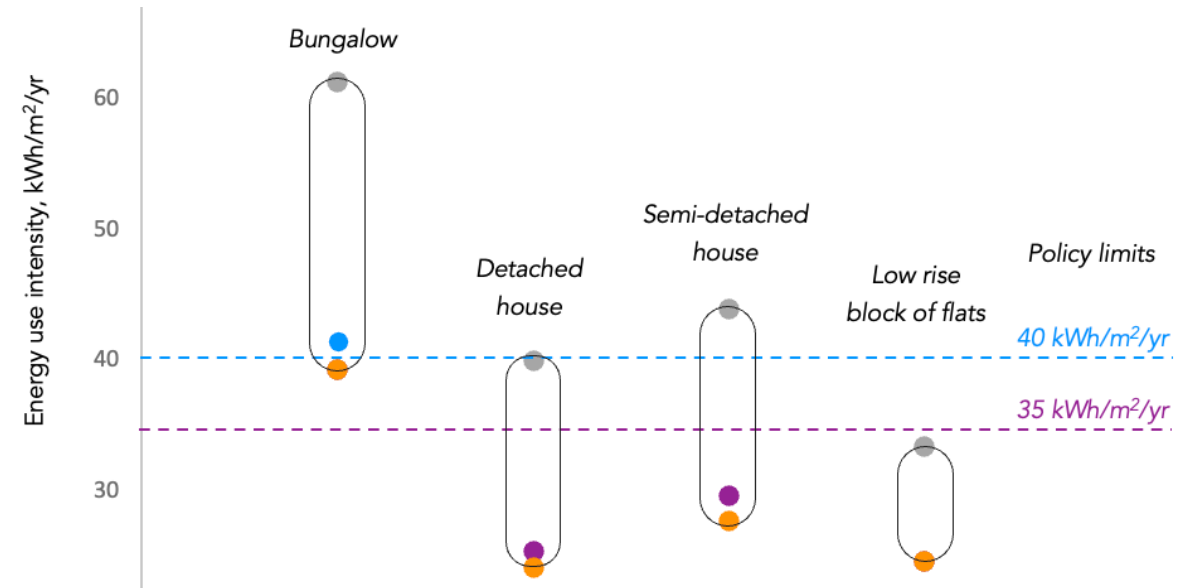


GLOUCESTERSHIRE LOCAL PLANS NET ZERO EVIDENCE BASE



NET ZERO CARBON PLANNING POLICY: EVIDENCE FOR GLOUCESTERSHIRE'S LOCAL PLANS ER2 - OPERATIONAL ENERGY MODELLING

September 2026 | P02

ER 2: Feasibility of net zero operational carbon policy

Introduction

This technical evidence base has been commissioned by Climate Leadership Gloucestershire on behalf of Gloucester City Council, Cheltenham Borough Council, Tewkesbury Borough Council, Forest of Dean District Council and Stroud District Council, to support the introduction of operational energy policies in new local plans.

Bioregional and Etude have been jointly commissioned to undertake this work in two distinct workstreams:

- ER 1: Identifying the basis for the level of climate action in local plans (led by Bioregional) – separate document.
- ER 2: Feasibility of net zero operational carbon policy (led by Etude) - this document.

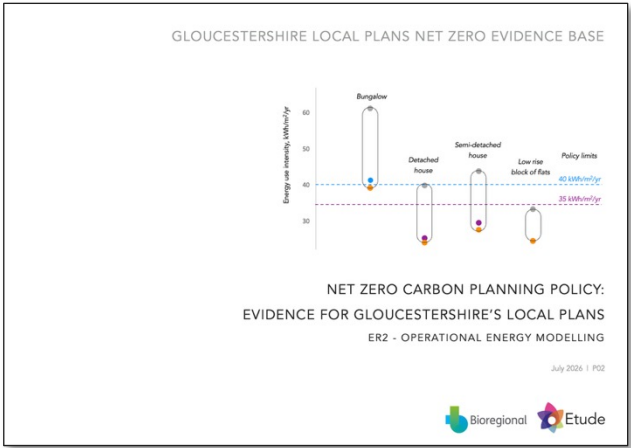
Document quality control

Issued by:	Anna MacKenzie, Etude
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Revision history

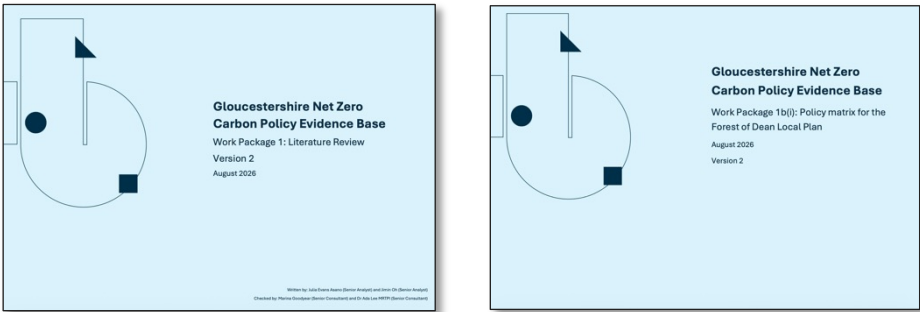
P01	23/07/2026	Draft issue to team (note: full QA pending, quoted figures subject to change)
P02	08/09/2026	Final issue Minor edits from QA process Addition of non-residential policies section

This document



ER 2: Feasibility of net zero operational carbon policy (led by Etude)

Separate documents



ER 1: Identifying the basis for the level of climate action in local plans (led by Bioregional) – separate documents. Forest of Dean, Stroud and the Shared Local Plan (Cheltenham, Gloucester and Tewkesbury) have their own versions of each of the above documents.

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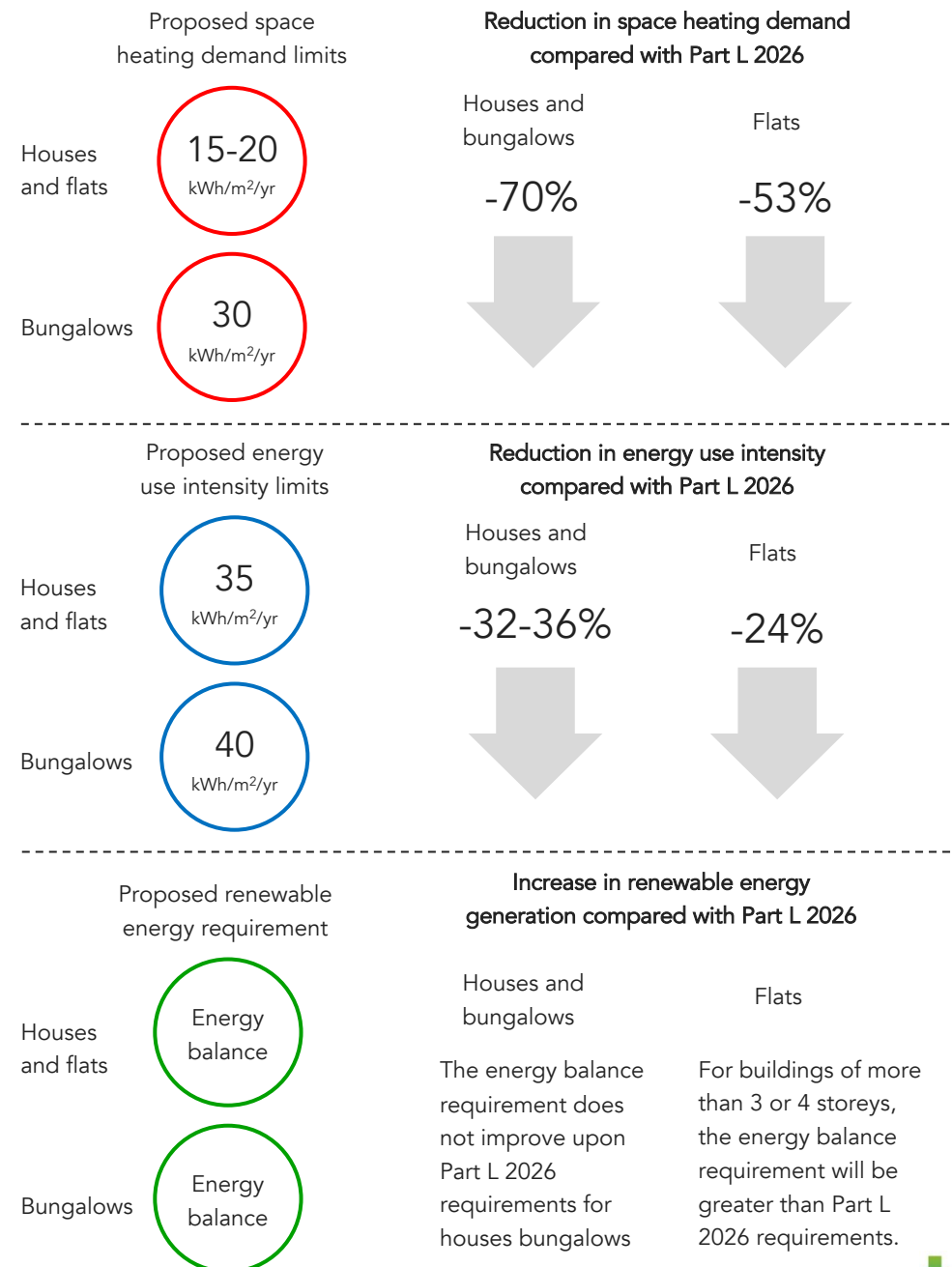
Appendices, including:

- Specifications for each typology
- Space heating demand calculations assumptions
- Solar PV assumptions
- Precedents: other adopted and emerging Local Plans with similar energy policies

A 5-minute summary

- The proposed operational energy policies present many benefits to supplement building regulations. This includes: reduced energy consumption and energy costs for occupants; a more comfortable and healthy home (improved air-quality, reduced drafts and greater acoustic comfort); more resilience to energy prices; reduced impact on the electricity grid; the ability to measure and compare in-use performance with design objectives.
- Ambitious yet achievable operational energy policy limits have been set, informed and tested by this energy modelling exercise.
- Four residential typologies have been modelled: a bungalow; a detached house, a semi-detached house and low-rise flats.
- We have taken the approach of defining the maximum-minimum feasible range of performance to assess where in this range the policy options sit. This helped us see both the feasibility and the relative ambition of the proposed policies.
- We tested two policy options:
 - Space heating demand of 15-20 kWh/m²/yr plus an energy use intensity (EUI) of 35 kWh/m²/yr.
 - Space heating demand of 30 kWh/m²/yr plus an energy use intensity (EUI) of 40 kWh/m²/yr.
- As a result of the energy modelling analysis, a differentiated policy limit approach was selected. All dwelling types have ambitious space heating demand and energy use intensity limits set but the bungalows have different limits to account for their relatively high heat loss areas, which made the lower space heating demand limits more challenging to achieve with standard construction methods.

An overview of how the proposed policies compare with building regulations requirements is summarised on the right.



1.0 Setting the context

The objectives of this study

The objectives of this study

The objectives of this study are twofold:

- 1) To provide a technical evidence base to support operational energy policies for local councils in Gloucestershire
- 2) To support the CLG in determining operational energy policy limits that meet their ambition and are practical and deliverable.

This evidence base supports the development of new local plans

This evidence base will support the the new local plans being developed by:

- **Cheltenham Borough Council, Gloucester City Council and Tewkesbury Borough Council**, are currently developing their new shared Strategic Local Plan.
- **Stroud District Council** are developing their new local plan.
- **Forest of Dean District Council** are also in the process of developing a new local plan.

Climate Leadership Gloucestershire (CLG)

The five councils listed above form part of Climate Leadership Gloucestershire (CLG), together with Gloucestershire County Council, and other public sector organisations.

CLG have defined clear ambitions and priorities. These are presented on the following page.

Gloucester
City Council



This evidence base has been commissioned by Climate Leadership Gloucestershire on behalf of Gloucester City Council, Cheltenham Borough Council, Tewkesbury Borough Council, Forest of Dean District Council and Stroud District Council.

How long will this evidence document stay relevant for?

- Different local authorities' local plans are at different stages of development and therefore this evidence base will be drawn upon at different times over the coming five years or so.
- The energy modelling and performance of the policy compliant scenarios will not change in that timeframe.
- The "maximum feasible" performance assessment is not likely to change significantly in this timeframe.
- Part L 2026 building regulations baseline will be relevant until at least 2030 and likely longer. If Part L is updated the baseline should be updated.
- SAP 10.3 (the methodology for determining the building regulations compliant baseline specification) will be replaced by the Homes Energy Model (HEM) by 2029. Therefore it's possible the baseline may change.
- Capital costs and running costs change on a quarterly basis and should be done close to the point at which they are needed. They are not included in this study.

The CLG's aspirations and goals

Climate Leadership Gloucestershire's (CLG) aspirations and goals

One of the key actions for CLG under the focus area of planning was 'agreeing a framework of climate change policies which are of the highest level of ambition possible', as agreed by CLG board members on 8th December 2025.

- Becoming net zero
- Becoming climate resilient
- Restoring and enhancing nature

The CLG's statement of ambition

The below statement of ambition was agreed by CLG members and planners at a workshop on 5th February 2026:

"Striving to **deliver the highest possible level of ambition** within planning policy to drive transformative climate action. Using an **approach which supports wider policy priorities** such as the **reduction of social and health disparities** and **supporting sustainable economic growth**. We shall do this through promoting key planning priorities to deliver consistent and aligned planning approaches and policy across all authorities"

CLG Priority no. 1: Zero Operational Carbon of new developments.

Listed as item number one in the CLG's priorities is the 'Zero operational carbon of new developments'. The priority considerations and best practice requirements identified include:

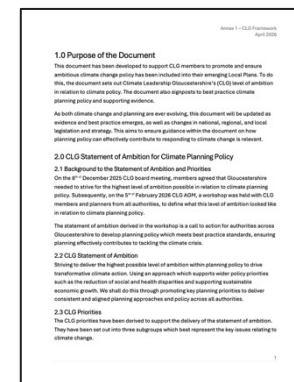
- Setting standards for net zero buildings using local energy efficiency standards
- Calculation of energy use intensity (EUI)
- Adopting a fabric first approach with maximum ambition for space heating demand
- Requiring that developments provide renewable energy that can meet the EUI.

This study covers:

- Operational energy policies for addressing climate change.

This study does not cover:

- The topic of embodied or whole life carbon.
- Capital costs of achieving the policy limits proposed.
- Comparison of energy / running costs for residents between scenarios.
- Retrofit
- Non-domestic buildings.
- Climate change adaptation



Climate Leadership Gloucestershire (CLG) developed the CLG Framework in April 2026, a document which lays out the ambition and priorities of the CLG with respect to Climate Policy. It is a dynamic and evolving document which will be updated as evidence and best practice emerge.

This evidence base responds directly to priority number 1: zero operational carbon of new developments.

Ambitious yet achievable operational energy policy limits have been set

A proposed policy that responds to the CLG's ambitions

Our energy modelling and technical feasibility work presented in this report respond directly to the CLG's priority of setting standards for Zero Operational Carbon new developments in local planning policy.

There is a strong precedent of successful operational energy policies

A number of local authorities across England have set operational energy policies within their local plan. Many of these have been adopted and are in operation, many others are at examination or in draft form (see Appendix E).

Planning Inspectors have been supportive of operational policies, as evidenced by the selection of comments presented in Appendix E.

Policy limits informed by pragmatic energy modelling

The proposed policy limits were developed in conjunction with the CLG and reflect a high-level of ambition paired with pragmatism and consideration of what is practically achievable for developments at scale.

The energy modelling results presented in the following section were directly used to inform the policy approach presented here on the right.

A differentiated limit approach was the client's preferred option. This accounts for how bungalow typologies typically find it more challenging to achieve the more ambitious limits set for houses and flats.

The space heating demand limit for houses and flats is expressed as a range to reflect how the highest level of ambition is expected, but the target acknowledges that this is ambitious and may not be achievable for all dwellings.

	Space heating demand limit	Energy use intensity limit	Renewable energy requirement
Houses and flats	15-20 kWh/m ² /yr	35 kWh/m ² /yr	Energy balance
Bungalows	30 kWh/m ² /yr	40 kWh/m ² /yr	Energy balance

The proposed policy limits developed in conjunction with the CLG and reflect a high-level of ambition pair with pragmatism and consideration of what is practically achievable for developments at scale.

2.0 Introduction to operational energy policies

Operational energy policies vs building regulations Part L

What is building regulations Part L?

All buildings in England are required by law to comply with building regulations. Building regulations Approved Document L (Part L) is the part of the building regulations concerned with energy and carbon in buildings. It is primarily a compliance tool rather than a design tool.

The current version of Part L is Part L 2021. This will be replaced by Part L 2026 (the Future Homes Standard) on 24th March 2027. Our modelling and analysis in this report uses compliance with Part L 2026 as the baseline.

There are four key metrics that a dwelling must meet or improve upon. These are: the new functional renewable energy requirement; the Target Emissions Rate; Target Primary Energy Rate (TPER) and Target Fabric Energy Efficiency (TFEE).

Building regulations metrics only account for a proportion of energy use (regulated energy) and do not consider unregulated uses (appliance use and cooking). In addition, it does not reflect actual energy used in the building and cannot be verified in use.

