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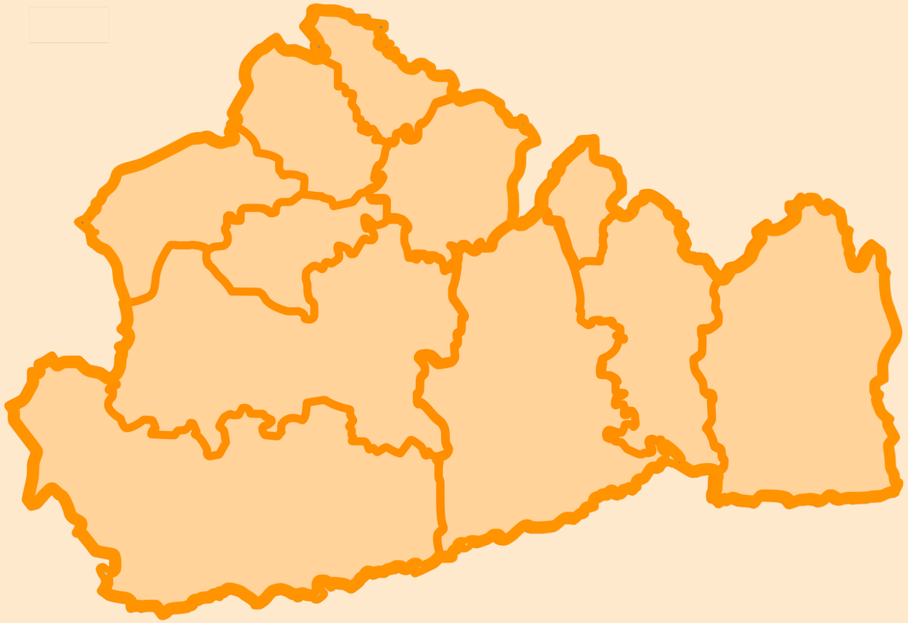


# Surrey Viability Toolkit

An evidence study to support planning policies which deliver Net Zero Carbon developments

## Part A: Summary Report

May 2024 | Rev B

Bioregional

Three Dragons

Etude

# The purpose of Surrey's Net Zero Carbon Viability Toolkit

### Developing policies that meaningfully address climate change

Surrey County Council and its districts and boroughs wish to develop new buildings policies that deliver buildings which exceed minimum national standards and meaningfully address the climate emergency.

The policies should be developed in order that new buildings are:

- Fully net zero;
- Utilise low carbon heat (i.e. no fossil fuel consumption on-site);
- Address carbon emissions from all operational energy uses (both regulated and unregulated energy uses), and;
- Address embodied carbon.

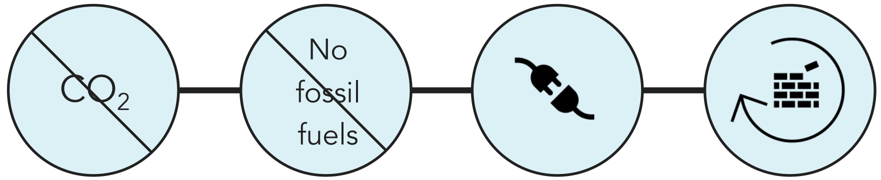
### Providing the tools for districts and boroughs to implement net zero carbon new buildings policies

As each district and borough within Surrey updates their local plan, the inclusion of net zero carbon buildings policies will require robust evidence to demonstrate technical deliverability and financial viability.  This Net Zero Carbon Viability Toolkit gives the districts and boroughs the tools they need to inform technical feasibility of delivering net zero carbon new buildings across different archetypes. The toolkit also provides costing data and information for districts and boroughs to undertake their own viability assessments for new buildings meeting net zero carbon metrics.

### Who is this Toolkit for?

This Toolkit has been designed primarily for planners and policy makers within Surrey's districts and boroughs to give them the data and information needed to develop their own evidence bases.

Surrey's objectives for net zero carbon buildings policies




Fully net zero | Low carbon heat | <u>All</u> operational carbon emissions | Address Embodied carbon

# The Toolkit Structure

The Surrey Net Zero Carbon Viability Toolkit is a suite of **five** separate components illustrated here.

This report

**Part A: Summary Report**

The summary report captures the main headlines and findings of the energy and cost modelling results. It also provides a summary of recommendations for policy to take forward.

**Part B: Energy modelling results**

Refer to this section for more detail on:

- The energy modelling process: what was modelled, how and why was it modelled that way.
- The assumptions used behind the energy modelling process.
- The results of the energy modelling for each archetype modelled.
- The design and specifications of the archetypes chosen.
- Running costs modelling assumptions and results.
- Embodied carbon recommendations.

**Part C: Energy and costs spreadsheet**

Refer to this spreadsheet for more details on:

- A breakdown of costing data and results
- The specifications of the dwellings modelled.
- Costing graphs for each dwelling archetype modelled.
- The assumptions used behind the cost modelling.

**Part D: Viability Calculator**

This spreadsheet can be used as a quick, one-page viability calculator tool.

It enables the districts and boroughs to plug in their own data and return

**Part E: Cost and Viability modelling results**

Refer to this section for more detail on:

- The cost modelling process and methodology.
- The assumptions used behind the cost modelling.
- The viability process and methodology.
- The assumptions used behind the viability modelling.
- The viability modelling results.

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# 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 $m^3/m^2/hr$ @ 50Pa.

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

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

**$CO_2$** – 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 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 $kWh/m^2/yr$.

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

**Future Homes Standard (Part L 2025) –** The proposed successor to the building regulations Part L 2021.

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

**$ktCO_2$** – kiloton of $CO_2$, 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.

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

# Glossary 2/2

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

**Policy Route 1 –** Policy target aligned with building regulations Target Emissions Rate (TER) indicator.

**Policy Route 2 –** Policy target aligned with absolute energy targets, the Climate Change Committee and LETI.

**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.

**Scenario 0 –** Baseline, Part L 2021.

**Scenario 1** – Future Homes Standard Consultation 2023, Notional Building Option 1

**Scenario 2 -** Future Homes Standard Consultation 2023, Notional Building Option 2

**Scenario 3 –** 100% reduction on TER, using FHS Option 2 specification (Policy Route 1)

**Scenario 4 –** Net Zero Carbon, Low-energy (SHD < 30 $kWh/m^2/yr$)

**Scenario 5 –** Net Zero Carbon, Ultra-low energy (SHD 15-20 $kWh/m^2/yr$)

**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 $kWh/m^2/yr$.

**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 $m^2$ of building footprint ($kWh/m^2/yr$)

**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 $CO_2$ emission rate (TER) sets a minimum allowable standard for the energy performance of a building and is defined by the annual $CO_2$ emissions of a notional building of same type, size and shape to the proposed building. TER is expressed in annual $kgCO_2/m^2$.

**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.

# 1

## Residential buildings: Approach to policy, energy, running costs and capital costs

# 2.3 Current industry definition of Net Zero buildings

### Industry definitions of Net Zero Carbon

A significant amount of work has been undertaken since 2019 to define and articulate the requirements of Net Zero carbon buildings. This includes the work undertaken and published by the Climate Change Committee (CCC), the Royal Institute of British Architects (RIBA), the Chartered Institute of Building Services (CIBSE), the UK Green Building Council (UKGBC), the Better Buildings Partnership (BBP), the Passivhaus Trust, the Good Homes Alliance (GHA) and the Low Energy Transformation Initiative (LETI).

Relevant reports and initiatives include:

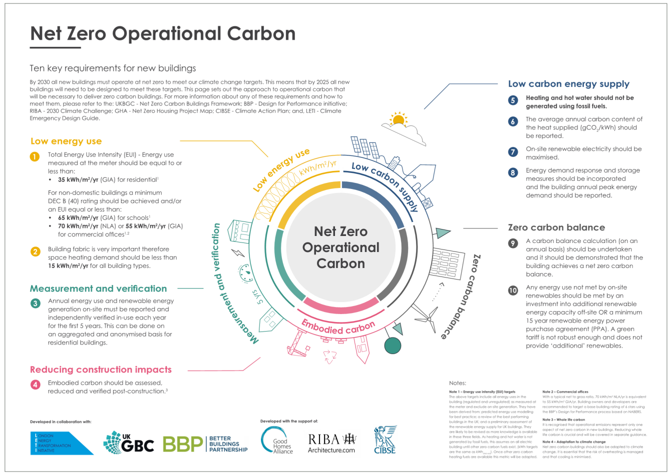
- UKGBC Net Zero Carbon - A framework definition
- LETI Net Zero operational carbon one pager
- LETI Climate Emergency Design Guide
- WLCN - Carbon definitions for the built environment
- RIBA 2030 Climate Challenge.
- UK NABERS
- The forthcoming UK Net Zero Carbon Buildings Standard.

The above documents and guidance are consistent in their approach, and all have similar metrics that include:

- Space heating demand (SHD) targets ( kWh/m$^2$/yr)
- Energy Use Intensity (EUI) targets ( kWh/m$^2$/yr)
- Embodied carbon targets kg $CO_2$/ m$^2$ either upfront embodied carbon (A1-A5) , lifecycle embodied carbon (A1-C4) or both.

This study uses the current industry definition of Net Zero Carbon (refer to appendix for detailed definition).


*Industry publications on Net Zero*




*Ten key requirements for a Net Zero Operation Carbon - A summary. Developed by UKGBC, LETI and BBP, and supported by the Good Homes Alliance, RIBA and CIBSE.*

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# 2.4 Current industry definition of Net Zero buildings:  Breaking it down

### A growing evidence base has led to an industry definition

The current definition of a Net Zero Carbon in operation for new buildings has been developed by UKGBC, LETI, the UK Net Zero Carbon Buildings Standard and BBP, and supported by the Good Homes Alliance, RIBA and CIBSE. In summary, it needs to achieve a low level of space heating demand and total energy use, cannot use fossil fuels on site and needs to generate renewable energy on-site to match its energy use on an annual basis.

### 1 - Energy efficiency

Buildings use energy for heating, hot water, ventilation, lighting, cooking, appliances and equipment. All energy use within the building must be considered (not only ”regulated” energy use) and need to comply with a maximum value, the Energy Use Intensity (EUI) which varies depending on the building type and represents ‘delivered energy’ generally.

### 2 - Low carbon heat

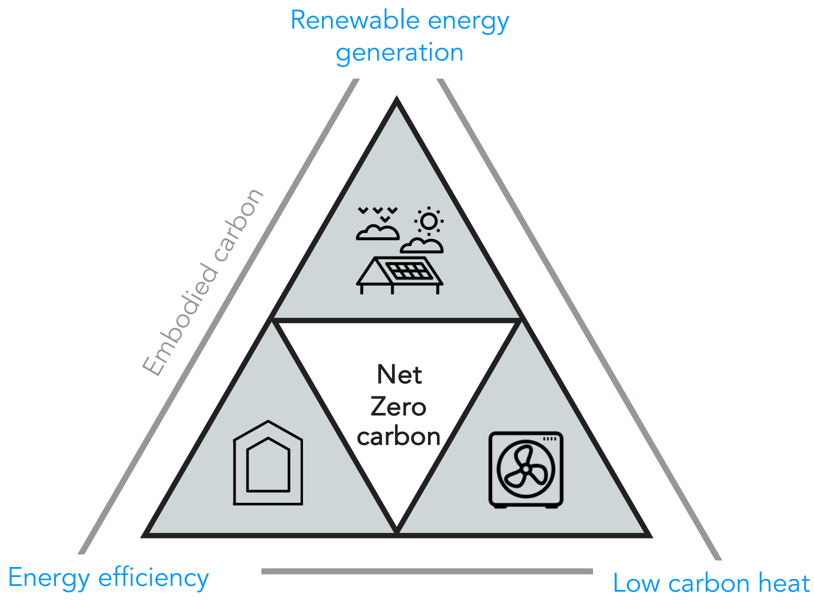
Low carbon heat is an essential feature of Net Zero Carbon buildings. All new buildings should be built with a low carbon heating system and must not connect to the gas network or, more generally, use fossil fuels on-site.

### 3 - Renewable energy generation

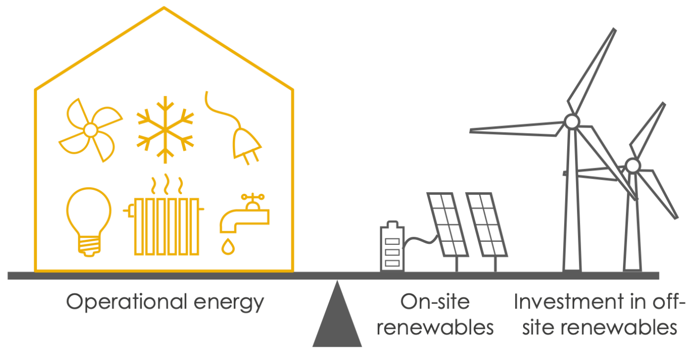
New buildings should seek to add at least as much renewable energy generation to the energy system as the energy they will use in an annual basis. In Surrey, solar photovoltaic (PV) panels will be the renewable energy system to deliver this objective.

### 4 - Embodied carbon

Operational carbon is only part of the story. Net Zero Carbon buildings should also minimise embodied carbon in materials and their impact throughout their lifecycle, including demolition.




