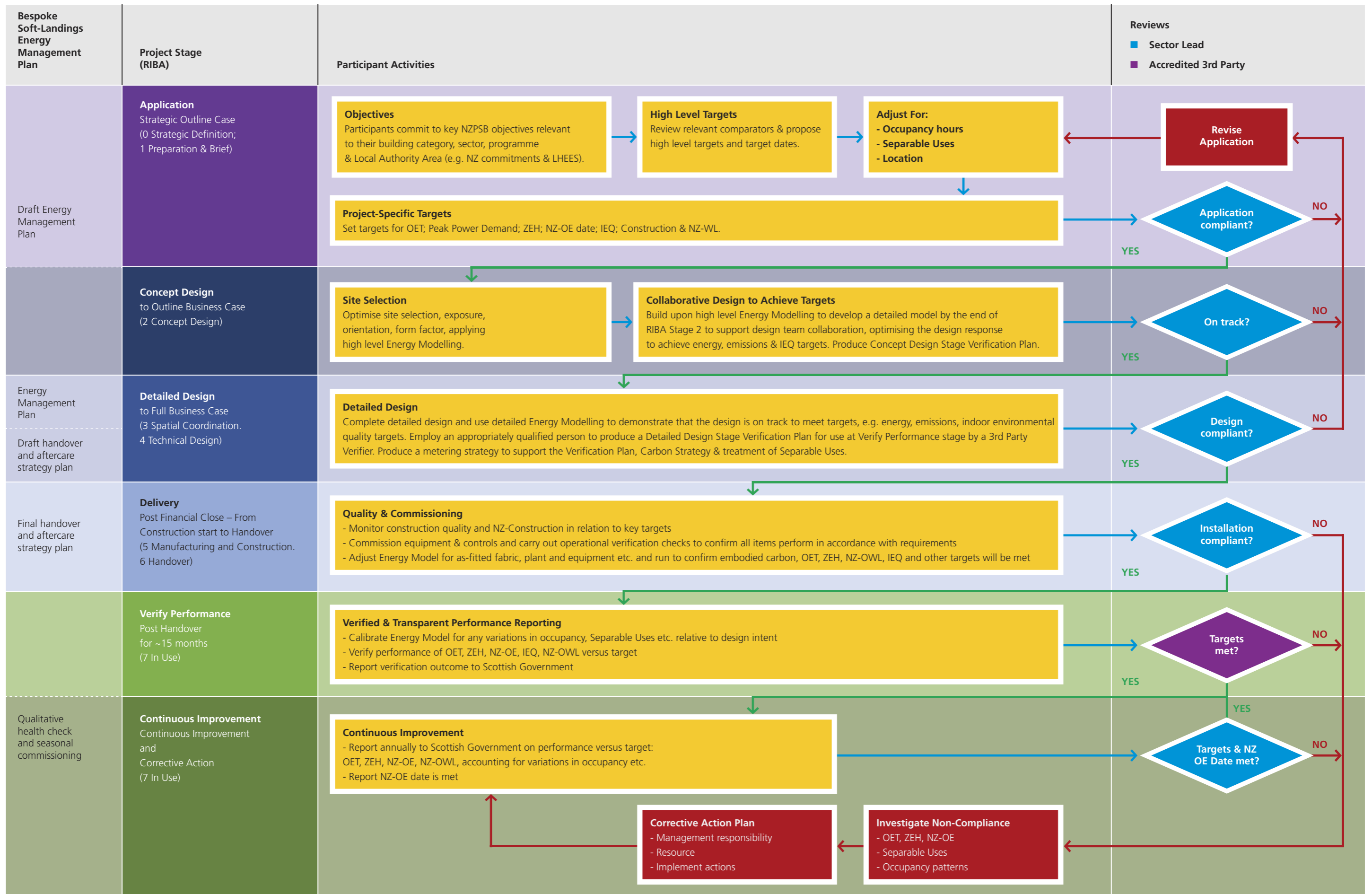
3.5. **Verify Performance Stage**

The Verify Performance stage is a key differentiating factor compared to current practice. It should commence on Handover and performance be monitored for at least twelve months of representative operational use to enable compliance with the OET and other quantitative targets to be verified by an independent third party. Occupancy patterns, weather data, contextual information and other drivers of energy use should be collated to determine whether the building is used as anticipated by the Energy Model. Instances of non-compliance should be rectified, taking account of changes in usage patterns. The Verify Performance Stage Report should set out the findings of the assessment and any corrective actions required.

3.6. **Continuous Improvement Stage**

The Participant should submit annual Continuous Improvement Stage Reports to the Scottish Government to demonstrate continued conformance with requirements. Where the operational energy use is more than 20% greater than the OET, this should be identified as a non-compliance and investigations carried out to improve performance. Non-compliances identified by the Continuous Improvement reporting process should be rectified in time to allow compliance to be evidenced in the subsequent report and should be subject to periodic third party verification at a frequency agreed with the Scottish Government.