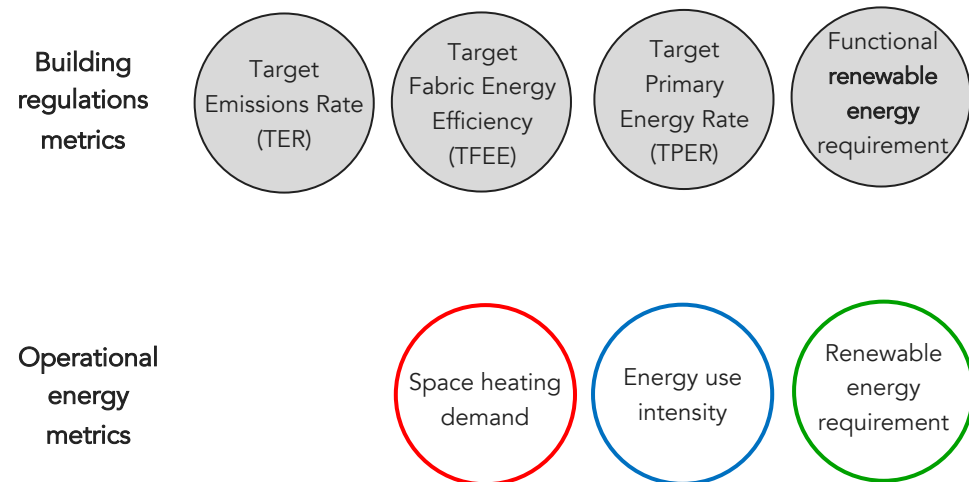
What are operational energy policies?

Operational energy policies relate to the actual energy likely to be required to heat and run the building, or the actual renewable energy generated.

There are three key metrics for operational energy: space heating demand (SHD); energy use-intensity (EUI); and renewable energy generation.

The EUI of the building can be measured in practice through taking meter readings and dividing the annual energy use by the internal floor area of the building (but energy used for EV charging must be subtracted first).

Operational energy metrics are suitable for determining alignment with net zero carbon objectives. The key differences between building regulations metrics and operational energy metrics are listed on the following page.



The four building regulations metrics (Part L 2026): the metrics are relative to a “notional” building and do not relate to actual energy used.

The three operational energy metrics are recommended by industry and have been adopted by many local plans in England. These are measured in kWh/m²/yr and can be verified in use through meter readings.

Part L 2021 to Part L 2026 transitional arrangements

Part L 2021 will be replaced by Part L 2026 (the Future Homes Standard) on 24th March 2027. There will be a transition period whereby full designs submitted to building control before this date will be able to remain under Part L 2021, provided they have been built up to at least the ground floor level by 24th March 2028.

Taller buildings, those above 18m or with seven or more storeys, will have a further six months to comply with the new Part L 2026 standard (i.e. from 24th September 2027).

Operational energy policies vs building regulations Part L: a summary

	Building Regulations (Part L 2026)	Operational energy metrics
Metrics used	- Target Emissions Rate (TER) (CO₂) - Target Fabric Energy Efficiency Rate (TFEE) (TBC) - Primary Energy Rate (PER) (TBC) - Renewable energy functional requirement The TER, TFEE and PER are relative metrics, they will change from building to building. And for the same building, will change from one revision of Part L to the next. It does not predict actual CO₂ emissions (or energy use).	Absolute energy metrics: - Space Heating Demand (kWh/m²/yr) - Energy Use Intensity (kWh/m²/yr) - Renewable Energy generation (kWh/m²/yr)
Definition of "net zero"	100% reduction on the Target Emissions Rate (TER) But TER only accounts for regulated energy (see below).	Energy balance (annual energy consumption = annual renewable energy generation).
Regulated energy included?	- space heating - ✓ - hot water ✓ - pumps and fans ✓ - Lighting ✓	- space heating ✓ - hot water ✓ - pumps and fans ✓ - Lighting ✓
Unregulated energy included?	- Cooking ✗ - Appliances ✗ Unregulated energy can account for 50% of energy in low-energy dwellings.	- Cooking ✓ - Appliances ✓
Renewable energy included?	Yes. The provision of renewable energy is a mandatory requirement of Part L 2026. The required provision is based on the ground floor area (GFA) of the building (approximately equal to 40% GFA but will vary depending on various factors).	Yes. Renewable energy generation has its own metric so it is clear to see what contribution is being made.
Embodied carbon included?	Additional policy mechanism required.	Additional policy mechanism required.
Calculation methodologies	Calculation through National Calculation Methodology compliance tools: Standard Assessment Procedure (SAP 10.3) or the forthcoming Home Energy Model (HEM) for dwellings.	Calculation through design tools: Passive House Planning Package (PHPP) for dwellings.
Does it promote good building design?	No. The benefits of building design and orientation is not captured in building regulations assessment methodologies (except in the case of renewable energy provision)	Yes. The significant impacts that building design and orientation have on energy use are captured through the space heating demand metric and the use of accurate calculation methodologies.
Can it be verified or measured in operation?	No. Abstract metrics and only accounting for regulated energy means that this does not be checked in operation.	Yes. The EUI can be calculated by reading the energy used at the main electricity meter and dividing it by the floor area of the building.

Operational energy metrics explained

Space heating demand

Space heating demand measures the amount of energy needed to heat a home or building. A space heating demand policy mandates a minimum level energy efficiency of the building fabric. It is affected by form, exposure, air-tightness, orientation as well as the insulation and window selection. It is independent of which heating system is used, but the type of ventilation system used will impact it. The Climate Change Committee recommends a space heating demand of less than 15-20 kWh/m²/yr for new homes.

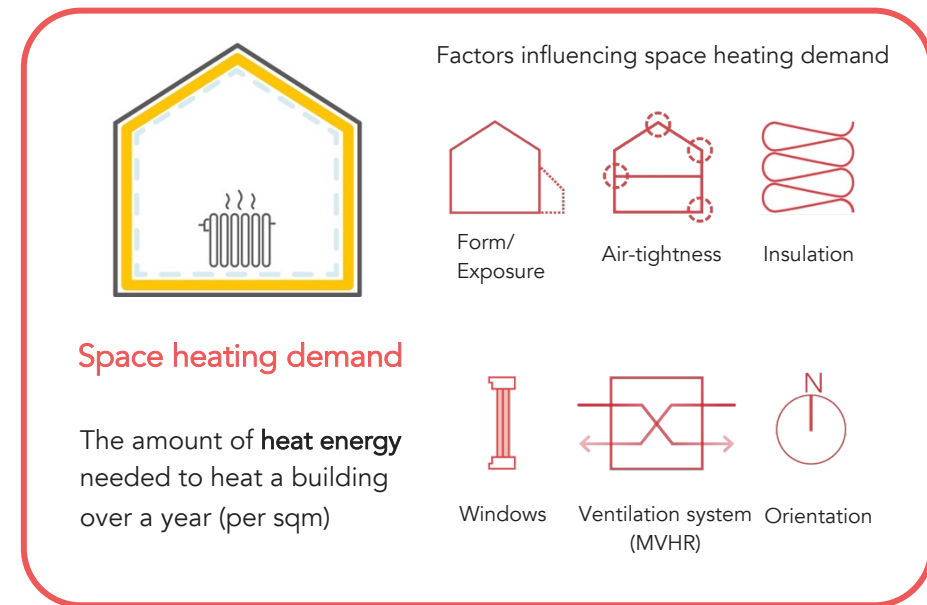
Energy Use Intensity (EUI)

The Energy Use Intensity (EUI) represents the total amount of energy used by a building divided by its floor area (GIA). It is reported in kWh/m².year. It can be checked in operation through meter readings.

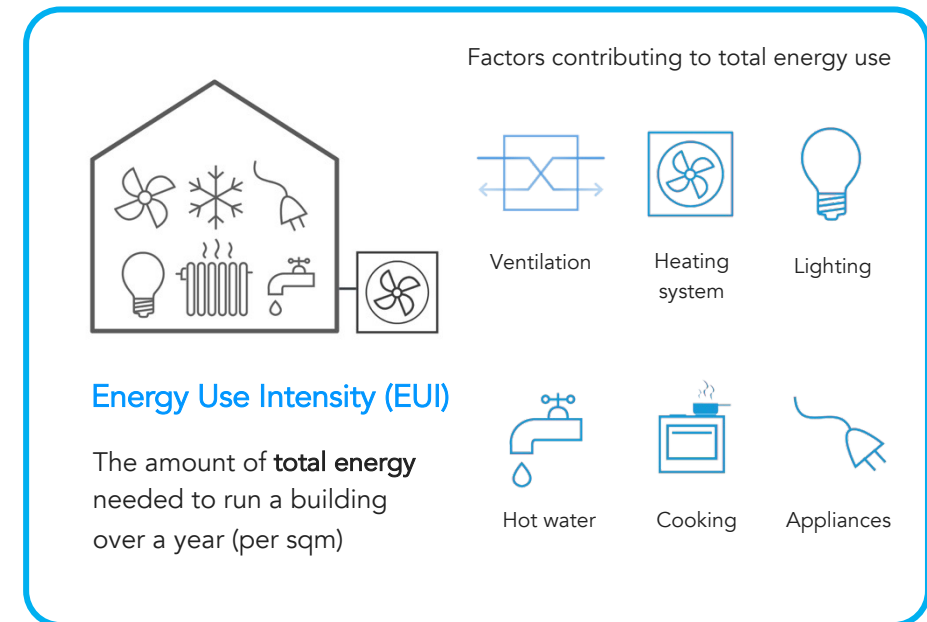
Renewable energy

A renewable energy balance is achieved when a building generates the same amount of renewable energy over the course of a year as it uses in a year. It is reported in kWh/m²(GIA)/yr. This will require a certain amount of installed renewable energy generation (usually photovoltaics). The more energy efficient the building, the less renewable energy is required to achieve an annual energy balance. A renewable energy balance is possible for buildings up to 4 or even 5 stories providing they have been designed efficiently and with maximum renewable energy generation in mind.

In the summer months buildings with enough renewable energy to achieve an 'energy balance' are likely to be net exporters of renewable energy to the national grid. In winter months they are likely to be net importers of renewable energy. In this way buildings can become an important part of the continued decarbonization of our electricity grid.



The space heating demand metric



The Energy Use Intensity (EUI) metric

3.0 Energy modelling results

Our energy modelling methodology and principles

What is energy modelling?

Energy modelling is the process by which we analyse the design of a dwelling using a methodology that is capable of predicting the likely energy consumption of that particular dwelling.

Each energy model is specific to a particular design. Each model considers construction type, insulation (u-values), window sizes and location, building form and orientation. Location specific weather and overshadowing are also considered.

Our energy modelling principles

Etude's stock models form the basis of our energy modelling exercises. They have been intentionally set up to adopt a consistent, defensible and evidenced approach to modelling. They generally adopt methods of construction that are being used to build housing at scale in the UK.

As experienced designers of low energy and Passivhaus buildings, we know that the best outcomes are achieved if the fundamentals of the building are optimized to improve energy efficiency. However, the stock models that we use in evidence base work are based on designs from large housing developments and are NOT optimised for energy performance. This approach assumes that the designs have been developed to be buildable at scale, using materials and skills that are readily available in the market. The performance achieved is therefore conservative.

Construction materials

Masonry cavity wall construction and beam and block floors are very common in UK housing. While other construction methods, such as timber frame, may have the potential to achieve better U-values, air tightness and thermal bridging. Supply chains and skills resources are based on the more traditional approaches so it is likely that this will change only very slowly.



Beam and block floor construction has been assumed in our calculations.



Masonry wall construction has been assumed in our calculations.



Cold roof construction has been assumed in our calculations.

The four residential typologies modelled

The four residential typologies

We have modelled four residential typologies to understand the operational energy performance of different types of dwellings. These have been selected from actual planning applications and represent typical developer designs.

- The semi-detached **bungalow** represents a common bungalow typology used today by developers. Its relatively small size and high form factor place it at one end of the heat loss spectrum.
- The **detached house** is a common typology. This design represents the more varied designs of this dwelling type.
- The **semi-detached house** is a very common typology. The relatively simple form is typical of a developer design.
- The **low-rise block of flats** is a common typology in urban areas.

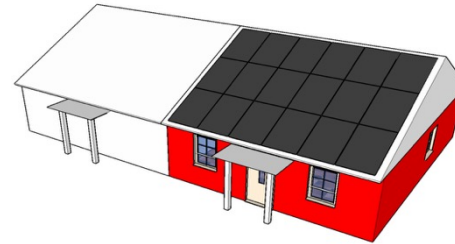
Every dwelling and design will perform differently

A number of different factors affect the energy performance of a dwelling, including:

- **Orientation** – how much sun, or solar gain, the dwelling captures.
- **Level of overshadowing** – more overshadowing increases the heating needs of the home.
- **Form factor** – this is a measure of the ratio of internal heated volume vs the area of external envelope that heat is lost through. A lower form factor is more efficient.
- **Exposure** – exposure to weather impacts space heating demand.
- **Design** – the size and location of windows
- **Insulation** – depth of insulation is included in floors, walls and roof.
- The **efficiency** of heating and ventilation systems.

Therefore, in practice, each building will have its own unique set of factors that will contribute to it performing differently to the next. The results presented in this report are therefore only indicative of how each typology will perform in practice.

Bungalow (semi-detached)



Gross Internal Area (GIA): 54.5 m²
Ground Floor Area (GFA): 54.5 m²
No. storeys: 1
No. units: 1
Orientation: SW
Form factor: 4

Detached house



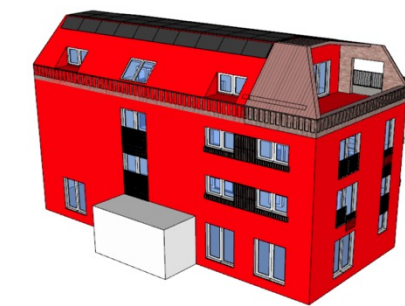
Gross Internal Area (GIA): 142 m²
Ground Floor Area (GFA): 71 m²
No. storeys: 2
No. units: 1
Orientation: SW
Form factor: 3.14

Semi-detached house



Gross Internal Area (GIA): 93 m²
Ground Floor Area (GFA): 46.5 m²
No. storeys: 2
No. units: 1
Orientation: SW
Form factor: 2.94

Low-rise block of flats



Gross Internal Area (GIA): 649 m²
Ground Floor Area (GFA): 162 m²
No. storeys: 4
No. units: 7
Orientation: SW
Form factor: 2.48

Our energy modelling scenarios

The scenarios we have modelled

We have modelled three scenarios:

- a baseline consistent with a Part L 2026 compliant dwelling,
- a proposed net zero policy compliant dwelling.
- a “maximum feasible” specification scenario.

The “maximum feasible” specification has been included to illustrate what can be achieved in commercial construction using readily available components. This gives us visibility on how the proposed net-zero policy compares with best-practice.

See table opposite for more details on each scenario. The resultant specifications for each typology to meet each scenario can be found in the Appendix A1 to A4.

The typologies we have modelled.

We have modelled a bungalow, a detached house, a semi-detached house and a low-rise block of flats. See previous page for details.

Our methodology and modelling software

Energy modelling has been undertaken using PHPP 10.6 and SAP 10.3.

(At the time of undertaking this study the Home Energy Model - or HEM – has not yet been released).

Solar PV requirement and generation

The required kWp for Part L 2026 compliance has been calculated using the Part L 2026 methodology.

The actual annual output has been calculated by taking the required kWp for compliance and using the Photovoltaic Geographical Information System (PVGIS), which accurately predicts actual electricity generation based on location (Gloucester in this case). We use this for energy balance purposes.

Scenarios modelled			Description
	00 Baseline	Future Homes Standard / Part L 2026 compliant specification	- Fabric and services – typical developer spec to “just pass” Part L 2026 (see Appendix A0 for rationale). - Solar PV generation as per minimum Part L 2026 functional requirement – see appendix for details.
	01a (bungalow)	Net zero policy compliant	- Fabric and services – to meet the proposed net policy limits illustrated below. - Solar PV generation – to meeting the larger of the following requirements: - minimum Part L 2026 functional requirement - Energy balance (as per proposed net zero policy)
	+ 01b (houses and flats)		
	02	“Maximum feasible” scenario	- Fabric and services – set to the “maximum feasible” specification likely to be achievable commercially, using readily available components. - Solar PV generation – maximum solar PV installation feasible on the roof of the dwelling.

Summary of the energy performance scenarios we have modelled.

	Space heating demand limit	Energy use intensity limit	Renewable energy requirement
Houses and flats	15-20 kWh/m ² /yr	35 kWh/m ² /yr	Energy balance
Bungalows	30 kWh/m ² /yr	40 kWh/m ² /yr	Energy balance

Summary of the policy limits modelled for Scenarios 01a and 01b. The proposed policy limits were developed in conjunction with the CLG and reflect a high-level of ambition paired with pragmatism and consideration of what is practically achievable for developments at scale.

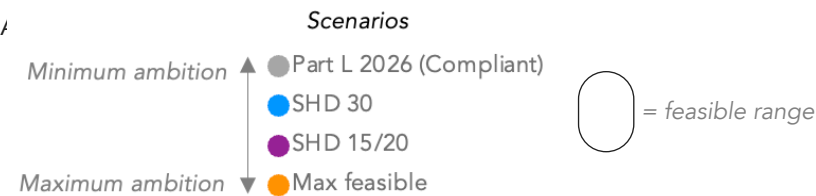
How to read our energy modelling results

How to read the energy modelling results

The same style of graph is used on the following pages to demonstrate the energy modelling results for each of the three policy metrics: space heating demand; energy use intensity and renewable energy generation.