*For the Climate Change Committee, energy efficiency and low carbon heat represent two key pillars of future buildings compliant with our climate change commitments*




**Net zero operational balance**

*Renewable energy should be provided to achieve an operational “energy balance” – the amount of energy generated in one year should be equal to or more than the energy used in a year.  Off-site provision can be considered where it is not possible to provide energy on-site.*
*© LETI*

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# 2.5 The building regulations landscape

### The current Building Regulations

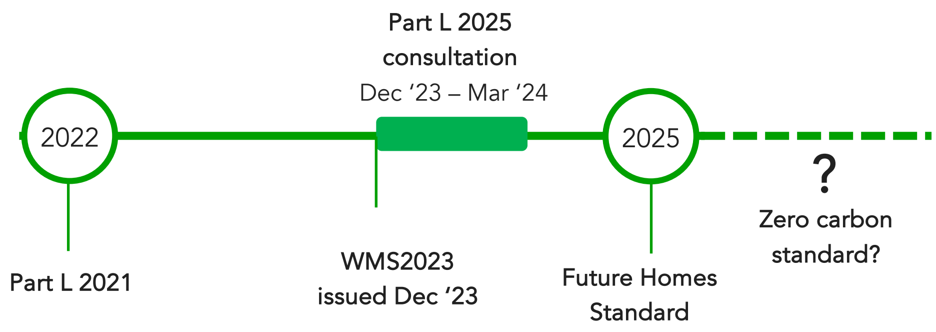
The current section of the building regulations that governs energy and carbon emissions is Part L 2021. This came into force in June 2022 and is due to be replaced by the Future Homes Standard (residential) and the Future Buildings Standard (non-residential) in 2025.

### Future Homes Standard Consultation

At the time of compiling this evidence base (Jan-April 2024), the government held a consultation on the content, standards and methodologies of the Future Homes Standard, the Future Buildings Standard and the Home Energy Model (Dec 2023-March 2024).

This is expected to be released in 2025, although no date has been confirmed and it is quite possible that it will be later than this. When the Future Homes Standard comes into operation it will replace Part L 2021, and the Home Energy Model will replace the Standard Assessment Procedure (SAP) – the methodology currently used to determine compliance with Part L of the building regulations for dwellings.

Since the consultation period has only just passed and the standards have not been finalised, we do not know with any certainty the details of the Future Homes Standard, the Future Buildings Standard or the methodologies for determining compliance with them.




*Policy changes are moving towards zero carbon, however there is much uncertainty surrounding the details.*

### Written Ministerial Statement 2023

On 13th December 2023 a new Written Ministerial Statement (WMS) was issued on the topic of "Planning – Local Energy Efficiency Standards".

The new WMS sets out to constrain the ability for local authorities to set their own standards, but it does not remove them.

However, there has been much attention given to the legality of the WMS and the weight that should be given to it over the obligations put on LAs by the Planning and Energy Act 2008 and NPPF to address climate change. Two notable responses include:

- Essex County Council and Essex Climate Action Commission have issued open advice[1] from barrister Estelle Dehon KC. The key conclusion being: "This means that the 2023 WMS cannot be interpreted to prevent LPAs from putting forward, and planning inspectors from finding sound, policies which are justified and evidenced and which use metrics other than the TER metrics other than the TER metric and/or do not require calculation by SAP."
- The High Court has allowed a judicial review of the WMS 2023, as requested by NGO Rights: Community: Action. At the time of completing this evidence base the outcomes are as yet unknown.

1https://www.essexdesignguide.co.uk/climate-change/essex-net-zero-evidence/essex-open-legal-advice-energy-policy-and-building-regulations/

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# New buildings: exploring two different strategic options

**Adapting the current system or changing it?**

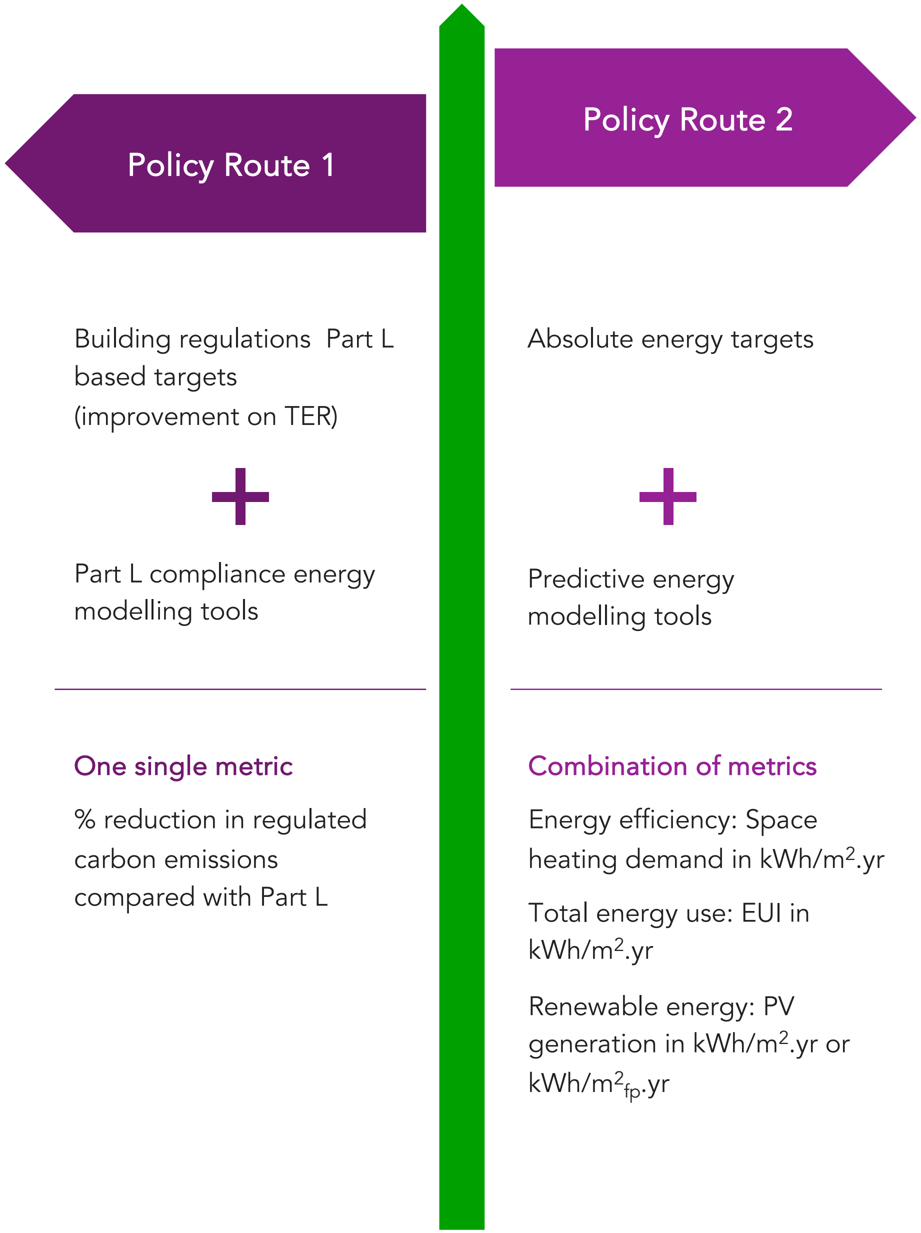
This evidence base study will explore the two broad policy options for local authorities wishing to translate their climate ambitions into requirements for new buildings in the county have the choice between two different strategic directions:

- **Policy Route 1 uses the building regulations framework - setting % improvements over the Target Emissions Rate (TER).** This system requires the applicant to use a Part L energy modelling software, and performance is measured against a single metric (i.e. % reduction in regulated carbon emissions). This metric cannot be measured at a post-occupancy stage.
- **Policy Route 2 uses absolute energy-based metrics**. This system requires the applicant to use predictive energy modelling tools and methodologies. Performance is measured against a number of metrics (e.g. space heating demand, Energy Use Intensity), A significant advantage of the Energy Use Intensity (EUI) is that it can be measured post-occupancy as it generally aligns with 'energy at the meter'. Many other local authorities have recently adopted, or are in the process of adopting, policies aligned with this option.

Some recent successfully adopted local plans have taken Policy Route 2:

- Cornwall Council
- Bath and North East Somerset Council
- Central Lincolnshire Council.

There are several other local authorities that are intending to follow the same route, including: Greater Cambridge; Bristol City Council; Leeds City Council; Winchester, Uttlesford and South Oxfordshire and Vale.




*Two types of approach are possible to go beyond the requirements of Part L 2021*

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# Determining compliance

Policy Route 1

Policy Route 2

**Policy Route 1: a building regulations aligned KPI**

A single target Key Performance Indicator (KPI) for compliance with the Policy Option 1 is a 100% reduction over the Target Emissions Rate (TER).

The strategy for determining the route to compliance was to use the most likely route chosen by a developer – the one with least capital cost. This consisted of:

1) Use of the minimum building fabric specification to pass the potential* Future Homes Standard notional building specification option 2 , with an Air Source Heat Pump system.

PLUS

2) Add photovoltaic panels to the roof to achieve a 100% reduction in carbon emissions using SAP 10.

Compliance was determined using the building regulations compliance software SAP 10 (due to be replaced by the Home Energy Model in 2025, still in development).

100% reduction on TER

***Notes of caution**

1) The fabric specification selected for determining compliance with this route (Notional building Option 2 in the Future Homes Standard Consultation 2023) is highly subject to change until the Future Homes Standard is finalised.

2) Creating a policy that uses a % reduction on the TER approach will not provide consistency to developers over time.

**Policy Route 2: absolute energy targets KPIs**

The Target Key Performance Indicators (KPIs) for compliance with the Policy Option 2 are based on absolute energy targets.

Separate targets are set for:

- Space heating demand (energy efficiency of the building fabric)
- Energy Use Intensity (overall energy use)
- Renewable energy generation.

The building fabric specifications were set at a level to meet the space heating demand at the lowest cost, most pragmatic level.

Air-tightness and Mechanical Ventilation with heat recovery have a large impact on space heating demand and are included as standard, allowing some of the u-values to be relaxed compared with previous scenarios.

Compliance was determined using the predictive energy modelling software PassivHaus Planning Project.

| | Low Energy SHD 30 kWh/m²/yr | Ultra-low energy SHD 15-20 kWh/m²/yr |
|---|---|---|
| Space heating demand | 30 kWh/m²/yr | 15-20 kWh/m²/yr |
| Energy Use Intensity | 40 kWh/m²/yr | 35 kWh/m²/yr |
| Renewable energy | Energy balance | Energy balance |

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# Energy and cost modelling analysis | Our approach to scenarios modelling

| | | | | Policy Route 1 | Policy Route 2 | |
|---|---|---|---|---|---|---|
| | Scenario 0: Part L 2021 | Scenario 1: Future Homes Standard - Option 1 | Scenario 2: Future Homes Standard - Option 2 | Scenario 3: 100% better than FHS - Option 2 TER | Scenario 4: Net Zero (Low energy) | Scenario 5: Net Zero (Ultra Low energy) |
| Purpose | Baseline<br>Energy, carbon, cost.<br><br>What is being built now, until the Future Homes Standard is released. | Exploratory modelling to understand potential FHS options. | Exploratory modelling to understand potential FHS options. | Potential policy option 1 - based on minimum FHS fabric and more PVs<br><br>Comparison with Part L 2021 | Potential policy option 2 - space heating demand (SHD) less than 30 $kWh/m^2/yr$<br><br>KPIs aligned with Cornwall and Bath & NE Somerset | Potential policy option 3 - space heating demand of 15-20 $kWh/m^2/yr$<br><br>KPIs aligned with Climate Change Committee and LETI. |
| Spec | Notional building spec, tweaked to pass Part L 2021 | FHS Notional building spec* option 1 | FHS Notional building spec* option 2 | FHS Notional building spec option 2 + PVs to bring TER to 0 | Spec to achieve SHD of 30, EUI of 40 and energy balance. | Spec to achieve SHD of 15-20, EUI of 35 and energy balance. |
| SAP 10 | Yes | No | No | Yes. To demonstrate compliance. | No | No |
| PHPP | Yes. To understand energy performance. | Yes. To understand energy performance. | Yes. To understand energy performance. | Yes. To understand energy performance. | Yes. To demonstrate compliance. | Yes. To demonstrate compliance. |
| iHEM | No | Semi-detached only | Semi-detached only | Semi-detached only | No | No |
| Cost analysis | Yes | Yes | Yes | Yes | Yes | Yes |

*wall and u-value specs improved slightly to reflect our experience that the Notional Building spec doesn't meet the TER when using Part L 2021 or HEM.

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# Energy and cost modelling analysis | Archetype selection

### Archetype selection

In order to undertake the energy and cost modelling for this technical evidence base, a number of domestic and non-domestic archetypes had to be identified and assessed.

There is obviously a very wide range of building types in Surrey and within each building type an almost infinite variety of buildings. In discussions with districts and boroughs, we have identified 8 building archetypes:

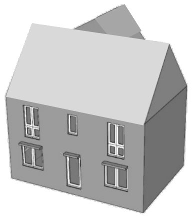
- six domestic: detached house, semi-detached house, terrace house, low-rise, medium-rise and high-rise apartment buildings. These have been modelled and costed specifically for Surrey.
- two non-domestic: office and light industrial/warehouse. We will re-use models and costing produced for the London area, and extrapolate the learnings and evidence for Surrey. Weather and cost data are similar.

We have then identified one building for each of these building types (see adjacent images). Each building is a typical developer-built example of that particular archetype. In reality there is much variation in building designs and specification, and site upon which they sit, and this impacts energy, carbon and cost. However, it is very common for technical evidence bases to use representative examples of different building types, as we are doing here. It can always be expanded with more buildings/building types if required.

