GD01 Low Energy Design

UNIVERSITY OF LEICESTER

Document Control

Rev	Date	By	Comments
B	Oct'17	L. Davies	Renamed Low Energy Design, Updated scope requirements
C	Dec 17	UoL	Sign off for release
D	Apr '19	L. Davies	Technical review update
E	May 2020	A Singleton	General update to tracker and other minors.
F	October 2020	UoL	General parameters updated.

Design Guidance

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Design Guidance

1. This document is to be read in conjunction with the University Guidance Documents including the ”ES”, “MS”, and “GD” series of guides, which give greater information regarding the philosophies of passive design and the need to try to minimise the services plant footprint. Note that some other relevant sustainability information can be found within the MS and ES series of design guides noted above.
2. The University has declared a Climate Emergency and needs to reduce its carbon footprint. It is committed to net zero carbon by 2050 at the absolute latest. It takes its responsibilities in this regard very seriously. In this regard
    a. Design solutions should aim to provide buildings and environments which are highly sustainable both in terms of their construction and continuing lifetime of operation.
    b. Designs should be well considered and provide buildings which minimise the size and complexity of the services installations. This should not be undertaken at any cost but rather consider solutions that optimise whole lifecycle costs which themselves should include capital and life refresh costs, maintenance costs, energy costs and carbon use and cost. This to be for the total building cost including services installations.
    c. Buildings and developments should be modelled and appraised to arrive at solutions which consider shape and orientation, windows and massing, U Values and infiltration, shading and materials to arrive at an optimum design taking into account the life cycle costs referred to above. Also refer to building design Guides.
    d. The University will expect to see option appraisals of all the above items at RIBA stages 1 and 2 further refined at BSRIA/RIBA stages 3a and 3b onwards to determine how adjustments will impact upon performance and such that an optimised solution can be arrived at. This is considered to be a whole team analysis of all aspects of sustainable design.
    e. The RIBA stage 2 onwards considerations must consider building performance in terms of passive environmental control and impact upon the size and complexity of the services solutions.
    f. Simple elegancy with straight forward simple controls are more valued than highly complex solutions.
    g. So far as controls are concerned note that most central campus buildings have transient occupants who do not own their own space and therefore user intervention controls are to be avoided.
    h. New or refurbishment works should aim to deliver built solutions that encompass a low carbon philosophy in the short term whilst allowing an easy retrofit to zero carbon in the longer term. The MS series of guides give more information in this regard.
3. Whole life cycle cost appraisals to consider the above must be undertaken at RIBA stages 2 and 3 to determine the projects optimised design solution which needs to be fully detailed within the tender documents.. This will require close collaboration of the whole design team including cost managers as the building design and consequent services design are integrated.
4. This following design guide shall be read in conjunction with the University’s Carbon Management Action Plan and serves to enhance the energy principles behind efficient building and building services designs. The University of Leicester have realised the considerable benefits of low energy design principles and a low energy ‘passive design’ ethos shall be considered as a minimum regarding:
    a. Optimisation of total building physics such as shape, orientation and thermal performance.
    b. Optimisation of solar gains when required whilst minimising solar gain overheating during summer months.
    c. Holistic occupancy control and profiling of M&E systems
    d. Plant efficiencies and minimisation of losses and auxiliary loads.
    e. Optimising the benefit of mixed mode system design including natural ventilation and passive cooling.
5. The University’s aspiration for all projects is to consider the holistic design approach to offer the optimum

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Design Guidance

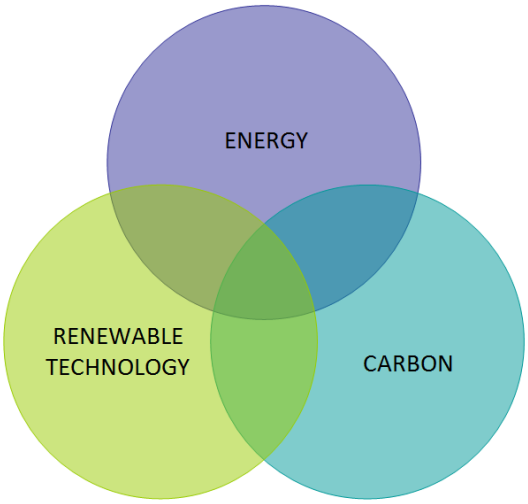
balance of the key considerations in any development as noted earlier.

a. The balance of these elements shall be led by the MEP service engineer working alongside the architect and cost surveyor to offer detailed assessment of the proposed methodologies to inform the Architectural/ structural design solutions and associated project cost plan.

b. Life cycle cost appraisal must be considered in respect of the preferred solutions also as part of the designer's obligations under CDM to better inform the University of their ongoing capital refreshment and maintenance commitment. The University's key considerations to be balanced are as follows:

Minimisation of the building's Energy demand is an essential requirement of the design process. Consumed energy associated with MEP systems and plant shall be minimised through effective building physics such that systems are not required as a compensation measure against poorly performing 'passive' building physics. Harvesting natural resources shall be at the fore of all design solutions

Renewable technology must be employed to add credible benefit to the University's base load energy consumption and not be applied as a carbon offset measure. Where renewable technologies are considered as part of the building design these shall consider all specific requirements of the general design guide GD04 in terms of acceptable energy and carbon contributions through the employment of 'bolt-on' technology. The balance of the carbon/ energy offset through integration of renewables shall be secondary to assessing the building physics.



Minimisation of the building's CO_2 is also a key requirement to assist the University's Carbon Reduction Commitment (CRC). This shall be considered at first design principles and shall not be treated retrospectively using 'carbon offset' methods of design. Targeting 'dirty' fuel sources and betterment of these CO_2 contributors shall be at the fore of all design proposals. Whilst Pt. L of the building regulations focuses primarily on betterment against the notional CO_2 model it shall not be assumed that this can be achieved by applying renewable technology only.