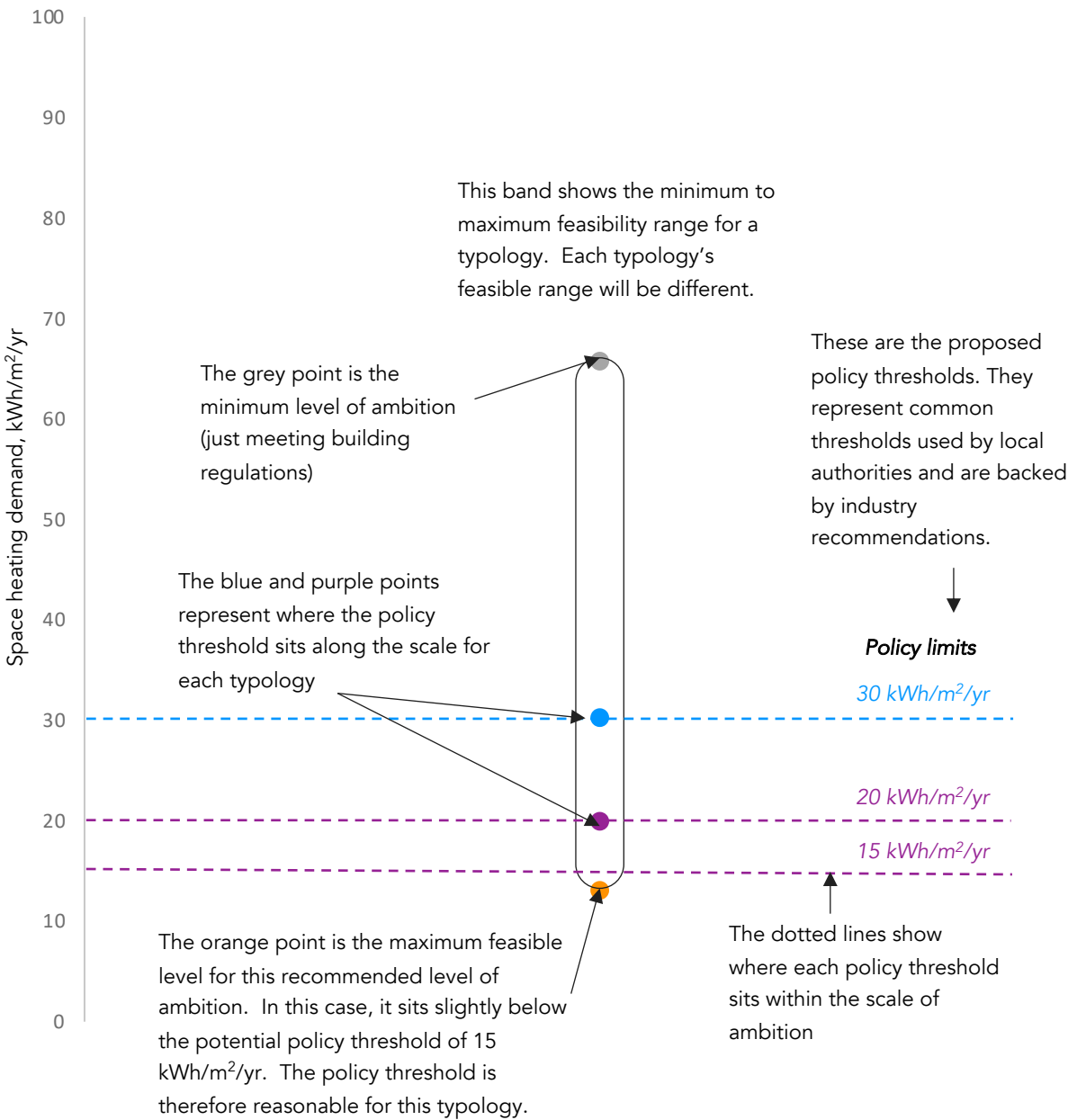
The graphs show the minimum-maximum range of ambition (described in our methodology of page 16).

The graphs allow us to see where along the scale of feasibility (from building regulations minimum to best practice) the suggested policy thresholds lie. They can inform us when a policy threshold may be too high for a given typology, or when it may not be ambitious enough.



Space heating demand (SHD), kWh/m ² /yr			
Scenario		Typologies	
		Detached	
● 0	Part L 2026 (Compliant)	66.5	
● 1a	SHD 30	30.0	
● 1b	SHD 15/20	20.0	
● 2.0	Max feasible	15.1	

The tables on each page show the same data visualised in the graph.



The graph shows the minimum-maximum range of ambition feasible for each typology.

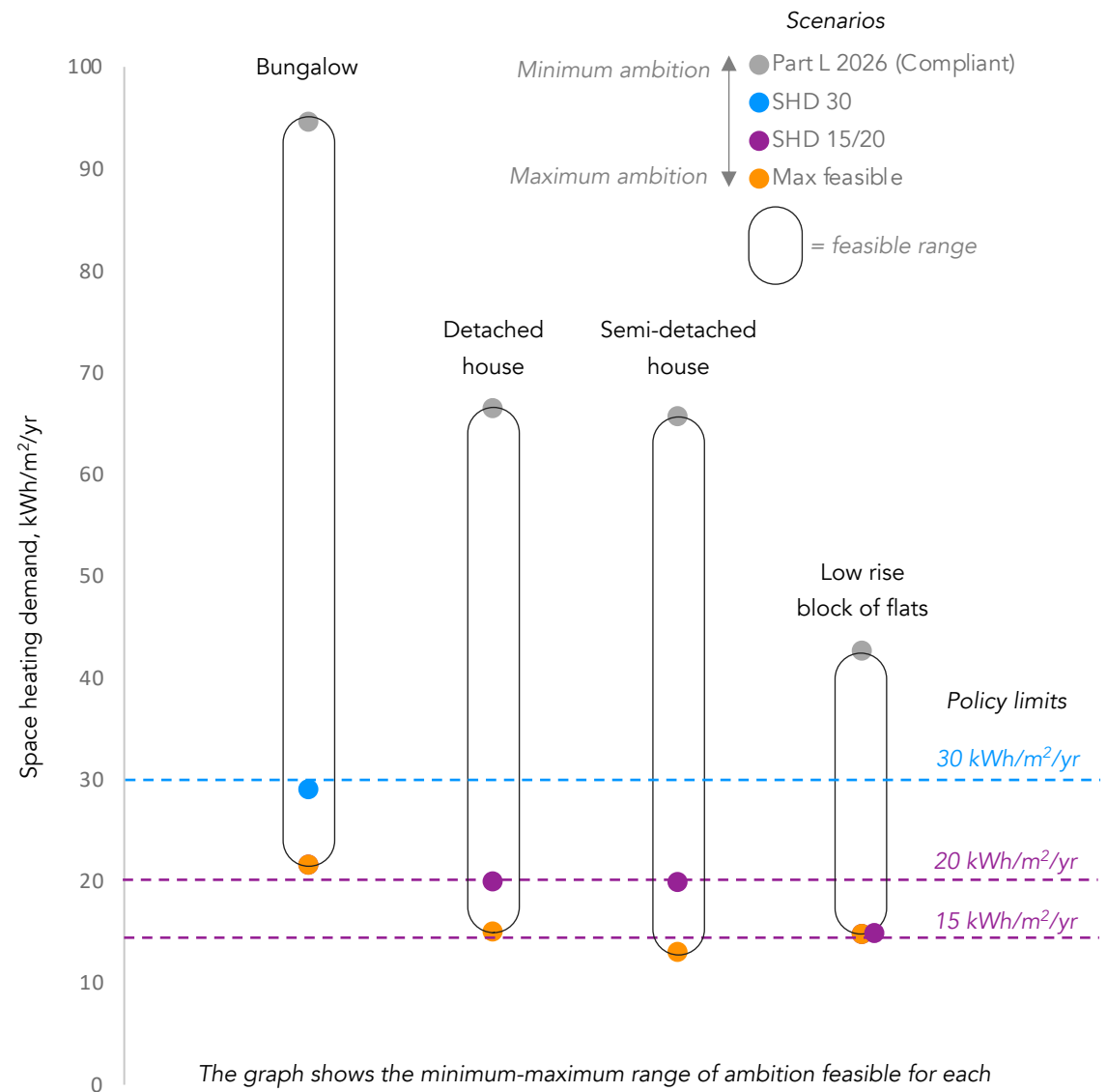
Energy modelling results – Space heating demand (SHD)

The scenarios we have modelled

The proposed net zero policy has been compared with:

- The baseline Part L 2026 compliance scenario, and
 - The “maximum feasible” scenario.
- The proposed net zero policy achieves a significantly improved space heat demand compared with a Part L 2026 compliant scenario for all four typologies.
 - The proposed space heating demand limit of **30 kWh/m²/yr** for the **bungalow** is set at the right level (a limit of 15 or 20 kWh/m²/yr exceeds the “maximum” feasible for this typology).
 - The proposed space heating demand limit of **15-20 kWh/m²/yr** for **houses and flats** is set at the right level. It represents best practice but allows some flexibility where needed (for example where dwellings are small, are detached or are overshadowed).

Space heating demand (SHD), kWh/m ² /yr			Typologies			
Scenario			Bungalow	Detached	Semi-detached	Low-rise
● 0	Part L 2026 (Compliant)		94.6	66.5	65.7	42.6
● 1a	SHD 30		29.0	/	/	/
● 1b	SHD 15/20		/	20.0	19.9	14.8
● 2.0	Max feasible		21.7	15.1	13.1	14.8



The graph shows the minimum-maximum range of ambition feasible for each typology. The minimum ambition is determined by meeting building regulations Part L 2026. The maximum ambition is determined by maximum fabric and services efficiencies likely to be commercially deliverable.

Energy modelling results – Energy use intensity (EUI)

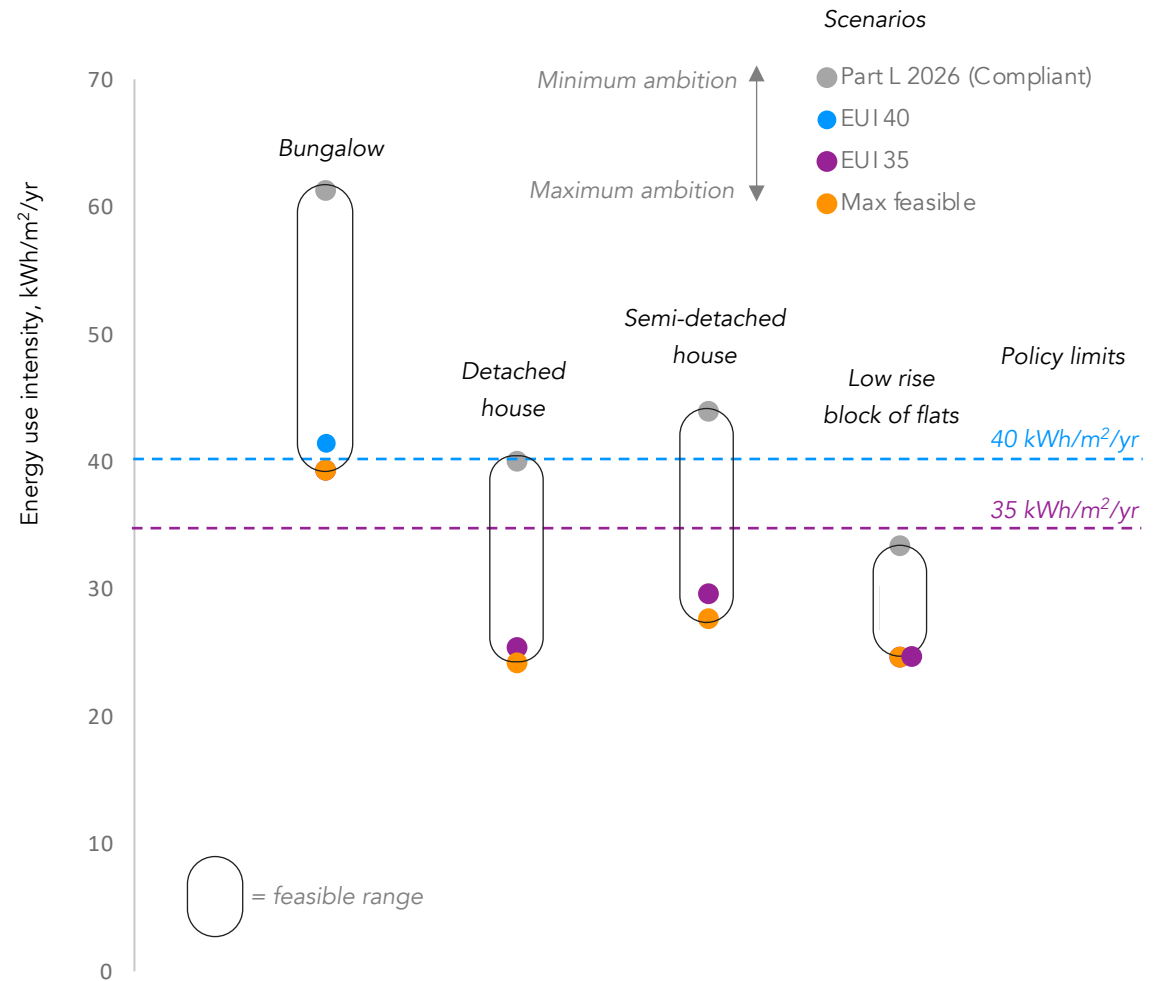
The scenarios we have modelled

The proposed net zero policy of EUI 35 kWh/m²/yr for houses and flats, and EUI 40 for bungalows has been compared with:

- The baseline Part L 2026 compliance scenario, and
 - The “maximum feasible” scenario.
- The proposed net zero policy achieves a significantly improved EUI compared with a Part L 2026 compliant scenario for the bungalow and house typologies. For the flats, the EUI is low even with the Part L 2026 scenario.
 - The proposed EUI limit of 40 kWh/m²/yr for the bungalow is slightly exceeded in the specification modelled. We can see however that it is possible to meet the limit set (as seen in the “maximum feasible” scenario).
 - The proposed EUI limit of 35 kWh/m²/yr is set at the right level for houses and flats. It is comfortably met in the modelled policy scenarios.

Energy Use Intensity (EUI),
kWh/m²/yr

			Typologies			
Scenario			Bungalow	Detached	Semi-detached	Low-rise
●	0b	Part L 2026 (Compliant)	61.3	40.0	44.0	33.4
●	1a	SHD 30	41.4	/	/	/
●	1b	SHD 15/20	/	25.4	29.7	24.7
●	2.0	Max feasible	39.3	24.2	27.7	24.7



The graph shows the minimum-maximum range of ambition feasible for each typology. The minimum ambition is determined by meeting building regulations Part L 2026. The maximum ambition is determined by maximum fabric and services efficiencies likely to be commercially deliverable.

Energy modelling results - Renewable energy

The scenarios we have modelled

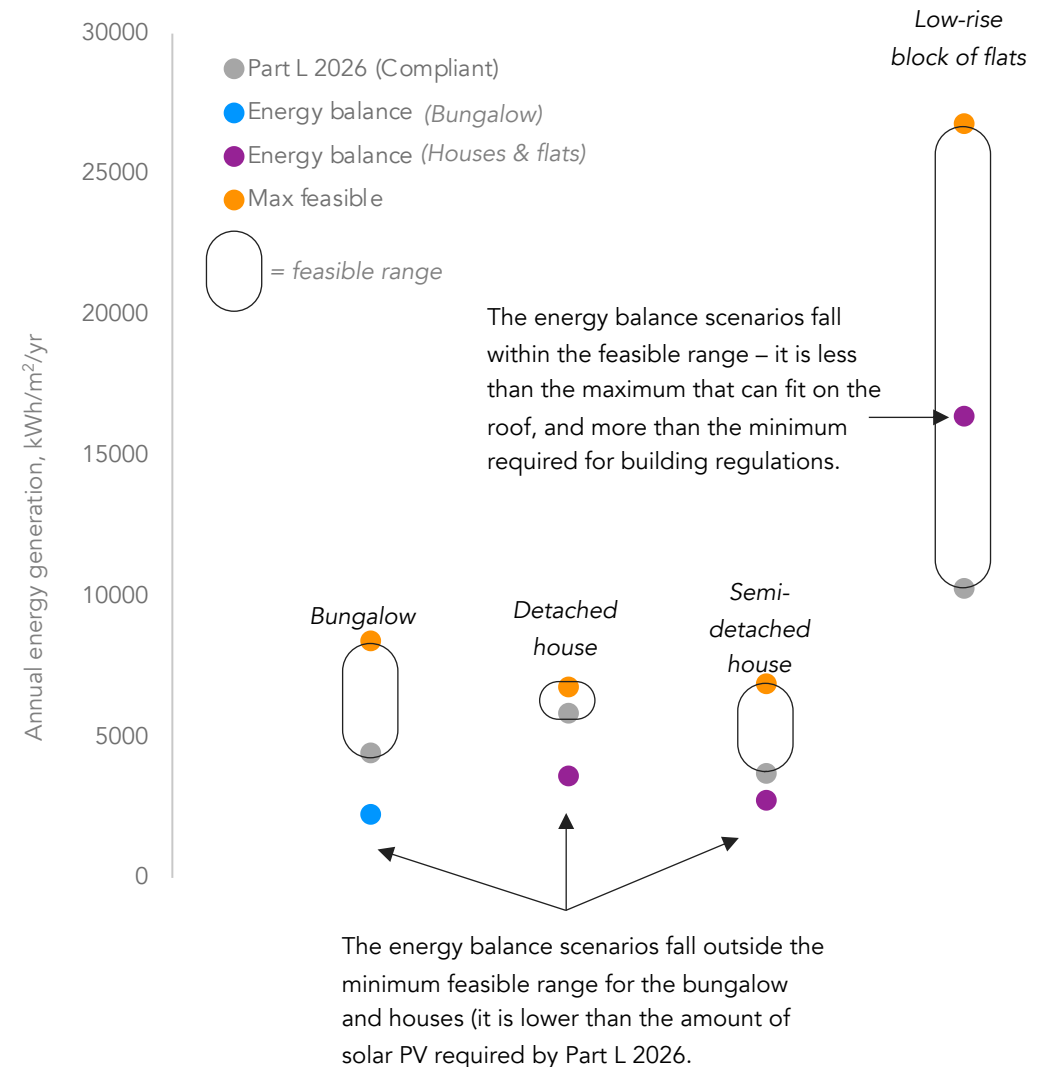
The proposed net zero policy of providing enough renewable energy to match that of annual energy demand of the dwelling (energy balance) has been compared with:

- The baseline Part L 2026 compliance scenario
- The "maximum feasible" scenario.

