Ulster University
Estates Services
Building Engineering Services Standard

SECTION	7
Section Title	Energy and the Environment
Service	Not Applicable
Element	Not Applicable

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Purpose

By 2050, the UK is legally required to have reduced its greenhouse gas emissions by 100% from 1990 levels. To meet this target all sectors of the economy including construction and education will need to decarbonise. Similarly, the Climate Change Act (Northern Ireland) 2022 mandates that Northern Ireland's net emissions for 2050 be at least 100% lower than the baseline.

The purpose of this standard is to provide a consistent approach and process to ensuring Ulster University capital developments and retrofits are aligned with the institutional drive for net zero i.e., buildings should be net zero ready and free of direct emissions and fossil fuel heating/cooling.

The overall objective is to enable the delivery of sustainable buildings by increasing energy efficiency, reducing carbon emissions and water consumption, increasing biodiversity, and supporting sustainable travel. Delivery shall also focus on enhancing occupant comfort, reducing complexity, and driving design for long life with low maintenance, flexibility, and end of life recycling.

To deliver net zero ready capital development and retrofit projects programmes must be realistic and allow for the additional complexities of sustainable design and evaluation.

Any university building incapable of operating at net zero is at risk of becoming a stranded property asset[1].

Requirements

The following requirements are set out for new buildings and retrofit projects:-

1. Standards

- For every new build project, evaluate the cost/benefit of Passivhaus certification with Passivhaus design advice to be sought from pre-feasibility stage.
- For every retrofit project, evaluate the cost/benefit of EnerPHit Certification. Where applied the EnerPHit Standard should use Passivhaus components to improve thermal comfort, durability, cost effectiveness and energy efficiency.
- For every new build project, BREEAM Excellent should be sought with enhanced appropriate benchmarks. Benchmarks shall be agreed immediately to ensure that design decisions support achieving the targets set. Refer to sustainability targets for new build and retrofit projects in section 7.
- For every retrofit project over £1M capital cost, BREEAM Very Good with additional benchmarks shall be sought. Refer to sustainability targets for new build and retrofit projects in section 7.
- Environmental Sustainability Retrofit Checklist shall be completed for all retrofit and long-term maintenance projects below £1m – see section 8.

2. Whole life carbon[2]

- For new build and retrofit projects, apply Whole Life Carbon Assessment at each RIBA stage[3] including implications of design decisions.
- Prioritise the retention, reuse and repurposing of existing buildings following the hierarchy[4] in LETI's design guidance for circularity in the built environment: i. maintain, ii. refurbish, iii. repurpose (with adaptation), iv. deconstruct and reuse and v. remanufacture and recycle.
- On projects under £1m where Whole Life Carbon assessments are not being undertaken, effort shall be focussed on reducing embodied carbon following the Embodied Carbon Reductions hierarchy[5] in the LETI design guidance: i. Build Less, ii. Build Light, iii. Build Wise, iv. Build Low carbon, v. Build for the Future and vi. Build Collaboratively.
- Reasonable endeavours shall be made to quantify the embodied carbon savings achieved[6].

3. Embodied Carbon[7]

- Target an embodied carbon performance of <750 $KgCO_2e/m^2$ [8] for new buildings.
- Target an embodied carbon performance of <450 $KgCO_2e/m^2$ for retrofit projects. It is expected that this target is likely to reduce as sector practice matures.
- Assess and reduce embodied carbon so that materials with high embodied carbon impacts are minimised:
    - Prioritise low carbon materials.[9]
    - Promote use of natural materials.
    - Consider modular off-site construction systems.[10]
- Create a baseline model and an optimised model[11]
    - Define baseline before any carbon measures are introduced.

- Highlight which building elements generate the most carbon emissions.
- Identify a list of alternative measures.
- Quantify the magnitude of carbon abatement that each alternative measure provides i.e., percentage carbon reduction from baseline model to optimised model.

4. **Operational Carbon[12]**
   - Target <55 kWh/m^2/yr[13] operational energy use in new buildings.
   - Target 60 kWh/m^2/yr[14] operational energy use in retrofit buildings.
   - Use a fabric first approach[15] maximising the performance of components and materials that make up the fabric to minimise the need for energy consumption through methods such as i. maximising air-tightness, ii. increased levels of insulation, iii. optimising solar gain, iv. optimising natural ventilation and v. using the thermal mass of the building fabric. Refer to sustainability targets for new build and retrofit projects in section 7.
   - Design using realistic predictions of the operational energy performance before the building is built to avoid the performance gap where actual energy use may be higher that the estimated use.
   - Use low carbon heating, for example heat pumps and target no new connections to the gas grid for building projects. **Heating and hot water should not be generated using fossil fuels**.
   - On-site renewable electricity shall be maximised.
   - Buildings should be adapted to climate change. It is essential that the risk of overheating is managed, and that cooling is minimised.

