



CIBSE

A service user approach to zero carbon

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High-performing partnership
Higher performing buildings

Introduction



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**TROUP
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High-performing partnership
Higher performing buildings

We are a high-performing building services consultancy with 240 people in eight offices, delivering projects in the UK and Europe across all sectors.

As a socially responsible and ethical partnership we provide roadmaps for our clients to decarbonise the built environment

GROWING PEOPLE

INVESTORS IN PEOPLE™
We invest in people Platinum

INVESTORS IN PEOPLE™
We invest in apprentices Platinum

INVESTORS IN PEOPLE | Champion

INVESTORS IN PEOPLE AWARDS 2022
WINNER

YOUNG ENGINEERS AWARDS 2019
Employer of the Year
WINNER: Medium company

Apprenticeships
Top 50 SME Employers 2022



PRINCESS ROYAL TRAINING AWARD
2017

Living Wage
Employer

THE INVESTORS IN PEOPLE AWARDS 2021
Winner

National Apprenticeship Awards 2022
National Winner

2018 TALENT CN AWARDS
EXCELLENCE IN LEARNING & DEVELOPMENT

HEALTHY WORKPLACE
Employer of the Year 2018
MAYOR OF LONDON

ACHIEVING QUALITY AND CONSISTENCY

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Part of Capita plc

BuildingConfidence

INTERNATIONAL QUALITY AWARDS 2022

Iwfm
CORPORATE MEMBER

CIBSE
The Institution of Building Services Engineers

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Awards

SUSTAINABILITY AT HEART

CLIMATE NEUTRAL COMPANY

NABERS
LICENSED ASSESSOR

UK GBC
Member

ADVANCING NET ZERO

RE WILD CARBON
NET ZERO
CARBON NEUTRAL 2022

RetroFirst

UKAS ENVIRONMENTAL
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Low Carbon Energy Assessor

BREEAM
LISTED ASSessor

Camden Climate Change Alliance TEAM GREEN

WELL AP

Camden Climate Change Alliance CARBON CHAMPION

BREEAM
ACCREDITED PROFESSIONAL

UKAS ENVIRONMENTAL
488

Low Carbon Consultant

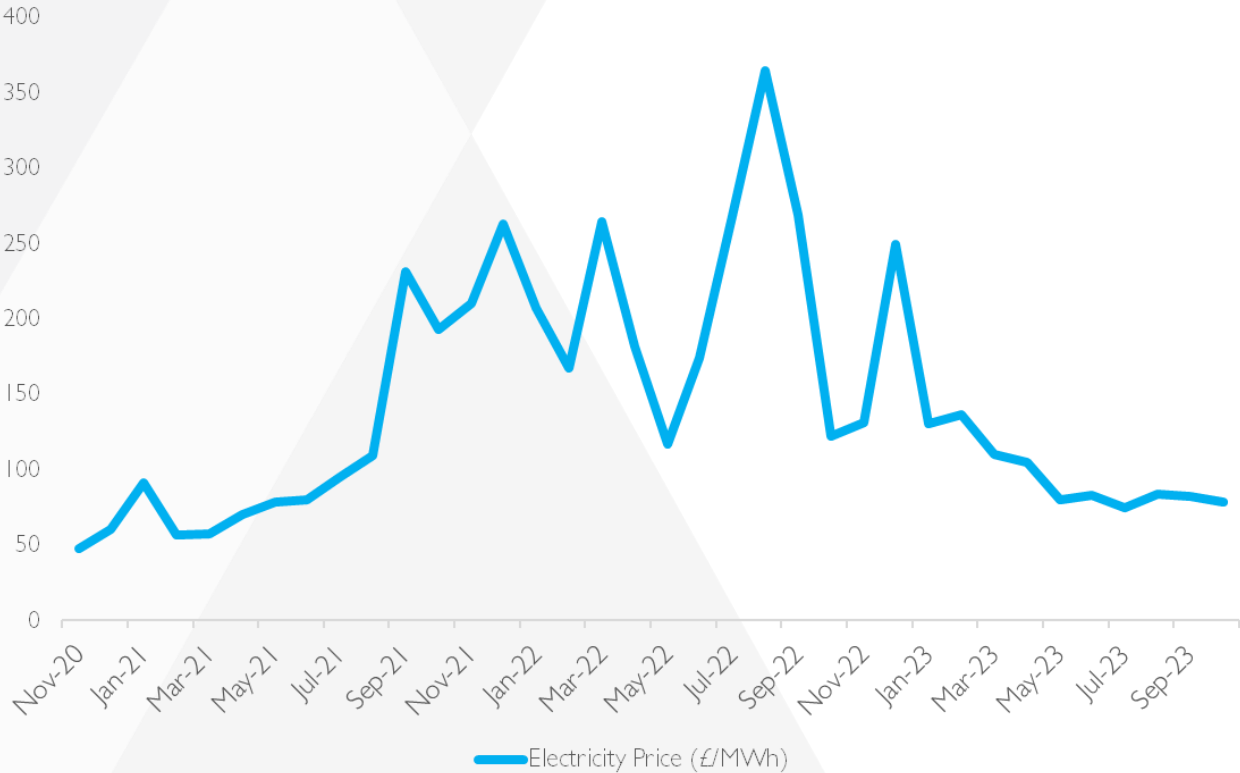
Delivering a 'Net Zero' National Health Service