For renewable energy we see a different pattern emerging. The modelling results show that:

- For the bungalow and house typologies the Part L 2026 requirement is more ambitious than the policy requirement
- For the low-rise flat typology the energy balance requirement is larger than the Part L 2026 requirement.
- The "maximum feasible" scenario shows that all typologies can comfortably accommodate the amount of solar PV required from both the Part L 2026 functional requirement and the energy balance requirement in the policy scenario.

Renewable energy generation, kWh/m ² /yr			Typologies			
Scenario			Bungalow	Detached	Semi-detached	Low-rise
● 0b	Part L 2026 (Compliant)		4,436	5,842	3,709	10,725
● 1a	Energy balance (SHD 30)		2,257	/	/	/
● 1b	Energy balance (SHD 15-20)		/	3,618	2,762	16,394
● 2.0	Max feasible		8,405	6,782	6,886	26,804



The graph shows the minimum-maximum range feasible for each typology. The maximum is determined by the size of solar PV array that can physically fit on the roof. The minimum allowable ambition is determined by meeting building regulations Part L 2026.

4.0 Summary of residential energy modelling results and policy recommendations

Why Gloucestershire's local plans should set residential operational energy targets: **space heating demand**

The proposed policy delivers a significantly lower space heating demand

The proposed policy will require homes to achieve a space heating demand of 15-20 kWh/m²/yr (or 30 kWh/m²/yr in the case of bungalows).

A lower space heating demand brings many co-benefits

Space heating demand is a measure of how well insulated a building is, and how efficiently it is ventilated.

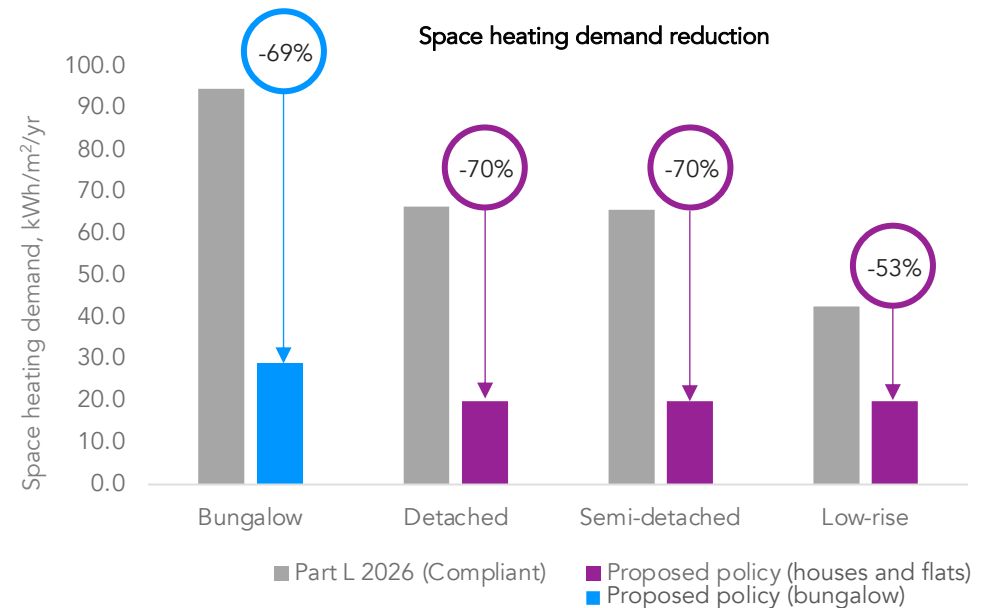
To achieve the space heating demand targets required by the proposed policy, the baseline building specification is upgraded as follows:

- Better insulated walls, roofs and floors – this will reduce the risk of condensation and mould;
- Triple glazed windows (rather than double glazed) – this will reduce cold drafts and reduce the risk of condensation and mould;
- Excellent levels of air-tightness – this will further reduce drafts and improve comfort;
- Mechanical ventilation with heat recovery (MVHR), a ventilation system that efficiently recovers heat from outgoing air. Incoming air is filtered and pre-heated – this will deliver improved indoor air quality and comfort.

More flexibility and more resilience

A more insulated, more air-tight dwelling loses heat much more slowly and requires much less heat to keep warm. Therefore:

- A home with a very low space heating demand will give occupants the option to use their heat pumps flexibly and save money – running them when electricity is cheap and avoiding peak times.
- Occupants will be less exposed to increases in energy costs.
- Homes will be more resilient in the case of any power outages and extreme cold weather.



% reduction in space heating demand delivered by the proposed policy compared with building regulations minimum (Part L 2026)



The proposed policy limits for space heating demand, differentiated for bungalows to account for their high proportion of heat loss envelope compared with volume of heated space.

Why Gloucestershire's local plans should set residential operational energy targets: **energy use intensity (EUI)**

The proposed policy delivers lower overall energy demand

Energy use intensity reflects the total energy use of a building. The proposed policy will require homes to achieve an energy use intensity (EUI) of 35 kWh/m²/yr (or 40 kWh/m²/yr in the case of bungalows).

Lower total energy use will lead to lower energy bills

The total energy use of a building directly impacts running costs and energy bills. Taking a simplistic view, a home that uses 30% less energy will cost 30% less to run. However, the presence of solar PV also has a big impact on energy costs and can further reduce energy costs.

Homes with lower space heating demands have more opportunity to take advantage of lower electricity prices by using variable tariffs. The improved insulation in these homes means occupants can be more flexible about when they are heated.

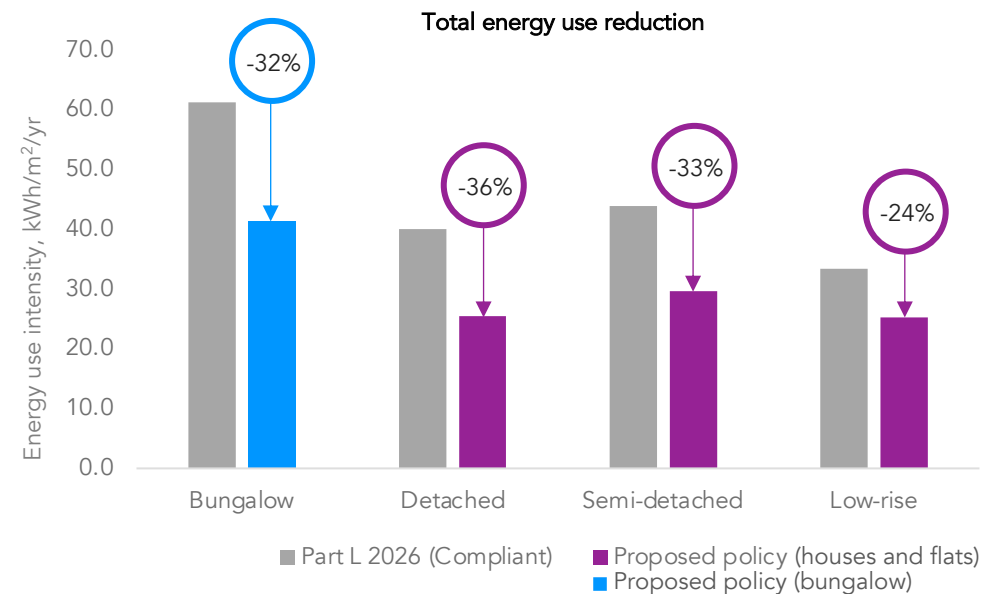
Occupiers of flats stand to benefit from the energy balance policy as this requirement will likely deliver more solar PV than the building regulations Part L 2026 requirement.

Lower total energy use reduces impact on the local electricity grid

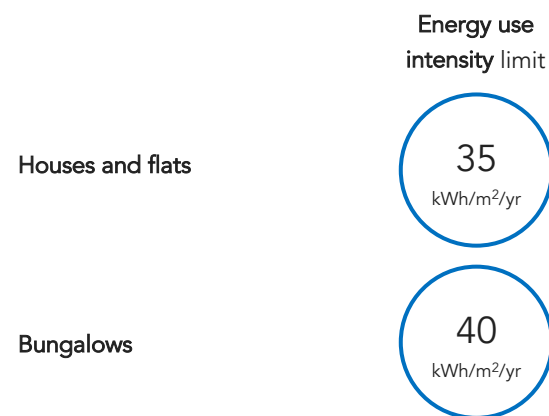
As our energy systems move away from fossil fuels the demand for electricity continues to rise, and will continue in coming decades. Meeting increasing electricity demands nationally and locally will require investment in electricity generation infrastructure. The lower the total energy use of new developments, the less additional strain they place on infrastructure.

The EUI metric is a helpful performance indicator that Part L 2026 does not measure

The EUI metric is a very useful metric for understanding the energy performance of buildings. It includes all energy used in the building, is simple to understand, and it can be monitored in-use by measuring electricity consumption at the meter. It also allows us to easily compare energy performance between buildings.



% reduction in energy use intensity (EUI) delivered by the proposed policy compared with building regulations minimum (Part L 2026)



The proposed policy limits for energy use intensity (EUI), differentiated for bungalows to account for their high proportion of heat loss envelope compared with volume of heated space.

Why Gloucestershire's local plans should set residential operational energy targets: **energy balance**

The proposed policy requires at least an energy balance to be achieved with solar PV on-site.

The renewable energy generation requirement for Part L 2026 has been significantly improved compared with Part L 2021. A good level of renewable energy generation is now required for all dwellings (exemptions are allowed only after all practicable roof space has been used for solar PV).

For the bungalow and house dwelling types we have assessed, meeting the minimum renewable energy requirement for Part L 2026 actually delivers a PV array that generates more energy than the home uses in the course of a year - in other words, the energy balance is exceeded.

Therefore, in these typologies, the Part L 2026 requirement is likely to require more renewable energy than the proposed policy.

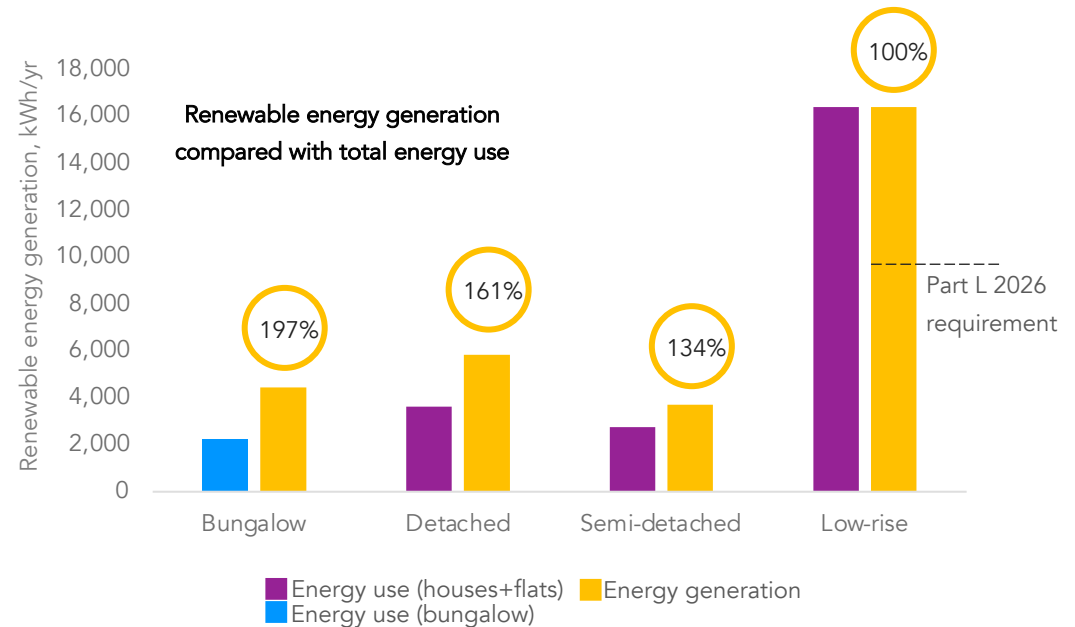
The energy balance requirement will be most relevant to flats

For dwellings and buildings with more than 2 or 3 storeys, the energy balance requirement will likely be greater than the Part L 2026 renewable energy requirement. This is because the Part L 2026 renewable energy requirement is based on a function of ground floor area, but total energy is a function of total floor area.

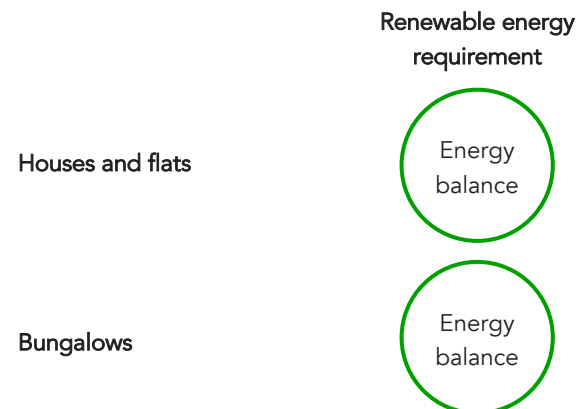
For this reason, the proposed energy balance requirement goes further than building regulations for many dwelling types, particularly higher density developments.

Energy offsetting

Where the energy balance requirement cannot be met on-site there is the possibility of an allowance to offset the shortfall through payment into an offset fund. The offsetting requirement will likely be triggered on higher density developments and will result in an increase the amount of renewable energy generation in the local area, contributing towards the requirement for clean, local electricity generation.



Energy balance expressed as a % of solar energy generated compared with total annual energy consumption of the dwellings. For the house typologies, the Part L 2026 solar PV requirement mandates more solar PV than the energy balance requirement and the energy balance is exceeded. For the flats the energy balance requirement is larger than the building regulations Part L 2026 requirement.



The proposed policy requirement for renewable energy.

5.0 Operational energy policies for non-residential buildings

EUI | Non-residential | Evidence of technical feasibility

Operational energy metrics for non-residential buildings are helpful

Operational energy policies can be set for non-domestic buildings in the same way that they can be for residential buildings. The metrics are the same: space heating demand (SHD), energy use intensity (EUI) and renewable energy.

Assessing and reducing space heating demand (SHD) and Energy Use Intensity (EUI) helps design teams reduce the energy consumption of buildings and the associated energy bills for occupants.

These metrics are supported by many in the industry including the Climate Change Committee, UK Net Zero Carbon Buildings Standard (UK NZCBS), Low Energy Transformation Initiative (LETI), UK Green Building Council (UKGBC) and the Royal Institute of British Architects (RIBA).

Our methodology for establishing performance levels

The [evidence base](#) for the emerging new London Plan offers a robust source of evidence for space heating demand and EUI limits for non-residential buildings. The technical feasibility of a range of space heating demand and EUI limits was tested through energy modeling and energy data analysis from constructed buildings. A cost assessment of the performance levels was also undertaken (although this uses London specific cost data).

It is recommended that the performance levels highlighted in level 2 are the appropriate level of ambition for non-domestic buildings in Gloucestershire.

The following pages draw upon the emerging [new London Plan evidence base](#) for evidence to demonstrate the technical feasibility of operational energy policies for non-residential buildings. Offices and industrial buildings have been selected to showcase the methodology of analysis, but all performance limits for the different typologies were established in the same way.

Space heating demand, kWh/m ² /yr (GIA)	Level 1	Level 2	Level 3
All typologies	30	20	15

Space heating demand - performance levels explored in the [London Plan evidence base](#). It is recommended that Level 2-3 is the appropriate level of ambition for Gloucestershire for all non-residential buildings.

Energy use intensity, kWh/m ² /yr (GIA)	Level 1	Level 2	Level 3
Office	130	90	70
Primary school	65	52	40
Industrial	40	35	30
Hotel	150	120	80
Student accommodation	80	65	50

Energy use intensity - performance levels explored in the [London Plan evidence base](#). It is recommended that Level 2 is the appropriate level of ambition for all non-residential buildings in Gloucestershire except offices, for which there is a general consensus in local plans and evidence of requiring an EUI of 70 kWh/m²/yr.

Operational energy policies in non-domestic buildings: industry standards and other local plans

Non-Residential building performance

Non-Residential buildings perform quite differently to homes, due to the different functions, occupancy and their form. They are generally much larger than housing blocks, which can mean that their fabric performs more efficiently per square metre of floor area. Their energy use will be more variable, due to the different equipment that might be used, and more complex heating, cooling and ventilation requirements.

Our methodology for non-residential buildings

We have not undertaken specific modelling of non-residential building types to demonstrate technical feasibility of different operational energy limits. Instead, we have presented evidence from various sources that can be split into two main categories:

- 1. Precedents for operational energy policies in non-residential buildings** - There are various local plans containing non-residential operational energy policies (either adopted or emerging). These give an indication of what may or may not be deemed acceptable or pass the examination process.
- 2. Industry standards and frameworks** - Key industry frameworks also provide indicative energy demand ranges for non-residential buildings. While these all aim to support net zero trajectories, their targets and limits can differ significantly between sources and over time, reflecting evolving evidence and a deeper understanding of specific building typologies. In some cases – particularly for offices – later iterations have revised EUI levels upwards or relaxed earlier ambitions where real-world performance data has shown that initial expectations were not achievable or did not adequately account for building use and services.

Local plans using energy metrics that have been approved or are under evaluation

- Adopted local plans:** there are numerous precedent local plans to refer to, from local authorities in different parts of the country.
- Emerging local plans:** there are also several plans in development and going through examination that can also be referred to.

Industry standards and frameworks

- RIBA:** EUI targets as part of RIBA's 2030 Climate Challenge. In the graphs on pages 29 and 30 a range is shown representing the 2025-2030 targets.
- LETI:** SHD and (some) EUI targets developed as part of the Climate Emergency Design Guide. These have raised the ambition across the sector.
- UK NZCBS:** EUI limits developed for the UK Net Zero Carbon Buildings Standard for various building typologies, based on broad industry engagement at the time of development. A range is shown representing 2025-2040 targets.
- NABERS (Offices):** National Australian Built Environment Rating System is a performance-based rating system for Offices. EUI range shown is approximately equivalent to star ratings 4.5 to 5.5, but these do vary per building..
- CIBSE Benchmarks:** These are based on energy use for different types of existing building, separated by fuel type and 'typical' and 'good practice'.