### 6 different scenarios/combinations of specifications

6 different scenarios will be modelled, combining different specifications in terms of fabric and ventilation, heating system and solar PVs.

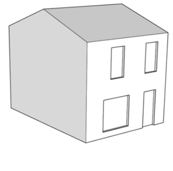
### Domestic archetypes selected



**Detached house**

142 sqm

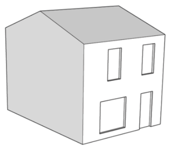
This building represents the generic **detached house** new build typology



**Semi-detached house**

93 sqm

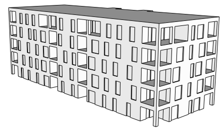
This building represents the generic **semi-detached house** new build typology



**Terrace house**

93 sqm

This building represents the generic **Terrace house** new build typology

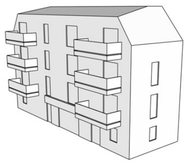


**Mid-rise**

5 storeys

2,600 sqm

This building represents the generic **Mid-rise apartment building** new build typology

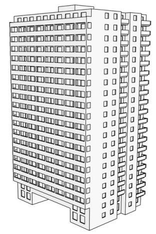


**Low-rise**

3/4 storeys

470 sqm

This building represents the generic **Low-rise apartment building** new build typology



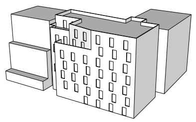
**High-rise**

19 storeys

16,300 sqm

This building represents the generic **High-rise apartment building** new build typology

### Non-domestic archetypes selected

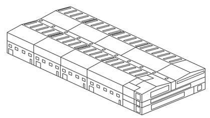


**Office**

7 storeys

4,000 sqm

This building represents the generic **office building** new build typology



**Industrial**

2 storeys

9,000 sqm

This building represents the generic **industrial building** new build typology

*Graphical representation of the 8 buildings chosen as archetypes*

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# Policy Route 1: Predicted energy consumption and renewable energy generation

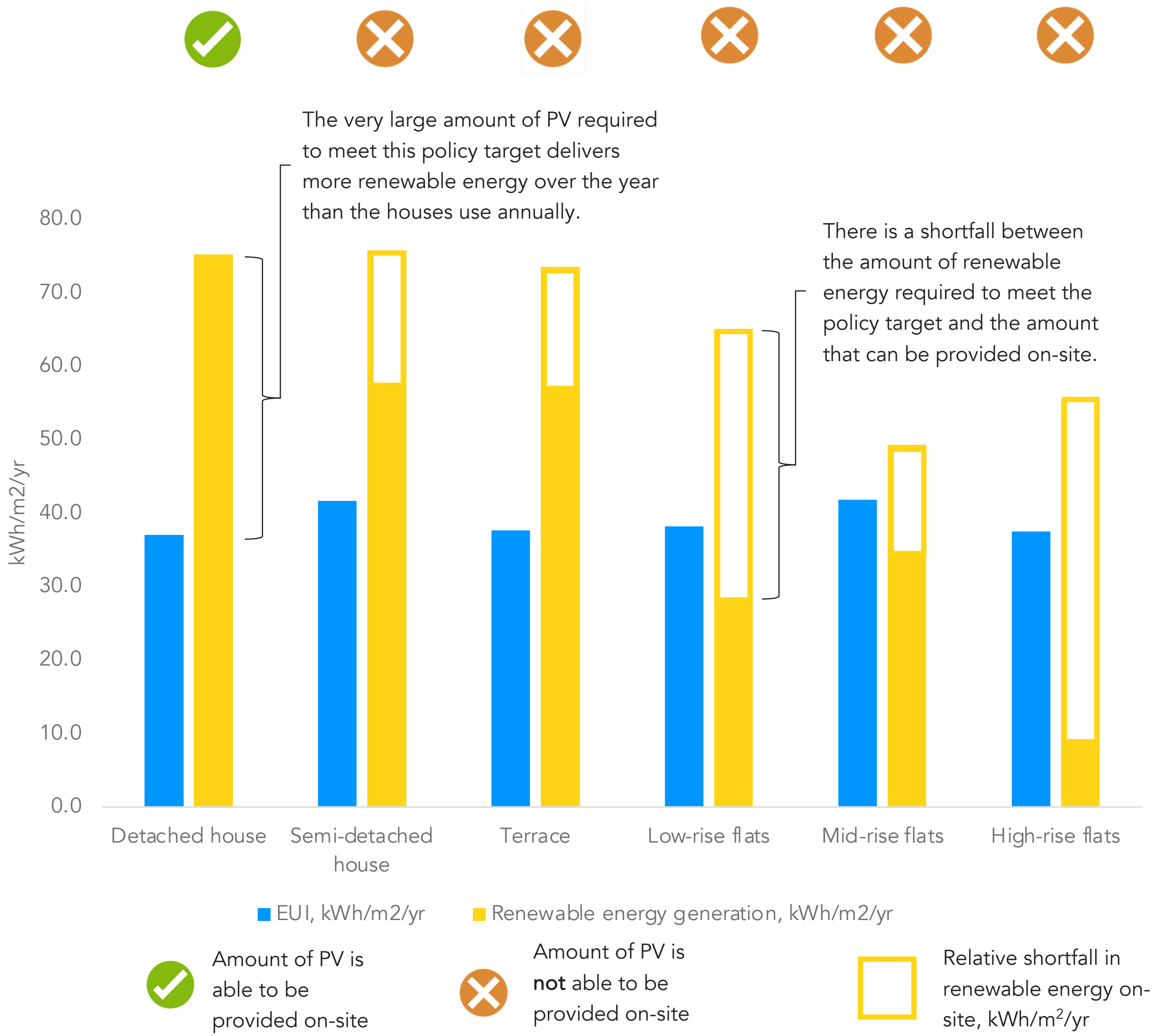
For Policy Route 1 the photovoltaic (PV) arrays were sized to achieve a 100% reduction on the Target Emissions Rate (TER) using SAP 10.

100% reduction on TER

The adjacent graph illustrates the predicted annual energy consumption of each archetype (blue column) compared with the annual energy generation of each archetype (yellow column). These predicted consumption and generation figures were calculated using PassivHaus Planning package so we could compare actual likely energy performance of the different policy options.

- To achieve this policy target (100% reduction in TER) results in very large requirement for PV – so much that there is likely to be more annual energy generation than energy consumption.
- In most cases, the area of PV required to meet this policy target cannot feasibly be installed on-site. Therefore, applicants would need to provide an energy offset to comply (if the council decide to operate an offset policy).
- There is likely to be a significant change in the calculation methodology between SAP 10 the Home Energy Model is released (due in 2025). Therefore developers will need to change how they respond to this policy at that point.

The very large amounts of photovoltaics required are due to the carbon factors set within SAP 10.




*This graph illustrates the predicted annual Energy Use Intensity (EUI) compared with the predicted annual renewable energy generation required for the specifications used to achieve Policy Option 1 for each archetype. Figures generated using predictive energy modelling (PHPP) to enable comparison between the different policy options.*

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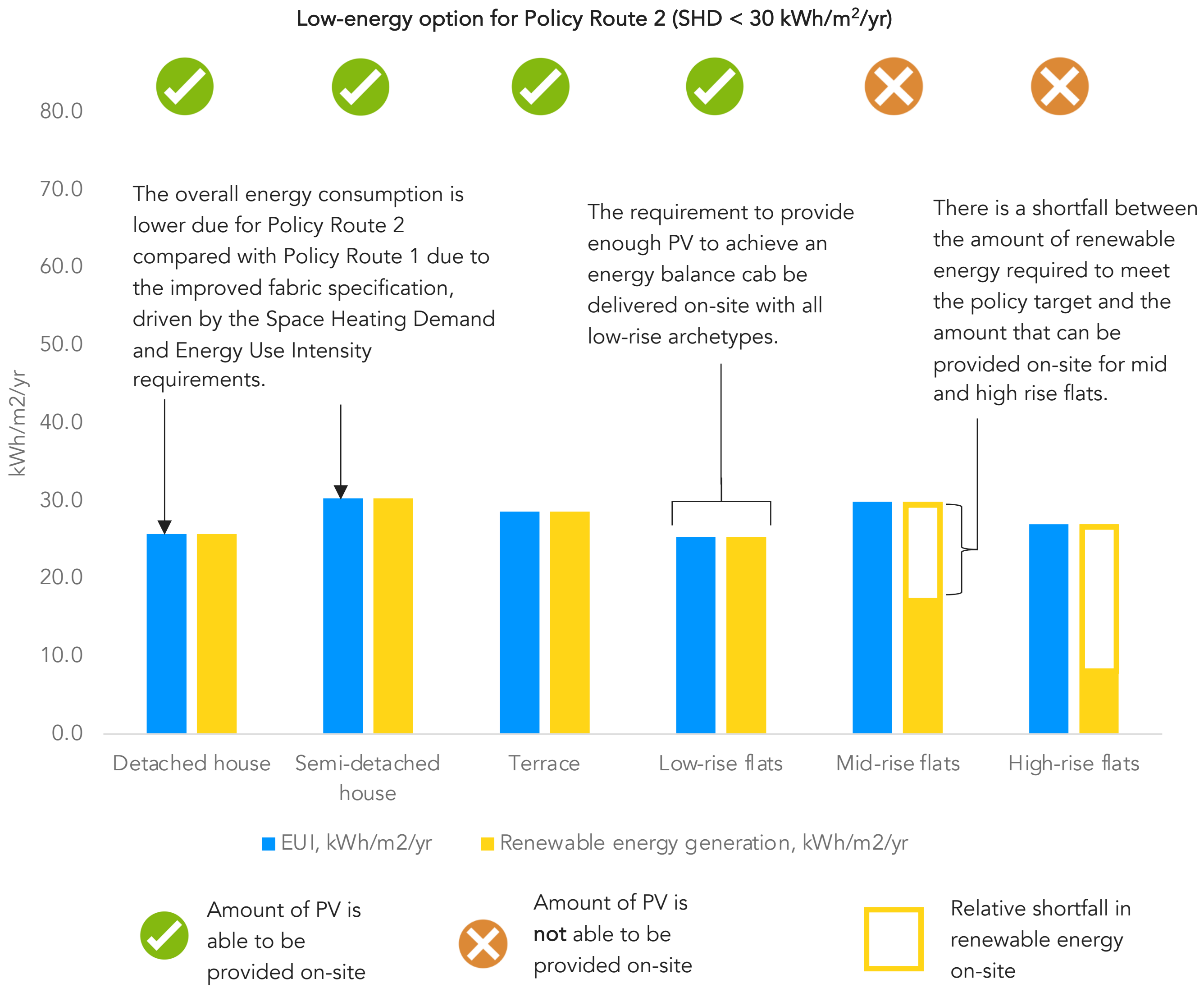
# Policy Route 2 ultra-low energy: Predicted energy consumption and renewable energy generation

For Policy Route 2 (ultra-low energy) fabric and services specifications were selected to meet the space heating demand and energy use intensity targets. Solar photovoltaic was added to meet the energy balance target.

| Space heating demand | Energy Use Intensity | Renewable energy |
|---|---|---|
| 15-20 kWh/m²/yr | 35 kWh/m²/yr | Energy balance |

The adjacent graph illustrates the annual energy consumption of each archetype (blue column) compared with the annual energy generation of each archetype (yellow column).

- Overall energy consumption of the archetypes following Policy Route 2 is lower than Policy Route 1. This is because the space heating demand and energy use intensity targets set minimum standards for energy efficiency.
- The amount of solar PV required is lower too, as the target only requires an energy balance. This can be achieved on-site for all archetypes except the mid-rise and high-rise flats.
- Energy offsetting will likely only be required for mid and high rise flats. Councils should consider an energy offsetting policy in order to enable applicants to comply with net zero policies where they cannot be achieved on-site.