NHS Net Zero Building Standard



Electricity costs UK (day ahead contracts)



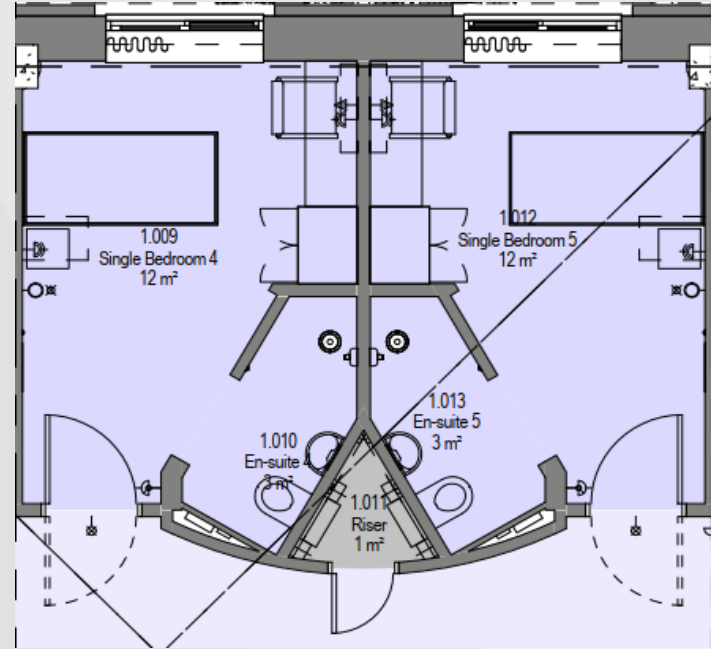
[1] Data from Ofgem, accessed 04/01/2024



The standard room

The standard room (Mental Health Bedroom)

- + Developed as part of the Procure framework in 2014
- + Signed off by the DoH
- + Enable the delivery of projects more efficiently from a commercial, programme and operational point of view
- + There is scope to investigate how environmental conditions can be improved