Summary of precedent information available from local plans and industry standards and frameworks. The above can also be used as a legend for the graphs on pages 29 and 30.



Office building and industrial building, two typologies examined for Gloucestershire.

Space heating demand | Non-residential | Evidence of technical feasibility (Offices and industrial)

Space heating demand – a recap

Space heating demand (SHD) is a measure of the performance of the fabric of a building. The amount of heating that a building needs in order to maintain a sensible comfort temperature is governed by the amount of insulation in walls, roof, and floor, the performance of the glazing, the infiltration rate (draughts) and the ventilation system.

Assessing and reducing space heating demand helps design teams reduce the energy consumption of buildings and the associated energy bills for residents and occupants.

Key considerations

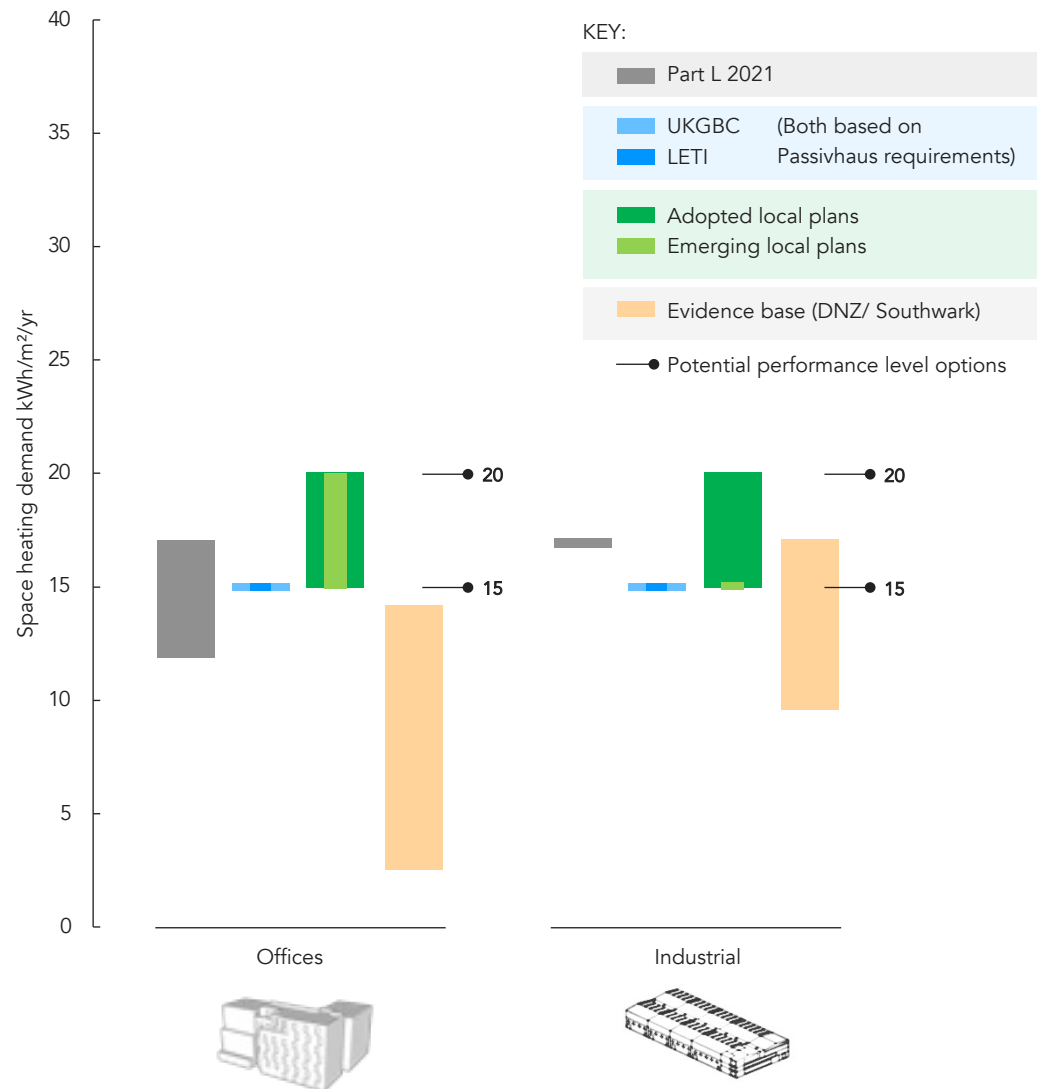
The building form has a considerable impact on the SHD. Non-residential buildings are often large volume spaces and therefore are able to achieve very good SHD performance. It's therefore appropriate to set an ambitious target.

Setting SHD limits for non-domestic buildings

The chart, right, gives an overview of the various standards, targets, local plan limits and evidence base results for non-residential Space heating demand. **Please note that the orange bars include energy models targeting different levels of space heating demand using various specifications to enable cost effective routes to be found to meet those levels. Note that all typologies show a range that meets or goes below the proposed target level (15kWh/m²/yr).** This is also equivalent to the Passivhaus Standard limit, and there are numerous examples of buildings of different typologies which meet this Standard.

Recommendations

A consensus of adopted and emerging local plans set a range of SHD targets of 15 to 20 kWh/m²/year. Various industry standards are set at the lower end of this range. **An SHD target of 15-20 kWh/m²/yr for Non-residential buildings** is supported by published evidence bases and industry good practice.



Analysis of space heating demand limits for offices and industrial buildings from a number of sources. This is taken from the [London Plan evidence base](#), which contains the similar analysis for other non-residential typologies.

Using Energy Use Intensity targets to improve the energy performance of non-domestic buildings

Energy use intensity – a recap

Energy Use Intensity (EUI), or metered energy use, is the total energy needed to run a building over a year (per square metre). It is a measure of the total energy consumption of the building (kWh/m²/yr). The EUI of a building covers all energy uses: space heating, domestic hot water, ventilation, lighting, cooking and appliances.

EUI is the industry best practice method for benchmarking and setting limits for the energy consumption of buildings and many local authorities are already using them (see box below right). They also form the foundation of the Net Zero Carbon Building Standard.

Key considerations

Non-domestic buildings are varied in type, function and the processes that take place within them. For this reason it is typically more challenging to set EUI targets for non-domestic buildings compared with residential buildings. Where EUI limits for non-domestic buildings are set in local planning policy there is also more variation than there is in residential policy.

Schools and offices tend to be the two non-residential building types that have the most consistent EUIs.

Setting EUI limits for non-domestic buildings

There are different options for setting EUI limits for non-domestic buildings:

- Setting bespoke limits based on bespoke modelling or benchmarks from industry standards.
- Aligning limits with other standards, such as the UK Net Zero Carbon Buildings Standard (UKNZCBS), LETI, RIBA and NABERS
- Requesting compliance with a certain level of credits under BREEAM V7 Ene 02 Operational Energy Prediction (see following page).

Adopted and emerging local plans using EUI limits

Offices

Central Lincolnshire has adopted limits of 70 (site average) & 90 (max) kWh/m²/yr, and Kensington and Chelsea have adopted a limit of 70 kWh/m²/yr. Five emerging local policies exist also propose a limit of 70 kWh/m²/yr. London borough of Newham proposes a limit of 55 and London borough of Southwark proposes a limit of 75 kWh/m²/yr.

Industrial buildings

Central Lincolnshire has adopted limits of 70 (site average) & 90 (max) kWh/m²/yr, and Kensington and Chelsea has adopted a limit of 35 kWh/m²/yr. Five emerging local policies for London boroughs also propose a limit of 35 kWh/m²/yr.¹

Schools

Central Lincolnshire has adopted limits of 70 (site average) & 90 (max) kWh/m²/yr, and Kensington and Chelsea have adopted a limit of 65 kWh/m²/yr. Seven emerging local policies also propose a limit of 65 kWh/m²/yr.

Energy use intensity,
kWh/m²/yr (GIA)

Office	70
Primary school	52
Industrial	35
Hotel	120
Student accommodation	65

Energy use intensity - performance levels explored in the [London Plan evidence base](#). It is recommended that Level 2 is the appropriate level of ambition for all non-residential buildings in Gloucestershire, except for offices which should use a limit of 70 kWh/m²/yr.



EUI | Non-residential | Evidence of technical feasibility | Offices



This page gives a summary of the precedents available for office buildings. The green bars show the adopted and emerging local plans, and the blue bars show relevant industry standards and frameworks.

Adopted and emerging local plans

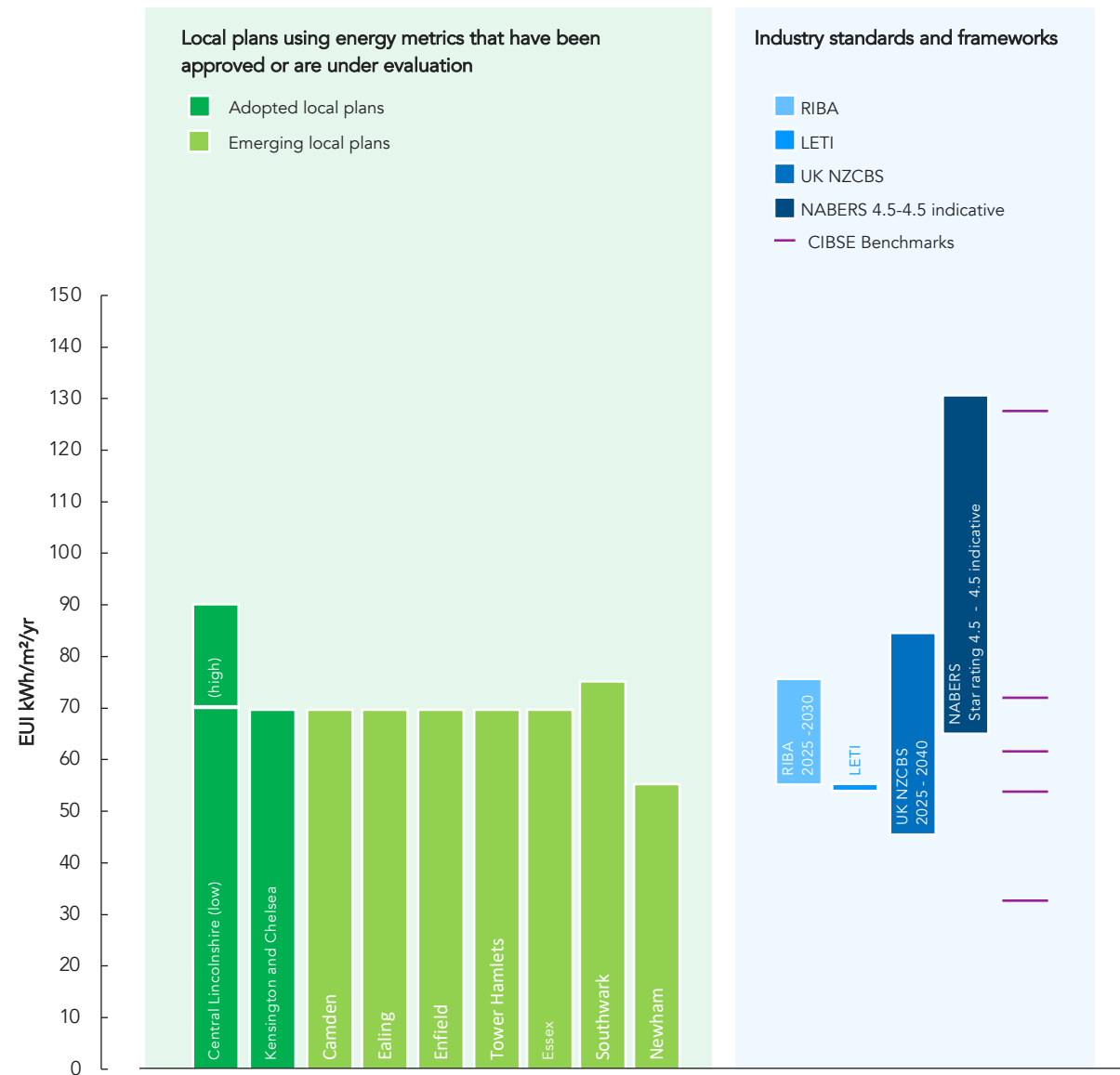
Central Lincolnshire has adopted limits of 70 & 90 kWh/m²/yr, and Kensington and Chelsea have adopted a limit of 70 kWh/m²/yr. Five emerging local policies also propose a limit of 70 kWh/m²/yr. London borough of Newham proposes a limit of 55 and London borough of Southwark proposes a limit of 75 kWh/m²/yr.

Industry standards and frameworks

The RIBA targets 75 and 55 kWh/m²/yr for 2025 and 2030, and the LETI target is 55 kWh/m²/yr. UK NZCBS standard EUI limits are 85 and 45 kWh/m²/yr for 2025 and 2040, from stakeholder engagement at the time of development. CIBSE benchmarks vary considerably according to the office type. The highest is “air conditioned, prestige” and lowest is “Naturally ventilated, cellular”. The NABERS Design for Performance group have recommended that the performance levels are aligned with NABERS star ratings of 4.5, 5 and 5.5, corresponding to EUIs of 70 to 130 kWh/m²/yr as appropriate levels. (Star rating of 6 corresponds to 55 kWh/m²/yr but was deemed to hard to meet as a planning requirement).

Recommendation

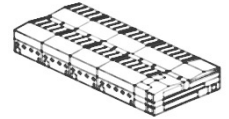
A consensus of adopted and emerging local plans set **an EUI target of 70 kWh/m²/yr for office buildings**. This target is supported by a number of published evidence bases, including some that have passed Examination.



Evidence of technical feasibility for offices. The CIBSE benchmarks relate to the 'Good practice electricity' levels for (with EUIs in kWh/m²/yr): Naturally ventilated, cellular (33), Naturally ventilated, open plan (54), Local government office (62), Central government office (72), Air conditioned, standard (128). Note that CIBSE benchmarks relate to existing buildings rather than new buildings.



EUI | Non-residential | Evidence of technical feasibility | Industrial



This page gives a summary of the precedents available for office buildings. The green bars show the adopted and emerging local plans, and the blue bars show relevant industry standards and frameworks.

Adopted and emerging local plans

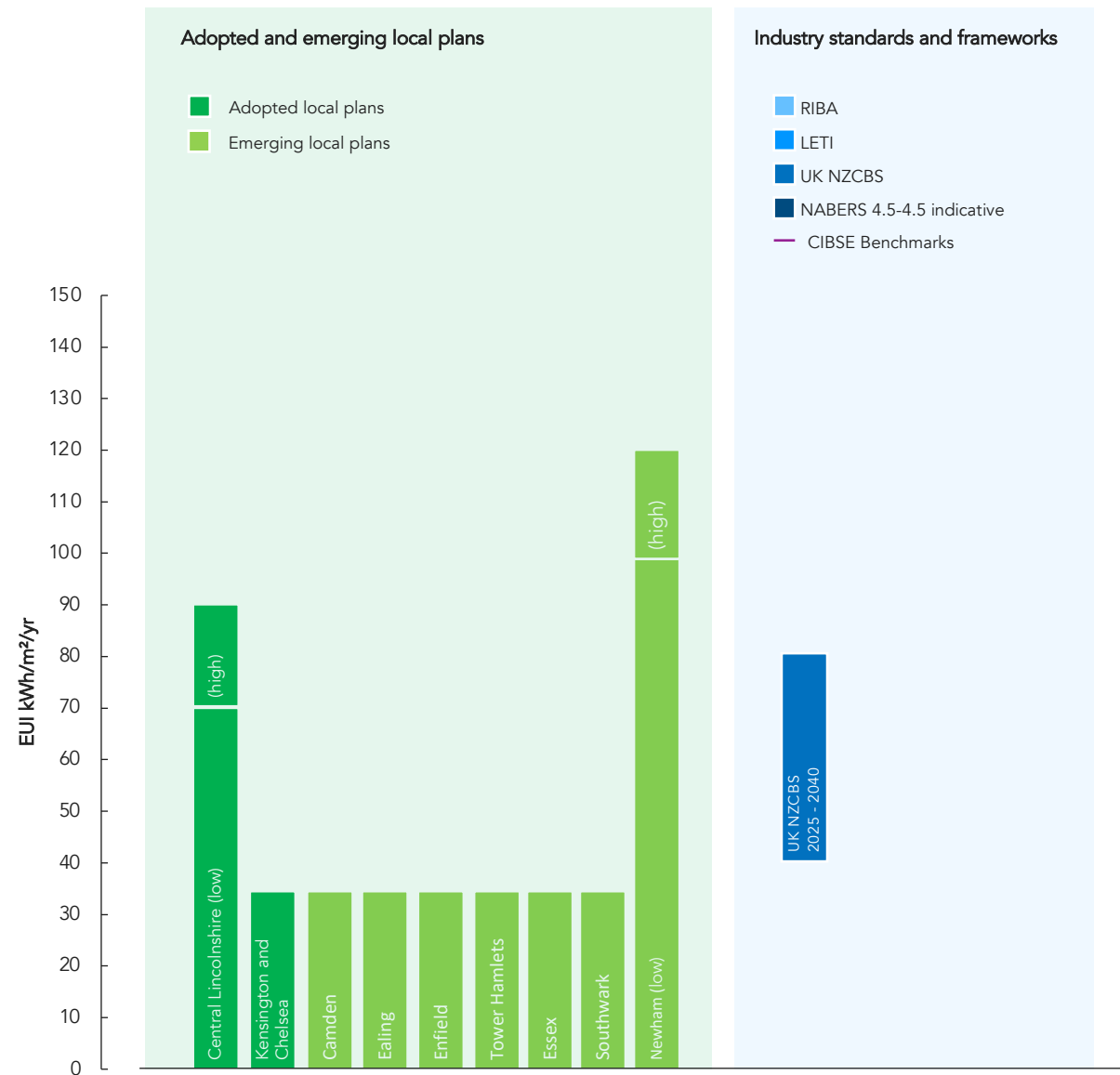
Central Lincolnshire has adopted limits of 70 & 90 kWh/m²/yr, and Kensington and Chelsea has adopted a limit of 35 kWh/m²/yr. Five emerging local policies for London boroughs also propose a limit of 35 kWh/m²/yr.¹

Industry standards and frameworks

UK NZCBS standard EUI limits are 80 and 40 kWh/m²/yr for 2025 and 2040 derived from stakeholder engagement at the time of development. There are no other specific EUI limits from industry standards and frameworks. UK Government are consulting on a performance-based energy rating framework, which will eventually affect large industrial buildings.