*This graph illustrates the predicted annual Energy Use Intensity (EUI) compared with the predicted annual renewable energy generation required for the specifications used to achieve Policy Route 2 for each archetype. Only for the mid-rise and high-rise would it not be possible to achieve the renewable energy balance KPI on-site. Therefore an energy offsetting policy and mechanism would be required to achieve compliance with policy objectives.*

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# Policy Route 2 low energy: Predicted energy consumption and renewable energy generation

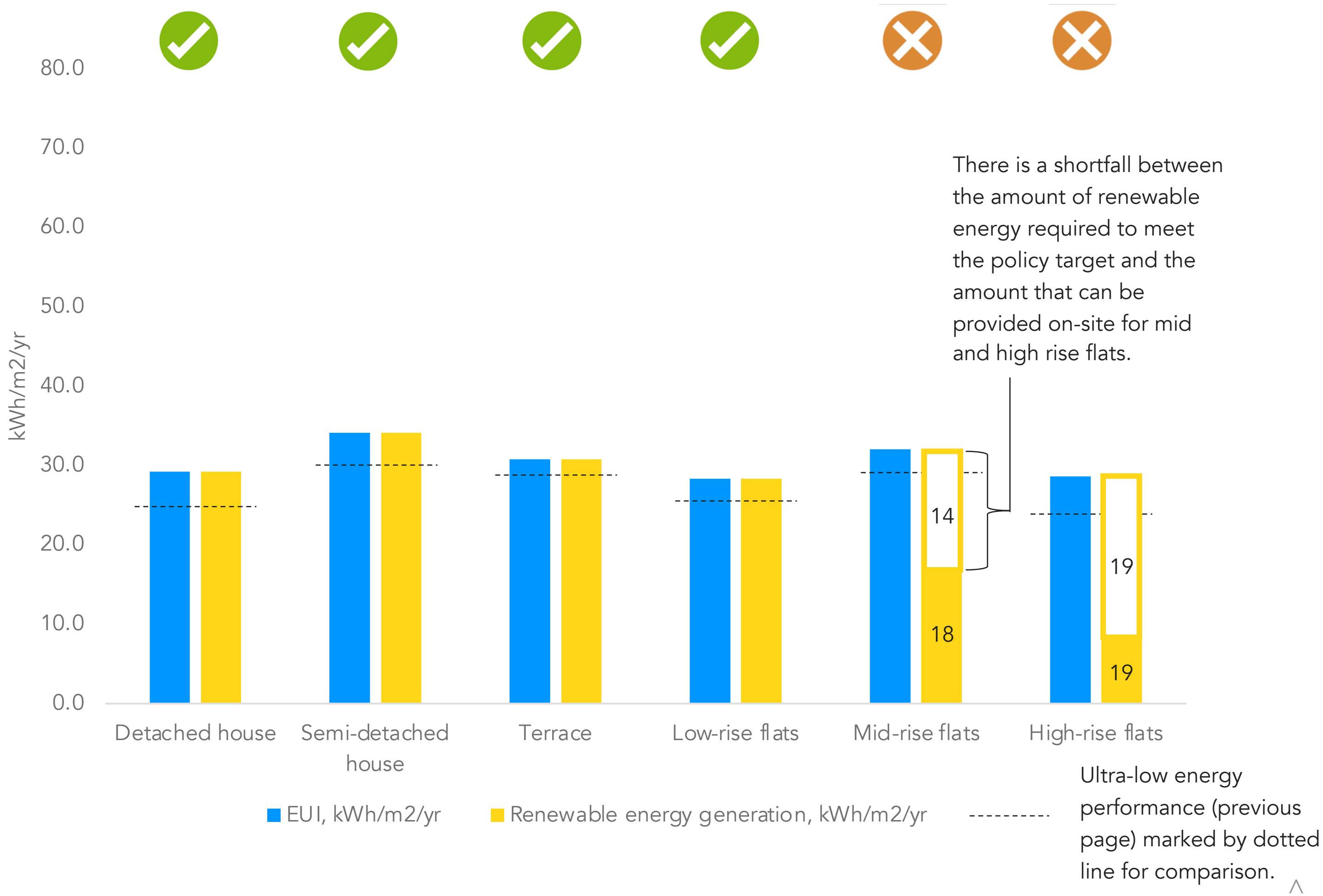
For Policy Route 2 (low energy) fabric and services specifications were selected to meet the space heating demand and energy use intensity targets. Solar photovoltaic was added to meet the energy balance target.

| Space heating demand | Energy Use Intensity | Renewable energy |
|---|---|---|
| <30 kWh/m²/yr | 40 kWh/m²/yr | Energy balance |

The adjacent graph illustrates the annual energy consumption of each archetype (blue column) compared with the annual energy generation of each archetype (yellow column).

- Results are very similar to the Ultra-low energy targets option for Policy Route 2 (see previous page). Energy Use Intensities are 6-14% greater for the low-energy targets compared with the ultra-low energy targets illustrated on the previous page (see dotted lines on this chart).

**Ultra-low energy option for Policy Route 2 (SHD = 15-20 kWh/m²/yr)**




Amount of PV is able to be provided on-site

Amount of PV is **not** able to be provided on-site

Relative shortfall in renewable energy on-site

*This graph illustrates the predicted annual Energy Use Intensity (EUI) compared with the predicted annual renewable energy generation required for the specifications used to achieve Policy Route 2 for each archetype. This shows the results for Scenario 4 (Policy Route 2 – low energy).*

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# Running Costs

Running costs are difficult to predict with accuracy as there are many variables at play.

Some of these variables have been modelled using low, mid and high values: energy prices; solar export prices, solar self-consumption and the 'performance gap'. All variables act independently of each other. When combining them we have combined them in a way that will produce low and high overall running costs.

This logic does not work when combining energy costs and solar export tariffs since high export tariffs rarely coexist with low energy prices (although low-export tariffs can exist with high energy prices).

The energy modelling report takes us through the impact and potential range of running costs of:

1. Energy efficiency
2. Solar self-consumption
3. Revenue from solar export and
4. The net effect of combing these variables the performance gap.

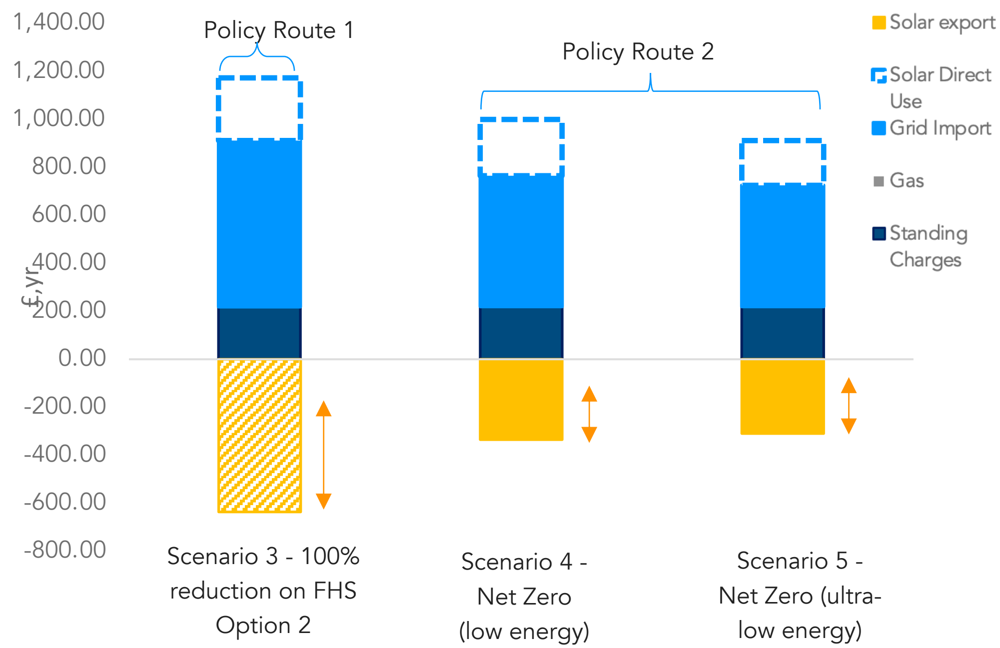
This page shows this final step only.

Key conclusions:

- Increasing energy efficiency decreases the amount of imported energy required (and hence the cost of it).
- Solar self-consumption significantly reduces the amount of energy required from the grid (hence saving occupants money).
- Standing charges become significant with lower energy buildings.
- Revenue from solar export can be significant – even to the point of completely offsetting energy costs if the PV array is large enough. However solar export tariffs are historically very variable and cannot be relied upon.

| | Policy Route 1 | Policy Route 2 | |
|---|---|---|---|
| Semi-detached house, today | 100% Reduction over FHS Option 2 | Net Zero (Low energy) | Net zero (ultra-low energy) |
| Imported energy cost (average) | £656 | £508 | £485 |
| Potential PV export revenue (range) | £85 - £850 | £45-£450 | £41-£410 |
| Potential net annual costs | £-194 - £571 | £58 - £463 | £75 - £444 |

*Potential net costs of the semi-detached house using today's (April 2024) average energy prices with today's (April 2024) range of solar export prices. A huge range of solar export prices are currently available but this is unusual and cannot be relied upon for the future.*




*Revenue from solar export is highly subject to changes in solar export tariffs. Example of potential energy costs for the "Mid" range for a semi-detached house. The mid-range reflects current energy prices as at April 2024.*

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# Running Costs: Summary and recommendations

### Energy efficiency

- Occupants are more insulated from rising energy prices in more energy efficient dwellings. Policies that encourage energy efficiency (Policy Route 2) are therefore recommended.
- With Policy Route 2, we see a reduction of 12-24% (SHD* < 30) and 20-31% (SHD* 15-20) in energy demand compared with Part L 2021 – and only a 6% reduction in energy demand for Policy Route 1.
- For flats, the only reliable way to deliver reduced running costs is through implementation of energy efficiency targets – e.g through absolute energy targets in Policy Route 2.
- The higher the energy efficiency the more occupants are able to take advantage of solar self-consumption, and the more they stand to save.

### Solar self-consumption

- The presence of solar PV benefits occupants and reduces running costs significantly by using some of the generated renewable energy on-site. Running costs are reduced by 20-40% in the scenarios modelled through solar self-consumption alone (without the use of battery storage). This means that occupants can make reliable and significant savings on their running costs whether or not any revenue is made from exporting renewable energy to the grid. Savvy occupants may be able to increase these savings even further through managing when their appliances run (peak demand shifting).

### Performance gap

- An Assured Performance policy can have a big impact on running costs. Dwellings will be delivered that are more likely to perform as designed.

*SHD = Space heat demand, kWh/m$^2$/yr. See all glossary of terms, pages 3-4.

### Revenue from solar export

- The benefit of exporting surplus solar energy generation has the further benefit of generating revenue. The amount of potential revenue will vary and will be proportional to the export tariff from the occupants' energy supplier.
- Net energy costs will depend on the balance between import tariffs and export tariffs, which change between energy supplier and market conditions. With the current (April 2024) ratio of potential export tariffs to import tariffs, energy efficient homes with large solar PV array may have minimal, or even negative levels.
- There is a clear benefit to larger solar PV arrays and these should be encouraged.
- Where an energy balance can be met on site without maximising the amount of solar on the roof, solar panels should be positioned in a way that occupants can add more a later date should they wish.

### Recommendations for policy creation

- Energy efficiency has clear benefits for running costs for both houses and flats leading to more stable energy costs. Policy Route 2 is recommended.
- In practice, occupants of flats will find it more difficult to benefit from reduced running costs from solar PV even if it is present on the building. Policies that require high levels of energy efficiency are even more important for flats.
- An assured performance policy helps to make energy performance and therefore running costs more certain.
- Solar PV on homes make a big difference to running costs. Policies should include a requirement for solar PV to assist in occupants' running costs.
- The larger the PV array, the bigger the benefit. Ensure applicants are meeting the policy targets through good use of roof space, and any additional roof space can be used by occupants for more PV.

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# Capital costs

### How we approached modelling

Each of the resultant specifications for the dwelling archetypes modelled (see Part B Energy Modelling Results, Part 6 Appendix) were costed by the cost consultant. The cost consultant's methodology can be found and detailed cost breakdowns can be found in the costing spreadsheet (Part C Energy and Costs Spreadsheet).

### The "current" baseline has been used to assess costs against

The "current" baseline can be considered to be a dwelling that meets current (as at April 2024) building regulations standards (Part L 2021). This was used as the baseline for cost uplifts.

### Potential future baseline

There is much uncertainty around the future baseline since the details of the Future Homes Standard are not known. The consultation documents released in December 2023 sought to get feedback on two levels of potential performance but our analysis shows that costs for delivering these vary fairly widely. See graph below right.

It would be reasonable to speculate that when the Future Homes Standard is released, the specifications and hence costs could sit somewhere between these two options - where exactly is unknown.

Therefore, we are not able to forecast a potential future cost baseline.

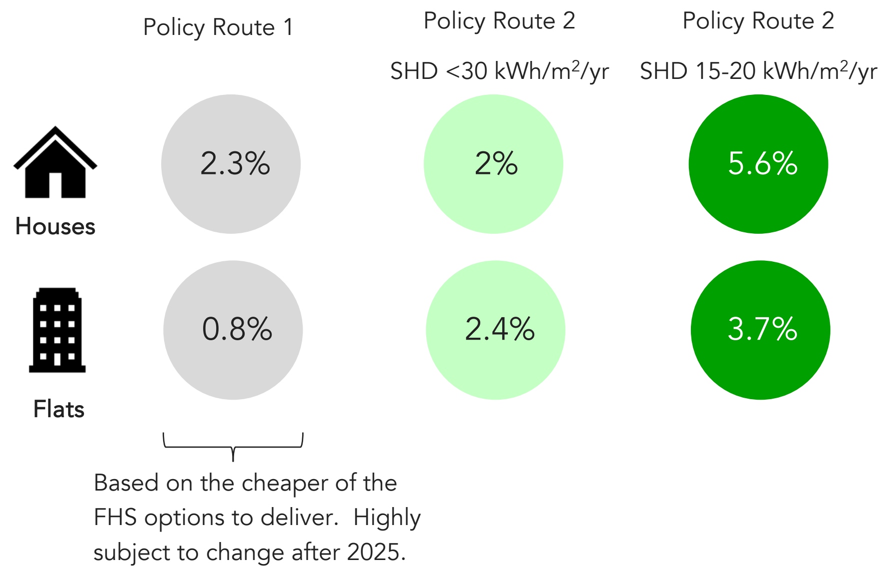
### Cost uplifts to achieve all policy options are relatively modest

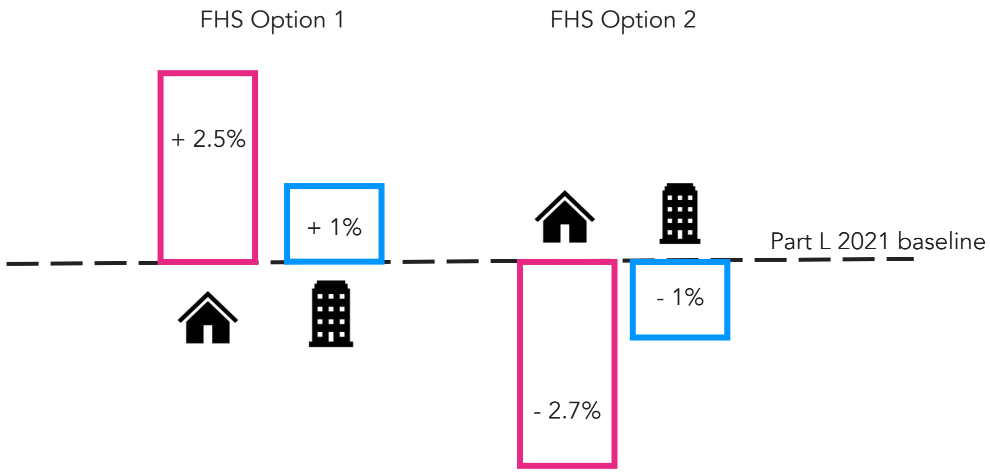
The graphic on the top right shows the relatively modest cost uplifts to achieve all policy options.