5. **Water use[16] and biodiversity[17]**
   - Refer to sustainability targets for new build and retrofit projects in section 7.

6. **Delivery and Data**
   - Provide energy, water, and embodied carbon data etc in a suitable data collection report/template to demonstrate achievement of project net zero and for sustainability reporting and transparency[18].
   - **Project programmes must be realistic and allow for the additional complexities of sustainable design and evaluation.**

7. Target Summary New Build and Retrofit Projects

Table 1 New Build Sustainability Targets [8,13,14,15,16 & 17]

New Build	Near Term Target: Present - 2027	Mid Term Target: 2028 - Mid 2030's *or* 2028 - 2032
Passivhaus	Business case evaluation	Business case evaluation
BREEAM	Excellent (plus targets below)	Excellent (plus targets below)
Embodied Carbon ($KgCO_2e/m^2$)	<750	350
Energy Consumption – New Build ($kWh/m^2/yr$)[19]	75	<55
Energy Performance Certificate	A/B	A
Mechanical Heat Recovery (% efficiency)	70	90
U Value (W/m2.k) Wall	0.28	<0.15
U Value (W/m2.k) Floor	0.22	<0.12
U Value (W/m2.k) Roof	0.18	<0.12
U Value (W/m2.k) Windows	0.28	1 (triple glazing)
G-Value of Glass	0.7	0.3-0.4
Air Tightness ($m^3/hr/m^2$ at 50pa)	10-5	1
Water (litres/person/day)	6	6
Biodiversity Net Gain (%)	10	15

Table 2 Retrofit Sustainability Targets [8,13,14,15,16 & 17]

Retrofit[20]	**Near Term Target: Present - 2027**	**Mid Term Target: 2028 - Mid 2030's *or* 2028 - 2032**
EnerPHit	Business case evaluation	Business case evaluation
BREEAM Very Good	Very Good (plus targets below)	Very Good (plus targets below)
Embodied Carbon ($KgCO_2e/m^2$)	<450	150
Energy Consumption – Full/Deep Retrofit ($kWh/m^2/yr$)	160	60
Energy Consumption – Partial/Light Retrofit ($kWh/m^2/yr$)	165	62
Energy Performance Certificate	C	B
Mechanical Heat Recovery (% efficiency)	60	80
U Value (W/m2.k) Wall	0.28	<0.15
U Value (W/m2.k) Floor	0.22	<0.12
U Value (W/m2.k) Roof	0.18	<0.12
U Value (W/m2.k) Windows	0.28	1 (triple glazing)
G-Value of Glass	0.5	0.3-0.4
Air Tightness ($m^3/hr/m^2$ at 50pa)	10-5	1
Water (litres/person/day)	7.9	7
Biodiversity Net Gain (%)	10	15

8. Retrofit Checklist: Environmental Sustainability Impact

Cost Code:				
Environmental Criteria:	**Y**	**N**	**N/A**	**Actions Agreed**
Section A - Materials (i.e., furniture, fixtures, fittings, and flooring)				
– Can materials with a higher recycled content be specified?				
– Can materials that use non-toxic materials & refrigerants with a low global warming potential be specified?				
– Can materials with lower embodied water be specified?				
– Are there opportunities to consider durability / intended lifespan?				
– Can materials / equipment with minimal maintenance requirements be specified				
– Can materials be sourced locally?				
Ceilings: – Review the potential for reusing ceiling tiles – If new tiles ensure a % of content is from recycled material – Investigate if manufacturer has a take back scheme for the material at end of life which confirms that no materials will be sent to landfill				
Doors: – Review the potential for reusing doors and frames – If new doors and frames ensure manufacturer has ISO14001:2015 – If new doors and frames ensure a % of content is from recycled material				
Hard Flooring				

– Review the potential for hard floor coverings to be reused				
Hardwoods and Timber – Review the potential for hardwoods to be reclaimed hardwood – If new hardwood ensure from a scheme such as Forest Stewardship Council (FSC), Programme for the Endorsement of Forest Certification (PEFC) or Grown in Britain (GiB)				
Paints and Coatings – Review the potential for paints and coatings to have been awarded the EU Ecolabel or ensure % of content is recycled				
Soft Floorings – Review the potential for soft floor coverings to be reused – If new ensure a % of content is from recycled material – Investigate if manufacturer has a recycling or ‘take back’ scheme				
Section B - Waste				
– Can a pre-retrofit audit be specified to identify opportunities for retaining and reusing existing materials from the proposed retrofit?				
– Will there be sufficient room on site for skips?				
– How many segregated waste streams are feasible on site?				
– Can any excavation materials be reused?				
Section C - Water				
– Can rainwater harvesting opportunities be investigated?				
– Can installation of water-efficient fixtures and fittings be specified?				