Recommendation

A consensus of adopted and emerging local plans set **an EUI target of 35 kWh/m²/yr for industrial buildings**. This target is supported by a number of published evidence bases, including some that have passed Examination.



More detail on the existing evidence of technical feasibility for industrial. UK NZCBS is the only industry standard using EUIs.

¹ The London Borough of Newham proposes a limit of 100 - 120 kWh/m²/yr for industrial buildings. These are for more intensive industrial buildings than generally assumed.



Renewable energy generation | Non-residential | Evidence of technical feasibility

The requirements of the Future Buildings Standard is not yet known

The requirements (if any) of the FBS have not yet been confirmed. It is expected that the non-domestic notional building will include PV based on a % of the building footprint but that there will not be an absolute requirement. This means that developers will likely be able to 'trade' better performance of other building elements to omit PV.

UK Net Zero Carbon Buildings Standard

The evidence based UKNZCBS minimum level of on-site renewable energy generation for non-domestic buildings is 45 kWh/m² of building footprint (measured to the external walls of the building). This is the minimum level and does not represent best practice.

Possible policy formats

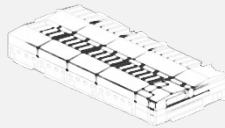
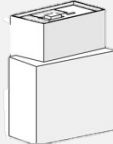
1. **Energy balance** - the variability of EUI in non-domestic development makes an energy balance policy unfeasible for most typologies.
2. **Energy generation target by m² of building footprint (kWh/m²(footprint))** - this form of policy ensures PV is installed on all buildings in a way that utilises roof space well. This is the recommended policy format.

London Plan evidence base

A detailed study was undertaken into technically feasible renewable energy provision for a range of different non-domestic building types for the new [London Plan evidence base](#). The results of this extensive study are reproduced on the right.

Recommendation

The recommended renewable energy policy for non-domestic buildings in Gloucestershire is to require **renewable energy generation consistent with the level indicated in the table on the right for Optimised PV**.

Non-residential typology		
	Good practice kWh/m ² _{fp}	Optimised for PV kWh/m ² _{fp}
 Office	45	75
 Hotel	50	80
 School	50	80
 Industrial	75	100
 Student Accommodation	45	75

Onsite Solar PV generation potential for various non-residential typologies, based on analysis undertaken for the new [London Plan evidence base](#).

Predictive energy modelling for non-domestic buildings

Part L modelling – non-residential buildings

The NCM (National Calculation Methodology) is the calculation methodology used on new non-residential buildings and is used through the Simplified Building Energy Model (SBEM) and Dynamic Simulation Modelling (DSM) tools in order to demonstrate compliance with Part L of the Building Regulations. However, this methodology was never meant to perform key functions that are required to assess Net Zero Carbon buildings, and most importantly they were not meant to predict future energy use accurately. This is why the use of predictive energy modelling is required to demonstrate compliance with Net Zero requirements.

Predictive energy modelling for residential buildings

For non-residential buildings, PHPP methodology (an excel based tool) has also been shown to predict energy use accurately. The methodology set out in CIBSE Technical Memorandum 54 (TM54) can also be followed for developments where a dynamic simulation model has been created.. Benefits of using predictive modelling on new non-residential building projects in include:

- Ability to model opening/working hours and occupancy patterns specifically.
- Inclusion of unregulated energy (e.g. IT and equipment).
- Possibility to compare predictive performance against benchmarks for similar buildings.

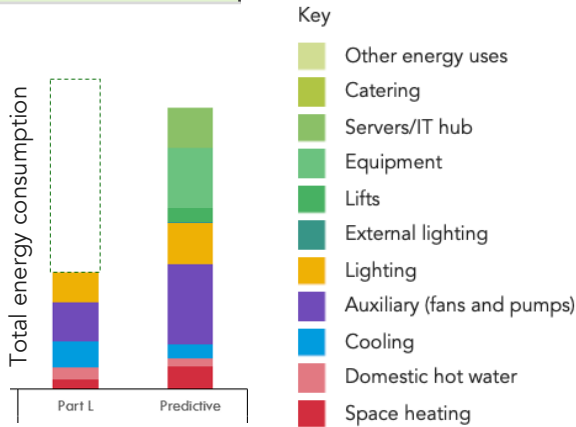
Applicants should summarise their key assumptions to make it easier for the local planning authority to review them.

Part L modelling	Predictive modelling
SBEM and DSM for Part L (e.g. IES , TAS)	DSM for CIBSE TM 54 (e.g. IES , TAS), PHPP, DfP NABERS modelling
Used to check compliance with Part L 2021	Used to predict space heating demand and energy use (PHPP is also used to check compliance with Passivhaus Standard)
No planned updates	Agnostic of building regulation methodology changes
Least accurate • High level of standardisation • Underestimates space heating and overestimates domestic hot water and equipment (incl. IT)	Most accurate • As-built performance predicted more accurately



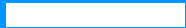
There is a significant difference between Part L modelling currently used to demonstrate compliance with building regulations and predictive energy use modelling which should be used to demonstrate compliance with the proposed policies.

(Source: Delivering Net Zero Study, 2023)



SBEM doesn't account for unregulated emissions, and grossly under estimates energy consumption, especially related to improvements to the building fabric.

Appendices



Appendix A0: Choosing the baseline

When selecting the Part L 2026 baseline for demonstrating differences in performance between the proposed policy and building regulations minimum performance we had two options:

Option 1) Use the “Notional specification” published in [Appendix R of the SAP 10.3 specification](#). The “Notional” building is a reference building used for comparison when demonstrating compliance of an actual building. The notional building uses standard specifications for energy efficiency (such as u-values, services efficiencies etc).

Option 2) Use a typical Part L 2026 compliant specification most likely to be used by a developer to “just pass” the four Part L 2026 requirements: TER, TFEE, TPER and renewable energy.

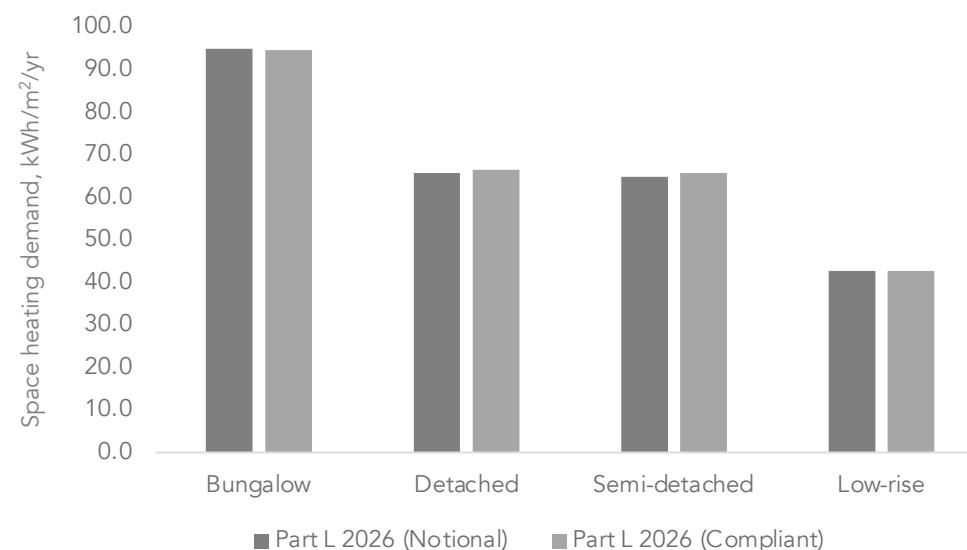
We have selected option 2 for this study, the typical Part L 2026 compliant developer specification, for the following reasons:

- The published notional specification does not always pass Part L 2026 and therefore could be an unrealistic scenario to model.
- The heat pump COP of 2.5 in SAP 10.3 is not possible to replicate in real-world design.
- The thermal bridging values in SAP 10.3 are not possible to replicate in real-world design.

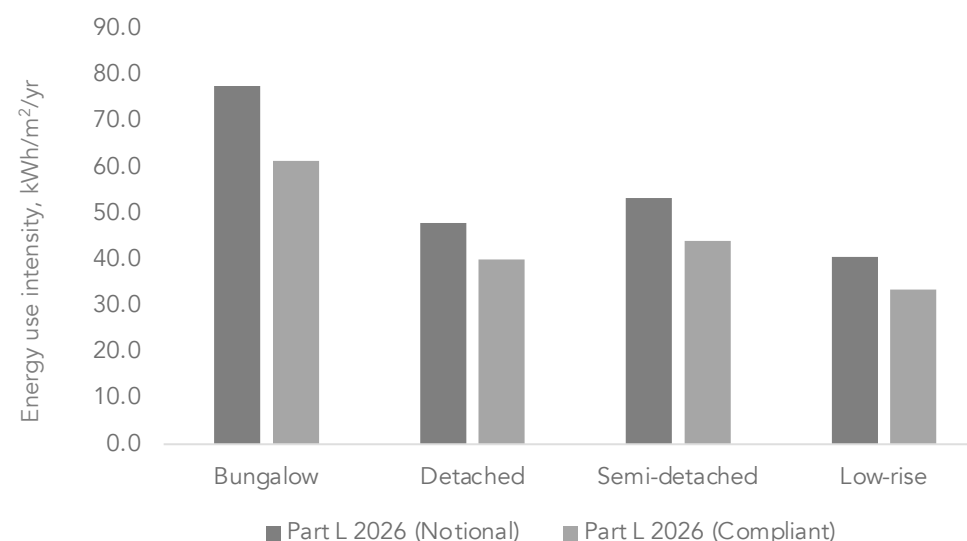
Our sensitivity analysis shows the baseline selected is a robust choice

The graphs on the right compare the performance of the two different potential baselines against two operational energy metrics: space heating demand and energy use intensity (EUI).

The EUI of our chosen baseline is lower than the notional building baseline because of the real-world heat pump selection. If the alternative baseline of the Notional building specification was selected the % improvements of the proposed policy would have been overinflated and therefore less robust than selecting a real-world developer response to Part L 2026.



Space heating demand – comparison between potential baselines shows that the space heating demand differences are very minimal.



Energy use intensity – comparison between potential baselines shows that the EUI of the selected Part L 2026 baseline is lower than that of the “Notional” building. This is primarily because the “Compliant” baseline uses a real-world heat pump with a better efficiency.

Achieving the policy requirements: what this looks like in practice

Space heating demand requirement

The space heating demand requirement is the main driver of energy efficiency in this policy.

The building fabric specifications used in our modelling for each scenario are shown on the right (and in Appendix A1 to A4).

We have used the most cost-effective route to achieving the space heating demand limits, based on typical fabric build-ups, standard component sizes and typical developer preference.

Achieving these space heat demand limits will require:

- Excellent window u-values
- Very low air-permeability
- Efficient mechanical ventilation with heat recovery (MVHR)

Energy use intensity requirement

The energy use intensity requirement is influenced by all energy uses in the building, but is most affected by the choice of heating system selected. To achieve the EUI limits of 40 kWh/m²/yr for bungalows and 35 kWh/m²/yr for houses and flats, air source heat pumps (ASHP) will be needed.

Direct electric space heating (e.g. electric panel heaters) or hot water (e.g. immersion hot water tank) will likely result in EUIs higher than the limits. This policy will therefore protect occupants from inefficient heating systems that cost significantly more to run.

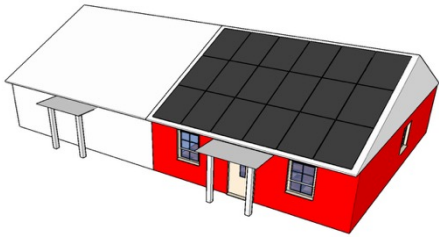
Renewable energy

The Part L 2026 functional requirement is based on ground floor area and therefore is the same regardless of the energy efficiency of the dwelling. For the bungalow and houses the requirement is greater than the energy balance requirement. For the flats, the energy balance requirement is greater and will require good use of available roof space. Appendix D shows images of example solar PV arrangements compliant with requirements.

	Bungalow	Detached house	Semi-detached house	Low-rise flats
	1a "Low energy" (SHD 30)	1b "Ultra-low energy" (SHD 15-20)	1b "Ultra-low energy" (SHD 15-20)	1b "Ultra-low energy" (SHD 15-20)
U-values (W/m ² K)				
Floor	0.13	0.13	0.13	0.13
Walls	0.15	0.14	0.18	0.15
Roof	0.09	0.11	0.11	0.11
Windows (W)	0.9 (g-value 0.45)	0.9 (g-value 0.45)	0.9 (g-value 0.45)	0.9 (g-value 0.49)
Doors (D)	1.0	1.0	1.0	1.0
Air permeability (m ³ /m ² h)	1.4	1.0	1.4	1.06
Ventilation strategy	MVHR (90% efficiency)	MVHR (90% efficiency)	MVHR (90% efficiency)	MVHR (90% efficiency)
Heating system	ASHP (SCOP 4.19)	ASHP (SCOP 3.99)	ASHP (SCOP 3.33)	ASHP (SCOP 4.25)
Hot water heating system	ASHP	ASHP	ASHP	ASHP
Waste water heat recovery (WWHR)	n/a	None	None	n/a
PV (kWp)	4.8	6.4	4.0	18.7
SHD (kWh/m ² GIA/yr)	29.0	20.0	19.9	20.0
EUI (kWh/m ² GIA/yr)	41.4	25.4	29.7	25.3
On-site renewable energy generation (kWh/m ² GIA/yr)	85.5	41.1	39.8	25.3



Appendix A1: Specifications for the bungalow



Bungalow

Area (GIA) m ²	54.46
No. storeys	1
GFA internal (m ²)	54.46
TFA	53.2
Orientation	SW
Climate file	Severn, Lyneham station
Form factor	4.04

Note re costing and viability

The proposed differentiated policy reflects Scenario 1a and this is the specification that should be used for costing and viability exercises.

Notes

1. kWp requirement calculated using SAP 10.3 as per Part L 2026 methodology.
2. SHD and EUI calculated using PHPP.
3. Renewable energy generation calculated using PVGIS.
4. Baseline specification does not reflect notional building but instead the most likely developer "just" compliant specification.
5. See Appendix C4 for difference between 'standard' and 'best practice' thermal bridging.

Bungalow	Baseline for costing	Policy compliant scenario for costing		Do not use for costing
	Baseline Part L 2026 compliant	1a "Low energy" (SHD 30)	1b "Ultra-low energy" (SHD 15-20)	2 "Maximum" feasible energy efficiency
U-values (W/m ² K)			"Ultra-low energy" policy limit not selected for the bungalow typology	
Floor	0.13	0.13		0.105
Walls	0.18	0.15		0.103
Roof	0.11	0.09		0.09
Thermal bridging ⁵	Standard	Best practice		Best practice
Windows (W) Doors (D)	1.2 (g-value 0.5) 1.0	0.9 (g-value 0.45) 1.0		0.9 (g-value 0.45) 1.0
Air permeability (m ³ /m ² h)	4	1.4		0.6
Ventilation strategy	dMEV	MVHR (90% efficiency)		MVHR (90% efficiency)
Heating system	ASHP (SCOP 3.58)	ASHP (SCOP 4.19)		ASHP (SCOP 4.14)
Hot water heating system	ASHP	ASHP		ASHP
Waste water heat recovery (WWHR)	n/a	n/a		n/a
Solar PV (kWp)	4.8	4.8		4.8
SHD (kWh/m ² GIA/yr)	94.6	29.0		21.7
EUI (kWh/m ² GIA/yr)	61.3	41.4		39.3
On-site renewable energy generation (kWh/m ² GIA/yr)	81.5	81.5		154

Appendix A2: Specifications for the detached house



Detached house

Area (GIA) m ²	142.19
No. storeys	2
GFA internal (m ²)	71.095
TFA	132.917
Orientation	SW
Climate file	Severn, Lyneham station
Form factor	3.14

Note re costing and viability

The proposed differentiated policy reflects Scenario 1b and this is the specification that should be used for costing and viability exercises.

Notes

1. kWp requirement calculated using SAP 10.3 as per Part L 2026 methodology.
2. SHD and EUI calculated using PHPP.
3. Renewable energy generation calculated using PVGIS.
4. Baseline specification does not reflect notional building but instead the most likely developer "just" compliant specification.
5. See Appendix C4 for difference between 'standard' and 'best practice' thermal bridging.