The % cost uplifts are less for flats than houses.

Note: the relatively low % uplifts for delivering Policy Route 1 are only relevant until the Future Homes Standard is released in 2025. Our modelling was based on the cheaper of the FHS consultation options to deliver (Option 2), however, as we have seen above the actual cost of delivering FHS compliant spec is likely to be higher than this.

**Average cost uplift compared with a Part L 2021 baseline.**




*% cost uplifts compared to Part L 2021 baseline of FHS consultation options 1 and 2. This shows us how variable the cost of delivering FHS compliant dwellings could be. The average of the cost uplifts is consistent with the baseline costs.*

# Capital costs

- Future Homes Standard consultation options 1 and 2 vary in cost to deliver – Option 1 being more expensive, and option 2 being less expensive to deliver than Part L 2021.
- It is highly uncertain what the Future Homes Standard will look like
- The majority of the cost uplifts between Scenario 4 and 5 (Policy Route 2) are related to the inclusion of triple instead of double glazing in Scenario 5.
- The Future Homes Standard (FHS) Option 2 turns out to be cheaper than the current Part L 2021 baseline because it does not require any provision of solar PV. If this option is the preferred option after the consultation occupants will not reap the benefits of solar PV and will have higher running costs compared with the other scenarios.

**Recommendations:**

- The Part L 2021 baseline is the right one against which to consider cost uplifts. The cost of delivering a FHS compliant home will not be known until the Future Homes Standard is released.
- It would be reasonable to speculate that when the Future Homes Standard is released, the specifications and hence costs could sit somewhere between these two options - where is unknown.
- % cost uplifts for delivering both Policy Route 2 options (Scenarios 4 & 5) are relatively modest.
- Potential capital costs must be balanced with potential running costs and energy performance.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# 2

# Non-domestic buildings:
Energy and cost analysis

# Energy and cost modelling analysis for non-domestic buildings

### Providing an evidence base for non-domestic buildings

Etude was part of a consortium of consultants who developed the energy and cost modelling for a net zero carbon evidence base for 18 London Boroughs – Delivering Net Zero. The Delivering Net Zero reports are available to download from Haringey and Merton Council websites.

https://www.merton.gov.uk/planning-and-buildings/sustainability-and-climate-change/buildings-and-energy

### This evidence base refers to back to Delivering Net Zero

We have not created a new set of non-domestic energy or cost models for Surrey's districts and boroughs. Non-domestic building characteristics are subject to a great deal more variation than domestic buildings. Similarly, non-domestic buildings can be used and operated in very different ways, with a wide variety of processes and functions being contained in them. For these reasons, energy modelling results can vary greatly depending on the building type, design and assumptions chosen. Therefore, remodelling for the Surrey context will yield significantly useful or more robust results than referring to the results from the Delivering Net Zero report. This is especially the case given that London is geographically close to Surrey and differences in weather will be minimal.

### Non-domestic archetypes looked at

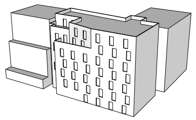
Four non-domestic archetypes were modelled in the Delivering Net Zero Study: office; industrial warehouse; school; hotel. These are illustrated on the right.

### Approach to cost and viability for non-domestic buildings

The costs illustrated in the Delivering Net Zero report have been reviewed by Three Dragons and commentary has been given on alignment with Surrey.


*The Delivering Net Zero evidence base has been used as the source of modelling and cost data for the Surrey Net Zero Viability Toolkit.*

### Non-domestic archetypes selected

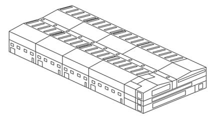


**Office**

7 storeys

4,000 sqm

This building represents the generic **office building** new build typology

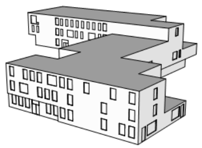


**Industrial**

2 storeys

9,000 sqm

This building represents the generic **industrial building** new build typology

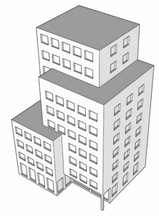


**School**

3/4 storeys

6,000 sqm

This building represents the generic **school building** new build typology



**Hotel**

11 storeys

3,900 sqm

This building represents the generic **hotel building** new build typology

*Graphical representation of the 4 buildings chosen as archetypes*

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# Energy and cost modelling analysis for non-domestic buildings I Specifications modelled


*Delivering Net Zero evidence base (for 18 London boroughs)*

*Prepared by Levitt Bernstein, Introba, Inkling, Currie & Brown and Etude*

### Specification scenarios modelled

The Delivering Net Zero study utilised a fair and balanced set of specifications which considered various levels of performance for fabric and ventilation, heating systems and renewable energy provision were modelled.

Three specific sets of building fabric, ventilation and renewable energy specifications selected are illustrated on the right.

The detailed specifications can be found in the appendix.

### Part L 2021 compliance modelling outputs

The different scenarios were modelled for 4 different archetypes using the NCM methodology for non-domestic buildings (i.e. EDSL's Tas and IES's VE).

### Part L modelling outputs for Policy option 1

Results were analysed to investigate how the different cases would perform against the requirements of Policy option 1 in terms of:

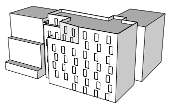
- Regulated carbon emissions - % improvement over Part L 2021

### Predictive energy modelling outputs for Policy option 2

The buildings were also modelled using a predictive operational energy modelling tool: EDSL's Tas and IES's VE using CIBSE TM54 methodology for non-domestic buildings. They were used to calculate the space heating demand (SHD) and Energy Use Intensity (EUI) for each scenario and each building.

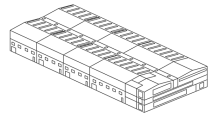
| Fabric and Ventilation | Heating system | Solar PVs |
|---|---|---|
| Business as usual* | Gas boiler | No |
| Good practice | Direct electric | High provision of PVs |
| Ultra-low energy | Less efficient heat pump | |
| | More efficient heat pump | |

*Many different scenarios were modelled for the Delivering Net Zero study for each archetype, combining different levels of fabric specification, heating system and renewable energy provision. The scenarios most applicable to the aims of Surrey's evidence base are shown above. * The 'Business as usual' scenarios is meant to represent the type of fabric and ventilation specifications that most applicants in London would consider 'standard' in the last 5-10 years.*

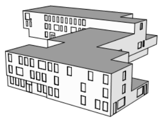


| Office |
|---|
| 54.8 kWp |
| 432 m² of PV panels |
| 70% of roof area |

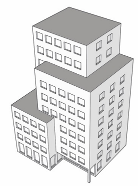
*Max PV option*



| Industrial building |
|---|
| 76.7 kWp |
| 666 m² of PV panels |
| 25% of roof area |



| School |
|---|
| 135.5 kWp |
| 608 m² of PV panels |
| 25% of roof area |



| Hotel |
|---|
| 45 kWp |
| 202 m² of PV panels |
| 50% of roof area |

*Summary of PV assumptions confirming total PV panel area and kWp output*

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# Part L energy modelling for Policy option 1 | Non-domestic buildings | Summary of findings


***Delivering Net Zero evidence base (for 18 London boroughs)***

*Prepared by Levitt Bernstein, Introba, Inkling, Currie & Brown and Etude*

Policy option 1 assumes that the Part L framework continues to be used to go beyond the minimum requirements of Building Regulations Part L 2021.

Part L 2021 methodology for non-domestic buildings is assessed using a new government-approved NCM modelling methodology. This methodology is expected to change in 2025 with the introduction of the Future Buildings Standard.

In summary, non-domestic Part L modelling undertaken indicates the following

- The results indicate a large range of $CO_2$ emissions reductions depending on the building typology.
- The results of the modelling suggest that a 100% reduction beyond Part L 2021 cannot be achieve on-site for any of the archetypes and an energy offsetting policy would be required to make up for the shortfall. Setting different policy targets across building types could be an appropriate solution.
- Better on-site % reductions are achieved where building fabric energy efficiency is improved.
- Improvements in % reduction are relatively minimal suggesting an applicant may prefer to opt for energy offsetting as opposed to improving the building fabric to achieve better $CO_2$ reductions on site.
- All results are highly reactive to the amount of PV provision, partially due to the fact that heating energy use tends to be significant underestimated.

Would not pass both metrics of Building Regulations Part L 2021

| < 0% | < 35% | < 60% | 60-80% | > 80% |
|---|---|---|---|---|

*Indicates which combination of scenarios aligns best with the approach to the residential specification for Policy Route 1 for Surrey.*

| Reduction in $CO_2$ - NCM - SAP 10.2 GLA(reg) | School | | | Office | | | Industrial | | | Hotel | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fabric & ventilation | Direct electric | Heat pump less efficient | Heat Pump more efficient | VRF | Heat pump less efficient | Heat pump more efficient | VRF | Four pipe chiller | Heat pump more efficient | Heat pump (400/300) | Heat pump (450/300) |
| Business as usual | 11% | 75% | 77% | 37% | 30% | 38% | 41% | 40% | 53% | 7% | 8% |
| Good practice | 3% | 40% | 40% | 53% | 49% | 54% | 41% | 40% | 53% | 10% | 11% |
| Ultra-low energy | 73% | 83% | 83% | 57% | 55% | 57% | 48% | 46% | 61% | 16% | 16% |

*Performance of each case in terms of $CO_2$ against the Part L 2021 baseline*

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# Predictive energy modelling analysis for Policy option 2 | Non-domestic buildings | Summary of findings

Energy modelling using TAS and IES software in conjunction with CIBSE TM54 was undertaken to estimate space heating demand and the total energy use (EUI) for the different non-domestic typologies.

- **Space heating demand seeks to improve energy efficiency.** As it can be seen from the adjacent table, the results are fairly consistent and would enable to use a particular level for policy (e.g. 15 or 20 kWh/m².yr). The school and office typologies have the widest range of space heating demand per floor area (GIA) relative to the other typologies.
- **Energy Use Intensity (EUI) seeks to reduce total energy use.** As it can be seen from the table below, the range of results is very wide and would require specific EUI targets for the different typologies. The benefit of introducing a more efficient heat pump is clearest for the hotel which has the highest EUI.

**Space heating demand – Predictive (kWh/m²/yr)**

| Fabric & ventilation | School | Office | Industrial | Hotel |
|---|---|---|---|---|
| Business as usual | 37 | 23 | 17 | 30 |
| Good practice | 12 | 12 | 12 | 24 |
| Ultra-low energy | 4 | 4 | 10 | 15 |

*Summary of space heating demand results ranges for each non-domestic typology and each different level of fabric and ventilation specifications*

Space heating demand: Worst | Best

Energy use intensity: Worst | Best

*Indicates which combination of scenarios aligns best with the approach to the residential specification for Policy Route 1 for Surrey.*

| EUI - Predictive (kWh/m²/yr) | School | | | Office | | | Industrial | | | Hotel | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fabric & ventilation | Direct electric | Heat pump less efficient | Heat Pump more efficient | VRF | Heat pump less efficient | Heat pump more efficient | VRF | Four pipe chiller | Heat pump more efficient | Heat pump (220) | Heat pump (400/300) | Heat pump (450/300) |
| Business as usual | 92 | 65 | 64 | 82 | 87 | 81 | 34 | 34 | 32 | 159 | | 158 |
| Good practice | 71 | 62 | 62 | 72 | 74 | 72 | 30 | 31 | 29 | 152 | | 152 |
| Ultra-low energy | 60 | 57 | 57 | 66 | 67 | 66 | 28 | 28 | 27 | 143 | | 142 |

*Energy use intensity result ranges for each case of each non-domestic typology*

# Summary costs per m² of construction | Non-domestic*

*Costs reproduced from the **Delivering Net Zero** study for 18 London Boroughs. These have not been made applicable to Surrey.

The tables below show the summary results for the non-domestic archetypes in comparison to the 'zero additional cost' Part L 2021 compliant option.