3.7. Process Diagram



4. Objectives

On initiating the project, the Participant should set out the approach to objective and target setting, for all environmental aspects, including those specific to Inclusive Net Zero Economy Outcomes. This should include the project's governance structure and resources. An essential resource for projects following the Standard is an Inclusive Net Zero Champion to coordinate compliance with the Standard, including articulation of objectives, targets and the delivery of monitoring and reporting activities throughout the development, delivery and operational life of the building.

The Standard is intended to be sufficiently flexible to be applied under a wide range of procurement routes, delivery mechanisms, finance options and accounting treatments. As a general guide, the responsibility to meet targets is owned by the lead Participant for which the building is designed and operated.

4.1. Net Zero – Inclusive Net Zero Economy Outcomes

The development of a NZPSB new build or major refurbishment should be preceded by a consultative engagement activity to determine core objectives shared with partners and local communities that will contribute towards improving the lives of people, supporting inclusive and sustainable economic growth and creating more successful places. This process should include an assessment of the impact of a building's location on the people's need to travel and the suitability of its facilities to support active travel and wellbeing.

Consideration should be given to these Inclusive Net Zero (INZ) Economy Outcomes when setting the Standard's targets that will influence their achievement. For example, extensive community use of a new or refurbished building could require adjustment of its OET and indoor environmental quality aspects.

Where appropriate, objectives that fall outside of the scope of the other carbon, energy and environmental objectives could be met by establishing bespoke targets to be quantified and monitored under the Standard to verify the project's contribution to INZ Economy Outcomes.

4.2. Net Zero – Construction

Projects should apply best practice in options appraisal and life cycle assessment to determine whether the project's core outcomes would be optimally delivered by major refurbishment of an existing building, or by new build. The construction embodied carbon of a major refurbishment project is typically significantly lower than that of a new build. This assessment should be consistent with and take account of assessment of Inclusive Net Zero Economy Outcomes.

New build and major refurbishment projects should have no greater construction embodied carbon than required by the Scottish Government for their building category (applying the Cradle-to-Construction definition). To simplify compliance, this requirement can be met by the following approaches and associated Scottish Government guidance and requirements for the majority of sectors:

- applying waste minimisation best practice and circular economy principles at the design and delivery stages

- quantifying the project's Cradle-to-Construction embodied carbon and demonstrating that it is less than the target identified by the Scottish Government
- specifying that additional materials required to achieve the Standard's low energy objectives are of low embodied carbon (e.g. thermal insulation)

4.3. Net Zero – Operational Energy

To meet this core objective, projects should achieve exemplar practice in all energy use, including thermal performance relevant to their building category and project type (new build or major refurbishment). The Scottish Government, in collaboration with stakeholders, publishes Net Zero – Operational Energy objectives for commonly occurring building categories that adopt the Standard.

Greenhouse gas emissions from energy use can be minimised by reducing demand; meeting needs efficiently; excluding energy sources that cause direct greenhouse gas emissions within the building curtilage from heating and hot water provision; optimising onsite renewable sources and establishing a credible offset regime for residual emissions. The Standard addresses reducing demand and meeting needs efficiently with an ambitious OET and reporting regime. Renewables and offsetting are addressed by ZEH and the Participant's Carbon Strategy.

4.3.1. Operational Energy Target

The Application Stage should include a draft OET, expressed in kWh/m² 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. The target should be ambitious and specific to the building categories that comprise the project, taking account of the conditions of the Exemplar, or other comparator building(s) it is based upon. This should include normalisation for typical drivers of energy use, such as Heating Degree Days, exposure, altitude and occupancy patterns. For example, the Scottish Government set 67 kWh/m²/year as the target for the core areas and core hours of new build schools under the first wave of the Learning Estate Investment Programme (LEIP) in 2019.

The OET should be based on an initial benchmarking exercise, using verified performance data from published indicative OETs; examples of existing NZPSB or exemplar case studies of similar building categories, as appropriate, provided by the Scottish Government. However, early adopters of the Standard are likely to have the burden and flexibility of identifying their own comparator buildings, subject to appropriate quality and verification checks. In the case of major refurbishment projects, consideration could also be given to deriving the OET from an improvement in the existing building's baseline energy use, subject to there being no significant changes in patterns of occupancy and other aspects of operational use.

For electrically heated buildings, the OET should be based on all-electric building comparators, taking account of the lower operational energy consumption of a heat pump compared to a fossil fuel fired heat source.

Consideration should be given to any proposed use of the building that will either increase or decrease energy demand compared to its comparator. This could include additional activities, occupancy hours and building services, such as increased ventilation provision or use. Consideration should also be given to the impacts upon energy utilisation intensity of agile and remote working and colocation of multiple organisations, as these may not be well represented in comparator buildings.

Where no relevant published OET or exemplary case study is available for the building category, an initial draft OET should be set that demonstrates a step change improvement over a relevant 'Typical' building energy benchmark (or baseline energy use for major refurbishment projects).