Detached house	Baseline for costing		Policy compliant scenario for costing	Do not use for costing
	Baseline Part L 2026 compliant	1a "Low energy" (SHD 30)	1b "Ultra-low energy" (SHD 15-20)	2 "Maximum" feasible energy efficiency
U-values (W/m ² K)		"Low energy" policy limit not selected for the detached house typology		
Floor	0.13		0.13	0.1
Walls	0.18		0.14	0.103
Roof	0.11		0.11	0.09
Thermal bridging	Standard		Best practice	Best practice
Windows (W)	1.2 (g-value 0.5)		0.9 (g-value 0.45)	0.9 (g-value 0.45)
Doors (D)	1.0		1.0	1.0
Air permeability (m ³ /m ² h)	4		1.0	0.6
Ventilation strategy	dMEV		MVHR (90% efficiency)	MVHR (90% efficiency)
Heating system	ASHP (SCOP 3.42)		ASHP (SCOP 3.99)	ASHP (SCOP 4.05)
Hot water heating system	ASHP		ASHP	ASHP
Waste water heat recovery (WWHR)	None		None	None
Solar PV (kWp)	6.3		6.3	6.3
SHD (kWh/m ² GIA/yr)	66.5		20.0	15.1
EUI (kWh/m ² GIA/yr)	40.0		25.4	24.2
On-site renewable energy generation (kWh/m ² GIA/yr)	41.1		41.1	47.7

Appendix A3: Specifications for the semi-detached house



Semi-detached

Area (GIA) m ²	93.1
No. storeys	2
GFA internal (m ²)	46.55
TFA	84.79
Orientation	SW
Climate file	Severn, Lyneham station
Form factor	2.94

Note re costing and viability

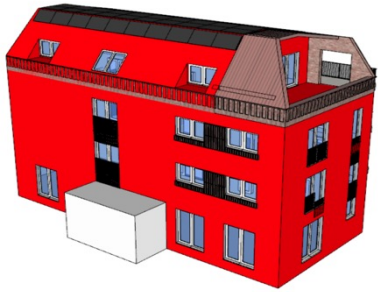
The proposed differentiated policy reflects Scenario 1b and this is the specification that should be used for costing and viability exercises.

Notes

1. kWp requirement calculated using SAP 10.3 as per Part L 2026 methodology.
2. SHD and EUI calculated using PHPP.
3. Renewable energy generation calculated using PVGIS.
4. Baseline specification does not reflect notional building but instead the most likely developer "just" compliant specification.
5. See Appendix C4 for difference between 'standard' and 'best practice' thermal bridging.

Semi-detached house	Baseline for costing	Policy compliant scenario for costing		Do not use for costing
	Baseline Part L 2026 compliant	1a "Low energy" (SHD 30)	1b "Ultra-low energy" (SHD 15-20)	2 "Maximum" feasible energy efficiency
U-values (W/m ² K)		"Low energy" policy limit not selected for the semi-detached house typology		
Floor	0.13		0.13	0.102
Walls	0.18		0.18	0.103
Roof	0.11		0.11	0.09
Thermal bridging	Standard		Best practice	Best practice
Windows (W)	1.2 (g-value 0.5)		0.9 (g-value 0.45)	0.9 (g-value 0.45)
Doors (D)	1.0		1.0	1.0
Air permeability (m ³ /m ² h)	4		1.4	0.6
Ventilation strategy	dMEV		MVHR (90% efficiency)	MVHR (90% efficiency)
Heating system	ASHP (SCOP 3.46)		ASHP (SCOP 3.33)	ASHP (SCOP 3.33)
Hot water heating system	ASHP		ASHP	ASHP
Waste water heat recovery (WWHR)	None*		None	None
Solar PV (kWp)	4.0		4.0	4.0
SHD (kWh/m ² GIA/yr)	65.7		19.9	13.1
EUI (kWh/m ² GIA/yr)	44.0		29.7	27.7
On-site renewable energy generation (kWh/m ² GIA/yr)	39.8		39.8	74.0

Appendix A4: Specifications for the low-rise block of flats



Low-rise block of flats

Area (GIA) m ²	649.01
No. storeys	4
GFA internal (m ²)	162.2525
TFA	507.47
Orientation	E
Climate file	Severn, (Lyneham station)
Form factor	2.48

Note re costing and viability

The proposed differentiated policy reflects Scenario 1b and this is the specification that should be used for costing and viability exercises.

Notes

1. kWp requirement calculated using SAP 10.3 as per Part L 2026 methodology.
2. SHD and EUI calculated using PHPP.
3. Renewable energy generation calculated using PVGIS.
4. Baseline specification does not reflect notional building but instead the most likely developer "just" compliant specification.
5. See Appendix C4 for difference between 'standard' and 'best practice' thermal bridging.

Low-rise block of flats	Baseline for costing		Policy compliant scenario for costing	Do not use for costing
	Baseline Part L 2026 compliant	1a "Low energy" (SHD 30)	1b "Ultra-low energy" (SHD 15-20)	2 "Maximum" feasible energy efficiency
U-values (W/m ² K)		"Low energy" policy limit not selected for the low-rise block of flats typology		
Floor	0.17		0.13	0.13
Walls	0.18		0.15	0.15
Roof	0.11		0.11	0.11
Thermal bridging	Standard		Best practice	Best practice
Windows (W)	1.2 (g-value 0.5)		0.9 (g-value 0.49)	0.9 (g-value 0.49)
Doors (D)	1.0		1.0	1.0
Air permeability (m ³ /m ² h)	4		1.06	1.06
Ventilation strategy	dMEV		MVHR (90% efficiency)	MVHR (90% efficiency)
Heating system	ASHP (SCOP 3.58)		ASHP (SCOP 4.25)	ASHP (SCOP 4.25)
Hot water heating system	ASHP		ASHP	ASHP
Waste water heat recovery (WWHR)	n/a		n/a	n/a
Solar PV (kWp)	11.7		18.7	18.2
SHD (kWh/m ² GIA/yr)	42.6		20.0	14.8
EUI (kWh/m ² GIA/yr)	33.4		25.3	24.6
On-site renewable energy generation (kWh/m ² GIA/yr)	15.4		25.3	24.7

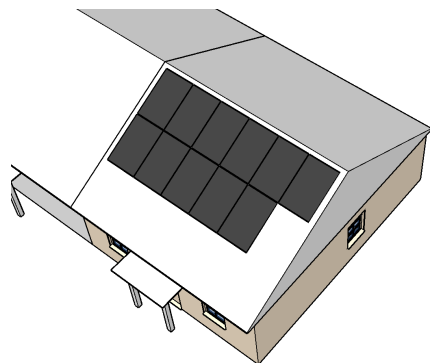
Appendix B: Example solar PV layouts required

Bungalow

Minimum requirement determined by: **Part L 2026**

4.19 kWp

(Approximately 11x 495* W panels)



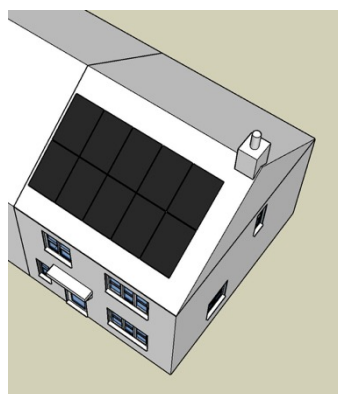
Panel sizes selected for optimal tessellation to roof

Semi-detached house

Minimum requirement determined by: **Part L 2026**

4.1 kWp

(Approximately 14x 495* W panels)



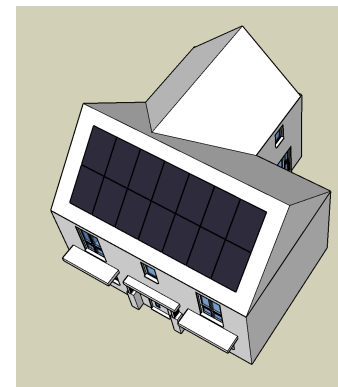
Panel sizes selected for optimal tessellation to roof

Detached house

Minimum requirement determined by: **Part L 2026**

6.3 kWp

(Approximately 14x 450* W panels)



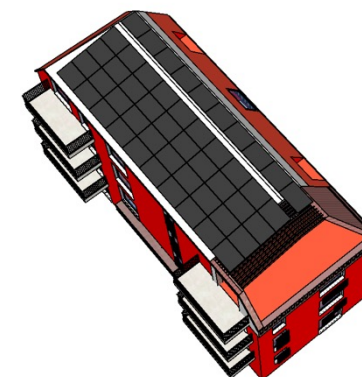
Panel sizes selected for optimal tessellation to roof

Low-rise block of flats

Minimum requirement determined by: **Proposed energy balance policy**

18.7 kWp

(Approximately 37x 505* W panels)



Panel sizes selected for optimal tessellation to roof

*Commercially available standard solar panels are typically 450-500 W each at the time of writing (summer 2026). Efficiencies are rapidly increasing at the panel efficiency selected for this analysis is robust considering the lifetime of the plan. Panel sizes and wattage vary by typology for optimal tessellation to roof.

Appendix C1: Space Heating Demand Calculations | Floors

Build-up

The floor build-up is based on LABC registered construction detail E5MCPF8 for masonry walls, which uses an internally insulated beam and block floor. This is a common approach for new homes in the UK. PIR insulation is assumed, as use of a higher performing insulation is expected to be less expensive than digging a deeper hole to achieve the same U-value with EPS or XPS.

Best practice U-value

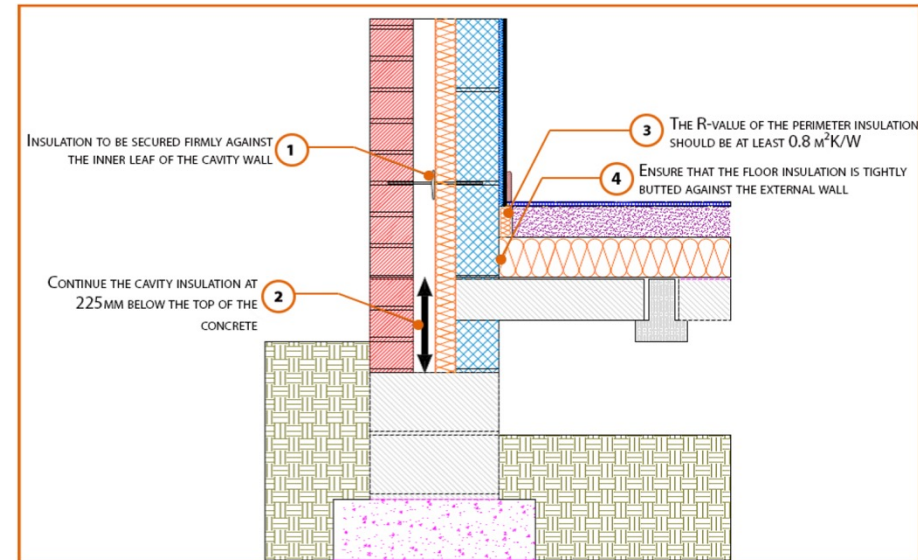
Assumed to be $0.105 \text{ W/m}^2\text{K}^*$, which is achieved with 200mm of PIR board.

Insulation thicker than this has not been considered due to the diminishing improvement in reducing heat loss weighed against the relatively high cost of improving it further. Adding more depth to floors requires additional brick and block courses and deeper excavation.

Worst practice U-value

Assumed to be $0.180 \text{ W/m}^2\text{K}^*$ based on the Part L 2026 limiting fabric parameter. A PIR board of 120mm thickness would slightly overshoot this and deliver a U-value of $0.169 \text{ W/m}^2\text{K}^*$.

**The U-values quoted above are for the floor cassette only (PHPP) and do not include the effect of the ground, which is included in the SAP U-value.*



LABC registered construction detail E5MCPF8 for masonry walls includes a floor build-up.



Beam and block floors are common in mass-built homes across the UK.

Appendix C2: Space Heating Demand Calculations | Walls

Build-up

The wall build-up is based on LABC registered construction detail E18MCPF2 for masonry walls, which uses a ventilated cavity wall. This is a common approach for new homes in the UK. PIR insulation is assumed.

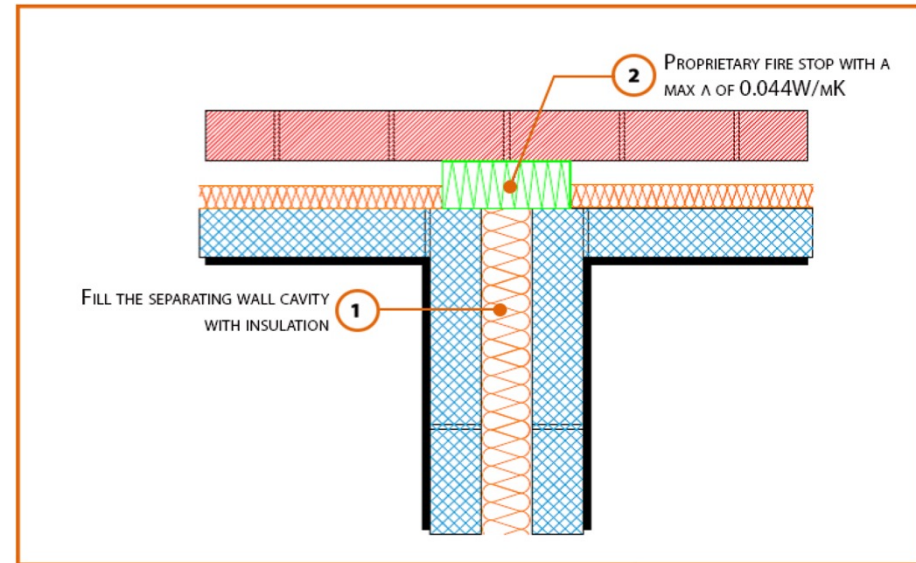
Cavity width

To simplify the PHPP modelling, a wall with a total cavity width of 250mm is assumed regardless of U-value. All wall elements including the outer brickwork are included in the U-value and PSI-value calculations, which improves consistency between PHPP and SAP/HEM. The external dimensions do not change as the wall U-value is varied.

For walls with thinner insulation down to 110mm (Part L 2026 notional U-value of $0.18 \text{ W/m}^2\text{K}$) or even 70mm (Part L limiting fabric parameter of $0.26 \text{ W/m}^2\text{K}$), results in a cavity of 140-180mm thick. This causes a very small improvement ($\sim 0.007 \text{ W/m}^2\text{K}$ per 50mm of cavity) in the U-value relative to real-world, which is in part cancelled out by the increase in external heat loss area.

Cavity ventilation

- **Part C 2021 Contaminants and Moisture** requires weep holes every 900mm above cavity trays. Typical practice on site is to create weep holes by leaving out a vertical mortar gap creating a 100mm^2 opening.
- **BS6946** defines unventilated air layers as those with $<500\text{mm}^2$ of openings per meter of length in the horizontal direction for vertical air layers. A 100mm^2 weep hole meeting the Part C requirement of every 900mm is only 111mm^2 per meter of length.
- **BR447** suggests using a thermal resistance of $0.18\text{m}^2\text{K/W}$ for cavities in wall constructions. This results in conductivities that are also similar to unventilated cavities.



LABC registered construction detail E18MCPF2 for masonry walls shows a typical wall in plan view



Insulated cavity walls are common in mass-built homes across the UK.

Appendix C3: Space Heating Demand Calculations | Roofs

Build-up

The ceiling build-up is based on LABC registered construction detail E12MCPF2 for masonry walls, which uses an insulated ceiling. This is a common approach for new homes in the UK.

Mineral wool insulation is assumed.

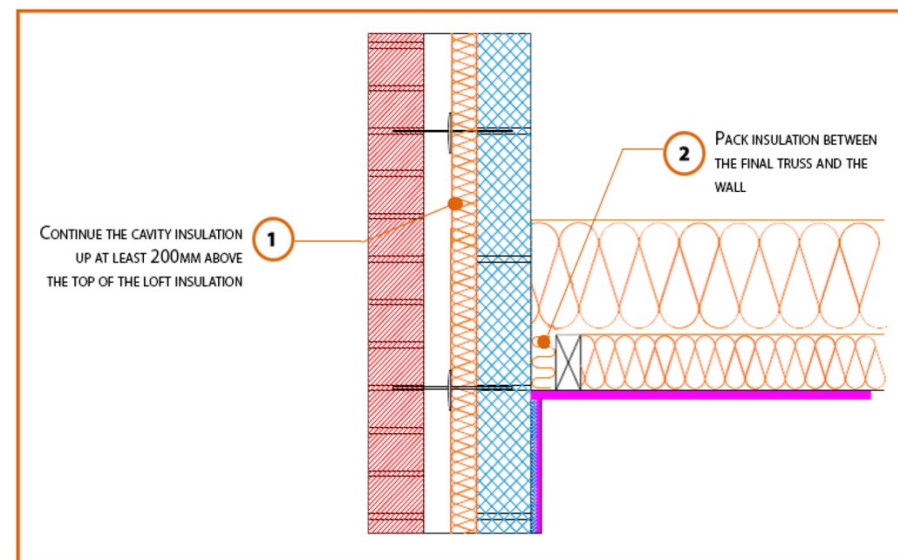
Best practice U-value

Assumed to be $0.090 \text{ W/m}^2\text{K}$, which is achieved with 150mm of lightly compressed mineral wool between ceiling joists and an additional 350mm on top.

Insulation thicker than this has not been considered due to the diminishing improvement in reducing heat loss weighed against the cost of improving it further.

Worst practice U-value

Assumed to be $0.160 \text{ W/m}^2\text{K}$ based on the Part L 2026 limiting fabric parameter. Mineral wool of 300mm thickness would slightly overshoot this and deliver a U-value of $0.151 \text{ W/m}^2\text{K}$.



LABC registered construction detail E12MCPF2 for masonry walls includes a ceiling build-up.



Ceiling level insulation is common in mass-built homes across the UK.

Appendix C4: Space Heating Demand Calculations | Thermal bridging

Standard Practice thermal bridging

Standard LABC Registered Construction Details.

Best practice thermal bridging

The main difference for the 'best practice' thermal bridging set is the use of a layer of foamglas block (or similar) for specific junctions where the insulation line crosses the load path, including:

- E5 Ground floor perimeter
- E12 Gable
- P1 Party wall to ground floor
- P4 Party wall to roof

For other junctions where the insulation line does not cross the load path, for example vertical wall corners and party wall junctions, the standard LABC details are not altered.

Appendix D: Solar PV - requirements of the Future Homes Standard (Part L 2026)

Solar PV as a mandatory requirement

Part L 2026 introduces a new functional requirement for solar photovoltaic (PV) panels on **all new dwellings**. This is a significant change from Part L 2021, under which PV was not mandatory. Critically, the amount of PV required cannot be offset by higher levels of energy efficiency, it must be provided.