**Office building** (~ £4,050/m² baseline construction cost)

| % uplift in cost per m² of construction | | With PV | | | |
|---|---|---|---|---|---|
| | | Gas boiler | VRF | Heat pump less efficient | Heat pump more efficient |
| Fabric & ventilation | Business as usual | ~~-0.9%~~ | -2.9% | -0.2% | 3.0% |
| | Good practice | 0.0% | -1.6% | 0.4% | 2.7% |
| | Ultra-low energy | 1.8% | 0.6% | 2.0% | 3.7% |

**Industrial building** (~ £1,300/m² baseline construction cost)

| % uplift in cost per m² of construction | | With PV | | | |
|---|---|---|---|---|---|
| | | Gas boiler | VRF | Four pipe chiller | Heat pump more efficient |
| Fabric & ventilation | Business as usual | ~~-6.5%~~ | 3.8% | 5.2% | 7.1% |
| | Good practice | ~~-2.2%~~ | 3.8% | 4.7% | 5.8% |
| | Ultra-low energy | 0.0% | 5.5% | 6.2% | 7.3% |

**Primary school** (~ £3,400/m² baseline construction cost)

| % uplift in cost per m² of construction | | With PV | | | |
|---|---|---|---|---|---|
| | | Gas boiler | Direct electric | Heat pump less efficient | Heat pump more efficient |
| Fabric & ventilation | Business as usual | -1.1% | -3.1% | 0.0% | 3.3% |
| | Good practice | 0.6% | -1.0% | 1.1% | 2.9% |
| | Ultra-low energy | 2.9% | -1.4% | 2.9% | 3.6% |

**Hotel** (~ £4,250/m² baseline construction cost)

| % uplift in cost per m² of construction | | With PV | | | |
|---|---|---|---|---|---|
| | | Gas boiler | Heat pump (220) | Heat pump (400/300) | Heat pump (450/300) |
| Fabric & ventilation | Business as usual | ~~-0.8%~~ | ~~-2.2%~~ | -0.3% | 0.8% |
| | Good practice | 0.0% | ~~-1.3%~~ | 0.5% | 1.6% |
| | Ultra-low energy | 1.4% | ~~-0.8%~~ | 1.9% | 2.8% |

✗ Would not pass both metrics of Building Regulations Part L 2021

*Summary of all non-domestic relative costs (£/m²) compared to the '0' baseline, overlaid with compliance with all Part L 2021 criteria*

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# 3

# Viability Summary

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# Economic Viability Modelling

## Background to the economic viability modelling

To understand the potential for delivering net zero solutions on both residential and non-residential development across Surrey, a set of costings and economic viability tests have been undertaken. This will help address the central question of whether net zero development policies are generally achievable across Surrey and within individual districts & boroughs or if some trade-offs with other policy objectives may need to be considered.

The viability analysis has been undertaken in accordance with national policy and guidance - including the December 2023 National Planning Policy Framework and latest Planning Practice Guidance. This includes consultation with the development industry active in Surrey and the eleven district and borough councils.

It is important to emphasise that, as this is a Surrey-wide study, the typologies and base assumptions employed in the modelling are necessarily high-level. In practice when they reach plan making stage, councils will need to undertake their own viability assessment of their policies. but they can make reference to the specific net zero costs contained in the full report to this study and the toolkit.

An individual development can be said to be viable if, after taking account of all costs, including central and local government policy and regulatory costs and the cost and availability of development finance, the scheme provides a competitive return to the developer to ensure that development takes place and generates a land value sufficient for the landowner to sell the land for the development proposed. If these conditions are not met, a scheme will not be viable.

**Typologies – residential testing**

| Typology reference | Number units | Development type | Land use | Density (dwellings per hectare) |
|---|---|---|---|---|
| Res 1a | 6 | Houses (tested with and without affordable housing) | Greenfield | 30dph |
| Res 1b | 6 | Houses (tested with and without affordable housing) | Brownfield | 30dph |
| Res 2a | 35 | Mixed (houses and flats) | Greenfield | 35 dph |
| Res 2b | 35 | Mixed (houses and flats) | Brownfield | 35 dph |
| Res 3 | 60 | Flats - 4 storey | Brownfield | 120 dph |
| Res 4 | 260 | Mixed (houses and flats) | Greenfield | 40 dph |
| Res 5 | 240 | Flats - 15 storey | Brownfield | 343 dph |

## Typologies used in the residential testing

The analysis is based on a series of development typologies, typical of the types of development found across Surrey. Typologies were tested on greenfield and brownfield land and in three overarching value areas, identified using Land Registry sales data. The value areas are labelled 1-3 in the study (see image on the following page). Sales values are highest in value area 3 and lowest in value area 1 but construction costs are largely constant throughout.

From other local studies in Surrey we have also identified a range of benchmark land values (BMLV) applicable to the different land uses. To capture the full potential range we have also modelled each typology at BMLV1 and BMLV 2, with BMLV1 being lower than BMLV2.

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# Economic Viability Modelling

**Testing assumptions information sources**

The viability analysis follows national guidance and good practice and has drawn on:

- Published data: the Building Cost Information Service (BCIS) (for build costs), Land Registry values and House Price Index (HPI) (for residential market values) , Energy Performance Certificates (EPCs) for dwelling size;
- Published viability studies for the Surrey local authorities;
- Discussion with district council officers;
- A workshop with developers;
- Industry norms and standard practice
- Government impact assessments.

Surrey has been divided into three broad value areas as shown on the right.

**Testing assumptions included - for residential development**

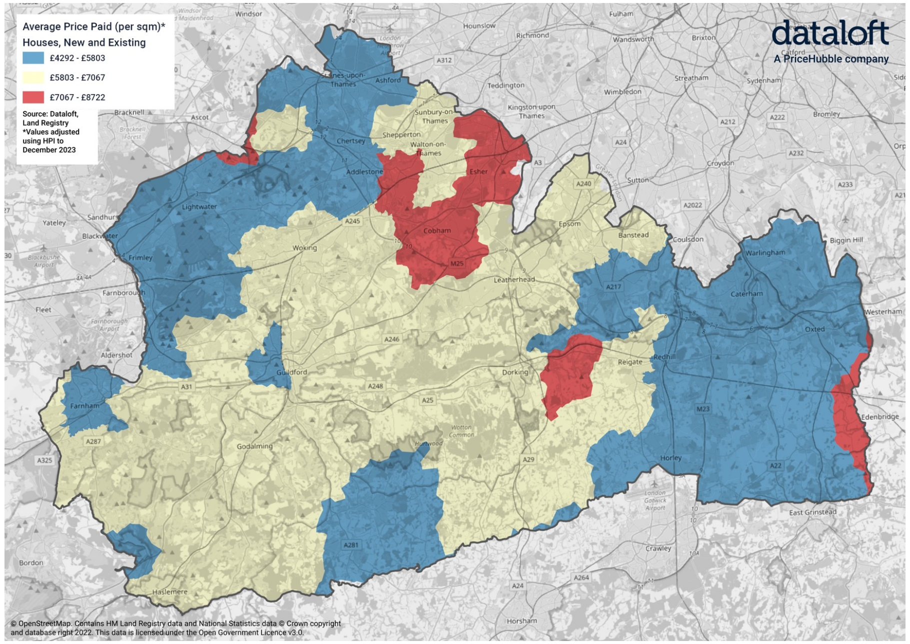
The modelling has taken account of the costs of meeting Building Regulations 2021 Parts L, F, O and S as well as biodiversity net gain and First Homes.

For sites of 10 or more dwellings, an affordable housing requirement of 40% has been modelled with a tenure mix of 35% social rent / 35% affordable rent / 25% first homes / 5% shared ownership. Sites of 6 to 9 dwellings have been modelled with and without affordable housing – to reflect differences in approach across Surrey.

An allowance of £5,000 a unit has been made for habitat mitigation measures and between £2,500 and £10,000 a unit for s106, depending on site size.

All dwellings are assumed to meet Building Regulations Part M4(2) and 5% Part M4(3)(a) for accessibility. 5% of dwellings on non-flatted schemes are reserved for self build and custom housebuilding.

CIL varies significantly across Surrey and, as a working assumption, a levy of £200 per sqm has been used in the modelling.




*Map showing the 3 value areas tested across Surrey*

**Average value of semi-detached house of 102 sqm in each value area (VA)**

VA1 = £540,600

VA2 = £673,200

VA3 = £724,200

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# Economic Viability Modelling

**Results of the residential modelling**

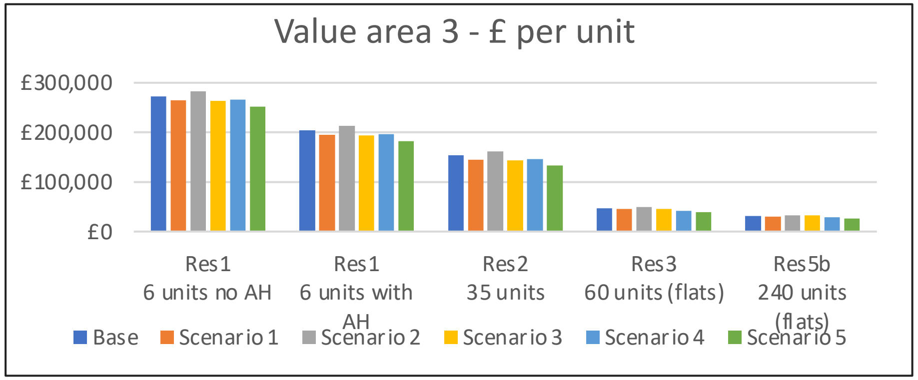
The results of the viability modelling demonstrates good general viability and that most development can absorb the additional costs of achieving net zero. However there are exceptions, particularly in lower value areas and on brownfield sites This is explored in more detail below.

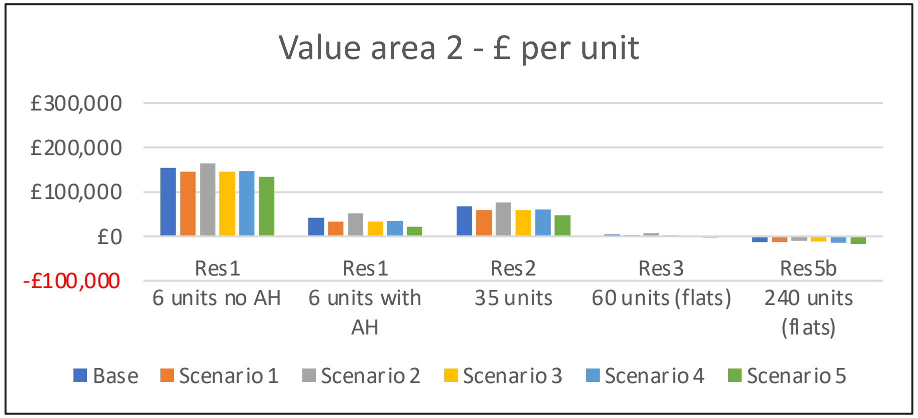
The results on **greenfield sites**, with an average CIL, show development consistently able to meet the policy costs associated with all net zero scenarios.

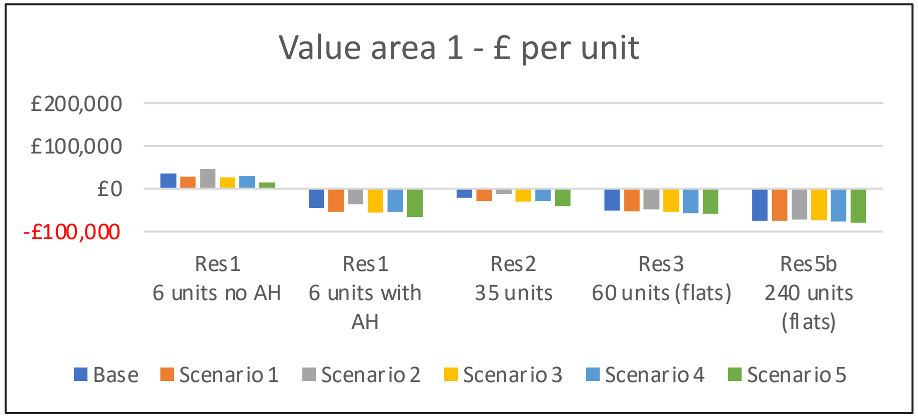
On **brownfield sites** the outcome is more varied and a sample of results are shown to demonstrate this on the right (£/unit).

- In the highest value area, **value area 3,** all brownfield development is viable and able to meet the costs of all net zero scenarios.
- In **value area 2** house-led development is viable on brownfield sites and able to meet the costs of the net zero scenarios but mid-rise and high-rise flatted development is not. Blocks of flats were already marginal or not viable at the base position and the additional costs of meeting net zero exacerbates the poor outcome.
- In **value area 1**, the lowest value area, only the 6-unit typology without affordable housing is able to meet the additional net zero policy costs on a brownfield site at BMLV2. (Not shown here but at BMLV1, the house-led typologies, Res 1 & Res 2, would be viable and able to meet the additional costs, although not the flatted typologies.) Consistently, flatted schemes are least viable but this is so with or without the additional costs of achieving net zero development.

To adopt net zero policies local authorities will need to carry out their own district-wide viability assessment taking into account specific local costs, land values and variances in house prices. Where development is marginal or not viable policy trade off may be required unless flexibilities can be found within land values or other development costs.




*The results above show the residual value on brownfield sites, with all costs deducted including BMLV2 and CIL of 200 sqm. The results are per unit.*

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# Economic Viability Modelling

**Future scenario – residential sensitivity modelling**

Further modelling was undertaken to explore whether potential changes in costs and values over the next five years would improve or worsen viability and the ability of development in Surrey to meet the highest net zero standards. It is recognised that forecasts do not necessarily become reality but they are a useful way of taking a longer term view of development viability. Using the best available evidence it has been assumed that over the next 5 years, house prices increase by 18% and build costs by 16.5%.