Design Standards

1. The following building physics design standards are to be considered as a minimum for all projects:
   Limiting envelope U-values:

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Design Guidance

Element	Minimum Performance Value	
	New Build	Refurbishment
Windows and Roof Lights (installed, inclusive of framing components)	U ≤ 1.20 (W/m^{2}K – Double Glazed)	U ≤ 1.20 (W/m^{2}K - Double Glazed) (where replaced)
Glazing Thermal Performance (g value)	0.37 g-value	0.37 g-value (where replaced)
Glazing Light Transmission (Lt value)	0.67 Lt-value	0.67 Lt-value (where replaced)
External Walls	U ≤ 0.135 (W/m^{2}K)	U ≤ 0.2 (W/m^{2}K)
Roof	U ≤ 0.135 (W/m^{2}K)	U ≤ 0.2 (W/m^{2}K)
Ground Floor	U ≤ 0.12 (W/m^{2}K)	U ≤ 0.2 (W/m^{2}K)
Thermal Bridge Free - ψ Value	< 0.01 W/mK	< 0.01 W/mK
Air Permeability	<3.5 m^3/h/m^2@50Pa	<10 m^3/h/m^2@50Pa

* Note: Changes to the above shall be agreed with the project management and estates team during concept design stage. Such changes must be accompanied by a lifecycle energy analysis in order to fully inform the effect of such a design change.

2. Building design philosophies shall follow low energy principles for all types of project design. The following design criteria outline limitations on key systems that shall be read in conjunction with this suite of documents to ensure the design principles adopt the most efficient services concept design possible. 'Fabric first' principles shall be employed on all projects to ensure the energy consumption is limited.
3. Through the Simplified Building Energy Modelling process, the building services engineer has an obligation to satisfy key criterion to ensure Building Regulations Part L compliance. Comparative regulated energy consumption data measured in kWh/m^2 is represented within the Building Regulations UK Pt. L (BRUKL) output document for information purposes however, this data does not form part of the Pt. L compliance criteria. To ensure the building services are designed to their optimum performance level, the building services consultant shall ensure a target % betterment of this simulated 'Notional' regulated energy data is met for ALL projects. The table at the end of this section outlines the % betterment values that shall be achieved over and above the 'Energy Consumption by end use' table for all types of projects which shall be read in conjunction with all other University performance criteria outlined within this document and associated Building Regulations requirements. Primary energy figures shall not be used for this assessment. Schemes will be assessed on a case by case basis with the University and the detailed appraisal of the servicing strategy options shall be the sole responsibility of the building services engineer. Where the specific criteria cannot be met, the services consultant shall issue a formal report to the University outlining the demonstrable benefits of the simulated design approach and clearly document why the criteria cannot be met.
4. All projects, regardless of Pt L and planning requirements shall achieve a minimum EPC rating upon completion as outlined in the table below. Appropriate consideration shall be given also to the DEC rating of the completed project post 12 months occupation. Where appointed to undertake RIBA stage 7 'in use' soft landings

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Design Guidance

management, the DEC target outlined below shall be an implicit requirement to be achieved through management of the handover and 'in use' process to ensure the operation of the building is as per the intended design. The table at the end of this section outlines the requirements for all types of projects.

NEW BUILD – Key Performance Criteria

Development Type	Min. Energy Rating		Energy Betterment over Notional BRUKL Model (kWh/m²) †	On site Energy Generation
	EPC	DEC		
General Academic Buildings	'A' (0-25)	'B' (26-50)	-20%	20% of Simulated 'Actual' energy represented within the BRUKL output document to be generated via on-site renewable technology. Refer also to GD04
Industrial/ Workshop Buildings	'A' (0-25)	'B' (26-50)	-20%	
Office Buildings	'A' (0-25)	'B' (26-50)	-20%	
Residential Buildings	'A' (0-25)	'B' (26-50)	-20%	
Laboratory Buildings	'A' (0-25)	'B' (26-50)	-35%	
Leisure Buildings	'A' (0-25)	'B' (26-50)	-35%	
Kitchen Facilities	'A' (0-25)	'B' (26-50)	-20%	
Retail Buildings	'A' (0-25)	'B' (26-50)	-20%	

REFURBISHMENT – Key Performance Criteria

Development Type	Min. Energy Rating		Energy Betterment over Notional BRUKL Model (kWh/m²) †	On site Energy Generation
	EPC	DEC		
General Academic Buildings	'B' (26-50)	'C' (51-75)	-5%	20% of Simulated 'Actual' energy represented within the BRUKL output document to be generated via on-site renewable technology. Refer also to GD04
Industrial/ Workshop Buildings	'B' (26-50)	'C' (51-75)	-10%	
Office Buildings	'B' (26-50)	'C' (51-75)	-5%	
Residential Buildings	'B' (26-50)	'C' (51-75)	-5%	
Laboratory Buildings	'B' (26-50)	'C' (51-75)	-10%	
Leisure Buildings	'B' (26-50)	'C' (51-75)	-20%	
Kitchen Facilities	'B' (26-50)	'C' (51-75)	-5%	
Retail Buildings	'B' (26-50)	'C' (51-75)	-5%	

† The % Energy Betterment over the notional Pt. L BRUKL shall be assessed in relation to the end use regulated energy demand of the of the building without any assessment being made of the primary energy consumption estimated by the SBEM software. This assessment shall be made purely in isolation of applying additional renewable energy technology and shall focus primarily on demand minimisation PRIOR to such application of renewables. This energy betterment may be assessed in line with local planning requirements where applicable, however this must be achieved passively through efficiency of design of the building form, thermal performance and servicing principles.

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