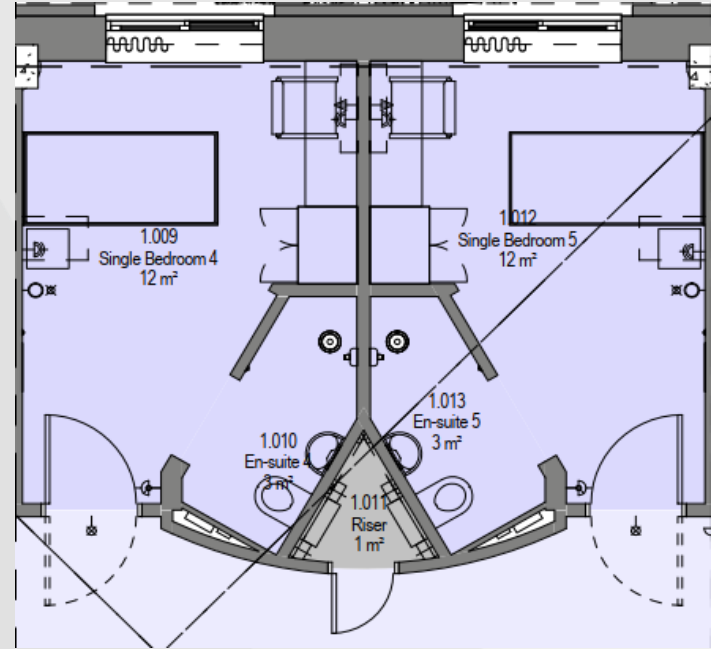


Standard room layout

The standard room @SLaM

The building services design inputs are:

- + 17 l/s supply in bedroom, 17 l/s extract from en-suite
- + Constant volume system via grilles
- + Supply Air Temp. 19degC summer and 21degC in winter
- + Winter Room Temp : 21degC
- + Summer Room Temp : 28degC max. 50 hours exceedance
- + Heat Loss 310W via LTHW Radiant Panel
- + Sensible Cooling Load 689W.
- + Average daylight factor >4.0

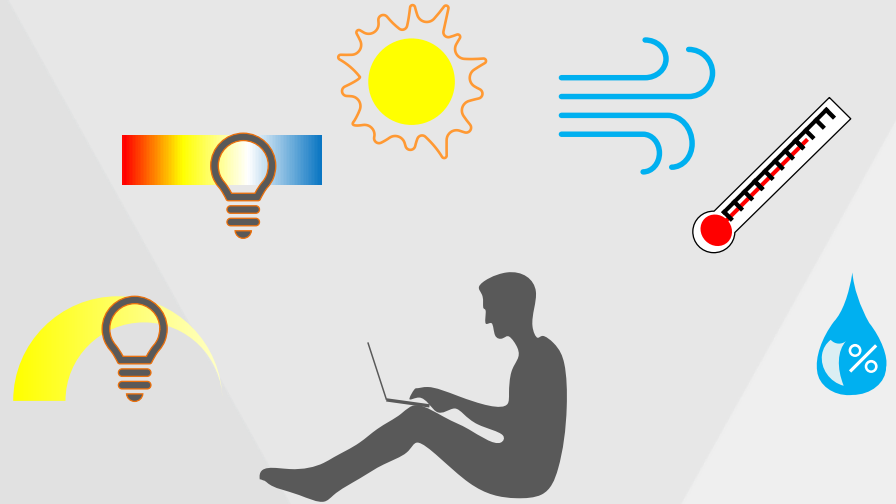


Standard room layout, SLaM children & Young persons

Environmental parameters

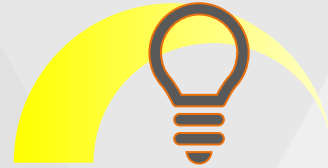
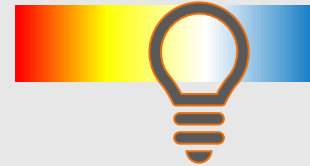
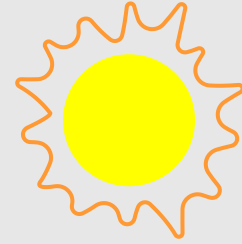
Building service design can impact:

- + Artificial light levels, and colour
- + Daylight availability & intelligent control
- + Air quality relating to pollutants and odour removal
- + Room temperature
- + Room humidity



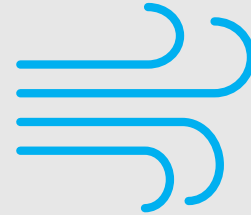
Enhanced lighting design

- + Standard room gives >4 ADF, no further daylight necessary
- + Variable colour temperature lighting (circadian lighting) 2200K-6500K as opposed to fixed
- + Increase maximum level from 300lux to 600lux, allow for greater variable control to individual needs