Two of the development typologies have been taken to illustrate the impact of the 5 year forecasts on development viability – one with housing and the other, a flatted scheme. The results are much more encouraging especially for the house led typology of 35 units, but still show relatively poor viability in value zone 1 with its implications for policy trade-offs and/or land values if net zero is to be adopted at the local level. This will be particularly so should councils wish to encourage flatted development in the lower value areas.

**5-year forecast – results per unit at BMLV2**

| RES2<br>35 units B/Field | Value area 1 | Value area 2 | Value area 3 |
|---|---|---|---|
| Base | £7,255 | £107,399 | £207,930 |
| Scenario 1 | -£2,542 | £97,764 | £198,311 |
| Scenario 2 | £17,892 | £117,861 | £218,362 |
| Scenario 3 | -£3,673 | £96,651 | £197,200 |
| Scenario 4 | -£1,468 | £98,820 | £199,396 |
| Scenario 5 | -£16,442 | £88,038 | £184,696 |

**5-year forecast – results per unit at BMLV2**

| RES3<br>60 flats B/Field | Value area 1 | Value area 2 | Value area 3 |
|---|---|---|---|
| Base | -£46,998 | £14,897 | £64,589 |
| Scenario 1 | -£48,960 | £12,967 | £62,676 |
| Scenario 2 | -£43,419 | £18,417 | £68,078 |
| Scenario 3 | -£49,191 | £12,740 | £62,451 |
| Scenario 4 | -£52,430 | £9,561 | £59,299 |
| Scenario 5 | -£55,717 | £10,389 | £56,148 |

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# 4

## Offsetting and embodied carbon

### Moving towards energy offsetting

Policy option 2 is based on energy metrics, most importantly the buildings' predicted energy use (Energy Use Intensity - EUI) but also the balance between annual energy use and annual renewable energy generation on-site.

In order for the role of energy offsetting to be clearly defined, we would recommend the following:

1. Option A - Policy option 2 should seek to minimise the building' predicted energy and maximise PV generation on site.
2. Option A - Once officers are satisfied that the building complies with these policy requirements, energy offsetting could be used to deal with the residual difference between energy use and renewable energy generation.

***Case study:*** *if we take the example of a residential development of 5,000m² GIA with an Energy Use Intensity of 27 kWh/m²$_{GIA}$/yr and a PV generation of 15 kWh/m²$_{GIA}$/yr. There is a shortfall between annual energy use and renewable energy generation of 12 kWh/m²$_{GIA}$/yr, which equates to 60,000 kWh/yr. The applicant should pay into the Council's offset fund a sum of £79,200 (i.e £1.32/kWh x 60,000 kWh) to enable the Council to install a renewable energy system elsewhere which would generate 60,000 kWh/yr.*

Another option is possible (Option B) in case the Surrey's boroughs and districts decide to set a specific renewable energy generation target. In this case, the energy offset will not seek to address the gap between the predicted EUI and renewable energy generation on-site, but the gap between the policy requirement for PV generation (e.g. 100 kWh/m²$_{footprint}$) and renewable energy generation on-site. The targets provided on this page are only indicative. If a district or borough wishes to proceed with Option B, it is recommended to undertake a technical evidence base to establish which targets would be technically feasible based on a variety of typologies and buildings.

**1**

**Option A**

**Set the EUI requirement at the right level to minimise energy use and require PVs to match the EUI**

These levels could be specific to each typology, e.g:

- 35 kWh/m²$_{GIA}$ for domestic
- 70 kWh/m²$_{GIA}$ for offices
- 70 kWh/m²$_{GIA}$ for schools
- 35 kWh/m²$_{GIA}$ for industrial buildings
- 160 kWh/m²$_{GIA}$ for hotels

**Option B**

**Set a renewable energy generation requirement at the right level to maximise renewable energy generation**

These levels could be specific to each typology, e.g:

- 100 kWh/m²$_{fp}$ for domestic
- 50 kWh/m²$_{fp}$ for offices
- 80 kWh/m²$_{fp}$ for schools
- 150 kWh/m²$_{fp}$ for industrial buildings
- 50 kWh/m²$_{fp}$ for hotels

**2**

**Option A: Work out the difference between the energy used by the development and how much renewable energy it will generate**

Any shortfall of renewable energy generation will lead to an energy offset payment

**Option B: Work out the difference between the target and the actual renewable energy generation**

Any shortfall of renewable energy generation will lead to an energy offset payment

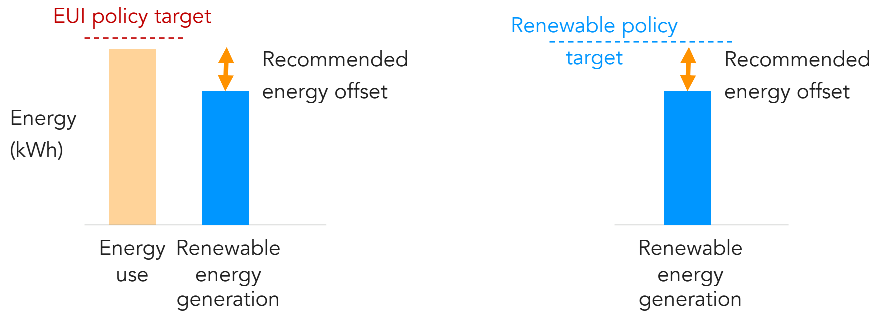


*Figure 10.5 – Two alternative options for the energy offset*

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# Embodied Carbon: Summary of proposed policy recommendations

Proposed policy recommendations have been set across four main areas:

1. Retrofit first and promoting circular economy
2. Lean building design and good material efficiency for lower embodied carbon
3. Reducing upfront embodied carbon
4. Reporting whole life carbon

For each of the suggested policy requirements we have set out:

- The types/scale of development the requirement would apply to
- The policy objective
- Suggested submission requirements
- A proposed requirement wording

More detail of examples of policy wording can be found in Part B Energy Modelling Results Section 4.2 reference.

Impacts on costs can be found in the same location.

**1 Retrofit first and promoting circular economy**

This policy recommendation seeks to prevent unnecessary partial or total demolition of existing buildings by requiring justification, additional requirements and potentially Whole Life Carbon optioneering studies.

**2 Lean building design and good material efficiency for lower embodied carbon**

This policy recommendation seeks to reduce resource use by encouraging all applications to be efficient in their material use and design.

**3 Reducing upfront embodied carbon**

This policy recommendation sets limits on upfront embodied carbon emissions for major applications and requires calculations and reporting to demonstrate compliance.

**4 Reporting whole life Carbon (WLC)**

This policy recommendation requires reporting on WLC emissions.

# 5

# Recommendations for planning policies

# Policy Route 1 (a TER approach): the conclusions and recommendations

We do not think that Policy Route 1 is a suitable option for local authorities in Surrey to meet their climate change targets and objectives: a TER based approach will not deliver fully net zero buildings, does not include all energy uses and may allow fossil fuels.

### Demonstrating compliance

- Applicants will need to use SAP 10 until the Home Energy Model is release in 2025 (or later).
- If Policy Route 1 is selected, the goal posts for applicants may change significantly when the Future Homes Standard and the Home Energy Model is released.

### Using building regulations calculations methodologies

- Building regulations calculation methodologies discount unregulated energy (anything that is a plug-in appliance) – this can represent 50% of a dwelling's energy consumption.
- Using SAP 10 we saw that a very large amount of solar PV is required to achieve the 100% reduction on the TER. This will be challenging to achieve on site for almost all dwelling types.
- Using the beta version of the Home Energy Model the amount of solar PV required to achieve this reduction was greatly reduced. Although the Home Energy Model is also under consultation and is highly subject to change. Upon release, a new evidence base may be needed to support the policy.
- SAP 10 is not predictive. Although it is intended that the Home Energy Model improves how it calculates predicted energy consumption, we do not know how well it will achieve this.

### Energy

- Policy Route 1 is likely to deliver greater energy consumption compared with Policy Route 2.
- Energy consumption is **22-31%** larger than Scenario 4 (low energy) and **31-44%** larger than Scenario 5 (ultra-low energy).

(Calculated using PHPP to give estimate of actual energy use)

### Energy offsetting

Due to the very large amounts of solar PV required to meet Policy Route 1, a high number of applicants will not be able achieve this on-site. Councils will need to decide whether to implement a carbon or energy offset policy to mitigate this non-compliance.

### Running costs

Running costs are highly dependant on a number of factors, including energy prices, solar export prices and occupant behaviour and habits.

1) Energy efficiency - The relatively lower energy efficiency likely to be delivered by developers using Policy Route 1 will disadvantage occupants and make them more vulnerable to the effects of increasing energy prices.

2) Solar self-consumption – Occupants will be able to take advantage of solar self-consumption but to a lesser extent than with Policy Route 2.

3) Solar export - For houses in particular, the very large solar PV array is a clear advantage, especially when solar export prices are high.

4) Performance gap – Part of the Performance Gap issue is due to energy modelling that is not predictive (e.g. SAP 10). We do not know how well SAP 10's successor (the Home Energy Model) will address this.

### Capital costs

It is cheaper to build than Policy Route 2. However our analysis is based on the cheaper of the two FHS Options and in reality is highly subject to change.

### A policy for low carbon heat

Unless a specific policy for low carbon heat is included it may be possible for applicants to pass the requirements of Policy Route 1 using a gas boiler and energy offsetting – this is particularly the case in the period before the Future Homes Standard and the Home Energy Model come into force. Therefore, a standalone low carbon heat policy is recommended to ensure Surrey's net zero carbon objectives are met.

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# Policy Route 2 (Absolute Energy Targets): the conclusions and recommendations

Policy Route 2 – setting absolute energy targets for new buildings in policy - is a suitable option for the districts and boroughs of Surrey. It will help achieve Surrey's climate change objectives, and is the more reliable route for keeping energy bills low for occupants.

### Demonstrating compliance

Applicants will need to demonstrate compliance through either predictive modelling outputs (such as PHPP or dynamic simulation software). Another option for dwellings would be to use the SAP Conversion Tool (adapted for Surrey) to convert SAP outputs to predicted energy outputs until the Home Energy Model is released.

Absolute energy targets are tangible and directly related to building energy consumption and therefore industry should easily be able to become more comfortable with them over time.

### Energy

Policy Route 2 enables the council to mandate minimum energy efficiency standards through setting Space Heat Demand and Energy Use Intensity Targets.

Modelling showed consistently lower energy consumption with both the low energy (Scenario 4) and the ultra-low energy (Scenario 5) option compared with all other scenarios (including Scenario 3 – Policy Route 1).

- Policy Route 2 is likely to deliver homes with lower energy consumption compared with Policy Route 1.
- Energy consumption (EUI) is **18-23%** lower in Scenario 4 (low energy) and **24-30%** lower than Scenario 5 (ultra-low energy) compared with Policy Route 1.

### Running costs

Running costs are highly dependant on a number of factors, including energy prices, solar export prices and occupant behaviour and habits.

1) Energy efficiency - Occupants are more insulated from rising energy prices in more energy efficient dwellings. Policies that encourage energy efficiency (Policy Route 2) are therefore recommended.

For flats, which the only reliable way to deliver reduced running costs is through implementation of energy efficiency targets – e.g through absolute energy targets in Policy Route 2 (which does not rely on revenue from solar export to lower net running costs).

2) Solar self-consumption – Occupants are more able to take advantage of solar self-consumption through smart heating controls in more energy efficient dwellings (Policy Route 2 recommended).

3) Solar export – The larger the PV array, the more occupants can benefit from solar export. For dwellings delivered to Policy Route 2 standards it is likely that there will be space to spare on the roof. Developers should design and install PV in a way that enables occupants to add more PV at a later date should they wish.

4) Performance Gap – An Assured Performance policy is recommended to ensure good quality construction that delivers energy performance intent.

### Capital costs

| | Policy Route 2<br>SHD <30 kWh/m²/yr | Policy Route 2<br>SHD 15-20 kWh/m²/yr |
|---|---|---|
| Houses | 2% | 5.6% |
| Flats | 2.4% | 3.7% |

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# Policy option 1 vs Policy option 2 | At a glance comparison

| | Policy Route 1 | Recommended<br>Policy Route 2 |
|---|---|---|
| **Metrics used** | Target Emissions Rate (TER) ($CO_2$)<br><br>The TER is a relative metric, it 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 $CO_2$ emissions (or energy use). | Absolute energy metrics:<br>• Space Heating Demand (kWh/m$^2$/yr)<br>• Energy Use Intensity (kWh/m$^2$/yr)<br>• Renewable Energy generation (kWh/m$^2$/yr) |
| **Definition of "net zero"** | 100% reduction on the Target Emissions Rate (TER) | Energy balance (annual energy consumption = annual renewable energy generation). |
| **Regulated energy included?** | • space heating - ✓<br>• hot water ✓<br>• pumps and fans ✓<br>• Lighting ✓ | • space heating ✓<br>• hot water ✓<br>• pumps and fans ✓<br>• Lighting ✓ |
| **Unregulated energy included?** | • Cooking ✕<br>• Appliances ✕<br><br>Unregulated energy can account for 50% of energy in low-energy dwellings. | • Cooking ✓<br>• Appliances ✓ |
| **Renewable energy included?** | Yes. Renewable energy is accounted for in the calculations. Carbon savings are rolled into one metric so it is not possible to see what contribution renewable energy is making. | 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 compliance tools:<br>• Building regulations Standard Assessment Procedure (SAP) for dwellings.<br>• Building regulations National Calculation Methodology (NCM) for non-dwellings. | Calculation through design tools:<br>• PassivHaus Planning Package (PHPP) for dwellings.<br>• TM54 or Dynamic Simulation for non-dwellings. |
| **Aligned with national policy?** | Yes. | Not yet. |
| **Does it promote good building design?** | No. The benefits of building design and orientation is not captured in building regulations assessment methodologies. | 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. |

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# Choosing policy targets

Local Authorities and Boroughs in Surrey have a choice over the standards set within their new net zero carbon buildings policies.