The generation requirement

The amount of solar PV that must be provided on the actual building must meet or exceed the annual generation of a notional PV array. The capacity of the "notional" PV array (kWp) is determined by the ground floor area of the dwelling: **40% of ground floor area × 0.22 kWp/m²**. The generation of the "notional" PV array is determined using **fixed assumptions on orientation (south-east), tilt (45 degrees), and overshadowing (no overshadowing)** – therefore it does not mirror the actual building like other aspects of the notional building. The actual dwelling's solar energy generation must match or exceed that of the notional array, but must account for actual orientation, tilt and overshadowing. Compliance is assessed using the SAP methodology.

Rules for maximising solar PV generation

Solar panels must be installed on each "reasonably practicable roof area", with all roof faces used where necessary to meet the generation target, regardless of orientation or overshadowing. Minimum offsets from roof edges, ridges and windows must be adhered to.

Exemptions to Part L 2026 PV requirement

Exemptions are very limited. North-facing pitches and heavily shaded roofs are not exempt from the maximisation requirement. The only full exemption applies where, despite maximising PV across all roof faces, annual generation remains below **720 kWh/year**. Applications for exemption must include diagrams demonstrating maximised PV provision. How building control officers will make judgements on exemptions is unknown. Development management officers will have a role in ensuring solar PV is suitably maximised through roof design.

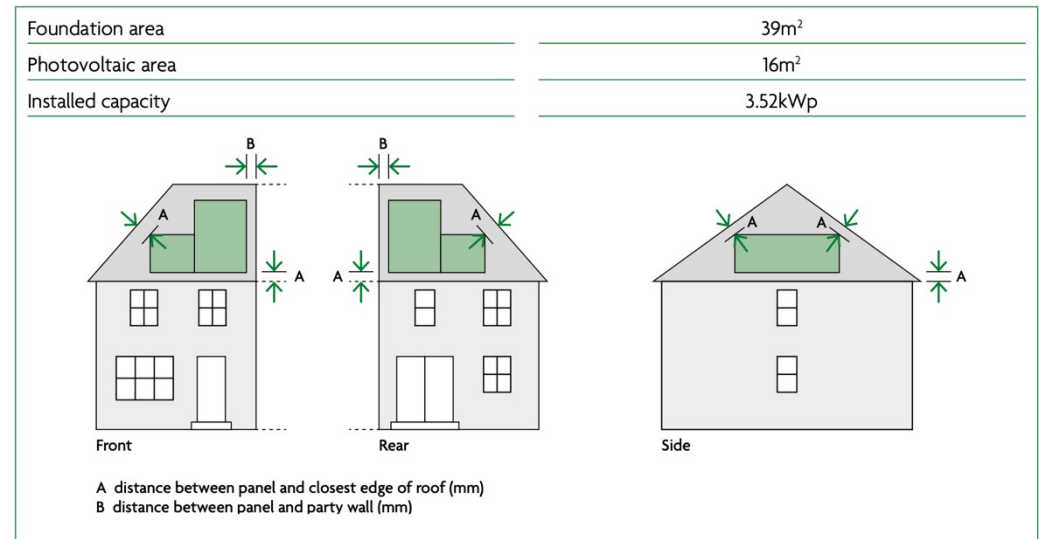


Diagram B1 Semi-detached or end of terrace hipped roof

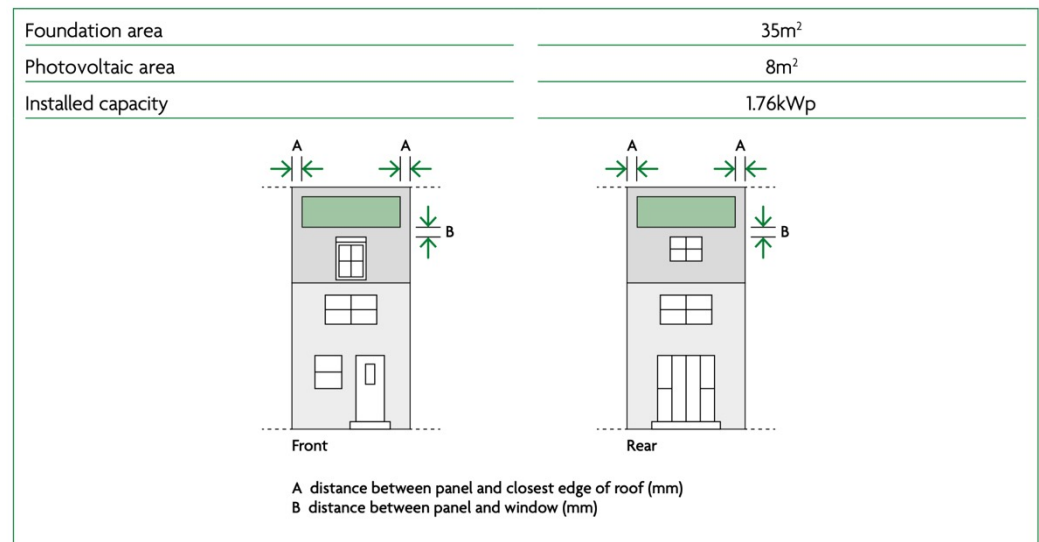


Diagram B3 Mid-terrace pitched roof with dormer windows

These diagrams from the Approved Document L 2026 illustrate how PV must be maximised.

Appendix E1: Precedents: other adopted Local Plans with similar energy policies (as at June 2026)

This table lists adopted local plans with similar net-zero energy-based operational energy and embodied carbon policies to those proposed by Climate Leadership Gloucestershire (CLG).

	Policy status	Space heating demand, kWh/m ² yr	Energy use intensity, kWh/m ² yr	Renewable energy
Winchester local plan	 Adopted Mar '26	Dwellings: 15	Dwellings: 35	Energy balance
Uttlesford (Passed examination – awaiting adoption)	 Passed examination Jan '26	Dwellings: 15 Bungalows: 20	Resi: 35 Non-resi: various	Energy balance (at least 120 kWh/m ² fp [industrial], and 80 kWh/m ² fp [other buildings])
Tendring Colchester Borders Garden Suburb	 Adopted June '25	Dwellings: 30	Dwellings: 40	Energy balance
Greater Manchester Combined Authority	 Adopted Mar '24	Houses: 20 Flats: 15	None	40% GFA
Cotswold Garden Village (Salt Cross)	 Adopted Feb '24	Houses: 20 Flats: 15 Non-resi: 20	Resi: 35 Non-resi: various	Energy balance
Central Lincolnshire	 Adopted April '23	Dwellings: 15-20 Non-resi: 15-20	Resi: 35 (site average) Non-resi: 70 (site average)	Energy balance
Merton	 Adopted Nov '24	Houses: 20 Flats: 15	Report only	Maximise
Cornwall DPD	 Adopted Feb '23	Dwellings: 30	Dwellings: 40	Energy balance
Bath and North-East Somerset Council (BANES)	 Adopted Jan '23	Dwellings: 30	Dwellings: 40	Energy balance

Key for tables:  = Adopted;  = At examination.

Appendix E2: Precedents: other emerging Local Plans with similar energy policies (as at June 2026)

This table lists adopted local plans with similar net-zero energy-based operational energy and embodied carbon policies to those proposed by Climate Leadership Gloucestershire (CLG).

	Policy status	Space heating demand, kWh/m ² yr	Energy use intensity, kWh/m ² yr	Renewable energy
Newham (at examination)	 At examination	Dwellings: 20 Non-resi: 20 Industrial: 15	Resi: 35 Non-resi: various	Energy balance (or 120 kWh/m ² fp [industrial], and 80 kWh/m ² fp [other buildings])
Epsom & Ewell (at examination)	 At examination	Dwellings: 30 Non-resi: 15	Dwellings: 40	Energy balance
Reading (at examination)	 At examination	Dwellings: 15-20 Non-resi: 15-20	Dwellings: 35 Non-resi: 70 (site average)	Energy balance
South Gloucestershire	 At examination	Bungalows and detached: 20 Semi- and terrace: 15 Flats: 15 Non-resi: None	Resi: 35 Non-resi: various	Energy balance (all) (or 150 kWh/m ² fp [industrial], and 105 kWh/m ² fp [other buildings])
Enfield	 At examination	Dwellings: 15 Non-resi: 15	Dwellings: 35 Non-resi: various	Energy balance (or 120 kWh/m ² fp [industrial], and 80 kWh/m ² fp [other buildings])
Camden	 At examination	Dwellings: 20 Non-resi: 20	Dwellings: 35 Non-resi: various	

Key for tables:

 = Adopted;  = At examination.

Appendix E3: The viability of similar energy policies has been demonstrated at Examination in Public (EIP)

	Policy status	Inspector comments
Winchester local plan	 Adopted Mar '26	"Having regard to the Council's viability evidence, including the requirements of the emerging Future Homes Standard and other Plan policy requirements that influence viability, in the round, I find the application of policies CN1 and CN3 would be unlikely to impose a significant financial burden on the Plan's planned development or have a significant effect on its affordability" ... no matter how energy efficiency is proposed to be measured, the environmental outcome, to mitigate climate change and contribute to the net zero obligation, will remain the same and it will meet the overarching aim of national policy. Therefore, based on the evidence before me, I find the Council's approach in policy CN1 and CN3, subject to the MMs proposed consistent with national policy, justified and effective. It is therefore sound."
Uttlesford	 Passed examination Jan '26 (awaiting adoption)	"We have considered the effect of achieving net zero carbon in operation on the viability of new development and are satisfied that realistic build-cost uplifts have been factored into Viability Assessment Stages 1 and 2 (INF7 and INF8). In the light of this, we accept the viability assessment reports findings that there is reasonable prospect of the Plan's strategic allocations coming forward viably"
Tendring Colchester Borders Garden Suburb	 Adopted June '25	"There is no evidence to suggest that, in this case, the longstanding aspiration for the garden community to meet the highest standards of sustainable design and construction measures would therefore make the development unviable or undevelopable over the plan period."
Cotswold Garden Village (Salt Cross)	 Adopted Feb '24	"...the application of Policy 2 in isolation, is unlikely to impose a high financial burden on the Garden Village scheme or have a significant effect on housing supply and affordability as other factors also impact on overall viability. The application of Policy 2 is not a factor likely to make a development unviable and there should therefore be no adverse impact on housing delivery and affordability."

Appendix F: Space heating demand (SHD) limit of 15, 20 or 30 kWh/m²/yr | Pros and Cons

Considerations when selecting a space heating demand limit

The choice of where to set the SHD limit should be made with consideration to the six issues highlighted in the table on the right.

	15 kWh/m ² /yr	20 kWh/m ² /yr	30 kWh/m ² /yr
Alignment with net zero	Aligned with LETI, UKGBC and UKNZCBS (for flats)	Aligned with Climate Change Committee recommendation of 15-20 kWh/m ² /yr and UKNZCBS for single family homes.	An increase in carbon emissions associated with energy consumption of 5-15% depending the typology (compared with SHD of 15/20 target, and if using ASHP). This would be greater if using direct electric heating system.
Technical feasibility	Technically feasible in most dwelling types. Can be challenging for detached houses (depending on orientation and form factor). Can be very challenging for bungalows (due to form factor).	Technically feasible in most dwelling types. Most detached houses should be able to meet the limit. Most bungalows should be able to meet the limit.	Technically feasible in most dwelling types, with noticeably more relaxed fabric efficiencies. Detached houses should be expected to meet this limit. Most bungalows should be able to meet this limit unless there are significant constraints.
Impact on Development Management	More cases of non-conformance and exceptions to navigate in the planning approvals process. This is because this ultra-low space heating demand can be challenging to achieve for bungalows and detached houses, or in cases where there is heavy overshadowing.	Fewer cases of non-conformance and exceptions to navigate in the planning approvals process.	Significantly fewer cases of non-conformance and exceptions to navigate in the planning approvals process.
Capital costs	Most expensive to deliver.	Costs less to deliver due to less stringent efficiencies.	Further capital cost savings.
Running costs	Yields the lowest running costs and the greatest flexibility on how and when the home is heated.	Marginal increase in running costs.	Marginal further increase in running costs. Less flexibility on when heating can be used.
Health, wellbeing and comfort	Good indoor air quality reduced risk of damp and mould. Lowest risk of drafts.	Good indoor air quality reduced risk of damp and mould. Low risk of drafts.	Good indoor air quality reduced risk of damp and mould. Low risk of drafts.

Glossary 1/2

Absolute Energy Targets – Energy targets based on predicted actual energy use (e.g. space heating demand, Energy Use Intensity and renewable energy balance).

Air Source Heat Pumps (ASHP) – an electric heating system that gathers ambient heat from surroundings to efficiently heat a dwelling.

Air-tightness – A measure of how much air naturally leaks out of or into a building, through gaps around doors, windows, keyholes etc. Usually measured in $\text{m}^3/\text{m}^2/\text{hr}$ @ 50Pa.

Archetype – A building type used for energy and cost modelling purposes. Selected to reflect common building types in Surrey.

Assured Performance - Quality assurance process during design, construction and operation in order to deliver the predicted energy performance of the building with no or a reduced performance gap. This could be achieved through a quality assurance scheme (such as Passivhaus or Nabers) adopted during design and construction.

Baseline – The starting point from which energy performance and cost uplifts are compared.

Building fabric – a term used to describe collectively the walls, roof, floor, windows and doors of a building.

Carbon budgets – The amount of carbon dioxide we have left to emit for a given degree of climate change. Often expressed as a fair share “budget” of an entity.

Carbon offsets – a way of balancing emissions in one area by reducing emissions in another or by sequestration of carbon*.

CO₂ – carbon dioxide, a greenhouse gas.

Coefficient of Performance (CoP) - a measure of efficiency usually used when describing heat pumps. The CoP is the amount of useful heat (or coolth) produces from every kilowatt of electricity used. E.g. a heat pump with a CoP of 3 produces 3 kW heat for every 1 kW of electricity it uses.

Communal heating system – a multi dwelling heating system.

Energy balance – where the amount of renewable energy generated by a building is the same as the amount of energy the building uses over the course of a year.

Energy efficiency – the relative amount of energy a building or system uses to achieve a certain aim (e.g. maintain a specific internal temperature)

Energy flexibility - When the building can shift its electricity demand in order to use electricity at times when it is cheaper/lower carbon.

Energy offset – The amount of renewable energy that is needed off-site to make up for the shortfall of renewable energy that can be provided on-site to meet policy targets.

Energy Use Intensity (EUI) – The total energy consumption of a building, divided by its gross internal area. Expressed in $\text{kWh}/\text{m}^2/\text{yr}$.

Fabric Efficiency – a measure of how effective a building’s fabric is at retaining heat or staying cool.

Form Factor - the ratio of building volume to exposed external surface area. Smaller form factors are better for energy efficiency.

Fossil Fuel Free - When a building is not connected to the gas network and there is no use of fossil fuels on-site. A low carbon heating system must be used instead (e.g. heat pumps).

Future Homes Standard (Part L2 2026) – The successor to the building regulations Part L1 2021 (residential buildings), to come into force in March 2027.

Future Buildings Standard (Part L2 2026) – The successor to the building regulations Part L1 2021 (non-residential buildings), to come into force in March 2027.

Glossary 2/2

Home Energy Model – The proposed methodology which will assess whether new dwellings demonstrate compliance with the Future Homes Standard (to replace SAP).

ktCO₂ – kiloton of CO₂, a measure of the amount of carbon dioxide emitted or offset.

kWh – kilowatt hour, a measure of the amount of energy used or generated in one hour.

Mechanical Ventilation with Heat Recovery (MVHR) – a form of building ventilation that recovers heat from stale air before it is vented outside the building and uses it to warm incoming fresh air.

Net Zero Carbon – where the amount greenhouse gases emitted by an organisation are equivalent to the emissions either: i) sequestered or offset , ii) displaced by production of renewable energy.

Notional Building – part of the building regulations calculation methodology. It is a dwelling or building based on the same geometry and orientation as the proposed building, but with the building specification (U-values, window area, heating system and efficiency etc.) made up of a set of reference values.

Operational energy – The total amount of energy required to run a building (e.g. space heating, cooling, hot water, lighting, pumps, fans, appliances, cooking. Note it excludes electric vehicle charging.

PassivHaus Planning Package (PHPP) – predictive energy modelling and design tool.

Performance Gap – The difference between the amount of energy a building actually consumes compared with what it is predicted to consume through energy modelling.

Renewable energy – energy from a renewable source e.g. wind or solar.

Renewable Energy Balance – Where the amount of renewable energy generated by a building is equal to the amount of energy it consumes over the course of a year.

SAP – Standard Assessment Procedure (SAP) is the calculation methodology currently used to demonstrate compliance with Building Regulations.

Scenarios for energy modelling - The six different standards or specifications each archetype was modelled to. See page 12.

Space heat demand (SHD) – the amount of heat energy required to heat a space. SHD is a reflection of building fabric efficiency and is usually expressed in kWh/m²/yr.

Space cooling – The amount of energy required to cool a building over a year, to maintain internal comfort conditions, measured in kWh/m²/yr (GIA).

Solar photovoltaic (PV) – a form of renewable electricity generation from solar energy well suited to buildings and urban environments. Can be stated in installed capacity (kW), annual generation (kWh/yr) or annual generation per m² of building footprint (kWh/m²/yr)

Solar self-consumption – The amount of solar energy used directly by the building at the point of generation. Expressed as a % of the total annual energy demand of the building.

Solar Export – Solar energy generated by the building and exported directly to the electricity grid.

TER (Target Emissions Rate) - The target CO₂ emission rate (TER) sets a minimum allowable standard for the energy performance of a building and is defined by the annual CO₂ emissions of a notional building of same type, size and shape to the proposed building. TER is expressed in annual kgCO₂/m².

Waste Water Heat Recovery (WWHR) – A proprietary system fitted to the outlets from sinks, showers and baths, which collects heat from the waste water and transfers it to the cold water feeding a hot water store.