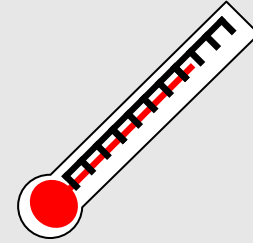
Enhanced ventilation design

- + Increase air flow from 17l/s to 34l/s enable greater removal of unwanted gases (CO₂, VOCs, NO_x, SO_x, O₃...)
- + 17l/s maintains CO₂ levels below 600ppm, further dilution of CO₂ not required, however should be considered to remove VOCs which are often associated with odours
- + Ventilation should be variable
- + Equivalent to new HTM, Increase filtration to SUP2, ODA3 = 80% PM10 reduction by using merv 16/F9 particulate filters. This gives a pressure drop increase of 40-45Pa or 5-10%
- + Include mixed mode ventilation to enable users to choose to open windows. Control accordingly



Enhanced temperature and humidity design

- + Rooms have minimal cooling currently, and temperatures are allowed to exceed 28°C for 50 hours per year
- + Adding a full mechanical cooling solution will enable users to choose their room's set point. This will require that the fresh air rate is increased to enable sufficient heat to be removed. User set point +/- 1.5°C
- + Currently rooms have no humidity control, dehumidification can be addressed through the cooling system and a steam humidifier is added to the air supply.