Section D - Energy				
– Are there opportunities to specify energy-efficient heating and cooling systems?				
– Are there opportunities to specify LED lighting?				
– Is there potential to specify passive infrared (PIR) and photocell sensors to the light fittings?				
– Are there opportunities to improve / increase the insulation of the building?				
Section E - Transport				
– Can secure, lockable cycle storage be specified? (1 space per 8 student users and1 space per 10 university staff)				
– Can cyclist lockers be specified? (1 locker per 8 staff/student members)				
– Can shower facilities be specified? (1 shower per 100 occupants)				
Section F - Biodiversity				
– Can a new space for biodiversity be provided in line with the scale of the project or – Can improvements be made to existing green spaces?				
– Review the potential for i. ‘Green Roof’ ii. Green wall/hedging iii. Planters iv. Mulched planted beds v. Wild pond vi. Bird nest/box vii. Bat roost/box viii. Bug box ix. Dead wood/log piles				

[1] A stranded asset is a building that is falling behind increasing stringent environmental requirements. Buildings that are currently in the design or early construction phase could become stranded before completed if not on the right pathway to net zero or still using fossil fuels, which will not align with the aspirations of current or future building users.
[2] Whole Life Carbon emissions are the sum of both operational carbon emissions and embodied carbon emissions over the life cycle of an asset including its disposal. LETI Carbon Definitions for the Built Environment Buildings and Infrastructure, leti.uk
[3] LETI Client Guide for Net Zero Carbon Buildings, August 2021 Edition pages 10-11, leti.uk and Government Property Agency, Sustainability and Net Zero, Design Guide – Sustainability Annex, March 2022 pages 30-36 assets.publishing.service.gov.uk
[4] LETI Circular Economy for the built environment: a summary. London Energy Transformative Initiative Publication, leti.uk.
[5] LETI Hierarchy for Embodied Carbon Reduction: Embodied Carbon. London Energy Transformative Initiative Publication, leti.uk
[6] Embodied Carbon analysis tools available, for example: Hawkins\Brown Emissions Reduction Tool, hawkinsbrown.com or FCBS Carbon Tool, fcbstudios.com.
[7] Embodied Carbon emissions of assets are the total emissions and removals associated with materials and construction processes throughout the whole life cycle of an asset. LETI Carbon Definitions for the Built Environment Buildings and Infrastructure, leti.uk
[8] RIBA 2030 Climate Challenge - target metrics for non-domestic (new build offices)
[9] LETI Low Embodied Carbon Specification and Procurement Guide: For Low and Net Zero Carbon Buildings, March 2023, leti.uk
[10] Construction using volumetric modular systems – modules precision manufactured offsite – can produce 45% less CO_2 than traditional methods, according to a study by academics from the University of Cambridge and Edinburgh Napier University. The research was conducted by Dr Tim Forman, Senior Research Associate at University of Cambridge, Professor Francesco Pomponi and Dr Ruth Saint of Edinburgh Napier University.
[11] LETI Embodied Carbon Primer: Supplementary guidance to the Climate Emergency Design Guide, January 2020 Edition, leti.uk
[12] Operational Carbon emissions arise from all energy consumed by an asset in-use, over its life cycle. LETI Carbon Definitions for the Built Environment Buildings and Infrastructure, leti.uk
[13] RIBA 2030 Climate Challenge - target metrics for non-domestic (new build offices)
[14] LETI Climate Emergency Retrofit Guide. London Energy Transformation Initiative, leti.uk
[15] Building Regulations Northern Ireland 2012 Guidance. Technical Booklet F2: Conservation of fuel and power in buildings other than dwellings, June 2022.
[16] RIBA 2030 Climate Challenge - target metrics for non-domestic (new build offices) & How to Conserve Water in Further Education Colleges. Building for the Future – Sustainable Construction for Professionals, October 2007.
[17] Biodiversity Net Gain is an approach to development that leaves biodiversity in a better state than before. Chartered Institute of Ecology and Environmental Management, cieem.net
[18] Offset of carbon emissions shall be at an institutional level.
[19] Energy consumption near term figures have been presented based on industry standards and benchmarks, including literature from CIBSE. Respective mid-term targets were to be based on a 60% reduction target, however, to maintain consistency with other University papers and exercises, a mid term target of 75 kWh/m^2/yr has been agreed:
CIBSE TM46 Energy Benchmarks
CIBSE Energy Benchmarking Dashboard
CIBSE Guide F: Energy efficiency in building (2012)
RIBA 2030 Climate Challenge - target metrics for non-domestic (new build offices) – note for any new builds outside the definition of new build offices the value shall be agreed with the design team prior to significant design being undertaken.
[20] Retrofit Sustainability Targets excludes historic building/buildings in conservation areas.