We recommend that Policy Route 2 (absolute energy targets) is the most suitable for the delivery of climate change objectives and to deliver homes with reliably low energy costs. The five main policies recommended, together with the recommended targets (and alternatives) are illustrated below.

| Space heating demand | Energy Use Intensity<br>Resi | PV generation | Offsetting | Performance gap |
|---|---|---|---|---|
| Ensures that space heating is reduced and that inefficiency is not 'masked' by the heat pump, helping to reduce the risk of high heating costs. | Covers all energy uses, reduces the risk of high energy heating system. It also provides the 'energy use' number for Net Zero and a simple metric for users post completion. | Addresses the need for greater PV deployment in an obvious location for them: the roof of new buildings. | When policy requirements cannot be met on-site due to constraints on roof space, applicants are required to pay into an offset fund. | Helps to ensure that the estimated energy/carbon performance is not only theoretical and that it is delivered, which is what matters. |
| No requirement | No requirement | No requirement | No requirement | No requirement |
| 30 kWh/m²/yr | 40<br>kWh/m²/yr | Maximise PV on roof | Carbon offset | Uplift to SAP / SBEM requirements |
| 15 - 20 kWh/m²/yr | 35<br>kWh/m²/yr | Enough to match EUI | Energy offset | Bespoke Surrey process |
| | | | | Passivhaus or other requirement |

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# Recommendations for planning policy: Policy wording and clauses

### Policy wording

Wording of policies must be formulated so it is clear whether a policy component is required or encouraged.

- For requirements (i.e. policy compliance must be demonstrated), phrases such as 'required to' and 'must' are to be used.
- For other policy components that cannot strictly be required by policy or are nice-to-haves, phrases such as 'are encouraged to' and 'should' are to be used.
- The phrase 'policy target' implies that the component is not mandatory.

It is important to make clear distinctions and be explicit on policy requirements to avoid any confusion at planning application stage, which can cause delays and ineffectiveness.

Additional wording in support of the policy requirements (either as supporting text in local plans or in supplementary guidance) should be produced to state what information is required for each application type. This is important to consider as the level of detail required for policy compliance will vary between Outline, Reserved Matters and Full applications. A position should be formed by the LPA on requirements for Hybrid applications and mixed-use developments. For example, full energy performance modelling is unlikely to be available at Outline stage but sufficient information to demonstrate principles required to achieve true net zero on-site are in place should be given.

If links to other policies are evident and/or a hierarchy in place of what requirements must be achieved, this should be made clear with individual components clearly laid out. For example, LPAs may decide that an EUI and space heating demand requirement must be complied with no scope for offsetting. Offsetting may only be a last resort option for a shortfall of on-site renewable energy generation. It should therefore be explicit that non-compliance with the EUI and space heating demand requirements is unacceptable.

### Policy clauses

Whilst it is important to be clear where strict policy requirement are in place, some flexibility is inherently required to accommodate exceptional circumstances. Exceptional circumstances should be assessed on a case-by-case basis by someone with sufficient expertise to make such a judgement. However, it can be useful to provide examples alongside policy requirements, such as:

- *"Exceptional circumstances where an on-site net zero energy balance is not achieved may only be found acceptable in some cases, for example with taller flatted buildings (4 storeys or above) or where overshadowing significantly impacts solar PV output."*

In the case of operational energy, exceptional circumstances are typically only likely to be justified in the case of tall buildings with a small relative roof area for PV or non-residential buildings with high energy demand such as data centres.

Although an exhaustive list of potential exceptional circumstances should not be published, as this could encourage developers to avoid policy compliance through pursuing a design with an exceptional circumstance, sample scenarios should be provided to Development Management officers, so they are able to assess the legitimacy of any non-compliance in the first instance.

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# Recommendations for planning policy

### Implementation considerations

Adoption of policies is a crucial first step to achieving intended outcomes, yet the implementation of policy is where any tangible outcomes will be determined.

It is essential that a dedicated officer, either within the policy or Development Management team, is trained up or hired to govern implementation of net zero policies. Net zero energy policy is a highly nuanced area that requires careful assessment and Development Management officers have a swathe of topics to assess when determining applications. Therefore, allocating net zero policy compliance assessments to a dedicated officer, or externally, is important to ensure sufficient attention is given. Policy reputation and efficacy could be undermined unless sufficient attention is given to assessments of compliance.

However, it is still important for training sessions to be delivered to Development Management officers on technical processes involved with net zero carbon development. This will strengthen broad internal capabilities to assess and scrutinise applications that may have submitted overly-optimistic building performance values for the sake of policy compliance. These may include:

- Understanding of modelling techniques and tools (e.g. PHPP)
- Building elements energy performance values (e.g. U-values)
- Low- and zero-carbon heating and ventilation systems/technologies
- Orientation, form factor and design features for solar PV generation

### Application assessment

To ensure the development industry are clear on what is required for detailed compliance with new policies, supplementary guidance should be provided. Such guidance should go beyond surface-level policy wording and state what information and documentation is required.

To ensure that policies on net zero operational energy, embodied carbon and overheating are delivered as intended, two key stages of assessing compliance are necessary:

- Planning application/design stage
- Post-completion/pre-occupation stage

Submission of data throughout design stages is what will determine policy compliance for the full planning application, yet this must be verified with as-built data to confirm true policy compliance. Pre-commencement and pre-occupation conditions must therefore be set at the planning application stage, which could include:

- Photographic evidence of building fabric, heating systems and ventilation technologies
- Air tightness tests whilst the air barrier remains accessible (to allow improvements to be made if required standards are missed)
- As-built reports for building energy performance, embodied carbon assessments and overheating measures

In cases where standards fall below required levels at the post-completion stage, it is important to have enforcement mechanisms in place to penalise non-compliant applications. This is a difficult issue to deal with as buildings cannot be deconstructed but the council should explore options with the Enforcement team on how to mitigate as-built risks.

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# Recommendations for planning policy: Mitigating the Performance Gap

### Mitigating the performance gap

In the UK, buildings consistently experience a gap between their intended energy efficiency at the design phase and their actual performance during operation. Achieving truly net zero buildings necessitates implementing rigorous systems to bridge this performance divide. There are two root causes at the heart of the Performance Gap:

i) inaccurate modelling, primarily driven by flawed compliance tools such as Building Regulations' SAP and SBEM.

ii) A lack of construction quality on-site, leading to poorly installed insulation, air-tightness or heating systems.

### Seeking better quality modelling and energy prediction

To effectively move towards genuinely net zero buildings, local policies must transition from reliance on SAP, which inadequately forecasts space heating demand and overlooks unregulated energy calculations.

To reliably achieve net zero buildings, alternative methodologies for assessing energy performance during the design phase are essential. Proven alternatives exist for both residential and non-residential buildings:

- **Residential**: Passivhaus Planning Package
- **Non-residential**: CIBSE TM54 paired with Passivhaus Planning Package or IES-VE

An alternative to requiring applicants to undertake predictive energy modelling which Cornwall Council & Bath and NE Somerset Council use is a SAP Conversion Tool. The tool recalculates inaccuracies of SAP to better align with outputs from more sophisticated modelling tools.

### Raising construction quality through Assured Performance

Assured Performance Policies are recommended as a crucial step in mitigating the performance gap. Local Building Control authorities may lack jurisdiction over all development sites, and even where they do, regular on-site inspections may not always be conducted. Therefore, management systems ensuring high construction quality are imperative to meet predicted energy performance standards.

For instance, factors like air tightness and thermal bridging are pivotal in achieving the operational energy goals outlined for net zero buildings. Monitoring these aspects throughout construction phases is essential, as a mere confirmation of insulation thickness does not suffice to gauge construction quality.

Several reputable schemes are available and proven effective, including:

- Passivhaus Certification (residential and non-residential)
- AECB Building Standard (residential and non-residential)
- NABERS UK (non-residential)
- Assured Performance Process (residential)
- National Energy Foundation (residential)

### Further recommendations

- Any modelling tool is only as accurate as the modeller using the tool. Request that all calculations are done with qualified assessors.
- The introduction of the Home Energy Model could also solve many of the issues above, if it is able to produce accurate modelling outputs whilst providing consistency as the selected Building Regulations modelling tool. However, it is not yet known how well this will perform.

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# Implementing net zero carbon policies: lessons learned from others

The structure of the policies recommended for Surrey (Policy Route 2, absolute energy targets) is consistent with other local authorities such as Cornwall Council and Bath & NE Somerset, who have implemented policies for new build homes using space heat demand (SHD), total energy use (EUI) and renewable energy targets.

The specific targets chosen within that framework should be considered to balance the impacts on the different parties involved in development with the needs to progress rapidly on reducing carbon emissions from buildings.

The table to the right is a qualitative summary of those impacts at different performance target levels.

Understanding how policies work in operation assist the future development of improved policies and informs other local authorities on what is deliverable. The council should develop a reliable monitoring system that enables the collation of policy performance data both for compliance at application stages and once the building is in use. This should be made available in a standardised format for ease of data input for developers and subsequent sharing of data. Surrey County Council could look to distribute this standardised reporting form to LPAs throughout Surrey to form a regional understanding of policy implementation.

| Concerns / Targets | SHD = 30<br>EUI = 40<br>PV = EUI | SHD = 15 – 20<br>EUI – 35<br>PV = EUI |
|---|---|---|
| Policy makers | Used by Cornwall and B&NES so has passed inspection process | SHD matches CCC recommendation so is evidenced. |
| Planning officers | There may be some groups of exceptions, where some projects cannot comply with targets. Specific exemptions and guidance should be identified. | There may be significant numbers of projects that can't comply, and officers will need to be able to judge which are genuine and should have derogations. |
| Designers | Low energy design principles will need to be applied and energy assessments carried out pre-planning | Ultra-low energy design principles will need to be understood and designs will have to conform to best practice principles |
| Contractors | Best practice required for airtightness and thermal insulation continuity | Specific products may be required and reduced flexibility in construction methodology |
| Developers | Preplanning (at risk) costs will include energy modelling and energy statements | Preplanning (at risk) costs will include thermal bridge calculations, energy modelling and energy statements |
| Community | Higher running costs for residents, higher peak demand on the electricity network | Lowest running costs and peak demand within what the CCC estimated the UK infrastructure could support.<br>best flexibility to operate as 'smart' buildings with the grid |

SHD = Space heating demand

EUI – Energy Use Intensity

PV – Solar Photovoltaics

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# The Future Homes Standard: Local Authorities and Boroughs should strive to go beyond it

At the time of writing this evidence base (Jan to April 2024) the Future Homes Standard was undergoing a round of consultation (December 2023 to March 2024) on the standards it should mandate and the methodology of how to assess it (the Home Energy Model).

The Future Homes Standard is due to come into effect in 2025 – although it could be later than this.

**The final standards and methodologies are highly uncertain and subject to change from the consultation documents**.

The two potential minimum performance standards – as illustrated by the notional buildings options 1 and 2 were assessed in our modelling.

### Energy efficiency

- In terms of fabric efficiency, there is **minimal improvement between the different options and the current Part L 2021 standards.**

### Solar PV

- While we don't know what the final FHS standards will be when it is released, the consultation documents show us that **it's possible that a home will be able to pass the FHS standard with lower levels of energy efficiency and no solar PV** (as demonstrated by Option 2 in the FHS consultation).

### Running costs

- The potential lack of PV being required for the Future Homes Standard has the biggest impact on running costs through:
  - i) greater overall energy consumption compared with alternatives;
  - ii) no ability to offset imported energy through self-consumption and
  - iii) no renewable energy generation to export and create revenue from.
- Taken together, this means **imported energy increases 40-100% for the FHS Option 2 home compared with the FHS Option 1 home.**
- The two FHS options have **very different potential running cost profiles** due mainly to the presence or not of solar PV:
  - A home built to FHS Option 1 standards is likely to be cheaper to run than a Part L 2021 compliant dwelling.
  - A home built to FHS Option 2 standards is likely to be more expensive to run than a Part L 2021 compliant dwelling.

### Capital costs

- Our analysis showed that FHS Option 1 is more expensive to build than the Part L 2021 scenario and FHS Option 2 was cheaper to build than the Part L 2021 scenario. We therefore have no basis on which to predict a potential future cost baseline.

### In summary

- Local authorities should not rely on the Future Homes Standard to deliver homes consistent with climate change objectives.
- We don't know what the FHS will look like when it is released.
- Improving energy efficiency does not appear to be a priority for the standard. Resultant space heating demands are likely to be in the region of 50-60 kWh/m$^2$/yr (for comparison the Climate Change Committee recommends 15-20 kWh/m$^2$/yr recommended for new homes and LETI (Low Energy Transformation Initiative) recommends 15 kWh/m$^2$/yr to meet our climate objectives.
- It's possible that solar PV will not be required – for this reason it's possible that running costs will be increased compared with Part L 2021.
- For an LPA to fulfil its duty and relative responsibility to comply with the Climate Change Act 2008, it should require policy that all new buildings are net zero by 2025 as per Balanced Pathway to Net Zero by the CCC. FHS does not anticipate to achieve this by 2035 at the earliest.

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