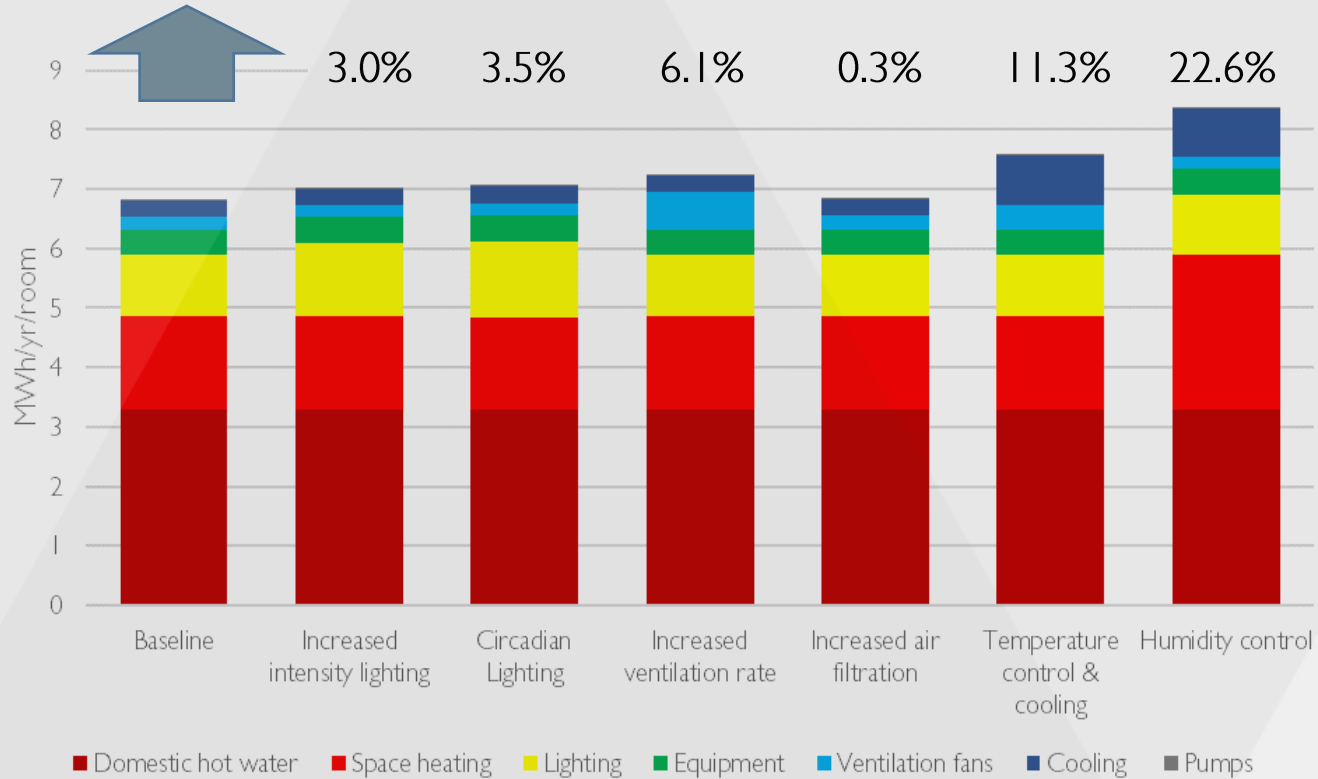


Environmental condition	Standard Room		Enhanced Room		Building services design
	Condition	Control	Condition	Control	
Artificial light level	Variable lux lighting system 0-300lux	Three stage dimming control	Variable lux lighting system 0-600lux	Continuous dimming control	Additional luminaires or power
Artificial light colour	3000K or 4000K	No control	Variable colour temperature 2200K-6500K	User selected colour temp / daylight mimicking	Circadian luminaires
Daylight availability	Average daylight factor 4.0 over 80% of room	Photosensor	Average daylight factor 4.0 over 80% of room	Photosensor	None required
Air quality CO ₂	No set point	17l/s CO ₂ dilution, achieves <600ppm	34l/s CO ₂ dilution, achieves <550ppm	Individual room sensors linked to fresh air damper	Variable fresh air system needed with 2 times peak fresh air rate
Air quality PM2.5	No set point	Minimum merv 13 or F7	>10µg/m ³	SUP2, ODA3 = 80% PM1 reduction	Upgrade filter merv 16/F9, increases pressure drop (~40-45Pa increase in pressure drop)
Air quality odour (VOC)	No set point	17l/s VOC dilution	>500µg/m ³	Driven by CO ₂ control	Variable fresh air system needed with 2 times peak fresh air rate
Room temperature	Winter: 21°C Summer: 28°C (max. 50 hours exceedance)	Constant volume fresh air system determines room temperature	+/- 1.5°C from user chosen set point	Constant volume fresh air system with variable chilled water flow rate	Additional chiller and chilled water circuit. Higher air supply rate Enhanced control
Room humidity	No set point	NA	40-55%	Room based sensing to control on/off of associated systems	Dehumidification off cooling coil and steam humidification

A modern bedroom interior featuring a man sitting on a window seat, a bed with a blue and floral patterned coverlet, a desk with a blue ottoman, and a closet with a yellow accent wall. The room has light wood flooring and a white ceiling with recessed lighting. A large window provides natural light, and a yellow pillow is on the window seat. A man in a white shirt and patterned pants is sitting on the window seat, holding a white mug. The room is furnished with a bed, a desk, a blue ottoman, and a closet with a yellow accent wall. The floor is light wood, and the ceiling has recessed lighting. A large window provides natural light, and a yellow pillow is on the window seat. A man in a white shirt and patterned pants is sitting on the window seat, holding a white mug.