In summary, in order of priority, the initial draft OET should aspire to:

1. Published indicative OET
2. Exemplary case study equivalence, where available and achievable
3. Step change improvement against 'Typical' building energy benchmark
4. Step change improvement against the overall Energy Use Intensity of the original building, adjusted for changes in occupancy patterns and energy-intensity of activities (for major refurbishment)

This activity should include the context for each comparator building to explain their performance and contrast them with the proposed building. The 'Typical' benchmark may require a composite of benchmarks from building categories represented in the project or be derived from portfolio or estate data available to the project team.

A description of the context of the comparator building will be of particular importance for projects that will be open for considerably longer hours than their relevant comparator and may need a higher OET. This need should be assessed by the Participant carrying out detailed Energy Modelling work and including the outputs in the Design Stage report. The Energy Modelling should demonstrate that if the building operated for the standard number of hours for the relevant comparator, it would meet the initial draft OET and should provide details on how this target should be adjusted for the expected operating hours and activities.

Unusually high process and equipment energy loads and their associated heating, ventilation and air conditioning (HVAC) systems should be quantified and their impacts forecast by the Energy Model. Examples of such loads include extensive medical or laboratory equipment; central laundries and sterilisation services; production kitchens; major flood lighting beyond the perimeter of the building (e.g. for multiple sports fields and car parking spaces); regional data centres and electric vehicle charging. For buildings in which these needs are significantly greater than the comparator building, they may be treated as Separable Uses. Where they can be separately metered, their consumption should be assessed separately from the rest of the building's use, and flexibility built into the OET to accommodate them.

In addition to an ambitious OET, all elements of all buildings should achieve excellence in energy performance. Particular care should be taken in relation to buildings to be heated by heat pumps and other low temperature or high cost heat sources, to ensure that the thermal envelope and air tightness are of appropriately high standard to design-out both underheating and high operating costs.

The building's peak power demand should also conform to an excellent standard of performance and a target should be set for peak demand that supports the achievement of the Carbon Strategy, including management through energy storage and load shifting.

Verification Plans should be produced during the Concept and Detailed Design Stages. The Detailed Design Stage Verification Plan should set out a robust metering strategy to support calibration of the Energy Model during the Verify Performance Stage, enabling account to be taken of actual operating hours and Separable Uses, demonstrating compliance or non-compliance with the adjusted OET. Preference will be given to approaches that combine whole facility with individual systems.

4.3.2. *Zero Direct Greenhouse Gas Emission Heating*

All NZPSBs should achieve zero direct greenhouse gas emissions from heating (ZEH), cooling and hot water in advance of 2024 for new builds and the majority of major refurbishment projects.

Exceptions to the ZEH target date will be subject to the Participant making the case to the Scottish Government that their temporary use of fossil fuels would enable a greater emission reduction to be achieved in the locality of the building through future actions by an agreed timescale, such as connection to a planned net zero emissions heat network by its NZ-OE target date.

4.3.3. *Carbon Strategy*

The Application should include a Carbon Strategy that states the date by which the building will achieve Net Zero – Operational Energy. The Carbon Strategy should set out how the building's energy needs will be met by an appropriate mix of onsite and remote low and zero carbon (LZC) technologies and other energy sources on handover and throughout operation. The strategy should comply with the Participant's, Scottish Government's and Local Authority's Net Zero commitments.

The Carbon Strategy should outline how demand, generation and storage will be balanced to minimise emissions, peak power demand, the need for grid reinforcement and curtailment of onsite renewables. This should include consideration of integrating electric vehicle smart charging points. The approach should seek synergies with Local Heat and Energy Efficiency Strategies and other local delivery plans that may be developed in the vicinity of the project; optimise whole life costs and achieve an optimum route to Net Zero – Operational Energy by the target date.

The Carbon Strategy should differentiate between approaches that are to be incorporated at handover and the scope of emission reductions that will be achieved in the future, *Continuous Improvement* stages and how they will be resourced, reported upon and verified.

4.4. **Net Zero – Other Whole Life**

Participants should apply current best practice in NZ-OWL relevant to their project identified by the Scottish Government. Participants are additionally encouraged to establish objectives to be achieved and reported upon in the design, delivery and in-use stages, such as water efficiency and other recurrent, non-energy emissions impacts. Circular economy principles should be applied to avoid waste and optimise materials use.

4.5. **Indoor Environmental Quality**

Participants should apply current best practice in IEQ relevant to their project as identified by the Scottish Government, prioritising parameters such as indoor air quality, avoidance of overheating, availability of natural light and volatile organic compounds.

The impact of material selection upon indoor air quality should be considered here, including but not limited to floor coverings, wall finishes, adhesives and insulants.

Consideration should be given to extending the design stage dynamic simulation modelling, in-use stage monitoring and verification to include other indoor environmental priorities, such as thermal comfort, acoustic comfort and water hygiene.

4.6. **Other Environmental Aspects**

Consideration should be given to applying the Standard's target setting, monitoring and verification regime to other environmental aspects of project-specific priority to Participants, the Local Authority area and the Scottish Government, for example green infrastructure, biodiversity, landscaping, flood risk management, climate change adaptation and resilience, health and wellbeing and active travel.



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