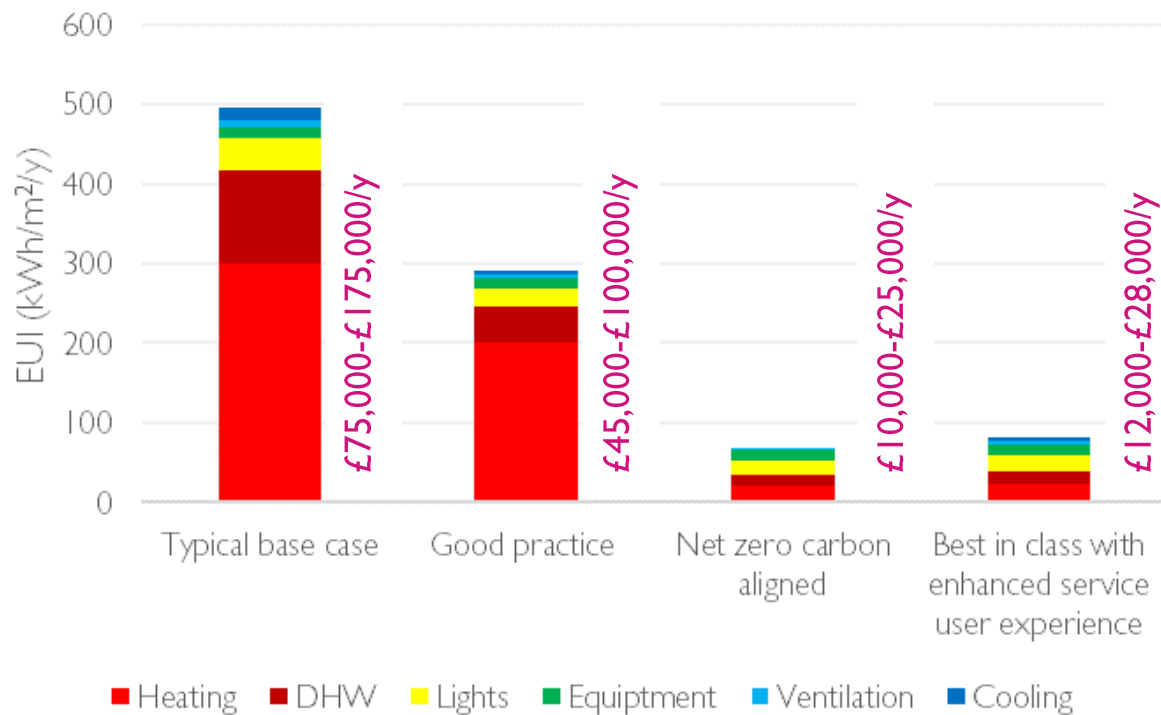
The impact to carbon emissions

Change in energy consumption



Service user rooms, are a small part of the facility... what opportunities are there to offset high energy use rooms with a better performing overall building?

Whole building energy consumption and costs



[1] CIBSE guide F – energy consumption of residential care homes

[2] TB+A operational energy modelling of net zero carbon residential care homes

[3] 1000m² GIA assumed

[4] low fuel aggregate fuel price 15p/kWh, high aggregate fuel cost 35p/kWh

NHS Net Zero Building Standard

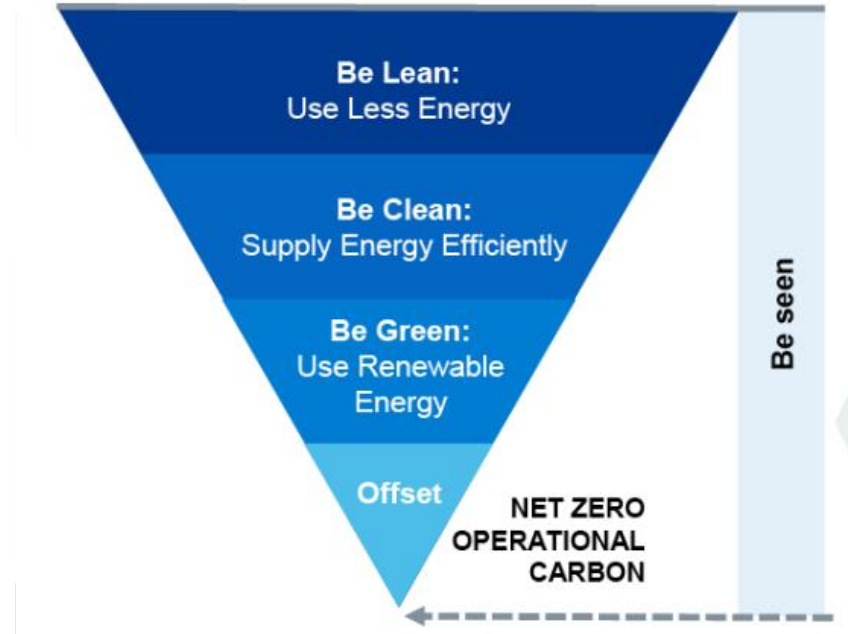
- + Published 22nd February 2023
- + Applies to all investments in new buildings and upgrades to existing facilities that are subject to HM Treasury business case approval process
- + Or any at pre-strategic outline business case approval stage from 1 October 2023 onwards
- + New mental health facilities included
- + The following slides focus on the operational energy aspects of the guidance in relation to user experience.



NHS Net Zero Building Standard

NHS net zero building standard

- + Set bespoke project energy limit
- + Set performance limits for building envelop and systems
- + Adopt a fabric first approach to reduce energy demands
- + Control systems so the correct amount of energy is provide at the correct times
- + Use highly efficienct building services
- + Install renewable technologies on site.



Energy hierarchy
NHS net zero building standard

The standard and design in mental healthcare

- + No separate approach has been deemed necessary for mental health buildings vs primary or secondary healthcare buildings.
- + The guidance notes that typical spaces in mental health (including CAMHS) can be matched to the space-type categories of the standard
- + Therefore can be assessed for compliance in the same way as any primary or secondary healthcare building.
- + Preference to natural ventilation means the buildings will perform better than the provided energy limits for operation energy.

Building performance targets

+ Low tech spaces performance targets

Minimum Standards	Part L2A Approved document 2021	NHS Building Standard - Primary
Thermal elements	Roof flat/pitched 0.18/0.16 W/m ² K	Roof 0.11 W/m ² K
	Wall 0.26 W/m ² K	Wall 0.11 W/m ² K
	Floor 0.18 W/m ² K	Floor 0.10 W/m ² K
	Windows 1.6 W/m ² K	Windows 1.2 W/m ² K
	Air permeability 3 m ³ /hm ² @50Pa	Air permeability 1 m ³ /hm ² @50Pa
Specific Fan Power		
DHW efficiency	91% to 92%,	>95%
Comfort cooling efficiency	SEER 4 to 4.5	SEER 5.5
Heating efficiency		sCOP 3.5
Lighting	Minimum luminaire efficacy 95 luminaire lumens per circuit watt for general lighting and 80 luminaire lumens per circuit watt for display lighting	2 W/m ² /100lux

Building performance targets

- + Medium tech spaces have Energy Usage intensity limits for regulated energy of between 39 and 95 kWh/m²/year

Medium-tech space-type categories				
Space-type category	Medium-Tech Type 1	Medium-Tech Type 2	Medium-Tech Type 3	Medium-Tech Type 4
Description	Clinical spaces containing consulting/ exam/ treatment work areas and critical care areas which are occupied 24 hours a day.	Clinical spaces containing treatment work areas which are occupied during the day only.	Clinical spaces containing consulting work areas which are occupied during the day only.	Clinical spaces containing beds ranging from single bedrooms to multiple patient units in wards. This space-type includes bed and sanitary facilities, and patient support facilities and are occupied 24 hours a day.
Space Occupied Schedule	24/7	7 am to 8 pm	7 am to 8 pm	24/7
Ventilation	10 ach	10 ach	6 ach	6 ach
Lighting (W/m²)	7.7	7.7	7.7	7.7
Lux	500	500	500	300
Daylight Control	No	No	No	Yes
Occupant Light Control	No	No	No	No
Equipment (low/high) (W/m²)	10/19	10/19	10/19	10/22
Occupancy (ppl/m²)	0.07	0.07	0.07	0.175
Setpoints heating/cooling	21/25	21/25	21/25	20/26
Hot Water Demand (high/low) (l/d/m²)	0.21/1.05	0.21/0.525	0.21/0.525	2.18/3.46

Conclusions

- + Whilst providing optimum conditions for service users uses energy, this is small compared to overall building energy consumption and the potential savings associated with net zero carbon design.
- + Implementing the NHP NZC from project inception is key to meeting the mandatory requirements
- + Achieving low energy, low cost operations must be planned from design with controls and building management systems built in.



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